Technological Change in Higher Education Information Systems (1980 to the Present): A Case Study of the Pennsylvania State University

Technological Change in Higher Education Information Systems (1980 to the present): A Case Study of The Pennsylvania State University

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TECHNOLOGICAL CHANGE IN HIGHER EDUCATION INFORMATION SYSTEMS (1980 TO THE PRESENT): A CASE STUDY OF THE PENNSYLVANIA STATE UNIVERSITY

Dedication

This thesis is dedicated to Theoni and Nepheli.

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I wish to gratefully acknowledge my family for their unwavering support and encouragement. Without their love and generosity this paper would never have been completed.

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Abstract

The dissertation offers a history of the significant impact of information systems on the routines of faculty and students beyond the classroom, and on institutional resources and policies. The paper provides an overview of information systems, their emergence, significance, challenges and value, and provides context for the overall changes introduced to higher education communities by these technological advances. One specific institution, Pennsylvania State University (PSU), is examined. The case study details PSU's development of an information system over 30 years. It describes the process by which PSU executed IS implementation during the period from 1980 to the present time, and the ways in which this major technological change altered the behavior of administrators, faculty and students. The principal motive of this investigation is to gain an understanding of the origins and development of IS at PSU, and to study the influence of the key players and their decisions to build a home-grown IS. An extensive set of interviews and data from the archives at PSU inform this case, assuring that the history fully presents the university's introduction and integration of its information systems and the experiences of stakeholders with these IS changes. The paper identifies important features of the PSU story and reflects on the insights and lessons that can be derived from it.

Chapter I. Introduction

> *It is said of a former president of Harvard that he ran the whole place with the aid of a secretary and a little black book in which he kept the names of the faculty, the subjects they taught, and their salaries. That was all the information he needed to make sensible educational policies (Sproull & Kiesler, 1991, p. 125).*

Sproull & Kiesler (1991) were writing about Harvard University in the 1930s, describing the information necessary to run a world class institution.[1] Today, the data entered in that little black book has morphed into complex campus information management systems that require focused business expertise as well as sensitivity to constituent demands. These information systems (IS), defined here as those platforms that integrate and support core business processes, are computerized applications and databases that organize, collect, store, process and manage the flow of information in order to support operations and decision making (Hossain, Patrick & Rashid, 2002). They facilitate administration operations, assure compliance to regulatory demands, and serve students and faculty in and outside of the classroom, changing the behavior of all stakeholders in the process. In the past 30 years information systems have become central to the functioning of the university and have performed vital functions for schools. "Advances in technology have dramatically enhanced the level of productivity and efficiency of universities and colleges, forever altering the way universities operate" (Guan, Nunez & Welsh, 2005, p. 134).

Higher education information systems expedite decision making, support resource management and strategic planning, recruit and retain students in a new and competitive

[1] Abbot Lawrence Lowell was president of Harvard from 1909-1933 and James Bryant Conant served from 1933-1953.

landscape and provide the information required by external oversight agencies (Guan et al., 2005). The marketplace that has demanded ease of use and constant access to information has forced IS technology to evolve, changing institutions and the experiences of faculty and student stakeholders (Pantazis, 2013). The recognition of the importance of student needs by academia has demanded procedures that sustain a student body "used to around-the-clock access to services and students who are remarkably awake and electronically active throughout the night" (Moneta, 2005, p. 5). Information systems that allow "one-stop academic support areas" and self-service registration, financial aid and cashless systems for students and faculty are driving the higher education marketplace, and must be seamless, convenient to use and focus on academic support (Burnett, 2002).

The emergence of these technological advances has transformed the culture of the college campus. Student and faculty dependence on information systems and technology has propelled structural changes to university operations and policies (Pantazis, 2013). Due to changes in faculty and student use of technology, schools have had to update their operations, create policy statements on IS use and install "IT leadership positions characterized as CIOs[2]" to lead the IT governance and decision-making structures that institutions have found necessary to formalize IT planning (Green, 2001 as cited in Penrod, 2003; Penrod, 2003, p. 19-21).

Some institutional changes to academic policies have been mandated in response to unforeseen events. Underhanded computer conduct propelled institutions to create

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[2] Chief Information Officers are routinely referred to as CIOs throughout this paper.

acceptable use policies in the late 1980s and early 1990s to set basic ground rules for the use of campus computers and network systems.[3] Policy was influenced by university experience with certain behaviors that "users of college and university networks [engaged in while exploring] the legal and logical boundaries of computer and network systems" (Mitrano, 2003). Not many would have warned of the mayhem produced by unforeseen crises, such as the first computer worm released in 1988 by a Cornell University student. Acceptable use policies were essential to inform policy and establish rules to educate campus users[4] (Mitrano, 2003). These policies support not only the instructional and research operations of a university, but also administrative and information system operations.

From the early 1980s to the present time, information systems matured and had widespread impact on universities, altering management policies for students, faculty and administrators. As personal computing became mainstream, universities recognized the importance of sharing new data technology and planned long-term projects to bring the vital innovation to their campuses. The declining costs of computing power coupled with the growth of the Internet provided easy access to information and to people across vast geographical distances for all users.

The dissertation offers a history of the significant impact of information systems

[3] Acceptable-use policies typically address "security ("no sharing of passwords"), privacy ("the university does not monitor electronic communications as a routine practice"), data retention ("the central computing organization shall retain logs for six months"), and responsible use ("no violations of law or policy")." (Mitrano, 2003, p.83).
[4] These IT measures are outlined in student handbooks and exist today as separate policies in the areas of mass messaging, privacy, data access and use and security. Mass messaging typically refers to spam; privacy policies are complicated as institutions must abide by U.S. laws; security policies deal with electronic worms or viruses and other potential security breaches; data policies often deal with student records.

on the routines of faculty and students beyond the classroom, and on institutional resources and policies. In this first chapter, the scope of this research is described, the research questions that guided the study are identified, and the methodology used to answer these questions is presented. Chapter 2 is an overview of information systems, their emergence, significance, challenges and value, and provides context for the overall changes introduced to higher education communities by these technological advances.

In Chapters 3 and 4, one specific institution, Pennsylvania State University (PSU), is examined. The case study details PSU's development of an information system over 30 years. It describes the process by which PSU executed IS implementation during the period from 1980 to the present time, and the ways in which this major technological change altered the behavior of administrators, faculty and students. The principal motive of this investigation is to gain an understanding of the origins and development of IS at PSU, and to study the influence of the key players and their decisions to build a home-grown IS. An extensive set of interviews and data from the archives at PSU inform this case, assuring that the history fully presents the university's introduction and integration of its information systems and the experiences of stakeholders with these IS changes. Chapters 5 and 6 discuss the important features of the PSU story and reflect on the insights and lessons that can be derived from it.

Scope of Project

All higher education institutions are consumers of information systems. Yet, in many instances, administrators, faculty and students do not comprehend how information systems serve their communities, how they are maintained, how dependent users are on the systems or how to procure, build, and maintain the best product for institutional stakeholders. Increasing awareness about information systems will benefit both administrators and IS providers alike, offering them increased knowledge of information systems and their importance to higher education institutions. This is increasingly important since recent articles in higher education industry newspapers and journals confirm that most institutions are grappling with the necessary strategic framework and decision making when acquiring or maintaining information systems. Increasing costs have made review of these services mandatory for all higher education institutions; institutions cannot operate without their administrative and technology systems, and many current systems and technologies are threatened with obsolescence as they face upcoming limits in decades-old administrative technology (Allison et al., 2013). New technologies and user demands require administrative action to improve outcomes as multi-million dollar systems are replaced in an age of budget challenges and directives to lower costs (Allison et al., 2013). The implementation process of IS has proven to be time-consuming, expensive and difficult to manage.

Institutions can no longer repeat the massive outlays of the 1970s and 1980s, decades described by Masland (1984) as an uncontrolled period of computer software use and hardware purchasing. In the early 1990s at California State University, Executive Vice Chancellor Richard West noted the fiscal challenges of a university wide information systems implementation. “We realized that if we were to upgrade our IT services and infrastructure on 23 separate campuses, we would go broke” (Hasset, Cunningham, Kancheva, Newsome, Wells, 2002). A further strain on IT budgets comes from present day students who expect ever increasing services through the web and other technologies (Teaching and Learning in Undergraduate Education at Penn State, 2004).

Although the impact of information systems on student, faculty and policies has been examined in previous research, there has been little written about the transformative effects of information systems at an institution, the demands on key stakeholders and the dynamics of change. The paper addresses this gap. By examining and analyzing the history of a full cycle information system (implementation, use, academic administration, governance) at one institution, a fuller understanding of the implementation of information systems in higher education develops. The Penn State case study examines how this university approached decisions about selecting or building software; how it handled the implementation, operation and user participation of this software; and how it addressed the impact of the new IS on participants, stakeholders, administrators and school culture. This examination of the PSU system reveals certain basic core truths about information systems in higher education: students, faculty and administration all have to be involved (campus and community wide); the good of the student is paramount; and university departments must work together on implementation and governance.

Penn State University

Cases about institution information system implementations are few, usually sparse in detail, and often offer only the perspective of one singular stakeholder, e.g. a vice-provost or a software IS provider. After extensive purposive sampling to identify an institution with sufficient research and institutional documentation to allow the development of a rich story of the introduction and evolution of a student information system (SIS), I chose Penn State University as the site for a detailed descriptive case. PSU's implementation is a good case study for several reasons. First, the university's student IS, eLion[5], a dynamic student repository and advising portal, has been recognized by technology industry leaders and educational groups. Second, PSU's IS resulted in major changes in the ways faculty and students conduct business at the university. Third, the story of this full cycle implementation evolves from many perspectives because of the considerable archival material available and the ability to interview many of the important people connected with the project. Finally, PSU is a good example of an institution that is part of the national norm. A large public university, it is not on either end of the technology extreme, neither novice nor expert, and the implementation was not an easy one, with negative and positive experiences for all stakeholders alike. Strategic portions of the PSU experience can serve as a guidepost to any school that wishes to improve its relationship with students, helping them succeed to graduation and beyond.

The implementation of eLion at PSU resulted in new organizational structures and changes to the PSU institutional culture. Originally proposed as a directive to provide students with access to their administrative data, the institution's implementation forced administrators to change their perceptions of decision making and the traditional structures they had depended on for student data. Instead, they learned to employ new tactics to install the technology necessary to support their students, faculty, administrators, and user community (Belinc, 2003; Wager, 2005). As a result, Penn State

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[5] According to Penn State University's President Graham Spanier in 2003, PSU's nickname is the "Nittany Lions so that's where the Lion comes from" in eLion (Transforming the Academic Enterprise: A Conversation with Graham Spanier, 2003).

has a self-described "long-standing vision that administrative information systems are developed collaboratively to best serve the needs of Penn State's stakeholder communities, including students, faculty and staff at colleges, central offices and administrative offices across all campuses" (Forstmeier, K., Hertzog, E., Plavko, K., Quinn, B., Rash, R., Schultz, K., & Seybold, C., 2007). The focus on student-centric services, however, transformed school culture and ensured the success of the project.

Research Questions

The case study examines how information systems have shaped Penn State University. The following research questions and subquestions guide the study:

1. What major technology developments transpired in PSU's information systems from 1980 to the present day, and what was the process by which they came about?

2. What significant changes to PSU student and faculty behaviors and culture occurred as a result?

   Subquestion 2.1. What can we learn and what do we need to know about the ways student and faculty use IS in order to provide effective IS services?

   Subquestion 2.2. Is this knowledge applicable to students and faculty nation-wide and in all types of institutions?

3. What insights does the PSU case study provide to academic administrators responsible for IT changes?

   Subquestion 3.1 Does the case suggest that certain conditions are important for successful IT change?

Subquestion 3.2 Does the case suggest a certain type of leadership or governance is necessary to complete an IS implementation and sell it to the community?

Methodology

To provide a national historical context for this study, I reviewed and mapped the broad changes that took place in information systems since their emergence in the 1980s. Although the introduction of this technology brought about a broad history of change, specific colleges and universities had different experiences. To understand Penn State's particular history with information systems and the process of its IS development and implementation, I conducted a directed web search of PSU's eLion System. A plethora of information about PSU's journey into IS, ending with its final IS product, eLion, came to light. The specific research appeared in extensive materials from in-house technical documents, strategic IT reports, institutional self studies, online power points on eLion and technology at PSU, technology magazines, external newsletters written by PSU employees to other institutions about their experiences, internal PSU newsletters (including the Penn State Intercom and PSU's own web site pages dedicated to information systems), and the three administrative areas that collaborated on PSU's IS: Enrollment Management and Administration, IT services, and Undergraduate Education. Also reviewed were online Cornell archives on Project Mandarin, whose technology PSU used to build its information system, eLion, showcasing common institutional challenges.

For the second research question about stakeholder experiences with information systems at Penn State, a search of the literature for information specific to students and faculty indicated what IS issues concerned stakeholders during this time and whether any particular event forced a policy change. Student blogs and newspapers reported students' experiences during and after the development of the new IS. Additional details came from PSU IS FAQs for students and faculty alike, student pamphlets and PSU faculty senate minutes. The transparency and traceability of the literature has been of significant help; and came about because of the enormous growth and use of institution websites, emergence of Web 1.0 and 2.0 technologies (including Facebook, Twitter, blogs) and the increased need for IS to handle university housekeeping of its collective knowledge base online.[6] These technology innovations have been adopted by all schools, big and small, public and private, just as they have been accepted in business and government.

Interviews and sample. In addition to a continuing search of these avenues to answer the third research question, as to insights gained by administrators, I studied interviews of key participants, including current and recently retired employees that were available in publicly published sources. For example, former PSU president Graham Spanier discussed information systems and their importance to PSU in a lengthy interview with Campus Technology in 2003 (Transforming the Academic Enterprise: A Conversation with Graham Spanier, Campus Technology, 2003).

Since various players who have differed in their recounting of PSU's information system development, purpose and deployment, I conducted in-depth interviews with eleven key informants to amplify the written record and help clarify questions. Prior to

[6] Technology literature is based on computational, definable and reproducible data, and is therefore transparent. I can also find a pattern of related literature and forward trace the development of different technologies. Emails, for example, always leave a trail of origin and are immutable. The history of registration can be traced from arena registration, to automated telephony to web registration.

these interviews, I created a case study based on secondary sources. When I arrived in Pennsylvania, I used the primary sources to fill in the confirmation gaps.

Using an approach email letter explaining the purpose of the research, I invited two students, one faculty member, one faculty member who also had been an administrator, and four administrators from PSU and two employees from Electronic Data Systems (EDS)[7] to participate in this study (Appendix D). Interviews took place with two faculty members from two different departments who had experience with the information system. PSU students involved with IS during this period were located by contacting former student leaders, reviewing campus website rosters and the minutes of IS committees and technology groups. Additional stakeholders were identified through interviews with employees. Also, intermediaries made formal introductions to prospective participants so as to improve the success rate in recruiting. Taking part in this research benefited participants by providing them with the opportunity to share experiences, extend practical advice and detail success stories with information systems in higher education. This study can also document their role in Pennsylvania State's history.

Data collection. One plan for the interviews identified questions based on gaps found in the written record while constructing this case study on PSU. Lines of inquiry included: PSU's efforts concerning data systems and the contributions of particular data systems to the work; what worked, what didn't work; and how teams operated over this long extended period of time. One to two-hour semi-structured interviews were

[7] EDS was a company employed by PSU in the 1980s to help build its student information system.

conducted with each participant in person or via telephone (depending on location). Interviews were not recorded and note taking was conducted on a laptop during the meetings. Prior to the interviews all participants were asked to sign a consent form to accept being interviewed and identified in the case study (Appendix E). Pseudonyms were used for the names of participants who did not wish to be identified. This minimized any risk these participants might encounter should their experiences be shared publicly. An interview script with a detailed sequence of questions acted as a guide to produce knowledge thematically in the areas to be explored (Appendix F).[8] Interview questions were kept brief and simple, introductory questions, follow-up questions, probing questions and direct questions, in order to get the fullest answers to inquiries being made (Kvale, 2009). The electronic notes from interviews were, and are, kept securely in a password-protected directory. Data were categorized to common experiences that the participants encountered, and any themes that emerged provided insight and assisted with further analysis of stakeholder experiences with the IS.

I found that my having an accessible knowledge of PSU systems, their acronyms, the players involved and the technology used was important to a successful interview. I always stated my background in computer information systems and employment history prior to the start of any interview. I also studied all the PSU systems available so when acronyms like AIS, CAAS, CAAIS, and names like Augustson, Blythe, Melander and Dunham were mentioned in conversation, I was able to ascertain quickly what my

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[8] A template for these interviews is provided in Appendix F. This interview protocol was customized further for each individual as I honed in on the areas of expertise and personal perspective that each person could provide.

interviewee was relating.[9]

When the interviews were complete, I read each set of notes at least three times in order to promote my familiarity with the content and to form a general impression of the data (Rubin, 2005). The use of thematic analysis enabled movement through three phases of inquiry: "recognizing an important moment, encoding (seeing it as something)" and interpreting (Boyatsis, 1998). Studying the transcript data helped me to recognize and identify codable common and distinct moments of the interviews. Throughout the process of interviewing, taking notes, and reading the interviews, the process of memoing was used (Rubin, 2005). My feelings about the interviews, a summary of what had transpired, and a record of the ideas and main concepts that arose from the interviews became part of the memoing (Luttrell, 2009, Rubin 2005). This process not only helped with understanding personal subjectivity but also made biases and "reactions transparent to others" (Rubin, 2005). In addition, memoing helped explore codable moments. Notable quotes were documented, translated into codes and themes, and ways were constructed to combine the separate codes, and then explored if they made sense (Rubin, 2005). The coding assisted with the study and analysis of PSU's information system.

Archival research methods. In March 2016, I visited the Eberly Family Special Collection Library at Penn State University, and spoke with students and employees. Prior to my visit, I was in contact with a Penn State archivist, and received the proper permissions to register to use the Eberly Family Special Collections Library. My online

[9] Appendix G contains an index of abbreviations for acronyms used, and Appendix H contains a list of key players referred to in the dissertation.

PSU library account provided access to the school's online catalog. Two months before my visit I had placed requests for materials to view in PSU's reading room as I had been warned that complex requests could take longer to complete. I was also informed that official university records are not available for 20 years after the date of creation. Since my requests fell within the restricted date range, I was unable to access 20 years of records from 1996 forward. I used my visit to tour the school, speak with students and employees and review the 36 boxes of records pulled for me from the archives. In some cases the contents of boxes had been combined. They were edited by the archivist to ensure I did not receive any data from the last twenty years, so most of my archive records ended in 1996. In some instances, I was able to locate data from 1996 onwards that had been accidentally left in boxes. Additionally some information was found online through PSU's website, including past student newspapers and yearbooks. I reviewed hard data from PSU about eLion, the Comprehensive Academic Advising System (CAAS), Administrative information systems, advising, the housing crisis, IT reports, reports developed by task forces mandated by PSU senior leadership, and unpublished internal communications such as typed memorandums or printed out emails. I also read meeting notes from the different subgroups and their newsletters. It is important to note that meeting notes from the different teams were located in different folders, were not in any order, nor was I allowed to organize the material, or mix up the individual folders from different people and departments.

As I read through the meeting notes, I realized that the minutes of meetings did not always reflect what happened. Meeting notes taken by one scriber in 1996 stated, "The recording of minutes stopped at 9:30 because this was only the beginning of a long CAAIS day. Warning these minutes only reflect what I think took place; others may have perceived it completely different" (CAAIS Meeting Notes, July 17, 1996). There were also some light hearted moments in the minutes, "We consumed 24 donuts" (CAAIS Meeting Notes, July 24, 1995).

While reading the memorandums and meeting notes, I kept track of the individuals who took on leadership roles, authored memos on SIS, or were members of committees. I looked these people up online to gauge their job history and titles at PSU and match them up with a timeline to determine their position. Most memos only listed people's first initials and then their last name. Printed out emails only had initials followed by numbers, so a little detective work was necessary. I lined up names from memos and initials from email addresses, and I emailed individuals for interviews using the messaging service on Facebook or LinkedIn. I reviewed college newspaper articles (some were precut and stored in the archival boxes), and used LinkedIn to match people's names and employment backgrounds, and contacted them, or people who knew them, using the message program. This technique helped me get in touch with EDS employees, PSU alumni who had been involved with the Integrated Student Information Systems (ISIS) in the 1980s, and former PSU employees that had moved to other schools within the Penn State University campuses. I also used Google.com, a search engine, to look for senior PSU administrators, some of whom still served on boards, in some cases, albeit in emeritus status. Reaching out to these senior personnel whose information was available online, I asked if they were willing to get in touch with certain individuals on my behalf.

Speaking with PSU employees or senior leadership did not produce many introductions. Also many former and current employees wanted to stay anonymous. Interviewee No. 1 said that even though the PSU experience with the IS implementation was positive overall, he had some criticisms and did not want his name used for fear of appearing as "traitorous" (Interviewee No. 1, personal communication, March 2016). Although Interviewee No. 1 had stayed in touch with other members of the senior leadership team, he was wary of introducing me to a few of the people I hoped to interview. Since one key actor in the case, Gary C. Schultz did not respond to interview requests, I used interviews culled from school newspapers and internal memos. Gary C. Schultz was a great resource in his recorded interviews, well versed in the history of computing at Penn State, having been a student and an employee for over 40 years. Schultz's name was brought up by countless interviewees as being the one to "get" if he was willing to speak to me after his legal troubles.[10] I was able to connect with former president Graham Spanier, J. Gary Augustson, PSU's CIO, and others at the University.

Interviewees seemed proud that I was familiar with technology and that I was researching their system. After confirming that I understood some technical terms he had recited, one participant said, "Good, if you understand that, I am not going to need to waste my time explaining things." (Interviewee No. 4, personal communication, July 2016).

The interview process led to one unexpected finding in particular. My initial

[10] Gary C. Schultz "grew up in Pennsylvania, graduated from Penn State, and then spent nearly 40 years working his way up to the top of the administration." He retired in 2009 as the Vice President for Finance and Business at Penn State, and came out of retirement, but was returned to retirement upon being charged in the Penn State child sex abuse scandal. At the time I was doing the research for this dissertation, the legal case was pending in the courts.

research had not named Electronic Data Systems[11] (EDS) as a major actor in the early 1980s at PSU. However, the primary sources in the interviews, meeting minutes and unpublished internal documents reported that EDS was more than a footnote to PSU's history. The involvement of EDS as captured in the archives and in interviews was instrumental in helping the PSU project become operational. Perhaps the system was not fully functional per the school's specifications and wants, but the effort from EDS laid the foundation for PSU's first integrated information system. The interviews were collected from 2014-2016, some 37 years after EDS's involvement and this length of time gap often amplifies retrospective bias.

I drew upon interviews and primary sources to help craft the narrative of PSU's information system implementation and strategy, and to analyze changes to student and faculty behavior, and to administration policies and procedures in implementing the system. I also used interviews to determine the social and organizational factors that may have influenced the information system work.

Internal documents clearly cataloged the problems with the original legacy system, the selection of EDS, the past EDS era, and PSU's IS evolution from ISIS to SIS to CAAS to CAAIS to eLion. Surprisingly, even after three decades, one respondent did remember EDS and the individuals who aided PSU in the development and testing of the student information system.

In the case of EDS, I was able to link retrospective interview data with internal

[11] Electronic Data Systems (EDS) was a technology consulting firm initially hired by Penn State to implement its information systems.

documents. I found that interviews enriched primary and secondary source documents by offering to help inform and shape the narrative of PSU's SIS implementation.

I reviewed over 4,000 pages of text selectively photographing and using 2,500 pages of documents. Records took a variety of forms: committee meeting minutes from various groups, internal memos among PSU staff, correspondence between PSU and consulting firms, strategic plans, and internal assessments. Interview data supplemented information from internal documents and helped frame the narrative of SIS implementation at PSU.

It was not possible to discover information for every week, month, meeting or activity. Gaps existed, in particular for the periods of November 1985 – November 1986 and December 1988 – September 1989. Specific events may have contributed to the lack of a paper trail from November 1985 to November 1986. EDS had left the project. The Office of Computer and Information Systems (C&IS) and Management Services (MS) were developing a strategic plan for the databases that the entire community could access. In the time period of December 1988 – September 1989 staff shortages abounded and a growing backlog of items needed action. This is all speculation, however. The answer could be as simple as – the records were lost, or misfiled, or destroyed.

Chapter II. Information Systems

Today, complex campus information management systems facilitate administration operations and serve students and faculty outside of the classroom through self-service registration, financial aid and cashless systems (Sproull & Kiesler, 1991). Morphing from that college president's little black book, information systems that allow "one-stop academic support areas" for students and faculty are driving the higher education marketplace (Burnett, 2002). By enhancing the level of productivity and efficiency, advances in technology have changed the operations of universities forever (Guan, Nunez & Walsh, 2005 p. 134). A visit to the past will provide insights to the "then" and "now."

History of Information Systems in Higher Education

A behemoth mainframe served the administrative or research needs of an institution during the first era of computing in higher education from the 1950s to the 1960s. Maintaining data in punch card format had limited storage and processing capabilities. Mainframes, the lone computer technology at the time, could only be operated by a small group of highly specialized technical personnel (Ryland, 1989, p. 21). Few universities were able to afford a mainframe computer because of the high hardware costs, labor costs, programming costs and the need for a large physical space to house the technology. Universities used mainframes primarily to perform basic business functions including payroll and accounts payable, and rarely for student services or related activities such as registration (Ryland, 1989, p. 21). A few schools, however, computerized student services. For example, the University of Cincinnati used the school's mainframe to process and maintain student admissions and registration records, as well as produce course rosters (Records Management History at the University of Cincinnati, n.d.). Cornell University's mainframe was able to process and report mid-term and final grades and produce transcript reports, a function not achieved by the University of Cincinnati until 1962 (Bordonaro, 1968).

During the second era of technology from the 1960s to the 1970s, the storage capability of mainframe technology improved with the introduction of magnetic disk storage systems that served as repositories of collected data (Ryland, 1989, p. 21). Many universities in the 1960s took advantage of this new technology and decreasing hardware costs to invest in administrative information systems in order to manage the enormous amount of data generated and collected in research and administrative records (Green, 2007, Godwin, 1963). Colleges and universities began using information systems (IS) to automate registrar and financial aid functions. Early information systems stored data from punch cards to process student financial aid requests and student registration, including student matriculation listings, course and class rosters, grades and exam scheduling (Bordonaro, 1968).

Institutions turned to IS out of necessity to anticipate enrollment problems caused by the increasing numbers of students[12] and to facilitate operations as they related to student schedules and study cards. Higher education institutions that were unable to forecast student enrollment, predict student registration or determine classroom

[12] In the 1960s, enrollment rose by 120 percent due to the growing size of the American middle class, the increasing numbers of college age students, the Civil Rights Act of 1964 and the Higher Education Act of of 1965 (National Center for Education Statistics, 1993, Gumport et al., 1997, Kinzie et al., 2004).

scheduling, barely escaped several student riots (Hotzmann cited in Rath, 1966). In 1968 at Penn State students protested housing shortages due to over enrollment of more than a thousand students (Bezilla, 1985).[13]

When the Family Education Rights and Privacy Act (FERPA) of 1974 required that institutions establish strict policies and procedures to protect data as it related to individual student records, academic institutions developed or purchased separate administrative information systems "to collect and protect key institutional data related to institutional finances, student records, human resources, and development of initiatives" (Green, 2007, p. 148; Alvarez, 2002). From the 1970s to the 1990s higher education management information systems were structured as separate silos, including admissions, registration, financial aid, bursar, academic support services and student support services. The Paperwork Reduction Act of 1980 (Public Law 96-511, 96th Congress) set standards for records retention and disposal (Miller, 1991; Paperwork Reduction Act Website, n.d.).[14] Institutions increased their allocation of financial resources to information technology because of the increasing costs associated with the specialized labor required to operate, develop, implement and support central university information systems and computing hardware (Ryland, 1989 p. 21).

The third period of technology in higher education from the late 1970s to the

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[13] At Penn State, "as the fall term of 1968 got under way, more than eight hundred students were squeezed-almost literally-into recreation rooms, study lounges, and other temporary quarters in dormitories already filled to capacity. As many as four hundred were reported to be searching for places to live in town when classes began" (Bezilla, 1985).
[14] Although the purpose of the act was "to ensure that federal agencies do not overburden the public with federally sponsored data collections," standards were "set for records retention and disposal" including government information policies on "disclosure of information, confidentiality, and security of information" that acted as a guide for the private sector and the schools (Paperwork Reduction Act Website, n.d., p 1, Trauth, 1989).

present day was defined by the personal computer revolution and the introduction of stand-alone smaller computers and networks that provided the foundations for today's Internet and decentralized the location of technology hardware and the task of managing personnel (Ryland, 1989). Stand-alone workstations surpassed high-speed mainframe capacities with user-friendly interfaces and applications such as word processing and spreadsheet software. Personal data productivity was now possible and computers appeared on desks at every level of an academic institution (Hawkins, 1989). With the prominence of the Internet in the 1990s, computers included Internet and web capabilities as standard features, and institutions began exploring the delivery of student services online, including student registration and financial aid (Allan, 2001).

Decreasing costs and continuing advancements in personal computers and networks altered the human machine relationship, vastly increasing access to computers and information only previously available to specialized technicians and authorized users of mainframe technology. A standard web browser and an Internet or network connection were all that was needed on a workstation in order to access an information system from anywhere (Rashid, Hossain & Patrick, 2002). Individuals with the appropriate permissions (Hawkins, 1989) had access to university owned systems that serviced the entire community, including admissions, financial planning (payroll), management and institutional research, general administrative services, financial aid, physical plant operations, library services, student records, food service management and medical record keeping (Chachra, 1984; Gillespie & DiCaro, 1981).

Furthermore, these newly available systems supported institutional decision-making in relation to resource management and strategic planning, promoted internal efficiencies, developed steps for student retention and recruitment and provided information to external oversight agencies such as the federal government, state government and accrediting agencies (Guan, Nunez, Welsh, 2005, p. 133-135). However, despite these advantages, universities that had invested significant funds in older mainframe technology could not immediately replace their outdated systems, called legacy systems, due to the costs. The legacy systems, particularly in comparison to modern PC-based systems, were inherently inflexible, difficult to operate and costly to maintain or adapt (Oliver & Romm, 2002). At the University of New Orleans in 1999, existing mainframe systems were viewed unfavorably as they did not take advantage of point-and-click and drop-and-drag state of the art technology (University of New Orleans, 1999 as cited in Oliver & Romm, 2002). Information held in older loosely coordinated legacy systems of student, alumni, financial and human resource management systems could not easily aggregate data to inform analytical decisions concerning institutional core processes, future planning, day-to-day management and retrospective analysis of institutional performance, academic productivity and student outcomes (Rockart, 1988; Green, 2006).

With the availability of new technologies, academic institutions implemented integrated, consistent online services to respond to growing enrollments on campus and online, the need for increased accountability, higher student expectations and the competition among institutions for students (Shea & Armitage, 2003). Under pressure to contain and reduce costs in an era of tight finances, including declining state funding support, schools used information systems for cost savings, streamlined processes and procedures (Oliver & Romm, 2002, p. 49). Academic institutions that could not add more physical space for student services offices started using online systems in the 1990s to establish a virtual presence augmenting traditional services (Shea & Armitage, 2003).

This virtual presence allowed academic institutions to employ web enabled IS to connect the data from various institution processes and mold that data to create an online model for users where "physical boundaries did not apply" (Burnett, 2002). These systems replaced existing information systems and integrated various institution processes, removing the silo approach to information where every department owned and maintained its own databases (King, 1989). In addition to administrative processes, universities implemented IS so that students could access a variety of campus functions using an online student self-service center. In order to register in past years, for example, students had to visit advisors, the registrar's office, the bursar's office, and the financial aid office. The coupling of academics and students affairs online provided a one-stop shopping arena where students could access services conveniently and the staff needed to perform those services could be reduced (Dungy, 2003; Oliver & Romm, 2002). The Southern Regional Education Board reported that institutions with the flexibility to meet changing student needs were more likely to experience enrollment increases and student satisfaction (Student Services Subcommittee, 2002).

Student Information Systems

New institutional IS initiatives to support students, often the largest group of users of services, challenge traditional university processes and assumptions. Historically, full service student support came from facilities and personnel within the campus environment, such as a central library and offices for admissions, registration and career counseling that were available only during normal hours of operation (Student Services Subcommittee, 2002). By contrast, student information systems today typically offer around the clock access. Administrators and faculty can obtain student data management and students can obtain services and information online, including access to registration (which includes academic and career counseling), financial aid, and campus card systems.

Student registration. Student registration is one example of a technology initiative that challenged established university processes and impacted the way students enroll in classes. In the first generation of technology in higher education, few institutions used mainframes to process registration records. "The model for registering students was to conduct an 'arena registration' where students reported to a registration site, oftentimes the school gymnasium, and were matched with courses" (Wager, 2005).

During the second era of technology from the 1960s to the 1970s arena registration was still the norm; however, all the seats within courses at a college or university were assigned punch cards. Students would queue in line for each course of interest and received a punch card for a seat in class. Students would not know if a class was full until it was announced, and if all the seats were taken, had to leave and join a line for a different class. Upon accumulating all of their course load punch cards, students would submit their bundle of cards to administration for processing by a mainframe, operated by a specialized technician that generated official course schedules.

Students also had to punch cards for alternate courses in the case of over enrollment or registration errors. For some, registration could take up to a full week (Bordonaro, 1968; Green, 2007; Wisconsin Higher Educational Aids Board, 2005).

The advent of the personal computer in the 1970s did not update the registration model at many institutions, as schools could not afford to replace punch card systems with microcomputers. Some institutions with microcomputers replaced punch card lines with a registration specialist who entered student course selections at a terminal using a keyboard that sent the registration information straight to a central university computer (Virtual Museum University of Michigan Histories of Information Technology, 2008). Students were not allowed to use the terminals. Since course selection was not in real-time, students still needed ways to choose alternate courses (Allan, 2001).

Voice response touch-tone telephone technology in the mid-1980s replaced the arena-registration approach.[15] Students used telephones to register their courses directly into an institution's computer but were still required to get signatures on registration forms to ensure that they were properly advised and guided. "This technique [allowed] students to register for courses without waiting in long queues" (Fahmy, 2007, p. 353) and gave registrants more control by supplying current information about course availability and prerequisites.

From the 1990s to the present day, web-based registration services moved online at many academic institutions. Students can register for the semester or add and drop

[15] Voice response touch-tone telephone technology "is a computer system that responds to voice commands, rather than input from a keystroke or a mouse." (Wisegeek Website, n.d.)

classes at their convenience from any computer with Internet access. Online registration has a number of advantages in that it is a fully automated process that puts students in control, does not require specialized operators and provides administrators and faculty with up-to-the minute data. (Hawkins, 1989; Hossain et al., 2002).

Another advantage of online registration is cost. In order to integrate and improve the delivery of student services where online registration is not yet available, universities have had to apply an expensive brick-and-mortar approach, physically establishing a student service center complete with offices and staff, and a student services desk manned by trained personnel (Wager, 2005). The introduction of a virtual student service center by Penn State University automated student registration and virtually integrated campus offices without physical cost. A one-stop online model also can improve the process when "registering for courses extends over many campus offices—academic advising, student aid, registration, student accounts, and often ancillary units that handle items such as student ID cards or health services" (Wager, 2005).

Career and course advising. Students need information that can help them determine their chances of completing a course or training program. A high failure and dropout rate can be forecast for academic programs when students are not prepared. At many institutions student registration information systems include a career and course advising component and require students to work with advisors to select an appropriate academic course of study to complete concentration, degree and career path requirements. These systems go beyond a static webpage by requiring student participation. Other institutions are eliminating some student to advisor contact, moving these functions to computers. Career and course guidance by computer was first documented on college campuses in 1978. The Educational Testing Service (ETS) with help from the Carnegie Corporation and the National Science Foundation developed the electronic career guidance tool, popularly known as Siggy, System of Interactive Guidance and Information (SIGI). Rolled out at 26 universities and four-year colleges as well as two-year junior colleges and community colleges in the Fall of 1978, Siggy was described as "[forcing] students to think, to explore themselves, and to reach rational conclusions about their futures" (Rapport, 1979). SIGI is still in use today over the Internet at some colleges and universities.

Over time advances in technology have changed how students access advising. Shea (2005) models these developments:

> Generation Zero: Student is unable to locate the information necessary to make an appointment with the adviser.
> Generation One: Student schedules an appointment after locating the telephone and office number of the advisor online.
> Generation Two: Student schedules an appointment after locating the adviser's email online and is able to click the email link to generate a mail message.
> Generation Three: Student schedules an appointment on the adviser's online calendar.
> Generation Four: Student schedules an appointment after comparing his online schedule to his adviser's calendar for mutually convenient times; and sets a reminder to be sent in advance of the appointment.

Generation Four is becoming the norm for academic institutions that "serve a student body that is used to around-the-clock access to services and students who are remarkably awake and electronically active throughout the night" (Moneta, 2005).

Penn State University's online service, eLion, is an example of an academic institution delivering Generation Four "integrated student services designed from the student's point of view" (Shea & Armitage, 2003). Students using the eLion system can "assess the impact of dropping a course on their grade point average," review their financial aid package and their progress towards degree completion, and receive tutoring information as an alternative to withdrawal. "Blended together are academic advising, registration, tutoring and financial aid information to provide the student with the full context in which to make a better decision" (Shea & Armitage, 2003).

At Arizona State University, eAdvising, the academic counseling portion of the student information system, provides another example of how registration and advising can go hand in hand. Students receive a structured approach and framework to complete their major concentration courses. If students do poorly in required classes or fail to sign up, they may be required to change concentrations. The eAdvising information system front-loads key courses to ensure that retention rates are higher and that students are in the right major. Austin Peay State in Tennessee goes one step further in its student registration and advising system. After logon a complex algorithm provides students with class recommendations for courses where the students "are predicted to make better grades" (Parry, 2012).

Students and registration systems. Although student registration systems "vary in complexity and sophistication," the automation of many student processes can allow students to approach their degree, academic plans, and "career interests and career decision making in a systematic way" (Helfgot, 1995). Student registration systems empower students to take more responsibility for their own advising by providing information that allows for active participation in their relationship with their advisor and university services. Sophisticated academic information systems have increased student expectations of extensive service availability and systems that support their student activities. Depersonalized systems, however, can add confusion, difficulty and time to mandatory procedures such as registration and may result in student complaints about or rebellion against system use. As a Harvard University student explained, the "value added [by a student registration] system really depends on how user friendly the system is. If you are going to substitute a really clunky system for the paper system, it's not going to be a step forward" (Mirval & Robbins, 2012).

Despite its numerous advantages Yale's 2001 online course registration system is an example of a system that disappointed students and faculty. It was supposed to integrate technology into campus life by allowing students "to search for courses, create tentative schedules and view them on a calendar and see the dates of final exams for the prospective system" and check the status of their program distribution requirements (Petrin, 2002; O'Connor, 2001). General access issues, heavy website load times and the inability to log onto the system inspired so much ire that students dedicated over a dozen articles in the school newspaper to these topics. An op-ed in the *Yale Daily News* aimed at incoming freshmen warned specifically about trusting the registrar, the architect of the system (Hancock, 2001). Students also forged a letter of resignation from the registrar in protest of the problematic school registration information system (Hancock, 2001).

Faculty and student registration systems. The faculty at Yale University fared little better with the school's online registration system. Administrators had hoped that the new system would benefit the faculty with preliminary class lists available two days after the close of course registration versus the six+ weeks in the previous system (Stevens, 2001). The chair of the Political Science Department, however, stated that the new "system still [could not] solve his department's most pressing problem – finalizing class lists" (Lee, 2002). Since many students waited until the last minute to submit their schedules online, departments continued to have difficulty with tasks such as assigning teaching fellows or assistants (Lee, 2002).

When working successfully, student registration systems have changed how faculty members stay abreast of and seek information or campus resources related to student academic requirements, institutional policies and procedures, "monitor student registration activities and recommend solutions to academic difficulties," and "maintain accurate records of interactions with students" (NACADA, 2008). Student registration systems provide faculty with a central database to view student enrollment, grades, progress towards degree, contact information, contact details, advisor information, concentration specifics, as well as faculty class lists, advisee lists, and the functionality to submit grades online (NACADA, 2008, Pacific University Oregon Registrar, n.d.).

IS can aid educators in their role as advisors to students, as student registration systems can allow faculty to spend less time providing information and more time supporting student success (Helfgot, 1995). Generally, faculty academic advisors provide support to academic progress, serving as mentors, advising students about curriculum and degree requirements and offering career guidance or preparing undergraduates for graduate study (NACADA, 2008). According to the National Academic Advising Association (2008), academic advisors have no fewer than 23 duties and responsibilities including the signing of all registration cards, change of course requests and any other related academic forms (Howard University Academic Advising, 2012). Even at schools where student course approval does not take place online and the use of technology is labor intensive, overall registration information systems can check course prerequisites, enforce credit hour and course limitations through online prompts and messages and conduct degree audits (Helfgot, 1995). Automation of student registration processes can provide faculty with more time to "work with students who truly have need of their assistance before registering: new students who need orientation and educational planning, students in academic difficulty trying to develop a plan to get themselves back to good standing, students who are undecided, and students who are selecting a major for the first time or changing majors, to suggest but a few of these groups" (Helfgot, 1995, p. 51).

Student registration systems and the university. Modern efficient registration and advising systems simplify the registration model for students and the university alike and assist administrators in determining resource allocation as related to class scheduling or student advising or even teaching hours per department, faculty teaching loads, and trends in student majors (Shea, 2005; Caffrey et al., 1967, p. 45). Furthermore, student registration IS can prove beneficial to administrators despite changing school processes. At Yale University, prior to the implementation of its online registration system, registrar employees took seven weeks to complete student course registration, three of which were spent processing “thousands of lines of illegible handwriting after students scribbled five-digit course numbers” (Petrin, 2002). At Harvard, administrators plan to use the new student registration database to increase the availability of data for planning and analysis (Miraval & Robbins, 2012).

"Putting services online is still a work in progress for institutions" (Shea, 2005). Harvard Law School (HLS) is one example of a school whose online services have required revision. HLS's new student information system (SIS), rolled out in January 2012, replaced an SIS that did not allow concurrent use, forcing students to wait hours to register online as opposed to seconds, and administrators unable to obtain timely reports (Harvard Law School, 2012). The HLS SIS is now working on incorporating faculty administration functionalities and career advising.

MIT moved its student registration online on January 30, 2012 to great success. A letter to the faculty from MIT's deans for undergraduate and graduate education, and head of information services and technology captures the system's achievements.

> A little over a year ago, if you asked faculty, students and staff to describe their experiences with MIT's Student Information Systems, you would probably hear words like paper-based, outdated, time-consuming, and inflexible. Today, significant progress has been made to modernize these systems and enhance the user experience. If you asked faculty, students, and staff the same question now, you would hear something very different: digitized, online, paperless, robust, efficient, flexible, and streamlined (Hastings et al., 2012).

In 2012, MIT's online systems were a "work in progress" as the school's student services were not yet all online. The financial aid system in 2012 was using paper mail to notify students of financial aid decisions. MIT's present day system provides students with online access to information about their financial aid packages (Hastings et al., 2012; MIT Online Financial Aid System, 2017).

Financial Aid Information Systems

The student financial aid office is "responsible for the determination of financial need and the awarding of financial aid" and provides monetary assistance to students according to federal, state and institutional regulations (Finaid.org, n.d.; Financial Aid – Western Oregon University, n.d.). Historically, student registration and the financial aid office have worked hand in hand.[16] Until the mid to late 1960s, the admissions office was responsible for financial aid at many institutions as only a small number of financial aid offices were in existence prior to 1965 (Duffy & Goldberg, 1998, p. 174). A dean of admissions or dean of students and a secretary typically prepared financial aid packages.

During the first era of technology in higher education from the 1950s to the 1960s, few institutions documented their use of computing to support their student aid initiatives. A Cornell University oral history from that time shows that early mainframe systems were used to process aid requests, scholarship lists and produce government reports (Bordonaro, 1968). The increasing availability of federal financial support such as the GI Bill of 1944 and funding from the 1957 National Defense Act, and its subsequent enrollment boom, convinced some academic institutions to employ information systems to produce required monthly status reports on veteran student progress and to invoice the Veterans Administration for tuition costs (Hansen, 2005 as

[16] Student registration records are necessary to verify student and academic status for financial aid benefits. Students can only register for classes when their financial obligations have been met. The Office of the Registrar at universities often "is responsible for supplying information to the Clearinghouse for the Student Status Confirmation Reports to lenders and other post-secondary education institutions for verification of students' loan deferment status." (Finaid.org, n.d.; Financial Aid – Western Oregon University, n.d.).

cited by Niemi, 2005).[17] Furthermore, in the 1950s, there was no standard method of determining need, and "a student deemed needy at one school might not be considered needy by another school, even if the two institutions considered the same information, which often they did not" (Duffy & Goldberg, 1998, p. 170). Bidding wars for students were common, and scholarship funds were used to attract and enroll students. A mainframe could have easily assisted financial aid offices in calculating scholarships for applicants and recipients. However, mainframe-trained personnel produced the lists and government reports, and admissions or financial aid personnel did not have immediate access to the data.

Many academic institutions established financial aid offices with the passage of the 1965 Higher Education Act (Duffy & Goldberg, 1998).[18] This legislation facilitated "unprecedented growth in federal student financial aid," and the government in turn demanded accountability from institutions in the form of financial aid reports (Kinzie et al, 2004, p. 20). Financial aid information systems, in the second era of technology in higher education from the 1960s to 1970s, processed student financial aid requests, produced scholarship lists, provided statistical reports to administration and determined eligibility for federal and state aid (Bordonaro, 1968; Wisconsin Higher Educational Aids Board, 2005). Some institutions began using technology to automate "the formal needs analysis process to estimate a family's ability to pay for a college education" (Kinzie et al, 2004, p. 15). The financial aid office and its responsibilities became more complex

[17] The U.S. government was regularly sending in 1951 tuition checks to 46,000 institutions and monitoring 1.6 M veterans (Fine, 1951).
[18] The National Association of Student Financial Aid Officers was founded in 1966 to support the development of the financial aid office.

due to increased reporting requirements. In 1966 Harriet Sullivan, the first financial aid officer at Wellesley College, described her duties as working with students, faculty, scholarship donors, alumnae, town, state and federal governments and performing intricate needs analysis to determine aid for recipients (Duffy & Goldberg, 1998, p. 176-77). The responsibilities of the aid office were further complicated by the federal government's requirement that schools "painstakingly document" award allocations based on the expected number of incoming students requiring aid for the next academic year, so as to avoid inconsistent distribution of aid (Duffy & Goldberg, 1998, p. 176). This documentation was most likely difficult to retrieve on mainframe systems or terminal systems operated by specialized personnel during this time.

Developments in personal computing and networks during the third era of technology in higher education from the late 1970s to today, allow financial aid officers, on a self-service basis, to access student aid records so that they can produce analytical reports concerning financial aid. With immediate access to the data needed to make financial aid decisions and policy, financial aid personnel can better serve their academic institutions. Furthermore, steady increases in tuition, college and university enrollment, and funding from federal, state and private sources as well as increased federal regulation require aid offices and their administrators to use newer technology to manage increased workloads and processes (Chess Consulting Inc., n.d.). In the 1990s the proliferation of networks enabled aid administrators to transmit enrollment and financial eligibility information to the U.S. Department of Education electronically (Chess Consulting Inc., n.d.). The visibility, size and responsibilities of the financial aid office continue to increase (Duffy & Goldberg, 1998). Beginning in the late 1990s financial aid offices of two or three individuals went beyond allocating aid to developing institutional policies that met enrollment targets and served as financial counselors to students and their families (Duffy & Goldberg, 1998). The analytic and reporting tools of financial aid information systems help academic institutions meet their revenue goals and address the quality of classes using financial aid policy (Duffy & Goldberg, 1998).

The processing of online student applications in 2009 by the U.S. Department of Education's Office of Financial Aid (FSA) inspired academic institutions to follow suit and similarly process applications online as well as provide self-service financial aid services (Professional Services Council, 2009).[19] Today, many institutions are in different stages of completing student financial aid information online, while several have placed the entire application process online to benefit both the student and the institution. This step has served as a signal for other universities to implement similar paperless financial aid systems. For example, "when financial aid awards became paperless this past fall semester at Kent State University, financial aid directors at The University of Akron knew it was time to follow suit" (Mertz, 2012).

A paperless financial aid system refers to a completely electronic system where statements concerning tuition billing, disbursements and student financial aid and loan applications exist electronically. The University of Minnesota (U of M) was one of the first academic institutions to offer paperless financial aid and is a prime example of how

[19] This new system calculates the student applicant's eligibility for federal aid in as little as 24 hours, compared to seven days under the paper-based system. Electronic applications now account for more than 98% of all applications—substantially decreasing FSA's processing and printing costs (Professional Services Council, 2009).

technology is changing the internal operations of financial aid offices. The use of the Web, whenever possible, for transactions involving students and the proclamation of email as an official means of communication have contributed to the acceptance of the financial aid system online (Sinsabaugh, 2005). In coordination with the U.S. Department of Education's (DOE) implementation of an e-signature student loan initiative for Stafford Loans, U of M inaugurated its "Paperless Financial Aid Office" initiative in July 2001 across four campuses with 33,000 students receiving some form of financial aid (Swalley, 2004; Sinsabaugh, 2005). Students are able "to apply for, process and receive more than $200 million annually in federal and institutional aid without touching a single piece of paper" (Swalley, 2004; Sinsabaugh, 2005). The institution has improved student service, eliminating waiting lines in the student service center, improving the morale of functional and technical employees and enabling staff to focus on students instead of on aid processing and data entry. Cost savings come from financial aid processing time (now four days as compared to six weeks), the reduction in 500,000 pieces of paper and their subsequent storage. Furthermore, the institution reports that it has "reduced temporary help, overtime, printing, and mailing expenses by $80,000 annually." (Swalley, 2004; Sinsabaugh, 2005).

Students apply for aid online at the University of Minnesota using the DOE's Free Application for Federal Student Aid (FAFSA). A DOE contractor processes the information and sends a file to U of M with eligibility and other data. The university uses this information (along with admissions, registration and budget projections from their IS) to package student aid and prepare Financial Aid Award Notices (FAANs).

Applicants are notified by email that the FAAN is available on the university's website. Students can access the site to accept grants and scholarships, claim or reject loans and reduce loan amounts, and sign for loans electronically on the DOE's website (Sinsabaugh, 2005). Funds are then disbursed to a student's account and an email notification is sent. Any credit balance can be applied to a student's bank account.

Paperless financial aid and the university. "Financial aid may be the least understood student service activity in our nation's colleges and universities," and as a result the university impact and activities associated with financial aid are too numerous to be outlined in this section (Cornell et al., 2007). Figure 1 below contains a sample of activities (Cornell et al., 2007). The areas of financial aid that have been described in the literature as being essential to paperless systems will be examined next.

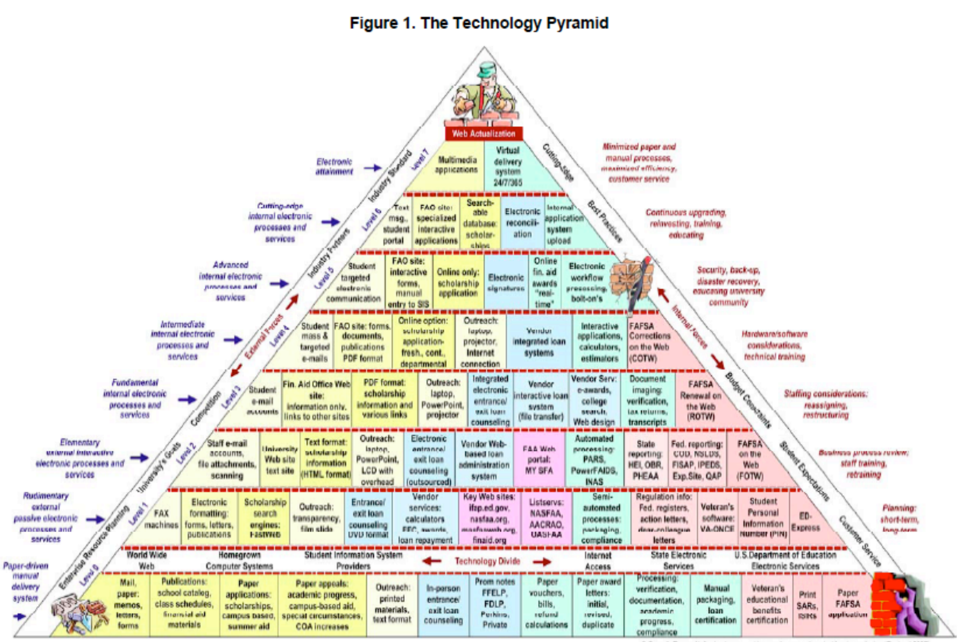

Figure 1. The Technology Pyramid (Cornell et al., 2007).

Financial aid and the university. The benefit of IS systems cross academic space, affecting climate and environment. The push for paperless financial aid information systems stems from a variety of reasons including reducing environmental impact, cutting costs for the institution and for students, improving operational efficiencies and processes for the institution and its stakeholders and securing records from potential disasters.

The American College and Universities Climate Commitment (ACUCC) is a pledge by presidents and their higher education institutions to take “actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students” (The American College and Universities Climate Commitment, 2007). The College Sustainability Report card provides “in-depth sustainability profiles for hundreds of colleges in all 50 U.S. states and in Canada” in order “to identify colleges and universities that are leaders in sustainability” so that institutions can “learn from each other's experiences and establish more effective sustainability practices” (Sustainable Endowments Institute, n.d.). Information systems are one way that universities can become more efficient therefore reducing their carbon footprint. One of the goals of the ACUCC is to use electronic processing to end paper use (White, 2010). “The Environmental Paper Network points out that paper production causes a wide range of environmental impacts, so by using less of it you can press many environmental buttons at once, reduce pressure on forests, cut energy use and climate change emissions, limit water, air and other pollution and produce less waste” (White, 2010). The financial aid office of the University of Wisconsin Madison consciously reduced paper use and waste as part of the institution's commitment to reducing its environmental impact.

> During the peak pre-tax period of February to April each year, students and parents fax in tax documents. Financial aid staff previously copied the printed statements and manually archived them once they were processed. Now, the ECM system captures the faxes, converts them to the desired image format and automatically ties them to the correct record in the student information system. (White, 2010).

Financial aid information systems also help colleges and universities realize operational efficiencies as well as environmental benefits (White, 2010). The University of Wisconsin Madison financial aid office reduced the school's document storage needs by allowing the institution to “[re-purpose] several thousand feet of floor space once used for filing cabinets” (White, 2010). Institutions can now “use these former storage areas instead of building new office space” (White, 2010).

In a quest for increased storage space efficiency and quick access to documents, administrative computing at the University of Maryland Eastern Shore went paperless and benefited from campus-wide savings and elevated productivity. The Financial Aid Office is now able to access student documents online rapidly versus retrieving them from overloaded cabinets, freeing up physical space in the process (UMES Administrative Computing, 2011).

Students and paperless financial aid systems. Benefits to students using self-service options include the faster processing of financial aid applications and the quick determination of status through online access to records that indicate completion (White, 2010). Furthermore, paper copies of financial aid applications are not easily shared or located, thereby necessitating multiple copies. Electronic records allow staff to answer student inquiries more efficiently. Although “the information offered to students is nearly identical to what has been offered in the past,” the paperless notification aspect of financial aid information systems impacts student responsibility and action as students must personally check IS regularly for updates (Mertz, 2012). Students who access their financial aid information online can track the status of their documents, determine whether they are missing materials from their files, and in some cases, accept or decline awards and sign promissory notes.

According to Frazier et al. (1999),

> Ease and convenience for the ‘customer’ is essential for any university to compete for today’s prospective students. Another factor in competing for high quality students is how long it takes to process applications and offer admission [and financial aid]. A student is more likely to enroll at the institution that responds quickly with an admission decision [and financial aid]. (p. 33)

The impact of technology on the financial aid office has a number of implications for all constituents. Students have access to current and correct information, as institutions need not wait until the next print run to produce financial aid handouts and brochures. School savings pass onto the students, where the “lower costs mean more money for aid” (Kantrowitz, 1996). In addition, processing data and not paper allows financial aid offices to shift their focus “to consumer education and counseling” and have “more personal contact with students with unusual or exceptional questions” while answering routine questions quickly via email (Kantrowitz, 1996).

The Southern Association of Collegiate Registrars and Admissions Officers advocated for electronic information systems after their institutions were forced to relax "admissions documentation requirements and financial assistance policies" in the aftermath of Hurricane Katrina (SACRAO Newsletter, 2005, p. 18). The devastation of the storm forced one institution to complete financial aid and student registration twice in one semester (SACRAO Newsletter, 2005).

Campus Card Information Systems

Campus cards have been called a "passport to life" (Dartmouth Card, 2011). They have evolved from simple identification vehicles to multi use instruments with far reaching benefits. Historically, students, faculty and staff have received campus photo identification cards at many schools (ISG, 2012). As part of the one-stop service systems that institutions provide in their campus wide information systems, campus card systems with access to services via a campus ID card, allow institutions "to serve their students in a seamless, unified way" (Huber, 2012; Fagan, 2005, p. 84). These card systems may be single-function (door card access), multi-function (vending & door access) or multi-application (part of a campus wide IS). Campus card information systems are convenient for the students who use them, the faculty who access them and the institutions who install them.

Mainframe computers did not support campus card information systems until the 1980s. In the 1960s, when campus card systems were first introduced by R.D. Products to Rochester Institute of Technology, mechanically placed holes on meal plan cards were "read to signify authorized access to the dining hall" (Huber, 2012). In the 1970s, California State Polytechnic University installed the first magnetic stripe electronic card to track student meal plans and obtain accurate meal counts. During the third era of technology from the late 1970s to the present day, many institutions introduced campus card systems to identify and reduce long food lines or food shortages, and to realize savings through less food waste and the elimination of a cashier at cash receiving locations. In 1980 Harvard and Duke Universities installed campus card systems with the express purpose of identifying and reducing long food lines (Adkins & Heinen, 1997). Coupon scripts, the paper tickets which were punched each meal and were issued in $10 and $20 books, were inconvenient as students often had to wait in line to purchase them and at the dining hall to use them until "their once hot meals were often lukewarm" (Adkins & Heinen, 1997, p. 2). In addition, if students lost their coupon books there was no way to replace the unused portions or prevent their unauthorized use (Adkins & Heinen, 1997, p. 2).

Other improvements during the 1970s and 1980s included door access, vending and copy machine services and software to store card transactions offline. However, even in 1985, a single campus card was not used everywhere, and some cards were not even attached to information systems (Adkins & Heinen, 1997).

> In the early 1980s, Duke students typically carried as many as six campus-related cards in their wallets, including their student IDs, library cards, dining cards and key-cards which they used to gain access to their residence halls. Except for the one issued by Dining Services, each of these cards was essentially a piece of cardboard with no picture and no magnetic strip, so students had no picture ID which they could use on- and off-campus to prove that they were enrolled at Duke, and the usage of most of these cards was not related to a computer database (Adkins & Heinen, 1997, p. 2).

In the 1980s, cashless payment systems appeared. Students or their parents could add money to campus student identification cards over the phone, in the student ID office or in a value-transfer station (similar to an ATM machine). Although Florida State University was the first public university to partner with a financial institution in the 1990s to link student campus cards (Huber, 2012), "the practice of [higher education institutions] forming relationships with financial institutions has [only] become more common" in the past decade (Millard, 2006). Students can now transfer and receive financial aid and pay tuition and other school fees using their campus card in conjunction with smart card IS (Huber, 2012). With embedded microprocessors "that *have* the processing power to serve many different applications" smart card technologies and cloud-based systems, "[enable institutions] to provide campus-wide transaction services without local systems, software or dedicated administrative staff" (NACCU, 2012). The technology is expensive, however, and schools are "hesitant to invest significant funds in a card that hasn't even taken off in the consumer arena" (Millard, 2006).

Students and campus card systems. Today, on many campuses, students can conduct their campus card transactions online and receive services as part of campus wide information systems. Students may use their ID cards to purchase meals on or off campus, purchase tickets to athletic events,[20] do laundry, access vending machines, write checks and even receive financial aid information. "Faculty, staff, and students can track all charges, add funds, and watch [their] account history including meal plan usage" (Rivier University Campus Card Services, 2012). Harvard's ID campus wide information package, Blackboard Transact, claims on its online site:

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[20] Harvard University first considered identification cards in 1954 as a means to "prevent interchange of bursar's cards for buying tickets to athletic contests." http://www.thecrimson.com/article/1954/4/28/council-considers-plan-for-possible-student/

> Blackboard Transact™ technology gives your students the convenience of one card for all their needs—from building access to campus meals, to on and off-campus purchases. They'll also have easy and secure access to financial aid credit balances, student payroll, or money deposited from home (Blackboard Transact, n.d.).

At Harvard University, students and faculty alike employ their ID cards to access physical and online library services. With one swipe students can use a debit account to pay for technology equipment and repair services on campus, purchase books at the Harvard Coop, make photocopies at libraries, pay Harvard related bills as well as food and laundry expenses and make purchases at off-campus retail merchants without using a bank (Haines-Stiles, 1999). Students no longer need to carry cash and are not at the mercy of copy machines that require crisp bills for payment. They no longer require a room key, a mailbox key and an entryway key. In the past when "an entryway key was lost, the locks had to be changed and every student in the entryway issued a new key" (Haines-Stiles, 1999). ID cards have improved campus safety and new proximity cards (where a user and card just need to be close to the card reader) are particularly helpful for those with disabilities needing to access university buildings, including dormitories, labs or computer departments (Haines-Stiles, 1999). The system at the University of Alabama allows security to know "immediately who is entering the building, and whether the student's photo on record matches the face coming through the door" (Millard, 2006).

Pennsylvania State University (PSU) recently overhauled its campus card IS to accommodate the services available at other institutions and to encourage campus card use. In addition PSU, recognizing that faculty and students need more "compelling reasons to use [their campus cards] rather than debit cards," has piloted an incentive program similar to credit cards that gives users cash back or gifts (Millard, 2006). PSU plans to give "students discounts on books, free event access, or just extra funds for going with card over cash" (Millard, 2006). This rewards system is "already in place at Georgia Institute of Technology for students who add a significant amount of funds to their cards at the beginning of the semester" (Millard, 2006). At the University of Maryland, Baltimore County, the school offers the Chartwells Reward Points program that can be used in dining venues in lieu of cash (UMBC Department of Campus Card and Mail Services, 2012). Deposits to campus card accounts and purchases of meal plans or meals in a dining services venue earn the rewards. "Unused points are forfeited at the end of the semester" (UMBC Department of Campus Card and Mail Services, 2012).

At Duke University, the DukeCard with its dining and flex accounts has become a part of the school's culture. "On the first day of first-year student orientation, resident advisors and First-Year Advisory Counselors alert new Duke students that their DukeCard will become their most valued possession over the next four years" (Adkins & Heinen, 1997, p. 4). When first-year residence halls make t-shirts sporting "Top-Ten Lists" of their experiences as Duke freshmen, statements like "The DukeCard: Don't Leave Home Without It" are often near the top of the list (Adkins & Heinen, 1997, p. 8). Use of the card has also made it into the vernacular of Duke students, as they ask "Can I put it on Flex?" (Adkins & Heinen, 1997). The school in 1997 considered itself a cashless society where wallets were unnecessary since students used their DukeCards for all their on-campus transactions (Adkins & Heinin, 1997).

Many institutions name their campus card: Harvard has CrimsonCash, Washington University in St. Louis has Bear Bucks, Cornell University has Big Red Bucks, Wellesley College has the Wellesley College One Card. Schools market these cards on campus and promote their value to student users. Bear Bucks at Washington University in St. Louis is “more than just an ID card” (Washington University Campus Card Services, 2012). The Dartmouth Card allows movement through many campus activities.

> Not just your official College ID, the Dartmouth Card is the most important piece of plastic you'll have while at Dartmouth. It will be your card for your Dining Meal Plan, your Da$h Discretionary account (Laundry, Vending, Tickets, Events); your door access to residence halls and facilities, and your library card. Your Dartmouth ID Card is all you’ll ever need. It’s Your Passport to Life at Dartmouth (Dartmouth Card, 2011).

Faculty use of campus card systems. For faculty members, a campus card serves as official photo identification, an employee ID and security badge that can grant access to campus buildings, events, libraries, recreation classes and facilities, and can be used to purchase items on and off campus. At some institutions faculty members get employee discounts based on university affiliation.

At Duke, the DukeCard is marketed as being useful to faculty “as a form of identification, as a library card and as a means for having a Flex Account” (Adkins & Heinin, 1997, p. 4). Faculty incentives to use the DukeCard include a discount dining program which encourages “faculty-student interaction by matching the amount of money which faculty members deposited - and the introduction of a Faculty Charge program which enabled faculty members to charge meals at campus eateries on their DukeCard and have the money deducted from their paychecks” (Adkins & Heinen, 1997,

p. 4).

Campus card systems and the university. Williams (2009) of Avisian Publications, an organization that researches ID technologies in education environments, states that:

> If you want to know just how important your campus card system is to your university, shut it down for one day. After you've quelled the riots and handled the nasty phone calls from students, faculty and staff, who want to know why they can't access their building, eat in the cafeteria, or make copies or check out library books, or do any one of a myriad of other things that campus cards allow, you'll have your answer.

Tom Bell, vice president of the Blackboard's Transact system used at Harvard University, claims that the shutdown at Tulane University in Louisiana was not simply due to the physical destruction of Hurricane Katrina, but because the campus card system was offline, preventing campus access (Williams, 2009). "Many administrators don't realize the school's transaction system is running 24/7 and is critical to a college," and that the campus card system supports the goals of the university by providing students with a safe and enhanced college experience through access to convenient services (Williams, 2009; Moore & Pete, 2012). Campus card systems reflect value as a reporting tool, allowing a school to see "how many door accesses they've had" or "how many people are attending one of their events" (Williams, 2009). One enterprising campus[21] "recently placed a card reader at a career counseling office" requiring all students to swipe their card to record that session (William, 2009). The institution uses the collected data to evaluate career counseling operations and usage among students. The

[21] This campus's name was not divulged in the article.

opportunities for future data collection are endless.

According to Conrad (2011), "by issuing … credentials with strong authentication mechanisms," universities invest in campus-wide well-being and show that security is a priority. At UT Arlington access to the locks of sensitive areas is restricted to ID cards with the correct security levels (Swanson, 2011). The latest campus card information systems are difficult to counterfeit when compared to door keys, magnetic stripe cards or proximity cards (Conrad, 2011). Furthermore, "issuing one smart credential also impacts administrative costs. Not only is the cost of a single credential lower than purchasing multiple forms of identification, but the reduced management and distribution time for one credential [has] significant impact on administrative costs" (Conrad, 2011). Logs from campus card IS are of help to campus police because campus card transactions can be traced, deterring potential criminals (Adkins & Heinen, 1997). Duke University uses the DukeCard to control "access to parking lots, recreational facilities and academic buildings" (Adkins & Heinen, 1997, p. 5). This access control measure has reduced overcrowding at recreation facilities by barring those who have no affiliation with Duke University and has helped to prevent crime (Adkins & Heinen, 1997).

Historically, campus card information systems have been managed under the auspices of the IT department on college campuses. The introduction and proliferation of campus card systems has resulted in the creation of new positions outside of IT, such as the Vice President for Auxiliary Services and GOCard Services director at Georgia Institute of Technology. The University of Alabama has a director of card services. At the University of Maryland, Baltimore County, the university shares a department to oversee campus card systems, the UMBC Department of Campus Card and Mail Services (UMBC Department of Campus Card and Mail Services, 2012).

The director of the campus card system at Duke University wrote a whitepaper discussing how the DukeCard System not only provides convenient services and safety for its cardholders, thereby improving student life, but serves also “as a management information system that allows the Duke administration to collect demographic data which helps determine the hours of operation and food options for eating facilities on campus” (Adkins & Heinen, 1997, p. 8).

Higher education institutions have a number of financial incentives to use campus card systems. According to McCall (2009), although the economic downturn has impacted university operations, the emphasis on student services continues and campus card systems have a major role in helping maintain financial solvency. The systems provide a link to student services that individuate one school from another. Campus card systems that have “closed loop” monetary functions act as both student IDs and as reloadable prepaid cards with incentives, getting a return on purchases students make from off campus vendors and programs (Williams & Mierzwinski, 2012). Cards with “open loop” monetary functions act as debit cards or credit cards that can be used anywhere, and at some institutions allow for financial aid disbursements. Schools partner with banks or financial firms for “open loop” cards because the firms pay schools when students use their cards and sometimes profit based on the amount of money students keep in their accounts (Williams & Mierzwinski, 2012). Typically these providers pay to upgrade the campus card information system, including software, cards and card readers.

This seems like a win-win for institutions, and especially for the financial institutions who get new long-term customers and profit on the deposits dispensed into student accounts, including financial aid funds, payroll income and disbursements.[22] (Williams & Mierzwinski, 2012). Due to financial constraints many schools cannot upgrade their campus card systems. George Washington University in Washington, D.C. postponed a multi-million dollar upgrade of its campus card system because of the poor economy (Martin, 2009).

Some controversy surrounding the involvement of banks in campus card information systems has affected student acceptance of the cards. Colleges and universities that enter into revenue sharing agreements with banks should consider any potential negative financial effect on students and adhere to best practices that allow students to choose where to bank (Williams & Mierzwinski, 2012, p. 30). “The outsourcing of student ID services and financial aid disbursement systems to banks and financial firms has given those firms an unprecedented opportunity to market add-on products – bank accounts, ATM/debit cards and even loans and credit cards – to students with virtually no competition” (Williams & Mierzwinski, 2012, p. 6). A student organized protest at Portland State University in Oregon occurred because students felt the school promoted a bank that cost them more in fees. State officials have investigated schools in Oregon and New York about the debit card relationships between colleges and banks (Chu, 2009).

[22] Banks reinvest “the deposited funds in higher interest revenue sources, such as capital funds to provide higher interest private student loans, home loans or car loans.” “In 2013 alone, the Department of Education is expected to disburse $160 billion to about 16 million students in loans and grants. This money provides valuable deposits and potential for free revenue for the bank as it is spent.” (Williams & Mierzwinsky, 2012, p. 14).

Information Systems and University Operations

Institutions rely on their information systems. Unreliable information systems impact all university stakeholders. Washington State University (WSU) is an example of an institution whose aging IS presented challenges and serious barriers to progress at the university (Byington et. al, 2010). "Unfortunately, WSU's IT infrastructure is increasingly unreliable, made up of obsolete systems that were not originally designed for the multiple tasks they now perform" (Byington et. al, 2010). Breakdowns in the school's system for registration, payments and financial aid frustrated parents and students (Byington et. al, 2010). The issue was so alarming that the accreditation report of the Northwest Commission on Colleges and Universities recommended that WSU "provide contemporary information management systems that will address the needs of the future for its student, academic and management support requirements" (Byington et. al, 2010).

College and university administrations have faced the issue of obsolescence surrounding their information systems for years. The 1963 report of the Southern Regional Education Board, "Guidelines for Planning Computer Centers in Universities and Colleges," states that "rapid advances in computer technology [may cause] computer equipment to become obsolete within relatively few years," and warns that when manufacturers no longer maintain repair parts for obsolete equipment, universities would need to stock these costly spare parts (Godwin, 1963, p. 9). Indeed at Harvard College, the registrar's office staff scours eBay for replacement parts on hardware for a student information system from the late 1970s that is no longer maintained by the manufacturer

(Anonymous, personal communication, 2012). WSU's “current 30 year-old student systems are unique to WSU and supported by only two or three technical staff members, some nearing retirement” (Byington et. al, 2010). The school does not have the staff to support the current systems and no vendor support exists for the application software. This is a pattern being repeated at institutions nationwide.

Security can also be a huge issue for IS. “On May 23, [2012] the University of Nebraska experienced a breach of the Student Information System, which houses data for current and past students, faculty, staff, applicants and others.” A UN undergraduate orchestrated the breach that affected employees, students, alumni, applicants to the university and parents of students who applied for financial aid. (University of Nebraska Administration Security Incident, 2012).

Information system security breaches have a major impact on academic institutions. Data breaches and theft are not only economically costly but may result in damage to an institution’s reputation in the eyes of employees, students and alumni. The potential loss of alumni donations raises serious economic implications for institutions whose information has been compromised. When Ohio University alumni learned that private financial and personal information had been accidentally leaked by their alma matter over a period of 13 months, some vowed to withhold future donations until security of their information was assured. More than 367,000 files containing personal information were exposed to non-authorized personnel (Wasley, 2006).

Martin (2009) states that “it’s difficult to say how often campus ID cards or campus card systems are hacked” especially because incidents are rarely made public and "it is just plain hard to determine what to classify as a hack" (p.4). A recent incident at Harvard University highlights the potential vulnerability that exists in campus card systems. In 2008 an undergraduate created counterfeit cards replicating the ID numbers of high-level university officials. This action allowed unauthorized access to buildings across campus and facilitated fraudulent charges on individual Crimson Cash accounts. As a result, Harvard was forced to launch a new campus card information system and IDs for everyone in the Faculty of Arts and Sciences (Martin, 2009).

Information systems have transformed student, faculty and academic institution processes and experiences. Specifically, technology has changed the way people are connected and how information is exchanged, thereby affecting the working and social relationship of users. IS technologies allow for the transmission, storage and retrieval of information, empowering users to both maintain their original roles as local resources and to become more active participants in self-service and knowledge transfer. Information systems provide access to users with proper permissions on a shared network or with access to the Internet, making their reach and accessibility just as global as email or the web.

Students and faculty use information systems to disseminate information and access the knowledge of the university community at large (Sproul & Kiesler, 1998). Students, faculty and academic institutions possess access to information that, prior to the technology, required their physical presence at offices that provided the services. Students needing to access academic services (library services, faculty, advising, tutoring), financial areas (bursar payments, campus cards), student affairs (registration, career services) were required to physically go to the corresponding office. A visit usually required planning in advance or waiting in long lines (Kleeman, 2005, p. 89). Students can now communicate with office personnel by email, search for information on campus websites or fulfill their needs using campus information systems through a self-service model. Empowered students have taken more responsibility for relationships with faculty, their advisers and their universities.

This technology has highly impacted student expectations. Advancements in computer and communications technology have transformed student behavior and the college student experience: 24-hour access to university services and information is expected; student communication with faculty is specific and immediate; college IDs have become smart cards and a form of currency; media sites can be utilized to mobilize the student body; and the general use of campus computer facilities is seen as an innate right as opposed to a privilege enjoyed by a few select technical majors. Students now expect extensive service availability, demand the appropriate bandwidth needed to operate their email, web and information systems activities and feel entitled to seamless and constant uptime. As a result, Northwestern University upgrades one-third of its networks annually to accommodate student, faculty and administrator computing needs (Zurier, 2009). Iowa State also continuously updates "its network infrastructure to keep up with the growing demand for bandwidth" required by these technologies (Zurier, 2009). Campus card systems and email are seen as essential services whose interruption would impair the general operations of the university, bringing services to a standstill.

The importance of information management and the cost of meeting increased user expectations due to emerging technology trends[23] is a common theme in higher education. Academic institutions have been motivated to rethink priorities in support and administrative structures, and in resource allocation for the management of technology. Furthermore, the use of technology systems required institutions to create acceptable use policies to set basic ground rules for the use of campus computers and information systems. Policy was informed by university experience with certain behaviors that "users of college and university networks [engaged in while exploring] the legal and logical boundaries of computer and network systems" (Mitrano, 2003). Unforeseen crises, such as the first computer worm, reinforced the need to create acceptable use policies in American higher education, informed policy and established rules to educate campus users. As a result student and faculty uses of IS are now governed by academic institution use policy. Despite identifying faculty and student responsibilities these policies are not equally explicit or understood at all institutions. Schools must establish and enforce policies that identify the rights and responsibilities of IS users. Lack of training or understanding can lead to confusion, frustration and even security lapses, by both faculty and students.

Structural and behavioral changes result in a need for greater coordination and development of IT governance and decision-making processes. Technology is user driven, and budgets must adequately support community use and expectations (Bartkovich, 2011). The rate of change related to technology has propelled some institutions to hire administrators to oversee the provision, planning, management and

[23] Emerging technology trends have also been associated with increased costs for the university.

support of these new technologies. Many colleges and universities employ an IT leadership position, the CIO, Chief Information Officer, to lead the governance and decision-making structures that institutions have found necessary to formalize IT planning (Green, 2001 as cited in Penrod, 2003, p.19-21). New formal organizations are being used to leverage technologies. Montgomery County Community College (MCCC) has an official technology governance body that is "charged each year to research, review and recommend approximately six significant technology hardware, software, policy, or training initiatives" (Schwartz, Craig, Trzeciak, Little, & Diaz, 2008).

Information technology can be seen everywhere on the modern campus, from student IDs used as cash cards to campus wide information systems necessary for payroll and enrollment (Barrat, 2003, p.381). Information systems have transformed university operations, student and faculty behavior and expectations, and are a communication tool necessary to support the university mission. They are a cost effective vehicle by which students, faculty and institutions can communicate and connect with one another on a global scale. "Organizations thrive when information flows freely" (Fried, 2003, p.124). Information system and web technology policies and services must reflect the culture, values and mission of an institution.

The technology advances brought to higher education by information systems have affected all stakeholders. IS implementations restructure organizations and policies and highlight the information the institution requires to conduct transactions with students. Implementation of technological advancements impacts the entire higher education community and requires procedures, policies and guidelines for total stakeholder involvement and success. With an unlimited budget any school can implement any change perceived to be of benefit. The increasing cost of university-wide information systems, however, has made review of information system implementations at institutions big and small mandatory for all higher education administrators (Olsen, 2003).[24]

Innovations in IS direct academic institutions to undergo a cultural shift, where services are delivered from a student perspective as opposed to an internal institutional perspective (Burnett, 2002). This shift “puts the student at the center of every interaction” (Burnett, 2002). Students today rely on campus wide access to IT, as well as technological quality, accuracy and responsiveness (Barrat, 2003, p.382; Burnett, 2002). They expect the same level of service at their school’s website that they receive at consumer sites, including chat, a personalized experience and communications based on preferences (Burnett, 2002).

Over the past three decades, technologies and information technology issues have become an increasingly complex but essential part of higher education. The personal computing revolution, the explosive growth of the Internet, the invention of the World Wide Web, search engines and digital and telecommunications innovations have seen higher education institutions shift from managing technology assets to managing information as the demands for “rapid access to information to expedite decision-making” increase (Ryland, 1989). Furthermore, “the use of digital technology for

[24] California State University’s PeopleSoft management information software system project is estimated to cost a total of $400 million (Olsen, 2003). The management information system project of Pennsylvania State University is expected to need $97 million (Tweedy, 2013).

finance, student information systems, and other administrative functions is now over 30 years old" and the cost of technology expenditures continues rising (Bates & Sangra, 2011). Undoubtedly changes in technology will continue to have significant influence on higher education. What events, foreseen and unforeseen, will affect future implementations? What areas (institutional, research, administrative and information systems) will demand the greatest resources? Are the rewards concrete or even measurable? An understanding of the historical impact of technology in higher education on faculty and students, as well as the necessary structural and policy changes that result, is beneficial to decision makers who are trying to forecast future technology needs and trends. Exploring the journey from a few pages in a college president's black book to a complex campus information management system is a logical first step.

Since the implementation process of IS is time-consuming, expensive, and difficult to manage, a more efficient use of resources can be applied to the future of administrative technology by analyzing past implementations that were groundbreaking and effective. The student information system at Penn State provides a strong example of one school's attempt to update and clarify the student management data vital for its future. Successful implementation of student information systems is crucial for every higher education institution.

Chapter III. Pennsylvania State University (PSU) Case Study (the 1980s)

Introduction

The student information system (SIS) at Penn State, eLion, has been cited by many as an outstanding service. A dynamic student repository and advising portal, it has been recognized by technology industry leaders and educational groups. Computerworld Honors Program named The Pennsylvania State University to its Laureate award in 2002, identifying eLion as a system "whose visionary use of information technology [produced] and [promoted] possible social change" (Kessler, 2002).[25] eLion received a grant from IBM (1996) and a certificate of merit from the National Academic Advising Association (NACADA) in Advising Technology Innovation Awards (1998); was a finalist in Academic Excellence and Cost Management from the American Council and the USA Group Foundation (2000); was presented with the outstanding advising program award from NACADA (2004); and was a recipient of Best Practices in Student Services Online from the Center for Transforming Student Services (2005) (The Pennsylvania State University Website, 2014).

The implementation of Penn State's information system resulted in new organizational structures as well as changes to its institutional culture. Originally proposed as a directive to provide students with access to their administrative data, the new IS forced administrators to change their perceptions of decision making and the traditional structures they had depended on for student data.

[25] The actual quote is: "Each year, the Computerworld Honors Program identifies and honors organizations worldwide whose visionary use of information technology produces and promotes positive social change" (Kessler, 2002).

In an interview discussing the effect of information systems on the contemporary university, past president of PSU Graham Spanier described how information systems have impacted the operations of Pennsylvania State University:

> In some ways, with all the data I have at my fingertips now I can't even keep up with it all. Right now I'm sitting in front of my computer screen and I have one icon that takes me to the development database—all of our donors—and I can at any given moment see which development officers are having meetings with which prospects today and see their notes on the meetings. I can then look at the alumni database and I have information on all of our alumni. I have the office of administrative systems business database; I can be looking at expenditure flows and how bills are being paid. I can look at the academic information system and see what's happening with courses and student demand. I could just spend my entire day at my desk watching everything that's happening. We're actually at the point in our evolution, I think, where our systems are allowing us to do more than we might even be inclined to do, but I consider that to be a very good situation. (Transforming the Academic Enterprise: A Conversation with Graham Spanier, 2003).

Penn State's mission evolved to promote a student centered focus in the use of university online services. The institution espouses a strong commitment to providing programs and seamless, user friendly services that "enable students to engage actively in their education and achieve their academic goals" (Penn State Undergraduate Education Strategic Plan 2008-2013, 2008, p. 2).

The Penn State case history tells the story of the evolution of information systems from early registration and data processing technologies to PSU's first information system. This chapter begins with an examination of the registration process, a pre-cursor to information systems. Registration evolved over the years in response to changing student needs and technologies. The chapter then covers the period of 1970 through the end of the 1980s when PSU issued directives to define the policy of university records and guide the development of a university wide information system. By forming committees to plan, design, build, deliver, manage and distribute PSU technology systems, users were able to voice their opinions about how to build and support the system. PSU also hired its first Chief Information Officer to assume responsibility for PSU technology projects and assets. The committees began to work with a vendor, Electronic Data Systems (EDS), to identify work flows and system requirements. Due to inevitable delays EDS fell behind on target dates, with some deliverables not up to PSU expectations. An external panel blamed both EDS and PSU for their communication failures. PSU forged ahead with input from the panel and staff, disengaged itself from EDS, and further invested time and resources in the school's information system, building the components necessary for completion. By the end of the 1980s, PSU believed the system operational but understood that a strategic information system was needed to focus on the needs of the student.

eLion

Originally founded in 1855 as an agricultural college, The Pennsylvania State University, enrolls over 80,000 students at twenty-four campuses and is Pennsylvania's largest source of baccalaureate degrees (The Pennsylvania State University Website, 2014). Over the past 30 years the organization of the school's university-wide home-grown SIS has evolved through four names, myriad iterations of stakeholders, organization ownership, multiple goals, and visions into an award winning system

(Belinc, 2003).[26]

> A number of University offices collaborated to develop the Penn State eLion system. Providing an integrated array of services focused on improving student advising and success, eLion has become one of the most frequently used internet applications by Penn State students (Teaching and Learning in Undergraduate Education at Penn State, 2004, p. 7).

The eLion,[27] a web-enabled portion of the school-wide Integrated Student Information System (ISIS), is a comprehensive student portal that provides valuable online services for students, faculty, administrators, and members of Penn State's academic community. Over forty administrative and academic functions associated with enrollment are accessible to students who typically use eLion to register for courses, perform a degree audit, verify enrollment, check grades, request transcripts, apply for financial aid, pay for tuition and fees, communicate with advisors and declare their academic course of study. Personal enrollment information is up to the second, accurate and accessible to students from any networked computer with a browser. Advisor-advisee appointments and communication have increased as has their quality, since now students are seeking advice not just advisor signatures. (Teaching and Learning in Undergraduate Education at Penn State, 2004, p. 7). The logic of eLion allows the system to provide specific information pertinent to a student. For example, if a student receives $1,300 in aid and would like to change his registration, the system will not require he contact a student aid officer for further instruction, but rather specifies the impact of his registration choice. "You have been awarded a Stafford Loan in the amount

[26] eLion has won awards from 1996-2005 (Penn State eLion Accolades Web Page, 2014)
[27] The naming of the eLion system is apparent to the entire community as the lion is the sports symbol for the school.

of $1,300. If you late drop this course, your enrollment status will be less than full-time and your loan amount will be reduced to $900. Do you want to continue dropping this course?" Academic advisers can depend on eLion to understand changing and complicated rules and regulations regarding institutional policy. (eLion Penn State University ComputerWorld Honors, 2002). Educators have also benefited from eLion by using the system to enhance classroom management to record and submit student grades to the registrar, review class rosters and the academic preparedness of their students prior to class enrollment and to post course related materials online (Teaching and Learning in Undergraduate Education at Penn State, 2004, p. 7) (eLion Penn State University ComputerWorld Honors, 2002). Operationally, eLion utilizes artificial intelligence to guide student course and concentration management and selection, useful for students and advisors alike (Wager, 2005; Gordon, 2007). Students can participate in online career workshops and study sessions (Wager, 2005). eLion allows students, faculty, and employees to correspond with one another and sense opportunities to build community. The resounding success of eLion warrants a closer look of how it came to be and how it satisfied the expressed needs of PSU students.

History of SIS and eLion at Penn State

An army marches on its stomach – Napoleon Bonaparte.
A contemporary university marches on its information technology.
If you don't have it and you don't understand it, you are doomed to failure.
Former EDS employee, personal communication, 2016

Early registration systems, precursors to IS and eLion at PSU. Today's students register, pay and complete degree audits[28] for classes from virtually anywhere in the world thanks to mobile technologies and the Internet. From any internet-connected device, students can access their institution's website and register for courses with a few keystrokes. Registration has come a long way from its beginnings as a pencil and paper process.

Known as the "long standing evil at Penn State"[29] and a rite of passage for generations of Penn State students, registration for many PSU alumni evokes memories of long lines, confusion and anxiety (The Daily Collegian, 1926). Registration was documented for over sixty years in the University's student newspaper, The Daily Collegian. Articles show that the registration procedures evolved as enrollment at the University increased, with the only constant being the complaints of students with each new iteration of registration.

Registration in March 1918 at PSU was completed using paper and pencil, and required students to "stand for several hours in line, waiting to be registered" (The Daily Collegian, 1918). Upperclassmen destroyed the orderliness of lines by inviting their freshman friends to the front of the line - ahead of those waiting. To counter this, PSU assigned students a number upon their arrival. In 1926,[30] admissions cards and

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[28] A degree audit is an automated report reflecting a student's academic progress toward the completion of a degree. registrar.missouri.edu/degree-audits

[29] In 1918, a Daily Collegian article described registration as the "long standing evil at Penn State."

[30] In 1926, to facilitate the registration of nearly four thousand students, the following steps were required. Each student was given an admissions card, and had a scheduling officer assigned whose name was on the back of the admissions cards. After the schedule was approved by the scheduling officer, it was taken to the registrar, students would then have to hand write their schedule on a large blank form that was inspected and kept by the registrar. Next came a trip to the Treasurer's office in the same building. Students would only get a copy of their schedule when they

scheduling officers were introduced, and in 1928, students were assigned specific registration times based on their last names, upsetting upperclassmen who "complained that it eliminated their long-held advantage over freshmen and sophomores in the choice of registration times" (The Daily Collegian, 1928). Introduced in 1948, "the labor-saving device" of carbon paper helped to speed up the copying of class schedules by students and department administrators (The Daily Collegian, 1948).

By 1952, registration had changed again at PSU. Students now had to see their advisers before the Fall Semester for preliminary planning, and had to secure advisor signatures on an official registration form upon arrival on campus in the fall. Advisers would give students a packet of all the forms which had to be completed (Foley, 2016). (see Appendix I for a list of PSU registration forms).

An alphabetical schedule, with seniors and juniors registering first, followed by all other students, marked the start of arena registration. The student had to take the official registration card to each department station of a scheduled class and had to secure the department representative's initials on an official registration card and received two course cards, a white one for the registrar and a pink one which would become part of the instructor's class roll. Telephones were on hand to call advisers and other offices to modify schedules as needed. Once course registration was complete, students had to go to "other stations where the various forms and cards" would be submitted. (The Daily Collegian, 1952, p. 2 and p. 8).

The 1950s saw a flurry of post-war growth at PSU, spurred by the GI bill. As

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had paid their fees and were given a receipt. (The Daily Collegian, 1926) enrollment grew by leaps and bounds, the once useful system was breaking down. Registration was extended and moved to the larger Rec Hall, where the lines grew longer despite the program changes. Problems persisted and administrators turned to technology for help. The "IBM Magic," punch card, was credited in 1956 for making registration "almost easy" (The Daily Collegian, 1956). Rented machines could process 100 student cards a minute, easily recording the class preferences of the 12,000 students then enrolled (The Daily Collegian, 1956).

In 1954, students felt that the system worked! "At long last, the University registration system has reached efficient — if not near perfect — operation. The system has overcome the handicap of being a small-school system in a large school" (The Daily Collegian, 1954). Most students were registering in a few minutes. The registration schedule allowed a more even flow of upperclassmen which reduced long lines, and registration forms were numbered for easy handling by students and checkers. The only flaw that remained was with the premature closing of courses. Shut out of required sections, students needed new course sections when demand was greatest. (The Daily Collegian, 1954, page 4).

A new concern arose in 1956, when a student complained about poor advising prior to registration. Despite being obligated to keep up with department and college changes in required courses, the advisor was not familiar with the requirements for graduation, nor knowledgeable of what substitutions could be made. (The Daily Collegian, 1956).

Figure 2. Students in Rec Hall registering for classes at Penn State, mid-to-late-1960s. Image: Penn State University Archives.

"The above mid-to-late 1960s photograph shows students waiting in long lines in Rec Hall to try to enroll in their pick of classes, a laborious and often stressful ritual endured at the beginning of each term (before today's semester system) by generations of students" (Registration in Rec Hall, 2015).

Pre-Registration began in 1961, where students with no changes would go through an abbreviated form of registration, not having to report to arena registration but would go directly to the registrar to submit forms and then to the Bursar to pay their fees. Any changes required a student to go to the main floor of arena registration. (The Daily Collegian, 1961, p. 5). Hundreds of students milled about the vast floors of Rec Hall to find their courses. In 1968, students lost an average of $37.21 per term because arena registration would make them miss work at their jobs.[31] (The Daily Collegian, 1968).

As enrollments increased, PSU registration moved to a new building in 1975 with a bigger room, but the complaints persisted. Many of the registration experiences reported centered on a lack of knowledge and direction. In the article, "Just follow the signs," students were described as apprehensive, not understanding the language associated with registration. "Packet" [a student] asked when she saw a notice commanding her to 'present #2 card and packet,' What's a packet?" (The Daily Collegian, 1975).

The eighties saw the continued evolution of the registration process. A new option available for Fall 1981 was the ability to register by mail, while in 1984 the Daily Collegian proclaimed that "Computerized Registration is here." The system was not immediately embraced, however, as technological glitches made for a difficult transition. The newspaper contained many stories of students waiting hours as computers crashed and schedules disappeared due to computer malfunctions.

With availability of telephone registration in the 1990s, arena registration become a thing of the past. Telephone registration (or teleregistration) meant students with a touch-tone phone could select their courses 24 hours a day during the set registration period using a system called TIPS, Telephone Information Penn State (SSC Meeting Notes, September 1988).

[31] It is unknown if these were full time students with part time jobs or full time jobs; or part-time students with full time jobs.

ISIS (student registration, admissions and enrollment on the mainframe). Penn State began using mainframe computers for data processing in 1957 to take advantage of their inherent speed, accuracy and cost effectiveness. The emergence of "stored program" computers capable of holding programs internally and transaction processing to input large volumes of data, process the data, and prepare printed reports, allowed PSU to computerize its records and administrative operations. Computers billed students and scheduled classes for students beginning in 1960, followed by transcript automation and the computerization of grade reporting in 1962 and 1968, respectively.[32] (King, 1984).

These mainframe computers were operated by computer professionals in a Data Processing (DP) department, "the division that programs and operates the organization's mainframe computer system. Only the professional DP staff had direct access to these computers and the ability and access to write programs, enter information, and produce reports. Employees in other departments who wanted to process information with a computer had to request services from the DP department and then wait for the results." (Course Technology, 2004).

PSU's administrative systems were stand-alone systems that used punch cards to input data to the mainframe, and produced outputs in the form of payroll checks or printed reports in batch runs for the student system, housing and dining systems respectively (Senior EDS employee, personal communication, July 26, 2016). Punch

[32] Very little information exists on the computer systems available at Penn State in the 1960s. Keith Wheeland, Assistant Director of Management Services was cited in The Daily Collegian 1984 article, "Computerization is Not New," mentioning the previous computing systems at Penn State.

cards were a transformational technology made out of cardboard, with columns of tiny holes that "allowed data to be recorded, stored, and analyzed" (The IBM Punched Card, n.d.). During registration, each student was given a punch card, and the university had a computer punch card for each available seat in a class. The student card was given to students in their registration packet by advisors along with a printed schedule of courses.

A tray of Course cards (one card for each available seat) was supplied to the corresponding department. The student would wait in line at a registration section that offered a desired course and attempted to retrieve a Course card for placement. If there was a seat available, the student got a card and then would wait in line to get the next punch card until course selection for the semester was complete. If a seat was not available, the student would have to go to the end of another line to try to gain entry to a different course. The process was long and cumbersome and often led to long lines and wait times.

After obtaining all the required class cards, the student would return both the student and course cards (one card for each course) to the registrar's office. The cards were taken to the University's central database processing location and fed into a mainframe computer by a data processing employee.

Administrative electronic data processing was housed centrally at the institution's administrative data processing center operated by the Management Services Department (Task Force Report on AIS to President Oswald, 1982, p. 11-2). Penn State's records varied between centralized and decentralized options. Academic, medical and financial records were centralized while others, such as department, committee, and personal records were decentralized. Some were in main campus records; others were in branch units. The University's records contained data related to privacy and confidentiality, including student achievements, performance, behaviors, problems, limitations, needs, finances, treatments, attitudes and aspirations. Responsibility for the records was diffused as well with each administrator, faculty and staff member expected to preserve the privacy and confidentiality of University clients.

Many institutions depended in the 1960s and 1970s upon the creation, preservation and use of data to perform their basic missions (The Privacy Commission of 1973, 1974). As an agency of the state, Penn State developed policy and aptitude to conform with state and federal legislation including the Privacy Commission of 1973, the Family Educational Rights and Privacy Act of 1974 and the Fair Information Practices Act passed by the General Assembly of Pennsylvania in 1975.

The Privacy Commission of 1973 led PSU to define a public policy regarding the maintenance of records and the institution's responsibility to notify clients of their rights related to institutional data. The new institutional policy was sensitive to the confidentiality of records, and committed to "help all concerned — administrators, faculty and staff — to judiciously attend to and balance the rights of the individual with the informational needs and responsibilities of the institution." (The Privacy Commission of 1973, 1974).[33]

Pennsylvania State University looked to the advent of computer technology as a

[33] The Privacy Commission proposed staff leader training that would inform about the existence of policy and educate faculty and staff regarding their responsibilities in relation to sensitive institutional records. Training increases awareness of the regulations, promotes institutional self-regulation and affirmatively demonstrates institutional and professional accountability in regard to records issues. (The Privacy Commission of 1973, 1974)

vehicle to promulgate and proliferate information necessary for academic decision making, as well as the maintenance of the confidentiality of student records. Student data affected (and still affects) virtually every office in the University. State and federal laws were changing how data and information at PSU were stored and collected. Student records required different procedures for maintenance, rendition and access. Data and information collected about students were retained "for the expressed purpose of facilitating a student's educational development" (Interim University Policy on Confidentiality of Student Records, 1975; University Policy on Confidentiality of Student Records, 1976). Penn State University administration further interpreted student records to be more than the personal property of students as they contained their characteristics, activities and accomplishments. L.M Brush, a senior PSU administrator, wrote in an unpublished internal communication in 1974 that student "records are the basis for the information on which the University functions today and plans for tomorrow" (L.M.Brush, personal communication, October 3rd, 1974). School information needed to be used in many forms to support the management of the instructional process of which the students were found to be the "key ingredient" (L.M.Brush, personal communication, October 3rd, 1974). In other words, students could not plan without knowing the content of their academic files, and the University could not plan any operations without knowing the content of student records.

Prior to 1972, students and their parents had restricted access to student data. Students could only access records in the presence of an administrator and had to pay for the information. They were charged with challenging[34] any errors so they were responsible for the contents of their records (University Policy on Confidentiality of Student Records, 1976; Interim University Policy on Confidentiality of Student Records, 1976). The Family Educational Rights and Privacy Act of 1974[35] and the Fair Information Practices Act passed by the General Assembly of Pennsylvania in 1975 provided students access to and the responsibility to maintain their records.

Penn State maintained many years of historical data and millions of records on its mainframe computer that were difficult to access. By the late 1970s, the mainframe computer batch systems processed data for administration information, human resources, registration, admissions and enrollment (Pennsylvania State University Administrative Information Services, 2010). The academic records of students, past and present were decentralized and stored on different technologies, including on paper in file cabinets in the Shields Building (R. Rash, personal communication, November 10th, 2016). Student transcripts in the 1970s were stored on microfilm and microfilm readers produced the official transcripts. James M. Herron, a records officer at PSU in 1971, wrote that microfilm was a "data base of student records"[36] that had improved internal operations at the College level, and the Records Office at University Park[37] had the sole and final

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[34] As a student you are "entitled to challenge and/or add to the factual basis of any record entry contained in your student records, files, and/or data. You are provided this right of challenge in order to ensure that record entries do not violate your privacy or other rights as a student. The right also provides for the correction or deletion of any inaccurate, misleading, or otherwise inappropriate information contained in your records."

[35] The Family Educational Rights and Privacy Act of 1974 (FERPA) was also known as "The Buckley Amendment." Final regulations were released by the Department of Health Education and Welfare on June 17, 1976. *University Policy on Confidentiality of Student Records, 1976.*

[36] The word data base is purposely spelled out as two words, database technology was not well known beyond academic computing circles.

[37] Main campus.

authority on academic records (J.M. Herron, personal communication, September 8, 1971).[38] Mainframe computers in the 1960s had operated at a fraction of the speed of today's computers. Conversely, the cost of computing power, in dollars, was decreasing (Task Force Report on AIS to President Oswald, 1982, p. 11-2).

Students wanted immediate access to their administrative data (Belinc, 2003, p. 4; Craighead, 1994), and administrative personnel found that the institution's fifteen year old batch system required constant modifications, and could not continue to be updated to meet the changing requirements of the University. New system development was at a standstill with a two years application development backlog (Improving Administrative Computer Systems: The Penn State Experience, 1982).[39] PSU was faced with technical staff leaving in droves as a result of their high level of dissatisfaction with the current system. The original mainframe architects, no longer at PSU, had left inadequate documentation on a legacy system that constantly failed and required its staff to perform "run, fetch, and delivery" chores (Task Force Report on AIS to President Oswald, 1982). PSU's computer subsystems, such as master information for students and student academic records, were written in different languages and used different files. Special programs called "bridges" had to be designed to allow for data transfer. The difficulty

[38] Although I was unable to locate a specific date of what types of administrative computing existed at Penn State prior to 1980, PSU's presentation at the AACRAO National Conference in 1982 reports issues with 15 year old systems, and R. Cunningham vice president for the Office of Research and Graduate Studies, (Churchill, 1982, p. 3) in an interview with the Daily Collegian states that PSU used computers for 20 years to reduce administrative costs.

[39] "The term applications development backlog refers to the excess demand for new computer applications that outstripped the supply of computer professionals available to develop them. The backlog problem—widespread and well known during this period—was a source of frustration for both the professional data processing staffs and the business departments that demanded new applications. An inventory manager, for example, might develop an idea for a computer application that could potentially reduce inventory costs and staff payroll costs, only to be told that the analysts and programmers in the DP department couldn't start on any new projects for two years." (Introduction to End-User Computing, n.d.)

and cost of making changes in the old systems posed the greatest problem. The work hours of data processing personnel were consumed by the maintenance of old-fashioned batch programs, while users found it difficult to endure the time delays and costs to obtain new application programs **(**Task Force Report on AIS to President Oswald, 1982, p. 11-1)**.** Offices routinely asked for information but their requests would typically not be served or met on time.

> Management services was spending about 80 to 90 percent of its time maintaining old programs and consequently had problems responding to the need for new programs. Costs [were getting] out of hand (Churchill, 1982, p. 3).

By 1982, it became evident that Penn State was spending more effort fitting different legacy technologies together than achieving any progress (Blythe, November 1992, p. 27). The technical staff was hindered by the fact that the old systems could not adapt to new technologies. Although Penn State had been using computers for 20 years for its operations in order to lower administrative costs, "very little use of computers at the college administrative level had existed" prior to 1982, according to Richard G. Cunningham, vice president for the Office of Research and Graduate Studies (Churchill, 1982, p. 3). Various departments throughout the University needed student information in order to operate but they had developed their own manual strategies, paperwork and systems to deal with the information (Churchill, 1982, p. 3).

> One thing was clear in 1982: The university's administrative computing systems were fragmented. The core systems were retreaded versions of systems that had been run in the 1950s on electronic accounting machines. Many of the core systems still retained 80 column card images of earlier days. The retreaded systems still assembled unit records on magnetic tapes, sorted them, accumulated them and printed them in large computer

> listings. The administrative computing staff continued to maintain these card-oriented systems, consequently increasing cost and decreasing satisfaction, instead of replacing them with online systems. (Blythe, November 1992, p. 27).

Penn State, according to a 1981 Ohio State University study, was among the top five universities in administrative use of the computer (King, 1984). However, PSU was facing a problem other academic institutions and businesses were also facing. Computer Information System (CIS) technology by 1981 was emerging from some twenty years of rigid and intractable batch processing into a new era of flexible interactive computing, word processing and other data management changes. (Cunningham, 1981). The University was very much interested in the idea of an integrated computer information system where all the subsystems would be connected and have access to the same information.

> There was an overriding intention to integrate; not just integrate application development tools, but to integrate the databases on which the university [depended] for day-to-day operation. It was agreed that data should be captured once, at the source, be stored non-redundantly and distributed to all who needed it. (Blythe, November 1992, p. 28).

In an integrated student system, for example, the records of the University Registrar and Office of Housing would be simultaneously updated when a student paid his housing bill, without the need for costly data transfers between systems. A cost effective reduction in paper would be realized as data could be displayed on computer screens. PSU wanted to control its computer and information system expenditures, particularly in decentralized units. By centralizing computing at PSU, the institution hoped to centralize technology leadership and long-range planning for both administrative and academic (instructional and research) applications (Cunningham, 1981).

Furthermore, accessing mainframe data was not possible for administrators, staff nor students because of myriad requirements: completion and acceptance of a job request using security forms approved by University data stewards; the action of an Access and Security representative; knowledge and skills in Natural programming language; and submission of the query for data into a queue with other jobs that would take at least a fortnight to process at best (Pennsylvania State University Administrative Information Services, 2010). The existing operating systems needed to be replaced (AIS taskforce: problems with administrative computer systems at Penn State, 1981).

President Oswald, AIS taskforce and call for RFPs. In response, on April 21, 1981, President Oswald announced that PSU would install "a comprehensive, integrated, administrative information system . . . to serve all segments of the University in the most effective and efficient manner possible" (Improving administrative computer systems: The Penn State experience, 1982). High priority would be given to a new student system in an attempt to have that system implemented by September 1983. In response, a seven-member Administrative Information System (AIS) task force, under the Administrative Computing Department, was established that same month to evaluate problems with existing systems and to recommend solutions (Churchill, 1982, p. 3; Improving administrative computer systems: The Penn State experience, 1982; Belinc, 2004, p. 4).

The task force began searching for the technology to improve administrative computer programs by hiring two outside consulting firms to explore the numerous approaches that could focus PSU's thinking on a suitable direction and method (Improving administrative computer systems: The Penn State experience, 1982, p. 8; Task Force Report on AIS to President Oswald, 1982, p. 11-2). The task force surveyed computer and information systems at other institutions, visited installations in both academia and business, and experimented with new (to PSU) database management system software. The task force contacted hundreds of administrators and users of the current computer system and asked what they wanted in the new system.

> To the best of the task force's knowledge, Penn State [was] the first large university to carry out a comprehensive study of problems with administrative computer facility and to consider conversion to a modern database management system. Our need for a major change now is to a large degree the result of our being at the forefront of administrative data processing vis-a-vis other large universities (but not industry). Certainly there is little evidence to support the view that Management Services has fallen behind their counterpart facilities at other institutions, particularly in view of the relatively low percentage of the operating budget devoted to administrative data processing at Penn State. (Task Force Report on AIS to President Oswald, 1982, p. 11-2).

With extensive input from its user community, the task force produced a report of recommendations for President Oswald and a "request for proposal" (RFP) to elicit bids from knowledgeable companies for a desired technology solution. The report provided the rationale and justification for commencing the AIS project, and the RFP included requirements of all of the six Universities administrative systems: student, human resources, facilities, financial, planning and budgeting, and business services (Improving administrative computer systems: The Penn State experience, 1982, p. 8).[40] (Task Force

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[40] PSU "has been trying to solve the problem internally for too long, and outside help was needed for an information system" (Paul Keenep, personal communication, Director of Academic Information Systems, October 28th, 1981).

Report on AIS to President Oswald, 1982).

The task force report discussed the evolution of data processing. Major changes had occurred in operating system software in the 1980s. Hardware advances permitted application programming advances, where instead of being in complex machine language that was painstaking and labor intensive, application programs could now be written in "user-friendly languages." Report write programs and query languages existed to enable users with limited programming skills to code some simpler application programs directly.

Database management software had now made it possible for institutional users to retrieve data within and across systems for reporting purposes. Database management systems (DBMS) facilitated and accelerated interactive use of computer information system facilities. Serious discontent with Penn State's administrative data processing that was attributable to internal and external causes was reported by the task force (Task Force Report on AIS to President Oswald, 1982, p. 11-2). PSU was ready to move from batch processing in its computer facility managed by data processing specialists to interactive terminals located in the offices of administrators (Task Force Report on AIS to President Oswald, 1982, 11-4).

The task force argued that it was a good time for PSU to consider upgrading its technology. The software tools and the vendor companies were available to do the work, so there was no reason for PSU to wait for additional CIS breakthrough technologies. The authors of the report acknowledged that the required new software, hardware and languages alone would not suffice to replace the old mainframe system. People had to change. Administrative users had to become more knowledgeable about data processing and become accountable for their performance in using AIS resources. Data processing experts would have to adapt to organizational as well as technological changes. Both data processing experts and users could no longer act as actors in a “we/they” scenario. They had to become jointly accountable for the success of AIS. President and senior administrators needed to plan and use information systems as a basic element in University operations so they could manage and use information as a primary resource. Administrators, program directors, and other stakeholders were expected to utilize data processing and word processing efficiently and effectively. A partnership between data processing and computer experts and users was necessary for a new information system to succeed. (Task Force Report on AIS to President Oswald, 1982, p. 11-5 and p. 11-7).

The report stressed that contract negotiations with vendors for the development of software programming was important and demanding work, as the customer and contractor had to reach a clear understanding of the work to be accomplished, and easily identifiable milestones by which progress could be measured on a monthly or quarterly basis needed to be established. PSU had to be well prepared in-house to receive vendors and meet their needs promptly. The task force used an attorney experienced in writing software development contracts to clarify its vision. (Task Force Report on AIS to President Oswald, 1982, p. 11-9).

Therefore, the RFP was very clear with its requirements, including the importance of the student information system to PSU.

> The system must be capable of accommodating current enrollments of more than 55,000 students at 22 different campus locations. In addition, it must record continuing education student information consisting of approximately 33,000 credit course enrollments per year, over 19,000 active students each year in correspondence, and more than 90,000 active students per year in non-credit courses offered in various delivery modes. (The Request for a Proposal for an Administrative Information and Management System for The Pennsylvania State University, 1981).

According to the RFP, the University wanted certain capabilities: online data entry that could easily be performed by office or administrative personnel; elimination of paper where possible; flexibility and an expandable database that could be changed with little difficulty; a student system for handling academic-related information; financial, medical, housing, biographical and demographic data; and equal access to the system from locations throughout University Park and the Commonwealth Campuses. (The Request for a Proposal for an Administrative Information and Management System for The Pennsylvania State University, 1981; King, 1984; Computerization is Not New, 1984). The development of the RFP represented 90% of the Task Force's effort. (Improving administrative computer systems: The Penn State experience, 1982, p.2). The task force benefitted from advice from outside consultant Joseph Wyatt, Vice President for Administration at Harvard University, who helped write the RFP before it was mailed to vendors. He offered valuable suggestions for clarification of the document and endorsed the RFP approach as a means of seeking outside assistance. (Wyatt, internal communication, 1981). On July 10, 1981 the RFP was mailed to forty-seven vendors.

Bidder conference. A bidder conference was held on July 24, 1981 to formally present the proposal and answer vendor questions.[41] After the conference, task force members took trips to other institutions/organizations in order to leverage outside experience, review vendor track records, and tune proposal methodology. (Improving administrative computer systems: The Penn State experience, 1982, p. 1-8; King, 1984). The task force also prepared white papers to inform the University community of issues as they applied to Penn State. One paper's topic explored Penn State's Data Bases, asking how many were needed. Another covered a review and comparison of selected administrative hardware and software systems and vendors. Additional papers contained a comparison of in-house versus vendor developed software, as well as one on centralization versus decentralization. There was also a revised statement of user needs. These papers helped increase the knowledge of the technology available in the computer hardware and software marketplace for the task force and participants.

The call for RFPs also created the establishment of a brand new position at PSU, Director of Computer Information Systems and Special Assistant to the President.

> This position is concerned with planning and coordination of University-wide computer related activities. These areas include: University data bases, codes and standards, communication systems, networking design, hardware acquisition, and assessing overall performance in terms of cost effectiveness and user satisfaction.[42] (The Request for a Proposal for an Administrative Information and Management System for The Pennsylvania State University, 1981).

[41] A total of 64 people representing 29 vendors attended. The announced deadline for submitting proposals was September 15, 1981 but was later extended to September 30, 1981. All vendors were required to include a student system in their submission. Vendors could bid on software, hardware or a combination hardware and software package. (Improving administrative computer systems: The Penn State experience, 1982, p. 1-8; King, 1984).

[42] After the search, Gary Augustson was named PSU's first ever CIO. He remained in this position for 24 years.

The new director was to have planning responsibility for both administrative and academic computing and work closely with the president and the appropriate academic and administrative staff members. The position would be concerned with University databases, codes and standards, communication systems and network design at all campus locations, and was responsible for the development and management of data communication systems linking colleges and campuses, as well as cost-effective and compatible hardware purchases.

Evaluation of proposals. By October 1981, the University received 22 bids from 19 vendors including from companies such as Digital Equipment Corporation, Sperry Univac and IBM, which had provided hardware for the old system, along with Boeing Computer Services, McDonnell-Douglas Automation, and Electronic Data Systems (EDS) (Improving Administrative Computer Systems: The Penn State Experience, 1982).

The task force evaluated the proposals, conducted meetings with vendors and asked users of the old system to evaluate the bids. Cost was not a factor at this stage in the evaluation. Gary C. Schultz, former AIS project manager from 1982-1983, remarked that a "surprising degree of consensus" existed among the users as to which bid should be accepted (King, 1984). Based on the findings, the task force decided on the top three choices, EDS, SCT and Peat, Marwick.

The group asked accounting firm, Deloitte Haskings and Sells (DH&S), to do an independent evaluation of the bids. Edward J. McGovern, CPA and Partner and Philip C. Semprevivo, Manager, Management Advisory Services spent three days with the task force. Both consultants had extensive data processing and information system experience in business and in higher education. Their first-choice of vendor was identical with the task force's findings.

According to DH&S, "Electronic Data Systems (EDS), (the conglomerate), responded most effectively to the spirit and intent of the RFP. They alone are willing to commit to bringing Pennsylvania State University administrative computing up to the state-of-the-art, and to a level of service far beyond that of current practice in higher education" (Survey of the AIMS Process, Deloitte, Haskins & Sells, 1981). The other vendors, according to Deloitte, were "a lateral step in respect to the spirit of the RFP" or too small to suit the scale of Penn State's operations, with the exception of IBM and Univac which primarily wanted to sell hardware and have Penn State do the project itself. Deloitte felt IBM and Univac's proposals were too risky for the large magnitude of change PSU requested (Survey of AIMS Process, Deloitte, Haskins & Sells, 1981).[43]

EDS wins the contract. The recommendation by the Task Force to begin negotiations with Electronic Data Services (EDS) was given to President Oswald on January 18, 1982. After having examined the possibility of purchasing a turn-key product from vendors PeopleSoft or SAP, Penn State chose Electronic Data Systems Corporation (EDS) to design and implement the software and IBM to remain the hardware vendor (King, 1984). Although EDS had never worked in higher education, the administration had confidence in the company. Gary C. Schultz, the school's project manager of AIS, 1982 – 1983, said:

[43] DH&S told PSU that if the school did not go with EDS PSU might not want to go ahead with the project at all (McGovern, Partner Deloitte Haskins & Sells, Internal Communication, December 22, 1981).

> Unfortunately, we did not feel those who had the experience could adequately fill Penn State's requirements. EDS expressed strong interest in getting involved in higher education and made a commitment as a new kid on the block (King, 1984).

EDS, however, did not have the same confidence in PSU. PSU's top administrative systems were housed in an unsecured, unhardened[44] backup data center, and protected by a retired employee who lived on a mountain top and would act as the institution's early warning system by calling the data center to shut down power when a rain storm was coming. (EDS Senior employee, personal communication, July 26, 2016). During contract negotiations, EDS warned PSU that if their systems, new or old went down, the university could not function, and strongly recommended that administrative data systems be stored in a robust environment (Senior EDS employee, personal communication, July 26, 2016).

Ron Rash confirms that there were unsecured backups.[45]

> The largest data center that was built to be a data center was the computer building. However, the computer building did not contain the business computers. When I was there in 1983, all of the reporting and record keeping were in the basement of Old Main. It had an old IBM computer system for record processing, key punch operations. And if it rained too hard, the water would come down the side of the elevator shaft into the basement. That is where the IBM mainframe was put to run EDS. It wasn't robust enough. It was called the wet room. When I was hired, I had to go through to find the money to have some people fix it, and the first IT director, Michael, then built his office behind the elevator shaft that used to flood that room. (R. Rash, personal communication,

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[44] Unsecured refers to the data center, unhardened refers to the security on the actual machines in the data center. The data center was not secure, but neither was the equipment in it. (Microsoft Baseline Server Hardening, https://technet.microsoft.com/en-us/library/cc526440.aspx).

[45] Ron Rash had a long relationship with Penn State. After acting as the CIO for the Commonwealth of Pennsylvania in 1977-1979, he worked for IBM in Central Administration. In 1983, he became the senior account manager from IBM's standpoint for all of Penn State's equipment. IBM was a huge supplier of technology to Penn State, so Ron Rash is familiar with the equipment that Penn State was using prior to the EDS development.

November 9, 2016).

Although PSU had awarded the bid to EDS, the school changed the scope of the project. Instead of providing a fully integrated system based on the RFP, PSU stripped the contract, removing the hardware and software components purchased from subcontracted vendors. EDS was left to sign a revised contract to write the code for a system without the system integration piece, and software development was not EDS's strong suit. (Senior EDS employee, personal communication, July 26, 2016).

The leading manager of EDS, W. Lowell Starling, was vehemently opposed to the $3M fixed price contract. In spite of this, EDS higher ups were interested in getting into the higher education marketplace. The Penn State contract seemed well worth the risk, especially when the only competition was a magnetic tape solution that higher education institutions had to install in-house with no assistance (Senior EDS employee, personal communication, July 26, 2016). The project was to be one of the first implementations of a relational database[46] (Senior EDS employee, personal communication, July 26, 2016).

According to a senior EDS official, Starling cradled his head in his hands at the end of contract negotiations. When one PSU employee inquired what the problem was, he was answered by another PSU employee who stated that Starling was trying to figure out how to perform a $6M contract for the $3M signed. PSU had gotten a good deal, and the school understood that. "Penn State worked off a fixed contract. They were caught

[46] "A relational database is a collection of data items organized as a set of formally-described tables from which data can be accessed or reassembled in many different ways without having to reorganize the database tables" (Margaret Rouse, http://searchsqlserver.techtarget.com/definition/relational-database, retrieved, October 12, 2016).

flat-flooted when they negotiated. Lowell Starling's goal was to keep the costs down" (G. Augustson, personal communication, November 7, 2016).

Going forward in quoting future proposals, EDS would mark up invoices by 50%, having realized how complicated higher education processes were, thereby pricing the company out of the higher education market[47] (Senior EDS employee, personal communication, July 26, 2016). By the end of the three years, EDS decided the effort had not been worth the risk. (Senior EDS employee, personal communication, July 26, 2016).

PSU and EDS, the contract. In April 1982, Penn State signed a two year[48] contract with Electronic Data Systems (EDS) to develop and implement a $3 million, computerized central database information system for six university areas: Budget Operations and Planning, Business Services, Facilities/Property Inventory, Financial, Human Resources and a Student System. (Churchill, 1982, p. 3; Hart et al., 2006; Belinc, 2003, p. 4; Computerized systems to be developed, 1982). The student system, which would comprise sixty percent of the project,[49] was prioritized to be the first designed and programmed (King, 1994).

The University aimed to modernize its systems in an innovative manner so that the school could be effective throughout the 1980s and into the 1990s, and "give capability for PSU to act as a single university geographically dispersed" (Interview with PSU President Bryce Jordan and Provost William Richardson, 1986). PSU mandated

[47] EDS never went into the higher education marketplace after this partnership (Interview No. 4, Interview, July 2016)
[48] EDS's contract ran from April 1, 1982 – February 29, 1984 (June 24, 1982, Volume 11, Number 28, Penn State Intercom, Computerized systems to be developed.)
[49] Augustson said that the system would eventually comprise 60 percent of the entire project.

University-wide participation so that the new system would meet the growing needs of central administration, and the common needs of departments, colleges and campuses. To this effect, the University formed a network of committees made up of administrators to work with EDS on the design for each of the six systems, Student System, Budget Operations and Planning, Business Services (General Stores and Purchasing), Facilities/Property Inventory, Financial and Human Resources. Working groups were assigned to each committee (Computerized systems to be developed, 1982).

The Working Groups were supposed to collaborate with EDS to develop and implement the new administrative systems. Working Group chairmen were charged with assuring broad University participation in the design of the new systems, and considering new and innovative approaches in the design of the new Facilities/Property Inventory Systems so that PSU did not err by recreating its familiar outdated systems. Working Group chairmen were also responsible for evaluating conflicting requirements, reaching satisfactory resolutions, and providing review and recommendations for approval/rejection of EDS deliverables. (Computerized systems to be developed, 1982; King, 1984).

The Student System Committee (SSC)[50] was responsible for coordinating the efforts of six working groups each composed of 10 to 15 University employees who worked with EDS on a specific area of information related to students (Student Aid Working Group, Graduate School Working Group; Academic Records Working Group,

[50] Fun fact. Dr. Spanier was a faculty representative for Human Development on the AIS Student System Committee in June 1982. When he left for another faculty position, he wrote to Bob Dunham and said; “I will be interested in following the AIS effort from a distance. I can honestly say that it is one of my current assignments I will miss greatly” (Spanier, internal communication, August 13th, 1982). Dr. Spanier would go on to become PSU’s 16th president.

Housing Assignment Working Group, Admissions Working Group, and Bursar Working Group (Computerized systems to be developed, 1982; King 1984). Robert E. Dunham, Vice President for Academic Services and Chairman of the Student Systems Committee of AIS, argued for student input in the development of the student system. "AIS was developed to make the students' life easier, so it only seemed right to include them in the process" (King, 1984). Five students were placed in a special group that was specific to student registration and drop/add. The Student System Committee members also visited several residence halls asking for students' comments.[51] Tom Thompson, president of the Undergraduate Student Government's Academic Assembly and a member of the group dealing with registration, remarked that, in general, the administrators valued student comments although the students did not have much contact with the company.

The Student System Committee group advertised in the Penn State Intercom, urging that members of the University community voice their suggestions and requirements to the committee.[52] Dunham urged the same action.

> The committee meets every two weeks and is collecting information from all groups and individuals who have concerns in this area. Now is the time for people to make their needs known. Once the system has been designed, it will be too late (Computerized systems to be developed, 1982).

Schultz explained that, "If we erred in anything it was on the side of too much user involvement, but I'd rather err on that side." He would add that other systems had

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[51] PSU students came up with the idea of a 1-800-call-in number to be used for telephone schedule adjustments. This alternative offset pressure from the computer system during drop/add registration period.

[52] The advertisement was not considered until after the Student Services Committee had met. According to Meeting Notes from 1982, there was little understanding of the University AIS project beyond the student system committee task force. Dr. Spanier (soon to be President Spanier), a then faculty member who served on the Student Services Committee, noted the need for a greater University-wide awareness of the activities of the AIS Project.

failed because the people who used the systems were not involved to the degree necessary. (King, 1984).

The student information system to be created by PSU and EDS was expected to be superior to any the University had previously maintained (Churchill, 1982, p. 3). EDS would design and implement the database software for the entire system using Software AG[53] on hardware provided by IBM (King, 1984).

PSU's partnership with EDS was complicated by the involvement of multiple personnel, committees and working groups. The PSU mindset that required so many levels of approval to get anything done was not compatible with a fixed term contract and cost EDS financially. Not surprisingly, a strained relationship developed. According to an EDS senior employee interviewed, "PSU kept saying well if you can do this, you can do that, but it wasn't under the agreed upon scope of the project." The working groups and committees made it difficult for PSU to make any necessary decisions, and ended up extending the effort's length of time. (Interview with mid-level EDS employee, July 2016).

The project begins. EDS began working in May 1982 with Penn State staff, "program users at all levels - from clerks to vice presidents," on the logical design phase, defining student related procedures then in place and requirements for the new student system (Churchill, 1982, p. 3). The automated and manual procedures in the six student

[53] Software AG is the company that provided EDS and PSU with the database for the entire system, and was already used at PSU. It would continue to be used for 25+ years. (https://www.plm.automation.siemens.com/en_us/about_us/newsroom/press/press_release.cfm?Component=229101&ComponentTemplate=822)

areas[54] were reviewed. The EDS systems engineers extracted descriptions at the working group level about how each system operated and what was needed from data processing in the future (Cunningham, 1982, Churchill, 1982, p. 3). Together with EDS, Penn State programmers joined forces within a new group, Administrative Information Systems (AIS), to develop the database for the Integrated Student Information System, ISIS, a project for all six major student areas that would allow for online processing and would interface with other university computer systems (Student System News, 1982).

In 1982, during the Student System Committee's first meeting with EDS employees in attendance, Dunham was serving as the Vice President for Academic Services, as well as the chairman for the Student System Committee. He outlined expectations for the Student System Committee and its working groups urging that meetings be held approximately every 2-3 weeks, and emphasizing that communication and periodic meetings with all working group members would minimize surprises and prepare participants for review and sign-off of contract deliverables. Likewise, he set expectations that there would be appropriate subgroups within the working group to concentrate on specialized problems. The group chairmen would be responsible for preparing a one page summary of activities for submission to the Student System Committee on the Monday prior to the SSC Thursday meeting and for scheduling all meetings related to their Working Groups (Student System Committee Meeting Notes, 1994-1996; Student System Committee Meeting Notes, 1982).

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[54] For reference, the six areas were: Undergraduate Admissions, Academic Records, Billing and Accounts Receivable, Student Aid, Graduate School, and Housing.

Camp Hill. In June and July of 1982, PSU forged a working relationship with EDS through meetings on campus, visits[55] to EDS's data center and mutual concentration on the first phase of the contract, which called for EDS and PSU to define current automated and manual procedures and requirements for the new student system in the six student areas to be reviewed (Kenepp, June 1982; Starling, 1983). EDS wrote that there was a "spirit of cooperation encountered in virtually all offices with which they have had contact" (Kenepp, June 1982). PSU wrote that "over 10,000 pages of documentation" were produced and distributed to each of the student information system working group members. P.L. Kenepp[56] felt that this amount of paper generated was "one indication that significant work [was] being done to develop a student system" (Kenepp, August 1982).

J. Gary Augustson. In July 1982, PSU completed its search for a single individual to own the AIS project. President John Oswald appointed J. Gary Augustson on July 15, 1982 as the Director of Computer and Information Systems and Special Assistant to the President. His position was considered as essential to the effort as the contracted information systems from EDS. Oswald wrote in his 1982 report to the Board of Trustees that "the University was at the point where critical decisions were required in

[55] On July 8th, 1982, EDS senior management officer, Starling, invited PSU Senior Administrative Advisory members to the company's new Regional Center in Camp Hill, described as EDS's most advanced data center as well as home to four hundred EDS Camp Hill professionals. EDS sponsored a Penn State Day in Camp Hill so that the members of the AIS Committee and members of the System Committees could visit the facility and see the latest in technology at work. Starling saw this full day event as an opportunity for team building and as a way to further the business relationship with PSU. Penn State Day at EDS provided presentations on the Data Center, its technologies, and how the technology was being applied to improve performance service to EDS customers. (EDS Senior employee, personal communication, July 26, 2016) (W. Lowell Starling, PSU internal communication, 1983). Based on this visit, PSU and EDS worked on a training plan for users of the student system meant to precede any contracted startup dates. The selected PSU staff would in turn train other PSU users (W. Lowell Starling, 1983)

[56] P.L. Kenepp was a PSU employee involved in the Student System Committee and AIS project as director of Academic Information Systems

the area of our computer and information systems capabilities." The significant two activities of hiring Augustson and EDS, Oswald promised, would provide both the "efficiencies and capabilities which should serve the University through the decade." (Oswald, 1982, internal communication).

According to the biography published in his hiring news release, Augustson had 16 years experience holding key posts related to database technology in three agencies of the federal government – the International Communication Agency, the Department of the Treasury and the National Security Agency.[57] He had served on the President of the United State's Panel on Information Technology, working with senior private industry and government officials to improve the use of modern information technology. Prior to his PSU appointment, he had developed and implemented information systems used around the world.[58]

Augustson began his twenty-four year career as PSU's highest ranking IT employee on September 1, 1982. Despite his extensive experience with information systems, he had no experience in higher education and no staff to support him. Unbeknownst to him, he was inheriting EDS consultants under a pre negotiated fixed price contract. Established university wide committees were in place and the charge to build AIS was in force. "You got it right, I inherited the position. It was hilarious. I got to know the search chair, and I asked him, Why didn't you tell me about EDS? And he said 'well, you didn't ask.' Augustson admitted that "all I knew about EDS was that they

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[57] He directed database technology research and supervised the development of technical systems for intelligence uses.
[58] Interestingly enough, despite his accomplishments Augustson was sometimes reported as a polarizing figure by key senior PSU administrators.

had developed hospital information systems, and they were hoping to get tremendous bang for their buck at the Research 1 Universities. What they didn't understand was that what they developed at Penn State wouldn't work at Ohio State, or another university." (G. Augustson, personal communication, November 7, 2016).

Electronic Data Systems (EDS) and PSU. Electronic Data Systems, a Texas based company founded in 1962 by H. Ross Perot, was the nation's largest computer services company to government and industry businesses (EDS Timeline Webpage, 2009).[59] An IT services industry pioneer and a recognized leader in the management of information technology, EDS was driven by the motto "our business is the intelligent use of computers" (Electronic Data Systems Corporation Encyclopedia Entry, n.d). The company designed, installed, and operated data processing systems for customers in the automotive, communications, energy, financial, government, healthcare, insurance, retail distribution, transportation, utilities, and manufacturing industries (Electronic Data Systems Corporation Encyclopedia Entry, n.d.; Breen, 2001, p. 106-117).

"EDS made promises during their presentation, during meetings, if you want to get it right, we can do it for you. They knew best" (Interviewee No. 1, personal communication, March 2016). According to this senior PSU administrator, the company's confidence was essential in securing the contract and was apparent in its visual presentations to clients. The EDS vice-presidents[60] had created a sales pitch at a cost of tens of thousands of dollars and "[explained] its outstanding computer

[59] EDS was acquired by GM for $2.5B in 1984, spun off in 1996, and purchased by Hewlett-Packard in 2008.
[60] EDS vice presidents were sequestered once a year for a week to create these sales pitches (Levin, 1989, p. 86).

capabilities, exacting personnel policies, and great financial strength" (Levin, 1989, p. 86). The company's client list, resources, training facility and Pennsylvania data center further contributed to the appearance of EDS as an attractive partner. The company's training facility was established in 1968 to respond to an industry shortage of experienced technical personnel in operations and system engineering, and produced graduates that became future leaders of the company. EDS had the world's largest private voice and data network in 1968 (EDS Senior employee, personal communication, July 26, 2016; King, 1984).

EDS emphasized its knowledge and convenience. Chairman and EDS founder Ross Perot, as well as sales personnel, told potential customers in presentations: "Concentrate on what you do best and leave the computing and data processing to us. We'll do it faster and cheaper than you. And we'll tell you in advance how much you'll pay for our services; your costs will be 100 percent predictable during the life of our contract" (Levin, 1989, p. 27; Management in Practice, 1973, p. 35-36).

EDS's offer of a fixed $3M price long-term contract versus the short-term hourly contracts typically offered by technology services companies was unusual for the time. When EDS set up a customer's data processing system, it would assign the staff to run it. Only when the system was running smoothly did EDS transfer some personnel to new projects. The longer contracts gave EDS stability, and was attractive to PSU because it allowed PSU to budget its future electronic data processing costs (Electronic Data Systems Corp encyclopedia.com entry, n.d.; Interview No. 3, Interview, 2016).

Despite these positives, Penn State was aware that the University was EDS's first higher education client. W. Lowell Starling and Katherine Viguers of EDS discussed the company's commitment to designing administrative systems for Penn State and higher education institutions in general during their first official meeting with the Student Systems Committee. They attempted to assuage any PSU concerns by informing the Student System Committee that other institutions were looking at the Penn State project with much anticipation. Success with the project was particularly important to EDS as the company prepared to enter the higher education market. And as such, EDS had staffed its project with individuals with "proven track records within the EDS corporation." (Student System Committee Meeting Notes, 1994; Student System Committee Minutes, 1982).

Logical design of the project. The project proceeded as expected. Over the summer of 1982, the interaction of working group members and EDS staff increased in preparation for the 1 September deadline of the current physical phase. There were no serious concerns expressed by EDS regarding the progress of the effort. Several members of the Student Services Committee and AIS committees and workgroups attended EDS's open house at Camp Hill on August 10th, the promised Penn State Day. (Kenepp, August 1982).

EDS spent the first nine months defining the system requirements, what the RFP had called the logical design of the project. At least 20 EDS employees worked with PSU employees from the different academic units initially on the logical design, and at least 60 separate EDS employees worked on development and implementation of the system. (EDS Senior employee, personal communication, July 26, 2016). In an interview with a senior EDS employee, the following anecdote was given:

> PSU was not using the time of the logical design to revitalize their system. The walls of the EDS office on campus were covered in flow charts, and one flow chart for the Graduate school showed just the VP, no inputs, no outputs. It was just him, a secretary, a telephone and a file cabinet. There was one associate dean on the bubble chart – there was a bubble with his office, and it had no data flows going in and no data flows going out. (EDS Senior employee, personal communication, July 26, 2016).

Despite the reasonably good working relationship with the University, air conditioning in the EDS work space on campus became a source of tension for some PSU employees. In the contract that EDS signed with PSU, the school was to provide EDS with one item, "two words,"[61] **air conditioning**. PSU had to air condition the work space of EDS employees, but they would be the only individuals with that privilege on campus. Gary Augustson (personal communication, November 7, 2016) and John Romano (personal communication, November 11, 2016) both remember that air conditioning was indeed significant for PSU employees. "Air conditioning was not permitted. Classrooms were not air conditioned. It was a tougher time. We didn't permit people to hang air conditioners out the window. We had to pump air down there[62] to get them [EDS] to breathe" (J. Romano, personal communication, November 11, 2016).

"That's all it takes to trigger a war. People had been asking for air conditioning at PSU for 20 years" (EDS Senior employee, personal communication, July 25, 2016). If there had not been any initial resentment for PSU employees, who were not given the

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[61] "two words" according to the EDS professional with whom I spoke (July 2016).
[62] EDS offices at Penn State were located in a basement.

chance to do the work EDS was hired for, there was now. One EDS employee said that "there was a high level of arrogance with PSU. We are Penn State. The idea that anyone from the outside could do something, it just stuck in their craw" (EDS Senior employee, personal communication, July 25, 2016). He felt PSU staff members resented the fact that EDS was hired, that they didn't get a chance to write the programs internally, and that most PSU employees, unlike PSU senior administrators, did not have a significant interest in the project's success. There was a we/they mentality between PSU subsystem employees and EDS consultants.

Furthermore, according to EDS, employees encountered a "classic line" from PSU departments when EDS was working on the logic requirements. This would go something like, "There was a student once who did this; how will your system handle it?" The response from EDS was always, "If it's an unusual circumstance, the department would have to run that student record manually" (EDS Senior employee, personal communication, July 25, 2016).

Another senior EDS employee said:

> We spent a lot of time on defining the requirements, the data flow, we didn't see it in our scope to redefine the business processes that would use the system as Penn State did not see the need to do that. New computer systems need new computer processes. If PSU was just going to use it the same way it used the old systems, it was spending millions of dollars for nothing. And in PSU's case, they bought new file cabinets to store the paper reports being produced from the new system. Since the business processes did not really change, the use of the system was significantly hampered. Implementing a new computer system without new business processes is futile. (EDS Senior employee, personal communication, July 26, 2016).

John Romano (personal communication, November 11, 2016) explains:

> The nature of the beast was EDS had made a decision that there was a lot of money to be made in higher education moving from mainframe environments to a distributed environment. That was true. Universities are not run like businesses, they run like fiefdoms. It's kind of nutty. At first glance, they didn't understand the complexity.

EDS's honeymoon with PSU appears to have been short-lived.

Office of Computer and Information Systems (C&IS). The Office of Computer and Information Systems (C&IS) was established in September 1982 to provide an executive level office that reported to Augustson for University initiatives in computer and information systems, with a special emphasis on long-range planning (The Office of Computer and Information Systems Strategic Plan, November 1985).[63] Every Penn State department was working on the AIS project. Schultz commented that, "the AIS Project represents a major commitment by the University. The cooperation and effort of a large number of individuals is necessary to make the project a success and thus far the enthusiasm and dedication of the System Committees and Working Groups has been outstanding" (Computer systems project on schedule, 1982). Student procedures continued to be documented and accepted, and PSU and EDS continued to prioritize student system deliverables contained within the RFP.

EDS and PSU completed the documentation and review of the in place system on September 1, 1982 for the Student System segment, and were actively working on the process for the Facilities/Property Inventory, Financial, and Human Resource systems. Effort on Budget Operations and Planning and Business Services was not scheduled to

[63] Augustson hired his staff under the umbrella of the Office of Computer and Information Systems. Specifics on how he built his team can be found later in the chapter, Insights from PSU Case Study, under the section, The Value of a CIO, Analysis of Gary Augustson.

begin until March 1983. Following documentation, EDS worked with PSU to design the new systems, incorporating requirements identified by system users. The design of the Student System was planned to be completed by December 1982, with the design of the other five systems to follow (Computer systems project on schedule, 1982).

Student procedures and information flows. In the early fall, a status report was circulated as part of a new internal newsletter called "Student System News," edited by P.L Kenepp, director of Academic Information Systems. This seventh in a series of newsletters was a specialty issue intended to educate the faculty on the new contract with EDS. According to the newsletter, the University felt that it was vital for faculty members to become familiar with the status of the new system development as they were the users and creators of the academic data of students. The tasks of advising, teaching, grading and planning "course offerings are in constant need of current and accurate data about students and the courses in which they enroll." (Kenepp, October 1982, no.7).

The newsletter described how a significant feature of the new student system would help faculty, administrators and staff by providing greater access to student data. The capability of online student registration could eliminate the many shortcomings of arena registration. With online terminals and printers planned for college/departmental use, new procedures would be defined for pre-registration/registration, drop/adding, grade reporting, and course scheduling. (Kenepp, October 1982, no. 7).

On September 1, 1982, EDS delivered documentation that described all student procedures and information flows across the University. This deliverable was officially accepted by the University on September 15. The first phase of the contract was completed. The effort was now to be concentrated on the design of the new system. (Kenepp, October 1982; PSU Request for Proposal Summer 1981, 1981).

Negotiating extra costs and advancing the admissions schedule to November 1983. In November and December of 1982, PSU and EDS negotiated extra cost items, and the school decided to move up the admissions module portion of the SIS delivery date to November 1983. As of November 12, 1982, the Admissions working group had held three meetings with EDS, academic records two, student aid one and the graduate school three. Housing and Billing had not yet met with EDS. At these meetings policy items were reviewed and requirements clarified. (Student Systems Committee Notes, 1982; Student Systems Committee Notes, 1983).

While working with EDS, the University realized certain desired elements had not been included as part of the original RFP. For example, the University had intended to start the entire student system at once but then decided to implement the subsystems in phases, so the implementation of the admissions subsystem was to begin in late September 1983. The reasoning was that the new administrative information system was modular, so admissions could be implemented without the remaining system parts. If the school had waited for total implementation, it would have missed an entire admissions cycle and the admissions subsystem would not have seen use until the Fall Semester 1984. PSU demands beyond the RFP were met in one of two ways, either the school paid additional funds or agreed to forgo a less important service (Gary C. Schultz in interview to King, 1984). When PSU and EDS entered negotiations for "extra cost" items, EDS reviewed and identified costs, and PSU found funding to support the development of the extra cost items (Kenepp, November 1982). By November, there were several adjustments made to the original implementation schedule for the new student system. (Student Systems Committee Notes, November 1982).

At the same time, it became clear that the deadline would not be met, and the target date was extended several times as the administration expanded its demands, and EDS fell behind schedule in implementing various portions of the system. In December 1982, PSU and EDS moved the deadline for the new logical deliverable from December 1, 1982 to January 1, 1983 so that both EDS and the working groups could ensure that the new logical deliverable was high quality. According to the SIS Newsletter at the time, EDS and PSU working group members labored "extremely hard," and a new rule was advanced that required PSU to respond with any comments or changes to any deliverable from EDS within fifteen days. (Student Systems Committee Notes, November 1982; Student Systems Committee Notes, December 1982).

When interviewed in the Daily Collegian about the new system, Schultz explained that delays were common in projects that involved designing a large-scale computer system from scratch. In addition to the changes concerning admissions, some of the equipment for the subsystem arrived behind schedule. Also the conversion of data between the old and new systems was a monumental task. This involved revising the format of data items so that they were compatible with the new database management system. "You cannot even begin to count the number of conversions we've had to make," said Robert D. Sheeder, project manager of AIS from February 1983 – December 1984, adding that files dealing with admissions, student aid, housing and biographical data had to all be converted. (King, 1984).

The new plan developed by EDS was reviewed by working groups, and approved by the Student System Committee. Undergraduate Admissions was to be completed November 14, 1983, graduate school admissions between January - April 1984, database conversion for 75% of the system for academic records, student aid and housing in April 1984, and the remainder of student AIS, May 7, 1984 (Kenepp, November 1983). Commenting on this time period, an EDS senior employee said:

> We realized higher education is not a business. It is a collegial environment. The committees reviewing the results of the committee recommendations were in some places four levels deep. For example, for the housing system. EDS would present to the Housing Committee, then it would be presented to the Student System Committee, and then to the Steering Committee. It was a classic academic mindset on those committees. One of the guys on one of the committees for one of the systems said: "This is a really good design, and it will really work well, but I am not convinced that this is the best possible design. We are Penn State, and we should have the best system ever." And EDS had to reply that we are not here to conduct the internal search for the optimum solution, we are here to get something done. EDS and the University had two different goals. The University staff wanted the ultimate/pinnacle solution, and EDS wanted a solution that worked. (EDS Senior employee, personal communication, July 26, 2016).

Academia wanted ideal while business accepted useful.

Futuristic logical design and EDS hardware features. On January 26, 1983, the logical design of the new SIS was accepted by the University and by over 70 working group and Student System Committee members. EDS had agreed to make the necessary changes to cover differences. The company recommended that the terminals of each academic department maintain one computer and one printer, whereas each campus would require four computers and four printers (one for each undergraduate admissions, registrar, bursar, and student aid office). Although EDS stated that 364 computers and 276 printers were needed at minimum, there was no discussion on how this number of machines being online would impact the system. (Student Systems Committee Notes, January 1983).

The logical design included some futuristic sounding items such as: online student billing and payment system with delinquent accounts automatically flagged; federal and state financial aid processing, planning and award packaging tools that tracked correspondence with students and produced administrative reports; as well as admissions application management tools to support marketing and recruiting efforts, and track application requirements (see Appendix J for futuristic logical design features). Expectations were high. The functionality of all the sub systems seemed to overreach the reality of PSU's circumstances. (Student Systems Committee Notes, January 1983).

Identification of remaining tasks. A draft of a work plan for the remaining phases of the student system was prepared by EDS on February 18, 1983 to guide unfinished student contract activities through December 1, 1984. The plan identified tasks, whether EDS or PSU was responsible for carrying them out, and the time frame for completion. Coordination was essential to ensure the tasks were properly sequenced and completed in time for installation of new hardware. (Starling, 1983).

In February, working groups had begun deliberations for defining coding schemes and data security criteria. EDS presented screen and report formats for review and acceptance. Since many features that EDS had designed into the new system utilized online capabilities, working groups defined where certain functions of the system would take place. 116 functions had been identified, such as admissions records, degree audit, room assignments, fee payments and charges. Since user officers had direct access to the database, many of these functions were assumed to be performed by the user, but the how, or where, had not been specified. This was an area of ongoing effort. (Student System Committee Meeting Notes, February 1983).

EDS and PSU working relationship falters. Even as they were making plans for moving forward, evidence of strain in the relationship of PSU with EDS appeared internally. Working groups began to voice their concerns to senior personnel. In a March 23, 1983 internal communication to Augustson, Loren M. Mortado, working group chair of the Bursar Group, explained his concerns commenting that he felt that EDS had not invested the time necessary to understand school needs, especially in budget and planning processes. The company had underestimated the complexity of higher education requirements and preferred to question the interpretation of the RFP instead (Mortado, internal communication, 1983). Mortado concluded:

> In summary, I believe that the spirit of the initial agreement entered into between Penn State and EDS – not solely a business contract, but two organizations plowing new turns in the field of electronic data processing and information management – has deteriorated. In the long term, EDS and PSU both have much to gain from this effort – Penn State in the development of the most comprehensive, state-of-the-art information systems available in higher education, and EDS in the future systems they will design at other universities, building upon their investment in the Penn State system. (Mortado, internal communication, 1983).

Resolving conflicts between PSU and EDS. By April 1983, Augustson had taken action. He set forth a new directive to the Student System Committee Chairmen to provide a more workable arrangement for resolving conflict between EDS's System

Engineers and Project Managers and Penn State's Working Group and System Committees. The creation of a more formal review process for problem resolution that involved Augustson of Penn State and Starling, continuing in project managing from EDS, would dictate meeting weekly to identify and resolve problems emanating from the contract for the development of the Administrative Information System (AIS) (Augustson, internal communication, April 19, 1983). Working Groups and Systems Committees were urged to forward problems deemed unresolvable directly to Starling or Augustson for consideration. The conflicts had to be documented, stating the position of both parties and the areas of disagreement. This formal arrangement would prevent Penn State and EDS representatives from spending unnecessary hours in unproductive debate on problems of a contractual or technical nature. (Augustson, internal communication, April 19, 1983).

No more changes. According to the Student System Committee newsletter, the student information system would become operational by January 16, 1984 (Kenepp, August 1984). EDS was now fully involved writing, testing and documenting computer code to support the capabilities PSU and EDS had spent the past year defining in the first phase of the project, logical design.

In an internal communication on September 2, 1983, Augustson wrote to the AIS Student System Committee, dictating that no more changes would be allowed. EDS and PSU had committed to an accelerated system implementation, he explained, and as such, even when committee members came across cases where the system did not provide precisely what was expected or wanted, they must "make the utmost effort to resist the urge to request system changes at this point in time." Care had to be taken not to point out and ask for revisions "which would divert time and energy away from the more important process of proceeding with system implementation." He maintained that the AIS system was flexible and easy to change, so PSU staff could add desired improvements once it was in place. He asked employees to identify any enhancements and document them, but to send only federally mandated changes on to Augustson. Additional changes this late in the project would negatively impact the overall system implementation. (Augustson, internal communication, September 2, 1983).

Response times, testing and backup. The admissions delivery deadline was pushed by EDS from the agreed on date of October 15, 1983 to January 16, 1984. The process internally took a toll on PSU personnel (Student System Committee Meeting Notes, October 1983). "Staff have spent an enormous amount of time on this project and are drained both physically and psychologically." Members of all working groups were being stretched to their limit, working at maximum capacity. (Student System Committee Meeting Notes, October 1983).

The issues with EDS became apparent at the October 17, 1983 meeting, where it was acknowledged that the system had significant problems. "Poor response time has been a severe detriment to the data entry process.[64] It has been ranging from 10 seconds

[64] "Response times are the times that staff and students experience when dealing with the system at the start of each semester. During the first week of classes, there is always a significant stress put on administrative computing resources with students registering, paying bills, dropping and adding courses, changing dormitory room assignments, receiving student aid, hiring graduate students, hiring staff and faculty, and advising students on their academic progress. In the first week, students want to find better courses at better times while the faculty judge the number of sections required for a particular course. The stress on the mainframes …. is enormous." (Ken Blythe, Database Management, November 1992, p. 29). For example, during registration week [as of Fall 1991/Spring 1992], more than 70,000 residential students and 160,000 continuing education students at 22 separate campuses

to time out at five minutes. Four different screens are required to enter application data. Admissions is losing time and the backlog is building." (Student System Committee Meeting Notes, October 1983).

EDS appeared to be in denial. In an internal memo, Starling of EDS noted that the learning curve by both EDS and Penn State was improving. His staff had examined both the estimated and actual time in task completion and felt more comfortable with the projects. Although EDS wanted the information system in production prior to testing, and requested this in the October 1983 meeting, PSU had never agreed and had been clear from the beginning. Dunham echoed the school's position that, before "the system can be moved into production, PSU must 1) have a product delivered and tested by EDS, 2) tested by the university, and 3) university staff must be trained to use it. And a revision cycle would be needed during test to correct discovered errors." (Student System Committee Meeting Notes, October 1983).

According to PSU internal documents, EDS was backtracking on a backup system, another requirement the University had outlined in its original contract. Systems this large and complex, John Romano, Vice Provost and Dean for Enrollment Management and Administration, iterated during meetings with EDS, cannot be guaranteed to have no problems. Therefore, in addition to the dates for testing and implementation, the implementation plan should include dates for the prototype presentation and a date when EDS completed its testing and gave the plan to Penn State to begin user testing. According to EDS, however, the company could not provide the

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were served across the state.

backup within the constraints of the PSU contract. (Student System Committee Meeting Notes, October 1983). During one interview an EDS senior employee claimed that EDS had never promised the backup system, because Penn State did not have the resources to maintain an administrative system in a robust and secure environment where backups would be successful (EDS Senior employee, personal communication, July 25, 2016).

Different working groups were having difficulty with the ever changing deadlines. EDS's adjusted dates impacted Student Aid while the Graduate School in 1983 prematurely developed new application forms to be used with the new system at a cost of over $30,000. (Student System Committee Meeting Notes, October 1983).

Furthermore, in internal communications and meetings the relationship between EDS and PSU was described as faltering. "There appears to be a two-part criticism of misunderstandings between EDS and Penn State: PSU staff feels EDS has promised some items several months ago which are now being retracted by EDS. EDS staff notes that these items were reported to be incorporated as part of the system if they could" (Student System Committee Meeting Notes, October 1983). During this meeting EDS asked that PSU no longer report that a problem existed, but rather ask what was being done to solve previously reported problems. (Student System Committee Meeting Notes, October 1983).

EDS personnel felt that they were on track to deliver all the subsystems they were hired to complete with the exception of degree audit. The systems may not have been the optimum solution for Penn State but EDS was not there to produce optimum solutions.

EDS was there to get it done, or else, according to one senior official, they would still be there. (Student System Committee Meeting Notes, October 1983).

The new system explained. Despite internal issues with EDS, and the fact that the original 1981 contract deadline of March 1984 was not met, Penn State University was working steadily to promote a positive message about the system. On March 1, 1984, the existing features of the new student AIS were circulated internally to Student System Committee Members by Paul L. Kenepp. The new student AIS was to "impact the use of student data in virtually every office of the University that deals with student information" (Kenepp, March 1984). The system would use online terminal processing and database information systems to provide student data access and update capability to campus offices. An online terminal would allow data retrieval from the systems. The integrated information systems would update data automatically if the records were affected by the action of any school office, e.g. as students added or dropped courses, the bill was automatically recalculated for the Bursar. (Kenepp, 1984).

On March 27, 1984, the Undergraduate Student Government sponsored a talk designed to explain the University's new computerized registration system. Dunham, Vice President for Academic Services, and Warren R. Haffner, University Registrar, explained the program to students who gathered in the student lounge. They reported that the new computer system was designed by Electronic Data Systems and known as AIS or the Academic Information System. The system would eliminate all the running around that had become part of arena registration (Sorchilla, 1984) and promised that the new system would be equipped to handle everything from academic records, billing, and financial aid to housing assignments, textbook ordering, and class scheduling (Carlson, 1984; Computer Registration headaches, 1984).

Dunham explained a new system of student forms for registration, that he warned would only work if 75 to 90 percent of students completed these forms. Schedules, on white slips, would be mailed to students in July, and students could call a special hotline to make scheduling revisions. Students were able to add/drop courses with the help of a computer terminal operator at the departmental office offering the course (Carlson, 1984). Dunham added, “We don’t know how well it will work (at first), but once we have the bugs worked out, it will be a super system. It will be purring like a kitten when you (students) come back in the fall.” (Carlson, 1984).

Delay of admissions letters. Not quite. Two months later, an article published in the June 18th issue of the Philadelphia Inquirer (a non-University newspaper) stated, “Pennsylvania State University’s fall freshman class will be missing about 1,000 students — at a cost of at least $200,000 — because a succession of time-consuming “bugs” in a new centralized Penn State computer system held up the mailing of acceptance letters. Most of the students chose to go to other colleges after the system malfunctions of the computer systems created delays of up to three months in sending the letters. The Dean of Admissions at Penn State, Donald G. Dickason (who would resign in September of 1984), said “it wasn’t the computers as much as it was a new software program that caused the delays” (Pohler, 1984; AIS: Too much, too soon, 1984). Dickason explained that typically the University would send acceptance letters in late November 1983 to applicants for the 1984-1985 academic year, but problems delayed the process until early

February 1984 (King, 1984). Dickason had predicted the delay would cause an enrollment decline of 1,000 new freshmen (King,1984). The computer system had been "down" repeatedly for several days or weeks at a time, preventing admissions officers from getting at student files and records (Pohler, 1984). According to Penn State admissions officer Edward Sevensky, some of the accepted students that the school had spoken with via telephone felt that "they had to make a decision for another college" (Pohler, 1984).

The negative perception of the Administrative Information System was now being reported state-wide on the front page of the state newspaper, highlighted next to a picture of President Reagan with the then Sri Lankan President. The system was not just having issues with admissions, however. Earlier in the week on June 12 during drop/add, the system had broken down again (Krebs, 1984).

In July of 1984, Augustson wrote to Senior Administrative Advisory Committee members advising that, as the University moved towards the completion of the Student System portion of the Administrative Information System, it was wise to delay additional work on AIS because a review was necessary to complete specification of the problem areas which were still unresolved in some of the systems. The break would provide PSU time to review the technology changes which had taken place since the original system design in July of 1981, and would allow individuals to participate in the Task Force to review the AIS project (Augustson, internal communication to Senior Administrative Advisory Committee, July 2, 1984).

Billing graduates, late billing students. The bad press did not stop there. On August 16, 1984, the Associated Press picked up an item from the Philadelphia Inquirer, which in turn had picked up articles from the Post-Gazette and Harrisburg Patriot both published on August 8, 1984. Despite having graduated in the Spring 1984, a large percentage of 5,000 alumni had received a tuition bill for Fall 1984 along with a letter from PSU President Bryce Jordan about tuition increases. The University bursar blamed the oversight on "startup problems with Penn State's new computer system" (Penn State's new computer forgets who graduated, 1984).

Penn State spokesman and the Executive Director of University Relations, Roger Williams tried to put the error in perspective.[65] "This shouldn't have happened, obviously, but it's easy enough to simply ignore the bill. We think this is going to be an extremely flexible, state-of-the-art system." (Penn State's new computer forgets who graduated, 1984; No tuition rest for graduates, 1984). However, the article did not stop there, reiterating the story in the June 1984 Philadelphia Inquirer about the loss of 1,000 students due to the late admission letter computer malfunction (No tuition rest for graduates, 1984; Snafu at PSU: Grads billed for tuition, 1984). Designed and expected to handle all student requests, the AIS had contributed to financial and academic losses and was no longer perceived as a robust solution.

Other problems developed. "The filing deadline for Fall Semester had to be moved back a week by the bursar's office because many bills were simply not mailed in

[65] Roger Williams was the executive director of Penn State University Relations from 1984 – 1995. (PSU Website directory search).

time for students to file them by the deadline" (AIS: Too much, too soon, 1984; King, 1984). Students could not settle their accounts to register for classes because they had not received their bills.

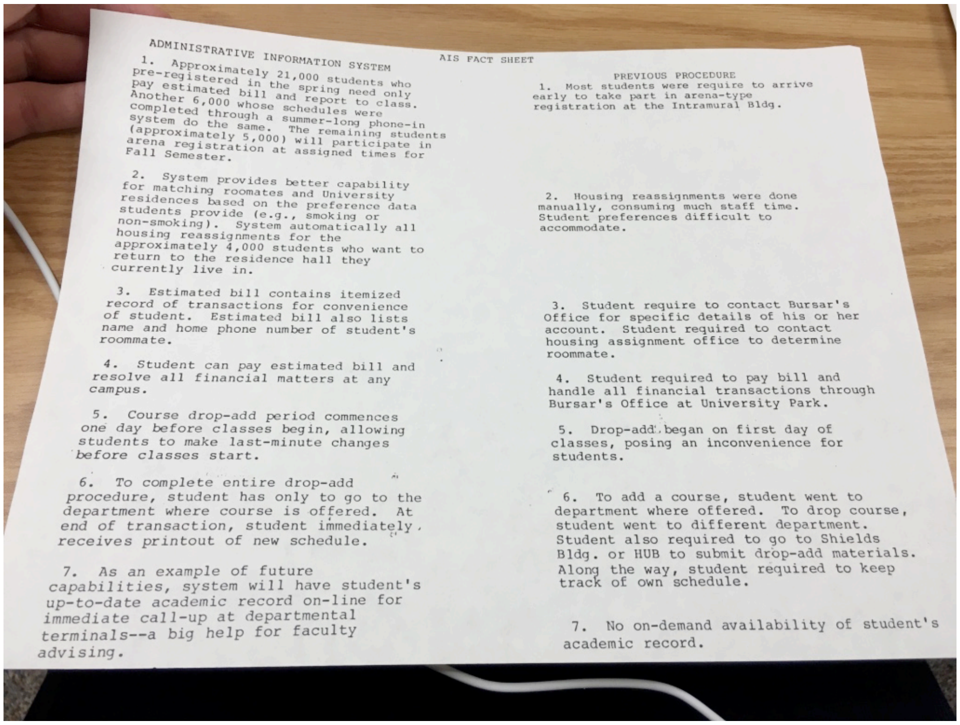
The situation had progressed to the point that Penn State needed to do damage control and issued a same-day press conference on August 16, 1984, addressing the image problem facing the new university system. Williams, with the assistance of Richardson, Dunham and Augustson, presented the following talking points:

> First, despite some highly-publicized errors, the AIS system was, on the whole, working very well, and promised great benefits to students in terms of time and convenience and to the University in terms of costs and efficiency. Since the system went online in July, it quickly and cleanly pre-registered 20,000 students, who needed only to pay their bill by mail and report directly to class. In addition, another 5,000 students completed their schedules via 800-number phone-in to University Park. Formerly, they would have been required to attend arena-style registration, whether pre-registered or not. In a system of this scope and complexity, some problems like the enrollment admission error and billing process that accidentally billed seniors are unavoidable. (Roger Williams, internal memo, August 16, 1984).

Penn State was adamant that the registration problems could not be blamed on the computer. Since World War II, registration at major American universities had typically been a nightmare. The biggest problem resulted from supply and demand — too many students and not enough courses or course sections. "A computer system such as AIS cannot prevent this supply and demand crunch from developing, but it can help us to deal with it more efficiently in different ways." (Roger Williams, internal memo, August 16, 1984).

Richardson admitted that the upcoming drop/add period would put a severe strain on the system, but claimed that after the process had been de-bugged, it would provide an extremely convenient way for students to complete the drop/add procedures. Since Penn State was expecting some problems during the drop/add period that was beginning two days after the press conference, the school had established a number of contingency plans that would allow students to complete drop/add without undue inconvenience (Roger Williams, internal memo, August 16, 1984). Finally, AIS was saving the University money, and in the long run would provide convenience to the student (Roger Williams, internal memo, August 16, 1984).

The press conference was well attended by members of the Associated Press, State College AM radio stations, local news channels 10 and 6, the Centre Daily Times, and UPI in Pittsburgh. PSU distributed the following fact sheet about AIS to those in attendance (Roger Williams, internal memo, August 16, 1984). The handout compared old and new procedures in registration, housing, estimated bills and drop/add.



AIS FACT SHEET

ADMINISTRATIVE INFORMATION SYSTEM	PREVIOUS PROCEDURE
1. Approximately 21,000 students who pre-registered in the spring need only pay estimated bill and report to class. Another 6,000 whose schedules were completed through a summer-long phone-in system do the same. The remaining students (approximately 5,000) will participate in arena registration at assigned times for Fall Semester.	1. Most students were require to arrive early to take part in arena-type registration at the Intramural Bldg.
2. System provides better capability for matching roomates and University residences based on the preference data students provide (e.g., smoking or non-smoking). System automatically all housing reassignments for the approximately 4,000 students who want to return to the residence hall they currently live in.	2. Housing reassignments were done manually, consuming much staff time. Student preferences difficult to accommodate.
3. Estimated bill contains itemized record of transactions for convenience of student. Estimated bill also lists name and home phone number of student's roommate.	3. Student require to contact Bursar's Office for specific details of his or her account. Student required to contact housing assignment office to determine roommate.
4. Student can pay estimated bill and resolve all financial matters at any campus.	4. Student required to pay bill and handle all financial transactions through Bursar's Office at University Park.
5. Course drop-add period commences one day before classes begin, allowing students to make last-minute changes before classes start.	5. Drop-add began on first day of classes, posing an inconvenience for students.
6. To complete entire drop-add procedure, student has only to go to the department where course is offered. At end of transaction, student immediately receives printout of new schedule.	6. To add a course, student went to department where offered. To drop course, student went to different department. Student also required to go to Shields Bldg. or HUB to submit drop-add materials. Along the way, student required to keep track of own schedule.
7. As an example of future capabilities, system will have student's up-to-date academic record on-line for immediate call-up at departmental terminals--a big help for faculty advising.	7. No on-demand availability of student's academic record.

Figure 3. AIS Fact Sheet. Image: Penn State University Archives.

System problems. On August 18, 1984, the Fall drop/add period began, and the arena registration that was supposed to be defunct still existed within the terminals inside the Intramural Building. The system was unable to handle the multitude of student requests, and long lines and delays resulted. Registration was not going as well as planned. Terminal operators were unable to see the number of seats available in a course from the program screens. The student information system did not have built in system checks. The 200 terminals being used resulted in response time increasing as many students faced long queues and waited hours. Kathy Leitzell, a secretary in the composition and freshman English office, recalled there were “a lot of lines” during drop/add. Despite some frustrations, the students were “very patient” and AIS was far superior to the old system. “I thought it was a lot better than all the paperwork the students used to have to go through,” she explained. “Some of the students didn’t realize the advantages of the system.” (King, 1984).

Associate Registrar Richard Sodergreen said long lines were also a problem in the Shields building. “It was extremely hectic. The lobby was next to jammed for five days.” Late registrations and individuals whose scheduling problems could not be dealt with by departments added to the chaos. Sodergreen reported that the lines were caused largely by the time it took the system to acknowledge commands. The response time was as slow as three to four minutes, and many student transactions took 15-20 minutes. (King, 1984).

Figure 4. Photograph of students waiting in long lines to complete fall semester schedules. (King, 1984). Image: Penn State University Archives.

AIS Project Manager Richard Sheeder stated that PSU had become aware of the slow response times in June 1984 when the system was first used for drop/add. During that testing period, the response time had been 14 seconds in 85 percent of the cases. According to Augustson, no one had realized the problem that simultaneous operation of registration and drop/add would cause as more terminals and printers went online. The IT department had not tested for that provision. Augustson reported that they "did not anticipate the phenomenon of students who intended to complete their schedules and then go through the drop/add process. There were certainly more than 5,000 students in drop/add. Some might say there were more than 5,000 in any one line." (King, 1984). The University had not anticipated the great number of students who would use the drop/add and the wait lines that would result in some departments. (AIS: Too much, too soon, 1984).

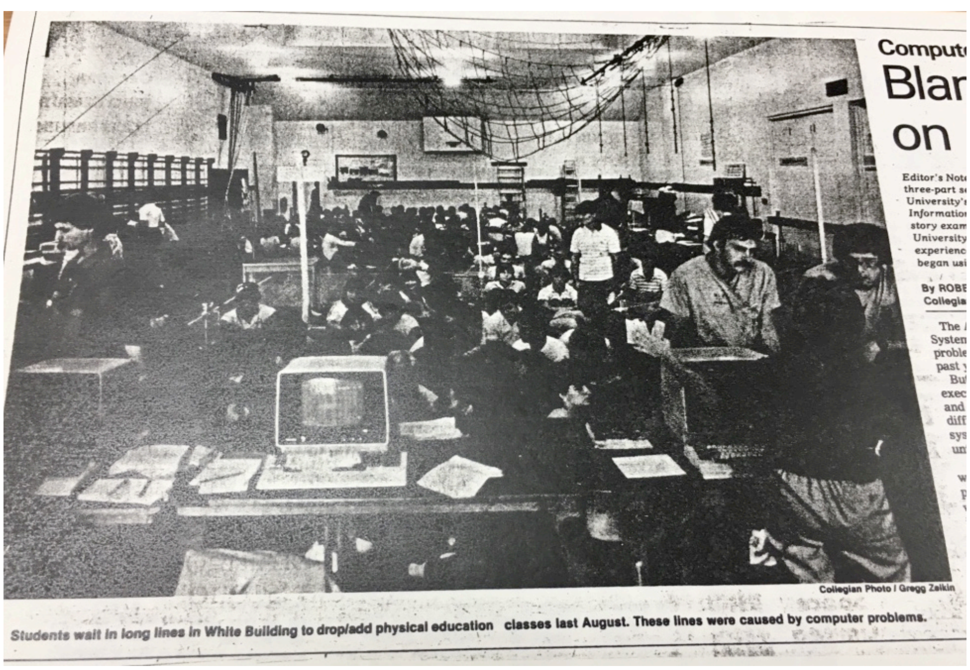


Figure 5. Photograph of students waiting in long lines because of computer problems (King, 1984). Image: Penn State University Archives.

The issue was not just with response time. There were reports of students who were dropped from all their classes without warning at the beginning of the Fall 1984 semester. The new system required an estimated bill from students who planned to attend the University, even those on financial aid. Under the old system, students had to present their pay receipts to get into arena registration, while those with complete financial aid did not have to file a bill. Under AIS when students on financial aid went to classes, they discovered they had been dropped and would have to late register or lose their place in class. In response, the registrar's office issued more warnings from the bursar to students to file their bills. (King, 1984).

Student aid. During July and August, issues and tensions mounted. In August and September, the University was still in negotiations with EDS and the company's internal departments about tradeoffs and costs. A flurry of memoranda showcased one issue that started with a May EDS bill for $3,500 that took until October to resolve. (Letter, W. Lowell Starling to J. Gary Augustson, May 10, 1984).

EDS had had enough. Starling wrote on May 10, 1984 that the Student Aid Office was identifying specification changes that had already been confirmed in March, coded and available for testing in April, and accepted by the University in May.

> EDS has in the past responded without charge to multiple requests for changes to Uniform Methodology processing. The continuing specification changes have cost EDS both man-time and schedule delays. In accordance with the contract provisions for EDS to be reimbursed for University caused schedule delays, a charge of $3,500 will be added to the May Invoice to cover the cost of a specification change. (Letter, W. Lowell Starling to J. Gary Augustson, May 10, 1984).

In the attachment EDS claimed that the registration subsystem changes had "caused an estimated fourteen (14 man months of additional work over what would have been required to implement the original design)." Subcontractor Software AG had confirmed EDS's concerns that performance problems would arise because of Penn State processes and the way PSU wanted its current registration system organized. (W. Lowell Starling to J. Gary Augustson, internal communication, May 10, 1984).

The Student Aid Office disagreed, saying that the need analysis should have been understood by the EDS staff prior to 1984-1985, that EDS records were in conflict with its own company's position, and that the office could provide documentation from EDS itself saying that the necessary information to program or incorporate the changes for the 1984-1985 processing year had been provided (Brugel, internal communication, September 7, 1984).

While the issue with the Office of Student Aid remained unresolved, EDS attempted to apply a $25,000 payment they had received from the Penn State Bookstore towards the additional Office of Student Aid work. Similar to other groups the PSU Bookstore was dealing separately with EDS. Bookstore management had expressed dissatisfaction, complaining "EDS' obvious lack of interest (almost unwillingness)" to develop a textbook system. The Bookstore wanted a $25,000 refund directly from either EDS or Augustson's MS office. "In no way, should the bookstore be put in a position of having to wait for a refund, while EDS and other elements of the University negotiate what are acceptable tradeoffs and/or billable items." (Schultz, internal communication, August 10, 1984).

At the end of August 1984, Dunham argued with Augustson about fees due to EDS, as it appears Augustson had taken the side of EDS:

> Gary as we discussed I do not feel that we in OVPAs have made any agreement to pay for "extra" work and therefore will not pay the $25k requested.
> RD
> 8-23-84

Augustson had written that EDS intended to bill the University for additional work. "In keeping with University policy, your office will have responsibility for providing the funds to support this additional work." Dunham, however, did not accept that EDS completed extra work, just the work that had been agreed to contractually. (Dunham, 1984).

EDS attempted a low key negotiation with the Office of Student Aid, stating that "there needed to be a shared responsibility for the errors made in the final design" for issues related to the Student Aid office system (Viguers, internal communication to Dr. John Brugel, August 28, 1984). However, since the logic that had already been chosen by EDS and the University had problems, if EDS were to deliver the packages as currently designed, ultimately the University would find the effort totally unacceptable. In a reply about the memo to Augustson and Dunham, Brugel of Student Aid stated that everyone needed to understand that, although EDS might provide some components, "MS will have to provide the remainder if we are to have the capacity to simulate aid eligibility and time this process to admissions" (Brugel, internal communication, September 7, 1984).

EDS wanted the University to drop a proposed Aid Simulation screen so that the company could complete Plus loans, University loans, and batch Pell. EDS encouraged Brugel separately to accept the trade, and to speak with Augustson directly, if he was going to do so. Through memos, EDS kept reiterating that although Aid Simulation was a nice capability to have, it was not as essential to the day to day University processing as the loans components. Arguments continued about process.

On September 24, Registrar W. R. Haffner took offense to Starling's May memo, asking why Augustson had completely accepted Starling's statements as fact on August 13. "If this is going to be the University's position each time a report, screen or application becomes an issue, why do we waste our time trying to gather evidence to support our position? (Haffner to Augustson and Dunham, internal communication, September 24, 1984). Augustson had written to Richardson, complaining that the other departments led by Dunham didn't want to pay their fair share for their extra work demands and he needed support from the Offices of the President and Provost (Augustson and Dunham, internal communications, September 1984).

Internal PSU politics became volatile. Augustson wrote that departments needed to assume responsibility for their own data entry, and that his office's services were no longer free. "There ain't no free lunch! One way or the other, the University pays!" He wanted to work with Dunham to find whatever supplemental funding Dunham needed for data entry support and in closing[66] wrote, "I need your help in moving this issue to closure. What can we jointly do to get this issue out of the discussion stage." Dunham's

[66] According to an interview with a senior PSU official (March 2016), Augustson was making an insincere request for assistance from Dunham, and so Dunham and his assistant Melander responded in kind.

assistant Melander replied that in the spirit of Augustson offering to help seek supplemental funding instead of continuing to provide data entry support out of Management Services (MS), the $20,000 line item in the budget given to MS personnel to cover Office of Student Aid personnel and terminal costs needed to be returned to the Office of the Vice President of Student Affairs so it could be redistributed. (Augustson and Dunham, internal communications, September 1984).

When asked about this time period, an EDS senior employee stated that upper level administrators like Dunham and Schultz were instrumental in the support of EDS. Provost Dr. Cunningham seemed to understand EDS's predicament stating to W. Lowell Starling, "you are being nibbled to death by ducks" (Interview No. 4, personal communication, July 2016). Dunham pushed through items, telling PSU staff not to waste time; and Schultz worked with EDS from day one, facilitating problem resolution. Since Augustson was hired after the EDS contract was signed, it was not clear to the senior EDS official contacted whether he was actually supportive of EDS. This was the exact opposite of the opinion that PSU employees had of him who believed he was a staunch supporter of EDS. According to the senior EDS employee, "Gary didn't want EDS to fail. Senior administration was trying to make the project go forward" (EDS Senior Employee, personal communication, July 2016).

Testing ground. In October of 1984, EDS was employing multiple software engineers to code for student aid who were previously unassociated with the effort, limiting the general knowledge about how the system was going to work, and making project continuity difficult to maintain (Sheeder, internal communication to J. Gary

Augustson, October 18, 1984). The Office of Student Aid did not think that the deadlines established were possible to meet, and there was general concern that "Student Aid staff [were] again telling EDS about procedures which EDS was informed in detail about last year." In an interview conducted at this time, a senior EDS employee stated that sixty people were working nonstop on the project. "The EDS space was just overrun with staff" (EDS Senior employee, personal communication, July 26, 2016).

In preparation for January's drop/add period, Augustson and his team increased the student information system's power by adding equipment and rewriting some programs to increase efficiency (King, 1984). Furthermore, by October 1984, some of the 12,000 admissions offers PSU would make by December 1984 were already being mailed out. With AIS, there was a seven to eight day turnover period between the arrival of the application and the University's reply. (King, 1984).

However, the school's replies made some students feel that registration and drop/add for the Spring Semester 1985 was yet another testing ground for AIS, with students providing their time and schedules for the experiments. One student explained in a Daily Collegian editorial that the student system was the largest of the six systems that were to be introduced over several years, and despite being an excellent idea, the university should not have sought to implement the largest system so quickly. "Believing the student system of AIS could be implemented in one year is a plot for a fiction novel or a dream." The editorial invited students to share their issues with the administration saying, "Your voice is needed if the lofty ideals of AIS are to become a working reality within your short time at Penn State. Dealing personably, constructively and honestly with problems is the only way Penn State will find out whether AIS will go down in history as a model for state-of-the-art computing or a monumental disaster." (AIS: Too much, too soon, 1984).

In reply, Augustson said that the phased implementation of AIS was designed to ensure that one part worked before any new part was added, so that "we don't do what we've been accused of by (The Daily) Collegian, which is to turn the whole thing on in one day without testing it."[67] He did admit that he had not realized the full significance of the drop/add process problem until the fall when more than 300 terminals wanted access to AIS simultaneously (King, 1984).

In early October, President Jordan met with the University Student Executive Council, USEC, led by Chairman and Undergraduate Student Government president, Adam Levinson, to listen to student gathered suggestions for AIS improvement. As reported by the Daily Collegian in the article, *New computer system critiqued, Jordan hears review group's suggestions for AIS improvement*, the meeting was closed and presented directly to Jordan because USEC was having difficulty submitting recommendations to administrative departments. Students voiced their concerns about the long lines and frustrating hours to complete transactions because of slow response times (Sorchilla, 1984). They proposed a three week period at the end of Fall Semester during which they could either call in or go directly to terminal operators in the Shields building to complete their schedules. Many students only needed to make one or two

[67] Historically however, PSU tested the new student information system without considering student use or general increased computer load on the system.

transactions, and therefore some long lines at overloaded terminals could be avoided. (Sorchilla, 1984). In response to the student concerns, the Administrative Information System registration group founded by Dunham and composed of students and faculty, recommended that fewer terminals be used during registration and that a backup system be developed where forms could be collected from students and run through the terminals at night.

Internally, it appears there was some dissatisfaction from Dunham's academic services office with EDS. In a personal communication on October 3, Augustson wrote to Dunham, "I am concerned about the all too frequent talk concerning 'taking EDS to court.' Much of this appears to be emanating from your office. I would appreciate your help in shutting this off." Dunham responded on October 4, 1984; "Gary can you be more specific?" Augustson wrote back: "Bob, I thought that I was pretty specific! Why don't you put your ear to the sound! Gar 10-5-84" (Augustson and Dunham, internal communication, 1984).

The exchanges continued to October 25, 1984, when Augustson objected to the comments Dunham supposedly made about the AIS system publically:

> Given all the heat the AIS system has taken for areas where it has not performed as it should have, it would be most beneficial to see it quoted publicly by a Senior University Official as a main, positive contribution to new effective procedures.

Apparently Dunham had said the "computer is flexible enough" to move admissions in the correct direction and fully understood the AIS system's contribution to the University.

Dunham responded:

> If you don't like the article call the Collegian – I didn't write it and you don't know what I said. 2 x I'm getting a little tired of your tirades!!

According to a senior PSU official who spoke on the condition of anonymity, the underlying tension between Dunham and administration was one of academic systems and information systems control. Most administrators believed that these were academic systems and that faculty and staff needed to have a voice, and they expected CIS to support academic systems with the services needed by the staff and faculty. One senior staff member believed that Dunham was the only senior administrator with power that could question Augustson, who in turn felt that everything had to be his way. "Gary Augustson was a pushy, arrogant person who wanted different systems across campuses. Ken Blythe, the first man under him was truly his principal, and the reason the IT department worked; Ken was a super guy, instinctively creative and had an ability to analyze what departments and staff needed (he knew what the registrar wanted); he knew how organizations work. Gary and Ken had a certain pride that Gary's crew could do the work." (Interview No. 1, personal communication, March 2016).

Meanwhile, The Pennsylvania State University Telecommunications Task Force produced a strategic plan in October 1984 reminding senior executives that "new technologies have an impact upon higher education and the way institutions like Penn State have organized themselves to deal with new opportunities." Penn State, the report assessed, had consistently accepted change in the past. Many examples existed. The print medium had led to the establishment of Printing Services at PSU, low-cost film in the 1940s brought about the Audio-Visual Services department, and television had preceded the establishment of both the former Division of Instructional Services for videos of classes and the Division of Media and Learning Resources, later combined into the Division of Learning and Telecommunications Services (WPSX - TV). The Office of Telephone Services arrived to address campus wide telephone usage having reached a critical level.[68] With the development of practical computers in the 1950s, the Computation Center was created to support academic uses of computers and the Management Services Center came about to support administrative computing. (The Pennsylvania State University Telecommunications Task Force Strategic Plan, October 1984, p. 7-1).

> If higher education is to respond positively to the pressure and opportunities that these advances offer, top level leadership of its institutions must understand the conceptual framework implicit in such concepts as the Office of the Future, the automated factor, the "wired-up" campus, the "smart dorm," and the electronic community in order to develop policies appropriate for the institution. Changes in the organizational approach will be necessary to take advantage of the opportunities offered by the information society. (The Pennsylvania State University Telecommunications Task Force, Strategic Plan, October 1984, p. 7-1).

The report cited Charles R. Thomas, the executive director of CAUSE[69], a professional society for the development, use and management of information systems in higher education, who wrote in 1984:

> Within the next five years, academic and administrative environments in

[68] When Penn State went to phone registration in 1980, 100,000 phone calls were being made per hour to six phone operators in the registrar's office. Penn State's telephone switch could only process 10,000 phone calls an hour. Registrar, Jim Wager reported, " . . . [People] couldn't call their doctor, they could not pick up the telephone without getting a busy signal." (J. Wager, personal communication, November 8th, 2016).
[69] CAUSE merged with EDUCOM to because EDUCAUSE in 1998.

> most colleges and universities will change dramatically as a result of the technical innovations. College and university administrators need to be aware of the affects of these technological trends in their institutions. Organization of an institution is one of the first areas affected by technological change.
>
> As it becomes necessary to understand the relationships among computing, communications, and other technologies, a need for new administrative talents emerges. Many leading colleges and universities are addressing this challenge by assigning responsibility for computing and other technological areas to a single administrative office or officer. Computing, voice, and data communications, video technology, institution mailing and printing are just some of the functions being assigned to these new administrative officers. (The Pennsylvania State University Telecommunications Task Force Strategic Plan, October 1984, p. 7-2).

The Task Force discussed Penn State's need for a Chief Information Officer (CIO), an executive position created at the very highest levels of the administration, in order to provide "focused, coordinated leadership for information communication and processing technologies" (The Pennsylvania State University Telecommunications Task Force Strategic Plan, October 1984, p. 7-2 and 7-4). Since information technologies would affect the entire University, the CIO had to be an important voice in the development and discussion of strategic objectives (The Pennsylvania State University Telecommunications Task Force Strategic Plan, October 1984, p. 7-5). Although long discussions about organizational issues were reported, the Task Force did not attempt to create a complete operational structure, thinking it best left to the new executive, the CIO.

Admissions losses. The computer system issues became a topic on the University Board of Trustees agenda; and on November 15, President Jordan told the PSU Board that total University enrollment had declined by 449 students from the prior year versus the 1,200 enrollment increase the administration had originally predicted. Jordan attributed the decline to several factors, including an "unexpected six percent drop in the acceptance of admissions offers and technical problems with admissions procedures and processing systems at the University" (King, 1984).

The University went scrambling. Publicly Penn State had the support of its senior administrators, like Associate Dean of College of the Liberal Arts John Romano, who explained to the Daily Collegian that problems were to be expected in the first few years of a large computer system, especially for a system as complicated as the Commonwealth Campus system. "Anyone who's worked with the conversion of data between systems will tell you the first few years are painful. But I am convinced that over the long haul, we've made the right decision" (King, 1984). Nearing the completion of the implementation schedule of the major redesign of its computerized systems[70] PSU now needed to discover privately what parts of the system needed refinement. (King, 1984). The school initiated the creation of a report on AIS and its impact, and hired a four-person external panel to review and mediate the issues between EDS and PSU.

Internal review of AIS. The report, *Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses*, received on November 8, 1984 had been compiled for the Vice President and Dean for Undergraduate Education Records during September and October of 1984. The University community expressed

[70] In 1984, the Executive Vice President and University Provost stated, "The University has been involved in a major redesign of its computerized administrative support systems over the last two or three years. We are now nearing completion of the implementation of the system which supports operations."

honest views[71] about the new system and was urged to provide assistance in the overall University effort to adjust to, and improve the performance of the AIS (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).[72]

All campuses, and the members of the University Park CES staff who worked with AIS, were asked to summarize the information from debriefing meetings and seminars in a four section report: efficiencies and inefficiencies generated by the system and suggestions and local plans to improve the system (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

The report indicated that users appreciated the better information on which to base decisions, the immediate access to official records and the sense of local control. From a student perspective, registration at Hazleton Campus was a much simpler process with practically no waiting lines and with early affirmation of course schedule.[73] At PSU's AIS Altoona Campus, AIS was reported to be expediting student inquiries regarding tuition, registration, admission and general information decision making (Observations

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[71] A few comments from the report include: (1) The reaction of the campuses to the initial AIS experience is basically enthusiastic about the concept, optimistic about the future, and frustrated about the present. (2) From the campus perspective "immediate access to the official record" is one of the most frequently cited benefits. This appears to be a positive factor, except in the periods of heavy use when access is severely limited. (3) The system has unified the previously separate approaches to registration which is now seen as a unified process rather than a sequence of seemingly unrelated events with student actions automatically fed into a single record. (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984)

[72] Information had been collected throughout the Commonwealth Educational System during September and October of 1984.

[73] Hazelton campus had a smaller enrollment than University Park. University Park in 1984 had 34,304 students enrolled. Today, University Park has enrolled 46,848 undergraduates (http://budget.psu.edu/factbook/StudentDynamic/HistoricalComparisonOfEnrollment.aspx). Hazelton Campus numbers for 1984 were not available, but today Hazelton has enrolled 900 students (http://hazleton.psu.edu/fast-facts).

and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984). Data was now available via terminal for any office that needed to know the financial status of a student.

On the flip side, traditionally, campus registrars had worked in an environment in which they literally could hold a student's schedule in their hand, and have a DP professional load the cards into the computer and generate first day reports. The new paper and screen effort was time consuming and redundant. Registrars found that the system required creation of a paper backup which had not been previously necessary, that there was poor and conflicting communication from University Park offices, and that the system required much longer work days and more total hours of work than the system it was supposed to improve. (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

The most frequently mentioned inefficiency of AIS was its inability to generate either formal or ad hoc reports. Sixteen of the campuses specifically cited examples, including directories of students; alphabetical class lists; list of student by advisor; student credit hour summaries; section enrollment reports; list of student by major and semester classification; and a master list of student schedules. (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

The report foresaw a possibility of severe morale problems as people realized that most of the weaknesses might not be eliminated by January. The general attitude of the system users was one of confidence that the problems would be corrected and the efficiencies eliminated in the Spring registration (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

The technology did not seem to be dependable as the "computer, protocol converter, terminal, and phone lines" were often down because the campus was processing paper transactions and entering them on the system in slack times (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

The downtime caused financial losses with incorrect fees levied and refunds calculated, uncollected bills prepared. Furthermore, the 84 terminals for add/drop at University Park were not enough for student and staff use (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

> Rather than a truly integrated student system, PSU has a group of subsystems which are deigned to function independently yet are bound together at critical points of subsystem interaction. Campus personnel work with more than one subsystem interaction and are therefore faced with screen formats with separate design standards and with terminology that is confusing and often useless. (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

The Commonwealth Education System report concluded that AIS was an important but still seriously flawed tool to facilitate student admissions, registration and general information flow. It was "imperative that the system be improved to increase the number of operational terminals throughout the University or alternative systems developed." School operations were also impacted because "the majority of campuses" moved to "flex time" schedule to have staff available in the evening when response times were better. (Observations and Recommendations from Fall 1984 Experience with AIS at the Commonwealth Campuses, 1984).

External review of AIS. At the same time the University was conducting an internal evaluation, Penn State hired four people as an external assessment panel to provide "an independent review of PSU's system development efforts from experts knowledgeable in large-scale, centralized university systems" (Dr. Richardson, unpublished internal communications, September / October 1984). Senior administration wanted to know whether the procedural approach PSU was attempting to automate and the steps taken were as effective as possible for current day operations in a large and very complex university setting.

In October, a panel of experts visited the Penn State campus.[74] The experts included: E. Lightfoot, Director, Administration Data Procedures, University of Washington; L.Pennington, Manager, Student Systems, University of Washington; R.E. Simpson, Director, Data Process Division, University of Texas at Austin; and R. E. Ebeling, Software System Specialist, University of Texas at Austin. (Dr. Richardson, unpublished internal communications, September / October 1984).

PSU hoped they would help provide direction in approaching further system implementations and determining potential remedies for current system problems. Specifically, PSU wanted to know: 1) Did the administrative procedures seem too

[74] The experts were to visit Penn State, and then review both the procedures which PSU used in its administrative operations relating to students and the logic used by their software contract with Electronic Data Systems to implement them. The invitation was issued in late September/October for a visit end on October 29-31, 1984 (Dr. Richardson, unpublished internal communications, September / October 1984).

complex? Was the effort overdesigned? What changes would the experts suggest to maximize staff productivity and service to students? 2) Did the original system requirements described in the RFP represent reasonable requirements? 3) Was EDS's effort adequate for PSU requirements? 4) Had EDS implemented the system using efficient coding and good programming techniques? 5) Were the hardware requirements sufficient? 6) Was the software of Software AG a good enough product? and 7) Was the database design by EDS reasonably efficient? PSU could not understand why the school had experienced problems with generating ad hoc reports and routine production reports against the database. What changes could be made to the database without rewriting the system? (Lightfoot et al, 1984).

Over two days, the panel of experts spent more than twenty three hours of intensive meetings with users, Management Services employees, University managers and officials, and EDS employees.[75] They visited offices and examined hardware and software. After their visit, they made their report to William C. Richardson, Executive Vice President and Provost. Their recommendations included that they should reorganize the Management Services Division, and provide a new director[76]; freeze the present AIS student system development and concentrate on improving the current deliverables; evolve toward user-controlled application systems; and develop a five-year plan for the

[75] The meeting was held at the Nittany Lion Inn, and the panel visitors traveled to different University offices. Employee presentations covered the organization missions of the six groups, admissions, records, bursar, grad school, student aid, and housing; the development of the RFP and the implementation process; and a student system critique. There followed a second day of technical review of the systems, their screens, software and hardware. There was also a report on Management Services which had served as the IT department to review configuration balance, tuning, evaluation tools, EDS progress, etc. (Lightfoot et al, 1984).
[76] It is unknown if this new director was meant to replace Gary Augustson.

university with senior-level university officials providing significant support. The report noted that there was disturbing absence of a sense of overall scope, and a comprehensive plan for administrative systems development with sufficient details to provide the direction for the University's AIS system was imperative.

The report noted that PSU had established the core of what could prove to be an excellent AIS system, but observed a number of failures and shortcomings, and held the opinion that EDS had not met its contractual obligations. However, they determined that with proper direction and support EDS could produce an effective SIS. The report was delivered November 7, 1984. (Lightfoot et al, 1984).

Panel blames EDS and PSU. By November 1984, EDS had not delivered degree audit, ad hoc reporting or financial aid products. Originally EDS had agreed to a performance criterion of a five second response time on the machine hardware selected. There was no real basis for knowing that EDS could not achieve this criterion, and according to the panel, the performance expectation had not been met. The opinion of EDS was that the company had expended a heavy commitment of extra staff time to achieve system success and that time spent working on the student information system was compensation for non-deliverance of the degree audit reporting and financial aid sections. Since the contract was negotiated for a fixed price, however, the panel did not see the validity of this position even though the members did express "sympathy for the project people who have put in much extra effort at personal sacrifice." (Lightfoot et al, 1984).

When faced with this criticism, the senior EDS employee responsible for this project said:

> We had a reasonably good working relationship with the University. We did not walk away bitter or feeling negative about Penn State. We had spent three years there. We delivered a functional system, that didn't do all of what they wanted, but we gave back the money for degree audit – because PSU couldn't decide what they wanted to do. (Interview No. 4, interview, July 2016).

The panel also had harsh words for PSU. Despite the RFP and contract, EDS and the University did not establish an effective method of communicating system requirements, project status, and change control. The establishment of a single contact person or group and the issuance of separate contracts for each development phase (general design, detail design, programming and implementation) would have contributed towards greater success. The consultants said that PSU personnel did an outstanding job to develop the original general requirements but they also were the main contributors to the problem. (Lightfoot et al, 1984).

First, PSU employees failed to separate the general design, detail design and programming implementation into separately contracted deliverable phases, and at the front end failed to specify in detail what was required of EDS.[77] Second, PSU did not establish an effective project management structure of dealing with EDS and used too many conflicting channels of communication. There should have been a single point of contact established early in the project and that person or group should have been responsible for coordinating requirements and schedules with EDS. The consultants

[77] Shouldn't this have been the job of EDS? According to an EDS senior employee I spoke with in July of 2016, the contract was so stripped down that EDS needed to document the University's current processes, and program them into a database system.

detected a "we/they" attitude at the University: contractor vs. university; user vs. user; Management Services vs. the user; University Park vs. the Commonwealth. This attitude contributed to the coordination problems encountered. (Lightfoot et al, 1984).

In a recent communication, Augustson stated that it was the norm to bring consultants in when things happen. "We did not find the 'we versus they' attitude surprising at all. In higher education, there is not a large research university where there isn't a 'we/they' mentality. It's a central and distributed organization" (G. Augustson, personal communication, November 7, 2016).

The panel further concluded that Management Services had not been organized to develop or coordinate development of major systems. The staff needed training. "Management organization, assignments, capabilities and performance need to be closely looked at and appropriate actions taken" (Lightfoot et al, 1984).

In terms of the overall system design of AIS and its performance, the four person panel found the functional design to be "fine." The database, however, needed rework as it was not designed for speed or efficiency. The programming methods were not appropriate for four generation language development, and indicated lack of training or knowledgeability on the part of the original programming team and, in some cases, the programs required further work to achieve optimum user friendliness. All programs needed a technical audit of the coding techniques for efficient and appropriate use of the programming language Natural. Software AG products were considered appropriate and proven products for this type of system. The software offered many advantages for both performance and capability, however, the requirements for computer resources were not negligible. The hardware selected had insufficient horsepower. (Lightfoot et al, 1984).

The consultants determined that procedures surrounding student registration were reasonable, workable and well within the limits of what the system was capable of supporting. They believed AIS responsibility should be transferred from EDS to MS staff despite an apparent lack of faith in the MS staff. They also felt that PSU should conduct extensive system testing, including a one-day live volume test to verify improvements. (Lightfoot et al, 1984).

The final recommendations were: PSU should develop a five-year plan with participation of senior university officials; reorganize its IT department (Management Services) by hiring a new director and develop its staff, participation groups and steering committee; provide extensive formal training for MS staff; work with EDS at the senior executive level to assure EDS support to correct shortcomings which were EDS's responsibility; and freeze development of the student system to concentrate on bringing the system up to minimum functional user requirements that were justified by cost benefits or service factors. (Lightfoot et al, 1984).

The most shocking component of the report was the recommendation that PSU consider doing most future development in house. With an improved user structure and improved MS staff this would be a viable alternative. PSU was to consider moving responsibility for the system development activity to user areas (registrar, admissions, bursar, housing, etc.) and had to recognize that user areas were in fact service departments for other departments on campus. (Lightfoot et al, 1984).

Responses to external assessment group report. Dunham and Augustson joined forces and replied to the report on January 31, 1985. The development of new capabilities of the student system would be frozen. The transfer of responsibility for the SIS to MS had started in Fall 1984 and would be ongoing, since PSU was still using the services of EDS under Task Order II to consult and assist in the turnover process. (Dunham and Augustson, 1985).

In summer 1984, the Administrative Computing Task Force (ACTF) had been appointed by the University President to develop a five-year plan with the participation of senior university officials. Prior to Lightfoot's panel, ACTF was already considering internal development of any additional AIS systems. The Management Services organization had made major strides in becoming more user oriented. The movement from a batch environment, which did not necessarily have a major focus on user service, to an online environment which supported a wide cross section of users, was a major undertaking. The University agreed with the panel saying that more education in the user departments would be necessary to assure complete understanding of this new role. (Dunham and Augustson, 1985).

Problems at student aid. The issues with AIS were really just beginning. The University was now responsible for providing its constituents with a full version of ISIS. The director of the University's Office of Student Aid, J. F. Brugel, wrote to Augustson in May 1985 that, as a result of the EDS product being inadequate and incomplete, there had been an unreasonable demand on University resources to finish the development and implementation of the Student Aid Subsystem, placing undue stress on Augustson's organization and Student Aid. "I fear Penn State does not have adequate programming and analytical skills to reasonably complete this project." (J. F. Brugel, internal communication to J. Gary Augustson, May 13, 1985).

EDS had left Student Aid with a product that forced the department to limit services, performing tasks manually which had been computer-assisted in the past. "The pressure on both offices is exceptionally high," Brugel wrote, and the project needed additional staff resources. He explained that, "the prospect of several thousand angry families maimed by our inability to deliver necessary support or service has motivated this plea for additional MS help. Clearly, PSU has been victimized by the timing and quality of the EDS product. Our bi-weekly AIS status meetings, though helpful in establishing priorities and maintain communication, do not assure me that our aid delivery can be reasonably accomplished" (J. F. Brugel, internal communication, 1985).[78]

EDS departs. By May 1985, EDS had packed up and left PSU. Wager, Augustson, and Romano all remembered that EDS gave no goodbyes. They and others described it as a departure they weren't expecting. "EDS left in the dead of night, when their contract was done, even though they had promised to do a degree audit" (J. Romano, personal communication, November 11th, 2016). The day before Romano had a verbal agreement to do a degree audit with EDS's Katherine Viguers for $25,000. Jim Wager recalled,

> They left in the dead of the night. The Penn State team would be responsible for testing and responding modules that were implemented, and every morning we

[78] According to Brugel, in 1985, more than 80 percent of University students were receiving assistance from one or more aid sources (Fellin, 1985).

> would go into the EDS campus office that was off campus, and we went in one morning and they were gone. They cleaned out and left. It was one of the craziest things I have seen in my life. It led to a strong perspective that the University would not outsource software development and it would become an internal process. There has been a lot of internal work, basic student system modules were written by Penn State for Penn State.

After the self-described “sour” co-development effort with EDS, a light, incomplete version of AIS was made available to mostly University professional academic advisors and a few of the faculty (Belinc, 2003, p. 4) (Hart, Hussey et. al., 2006). University programmers, who had worked with EDS to develop the technical skills needed to support the independent initiative, were placed in AIS (Hart, Hussey et al., 2006). AIS now had the ability to train new programmers, “develop more innovative projects” (Hart, Hussey et al., 2006), and actively work on the incomplete systems PSU had started with EDS: Administrative Information Decision Aid (AIDA), ISIS (student registration, admissions, enrollment) and IBIS (human resources).[79] (The Pennsylvania State University Website – The Road to LionPATH, 2014). After the EDS departure, Penn State continued to evolve its own IT support systems for students and administrators.

Augustson wrote to Provost Richardson, with a copy to Dunham:

> As you know, we are hard at work implementing the Student Aid portion of AIS. EDS left us with an incomplete and undesirable product. Without extra effort by Management Services, we would not be where we are today. The Office of

[79] “There are three basic families of information systems required in a university: business systems, student systems and alumni systems. At Penn State, these three families have names: the Integrated Business Information Systems (IBIS), Integrated Student Information Systems (ISIS) and Alumni/Development Information Systems (ADIS) which was not developed at the time of 1982. Each of these systems is made up of subsystems. IBIS, for example, is made up of a personnel subsystem, payroll subsystem, position management subsystem, facilities management subsystem, purchasing subsystem, departmental accounting subsystem and financial subsystem. But they are all integrated into one database architecture.” (Blythe, November 1992, p. 28).

> Student Aid and Management Services are working closely together to assure that no critical deadlines are missed as we move into the summer. Bob Dunham and I are conducting bi-weekly review meetings to assure that we are making satisfactory progress. (Augustson, internal communication by May 28, 1985).

The new motto of the school became "We can do this ourselves," and this paradigm served Penn State well until 2008 when the technology evolved and the information system was no longer sustainable (Interviewee No. 3, personal communication, March 2015). In 2016, "after an extensive vetting process, Penn State decided that it was most cost effective and efficient in the long run not to build a new system in-house, but to purchase Oracle's PeopleSoft Campus Solutions to replace ISIS" (LionPath Penn State's New Student Information System, 2016). Although implementation of the Oracle PeopleSoft Campus Solution product required the use of external consultants, internal support by Penn State employees was crucial.

C&IS strategic plan. With the departure of EDS in 1985, the scope of work for the Office of Computer and Information Systems (C&IS) was further expanded as planning and management responsibility for University-wide telecommunications activities was placed under its direction. The mission of C&IS was to assure that the benefits of available and emerging technologies were open to the entire community. C&IS was not responsible for dictating to academic units how to employ computer technology. That was the job of task forces like the Administrative Computing Task Force of Academic Computing Planning Committees. (The Office of Computer and Information Systems Strategic Plan, November 1985).

C&IS's strategic plan in November 1985 confirmed what every other computing task force realized that, “the databases are full of valuable data but they are not sufficiently accessible to serve decision makers” (The Office of Computer and Information Systems Strategic Plan, November 1985).

The concerns of the panel of 1984 about Management Services had been addressed, with the report stating that, “Management Services staff has demonstrated that it can learn, adapt, and rise to meet new administrative information system challenges. They have been willing to adjust to ever changing workloads, priorities, and assignments.” C&IS’s focus for improvement was on computer and information systems personnel who had to become more involved in strategic and tactical planning activities at all levels (college, campus and University-wide) in order to anticipate information needs and support requirements. By 1987/1988, C&IS had an objective to implement disaster recovery procedures, purchase additional redundant equipment, and investigate and recommend a backup site for telecommunications support at a cost of $138,000. (The Office of Computer and Information Systems Strategic Plan, November 1985).

Importance of people in the effort. In an interview with then President Jordan and Provost Richardson in November of 1986, Richardson reflected that, although the hardware was an important part of the academic computer strategic plan, PSU’s recognition of people was even more significant. PSU’s “plan really emphasizes the need to have people in every college and within various disciplines who can provide informed support to the disciplines on the ways in which computing can be applied to those disciplines.” (Interview with PSU President Bryce Jordan and Provost William Richardson, 1986).

According to Jordan, fellow presidents who were managing and planning for computing and information technologies would benefit by: ensuring that the institution had a knowledgeable person in terms of IT who was able to manage people; that the institution's president was also knowledgeable in computing and was aided by someone who knew a great deal about the process and how to make it work; and "face the fact that it's going to cost a lot of money." Despite PSU knowing what it knows, Jordan ends the interview by saying Penn State's main weakness was being dependent on a single person named Mike Z.[80] (Interview with PSU President Bryce Jordan and Provost William Richardson, 1986).

Determining academic computing needs. In 1987, senior administration decided that the Central Administrative Computing areas should not grow any larger, so new computer positions were added to user offices. Central computing was to maintain the basic portfolio of administrative information systems required to run the university, and staff in user offices (registrar, bursar, financial aid, human resources) could focus on helping their offices be more effective and caring for their strategic needs. In this early stage of planning, the institution could immediately respond to IT-focused changes such as small upgrades to existing programs and services in user offices. While user offices and central computing managed daily operations, Central Administrative Computing focused on large-scale initiatives to advance IT at Penn State. The growth of distributed staff would be (and was) accomplished with the reallocation of existing staff dollars. By holding central staff at a fixed level, and allowing distributed staff to grow, personnel

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[80] I was never able to find out who this was. Five different senior IT administrators were unable to tell me.

who had performed previous manual work at Management Services under CAS would be transformed into a staff that did computing work (Blythe, 1992, p. 30).

Research and the records acquired concerning ISIS, the student information system at PSU, in 1987 - 1989 revealed that these two years mostly involved system support, and information gathering. One discussion was based on a directive from July 1985 by Richardson to the Academic Computing Planning Committee. Directed to assess the current academic computing facilities, the Committee was to discover, to the degree possible, the future computing requirements of the academic community.[81] 1987 to 1988 represented a turning point for Management Services. Although the student system was largely complete, vital new capabilities were being added (Management Services 1987 – 1988 Strategic Plan, 1988). Also, during this time period the Office of Undergraduate Admissions worked to accelerate its move towards functional independence from Management Services. MS's role as the owner of the administrative systems remained unchanged (The Annual Report for The Pennsylvania State University, Undergraduate Admissions Office, Information Systems Section, No. 1, March 1987-February 1988).

Information System Section (ISS). The Undergraduate Admissions Office had its own Information System Section (ISS)[82] that provided support in electronic data processing, and information analysis to the Undergraduate Office. ISS staff resources had been focused on facilities renovation and relocation during the year and this

[81] Most of my data from 1988 and 1989 were from the folder ISIS Strategic Planning, Box 28, Office of Administrative Information System Records. The box was very disorganized.
[82] ISS provided technical support for admissions reports, and data analysis. ISS was responsible for acquisitions, modernization and replacement of new equipment during 1987 and 1988.

concentration had affected other University needs. (The Annual Report for The Pennsylvania State University, Undergraduate Admissions Office, Information Systems Section, No. 1, March 1987- February 1988).

The IT Group, ISS, of the Office of Undergraduate Admission (OAU), partially relocated and rearranged its work space closer to the computer systems. "The past year saw significant changes in the level of staff accessibility, both physical (and perhaps more importantly) psychological, to the information resources available to the University Admissions Office." In 1987 - 1988, ISS required almost 900 programming hours to accommodate 300 special data requests. However, during the same time, "ISS experienced a high level of turnover in staffing for the period, seriously affecting the facility with which it has been able to accomplish its mission." At the end of 1988, ISS remained understaffed by 2.0 full time professional programmers. (The Annual Report for The Pennsylvania State University, Undergraduate Admissions Office, Information Systems Section, No. 1, March 1987- February 1988).

Communications from March 1987 and October 1987 show that C&IS was still fielding requests for access to data in the system. In an internal communication, March 20, 1987, from Dunham to Blythe, Augustson's right hand IT man, Dunham reported that the Student System Committee was still functional, and at its meeting had requested additional student data retrieval options for the new system (Robert E. Dunham to Kenneth C. Blythe, internal communication, March 20, 1987). On October 7, 1987, Carol A. Cartwright[83] wrote to Dunham, saying her group, the University Scholars Program had "experienced difficulty sharing and accessing information with other units in the University concerning its students." The principal reasons for the absence of ready access reflected the lack of interactive PCs with their own AIS screens. 1,600 members had the need to access and supply data. Cartwright was concerned because she approved and funded an automation plan to permit staff ready access to data without constantly dealing with the inadvertent inefficiencies that arise when a small office is keeping student records for a substantial and diverse University-wide population. Her office could not make do with a registrar's office that simply designated whether a student was or was not enrolled in the program. She wrote: "People can't access the same data…our lacking interactive capacity with student records, pertains to AIS" (Cartwright, 1987).

AIS charter. At a March 1988 meeting, the Student System Committee (SSC) established a subcommittee to identify the needs of Penn State in the area of computerized institutional data and to recommend methods, tools, and framework to support ad hoc access and reporting within ISIS. The subcommittee work of 1988 was related to a directive in October 1986 from the President on AIS data administration (President's Statement and Charter on AIS Data Administration at Penn State, October 15, 1986, p. 1).

Jordan had stated that in order for the school to achieve its strategic goal and honor the mandate to position itself among the major public universities of the country,

[83] Carol Cartwright "served as a member of the Penn State faculty from 1967 – 1988, where she led a variety of research projects and authored numerous books, professional publications, and technical reports." Cartwright also served as president of Kent State University from 1991 – 2006, and president of Bowling Green State University from 2008 – 2011. (AGB Consulting Carol Cartwright Bio Website, 2018).

"decision makers across the University had to be provided with ready access to data that [was] timely, accurate, complete and secure." (President's Statement and Charter on AIS Data Administration at Penn State, October 15, 1986, p. 1-2). Having recognized that data administration was a vital tool for the policies and processes of the school, Penn State had invested time, talent and resources for a new Administrative Information System (AIS). The AIS would aid decision making, ensuring data accuracy and consistency as it eliminated redundant data entry and storage costs, therefore providing cost reductions. Striving for excellence was imperative for all PSU participants. Users and data managers were as important as hardware and software technologies according to President Jordan (President's Statement and Charter on AIS Data Administration at Penn State, October 15, 1986, p. 1-2).

The charter recognized that school information requirements were critical, that data had to be planned for carefully and managed so it could be available where needed and protected from misuse. The charter outlined steps for the development of AIS, including increasing effectiveness, consistency, end-user training and communication (see Appendix K for excerpts from the charter). (President's Statement and Charter on AIS Data Administration at Penn State, October 15, 1986, p. 1-2).

The charter did not imbue responsibilities of data administration to a single person or group but required all units participating in the administration information system to share in the responsibilities of data administration. Initiatives for system planning, policy development and research activities that affected AIS data administration were the responsibility of Augustson, and undertaken with the direct involvement of the

Administrative Computing Task Force (ACTF), in which representatives from subsystems were members (President's Statement and Charter on AIS Data Administration at Penn State, October 15th, 1986).

The charter goes on to define the positions and roles of university members as data stewards, operational users and informational users of AIS, information service coordinators, associates and security representatives, and the managerial role and responsibility of AIS Data administration by Management Services.

Meeting notes from April, May and June show that the SIS committee, now known as ISIS, was working to extract legacy information by using "flat files," simple unformatted text files that could be manipulated with tools like spreadsheets, databases and ad hoc query tools. The purpose was to support reporting in the ISIS environment by PSU administrative groups under restrictions imposed by Management Services. Although this would result in the administrative groups having duplicated data throughout the university, thereby defeating one purpose of the information system built with EDS to have an integrated system, it gave relief to administrative groups unable to access information.[84] (President's Statement and Charter on AIS Data Administration at Penn State, October 15, 1986).

Under the responsibility of Management Services, central offices were also being reviewed and identified (Student Systems Committee Meeting Notes, June 1988). The role of central offices other than Management Services in supporting Ad Hoc processing

[84] Microfiche output was still being used throughout the University to store and retrieve historical data and create reports for the administrative groups.

was essential because there was a critical need to distribute data at the University and to inform users about what the data meant. According to Jim Wager, the registrar, understanding the data and "good documentation pays off in fewer problems and follow-up calls from the users" (ISIS Ad Hoc Support Subcommittee, May 23, 1988). The ISIS Ad Hoc Support Subcommittee worked from March 1988 to September 1988, producing recommendations as to which tools and computer languages should be available for ISIS and ad-hoc reporting (Student Systems Committee Meeting Notes, June 1988; September 1988). On October 13, 1988, the subcommittee proposal was amended to include a policy for creating and using ISIS extracted files by Management Services. The policy delineated the responsibility for the "creation, use and maintenance of extracted files directed from the Integrated Student Information System (ISIS) database" (Appendix A, Proposal for Supporting the ISIS Ad Hoc Environment Developed by the ISIS Ad Hoc Support Subcommittee, 1988). The final proposal of the ISIS Ad Hoc Support Subcommittee was completed on July 28, 1989 and circulated to the Student System Committee on August 17, 1989 (Student System Committee Notes, August 1989). The committee finalized recommendations for: flat files to support ad hoc processing; a descriptive list of processing options; output options[85] and software which Management Services would support for ISIS ad hoc, output options supported by other intermediate processors connected to Management Services; and policies and procedures to implement and support the new ISIS ad hoc reporting environment. Also recommended was support

[85] Output options include printers, terminal screens available at the time to staff, and downloading capabilities on certain computers.

for a data administrator which included the creation of one new position and a new committee; an access and security representative (ASR) responsible for data access and security matters for appropriate offices; and a data administration advisory committee assuring the needs of user offices related to University data (Proposal for Supporting the ISIS Ad Hoc Environment, ISIS Ad Hoc Support Subcommittee, July 28, 1989). The committee also updated university policy on data, renaming the report "the Use of Computerized Institutional Data" (Proposal for Supporting the ISIS Ad Hoc Environment, ISIS Ad Hoc Support Subcommittee, July 28, 1989). Comments were to be received by January 19, 1990 concerning policies related to ad hoc reporting at PSU (Richard D. Sheeder, internal communication, January 9, 1989).

The lengthy completion time of the report and receipt of comments manifested because multiple projects and review committees were taking place on campus, computing user needs and defining the present and future University computing environment. In 1988, the strategic future of ISIS was being crafted (see Appendix L for meeting notes and documents discussing the strategic future of ISIS).

Strategic future of ISIS based on 1985 request. Meeting notes and a collection of documents in June of 1988 from sporadic SIS Committee meetings discussed the strategic future of the student information system, ISIS, based on Dr. Richardson's July 1985 request to determine the nature and size of Penn State's academic needs.

One PSU senior administrator felt that "the availability of the necessary computing resources" would give Penn State "the edge over other institutions." A strong, forward-looking academic computing program could differentiate an outstanding university from one of national distinction. Since 1985, the SIS committee had made certain assertions that strong central and academic leadership was essential to the plan, and that its people were the driving forces in providing ideas in software design and applications.

The planning document prioritized clusters of events that could require ISIS to be restructured for effectiveness. For example, “the costs of higher education will continue to rise” was one event, whose probability was marked as high (ISIS Strategic Planning: Cluster of Events, June 1988). Some of the cluster of events also prioritized as high included schedules and finances (see Appendix L for more cluster events).

The priority list showed that delivery of student services online was a strong requirement for Penn State to remain competitive. Students as consumers would demand accurate and timely information, and would expect the electronic delivery of information services as the normal way of conducting academic business. (ISIS Strategic Planning: Cluster of Events, June 1988).

Two tracks for student services were recommended. The first was the high service route where the client (student) was located through technology and online knowledge/expert systems; and the second was the human, “we care” route which provided opportunities for clients to be in contact with people in relevant offices on an individual consultation or counseling basis, supported by high service systems. (ISIS Strategic Planning: Cluster of Events, June 1988).

Advising services at Penn State were discussed and determined to fall into three categories — information support, decision support and mentoring. Technology and online expert systems would provide services in the first two categories. Advisers and students would have fingertip access to information about academic courses, programs, rules and processes as well as access to knowledge based systems for guidance in academic and career decisions. Mentoring would be the one individual human, "we care," "high touch" interaction between students and advisors to provide guidance and support (ISIS Strategic Planning: Cluster of Events, June 1988).

ISIS strategic planning. In August of 1988, Robert Dunham, the Vice President for Academic Services, wrote to Student Information System Committee members who had the summer to think about ISIS and general issues facing ISIS from 1988 to 2001. He asked them to prepare for participation "in a series of extensive and intensive discussions by the Committee to be held over a two day period early in September." He said, "come prepared to actively, indeed, vigorously engage in a careful examination of implications for the future of the ISIS" and cautioned that the discussions would not be successful if people were not prepared. Every committee member was expected to be fully engaged, to lead a discussion of a topic, and participate in the assembly of the final report of the Committee. (Dunham, 1988).

The two-day period of full day meetings on September 14 and 15 reviewed the major issues facing Penn State between 1988 and the year 2001. Prior to the meetings, SIS committee members had identified future events, impacts and directions for technology at the school; reviewed and identified the critical strengths and current limitations of ISIS relative to desired future characteristics; identified goals objectives and strategies to be adopted for ISIS; and prepared recommended actions and changes needed in policies, committee structures, support organizations, users, offices, telecommunications and computers or linkages to other information systems (ISIS Strategic Planning Agenda, September 14, 1988).

The Committee actively sought data from members to ensure that the Integrated Student Information System would be developed in appropriate ways. Changes could potentially involve university policies, the restructure of the Committees guiding the development and management of ISIS, and organizational support structure that included providing management, resources, and staff for ISIS. (ISIS Strategic Planning Agenda, September 14, 1988).

Input was requested on the goals and objectives for the ISIS system. The committee discovered there were clusters of environmental factors that had implications for ISIS and the system needed to be restructured for effectiveness. It had the potential to create invisible offices to serve new markets of students that were consumers (referred to in the report as "educational consumerism"). More and different services that could combine technology with a personal approach would be needed as part of ISIS.

> The idea of technology being transformed into "invisible" administrative offices suggests technology may be used to provide "invisible" classrooms and "invisible" dormitories. Through technology, an environment less dependent on paper will be developed, with grades and transcripts transmitted electronically and with students carrying "smart cards" that have chips to store vast amounts of data-personal, academic, and financial. (ISIS Strategic Planning Meeting, September 1988, p. 3).

The ISIS group found that there were three current sources of system difficulties: problems in getting programming changes completed, which caused people to stop making suggestions to improve the system; the slow response time at critical processing periods during a semester; and the complications provided by security approvals on a screen-by-screen basis. The current system may have been "friendly" for inputting and processing data but it was still not "friendly" for getting information and data out. (ISIS Strategic Planning Meeting, September 1988, p. 3).

Use of ISIS was described as "cumbersome" when researching information or taking action on a single student because so many screens were involved. In addition, ISIS had to be improved to provide direct response to students and parents about financial status. The group was also forward thinking seeing that "no limit will be placed on the number of terminals — all faculty and staff will have terminals; response time will be under 5 seconds; reports will be available online (as opposed to batch); students will interact directly with database for service; transactions will be online (example: admissions applications)" (ISIS Strategic Planning Meeting, September 1988, p. 5). The SIS committee understood that even if they could not picture the future accurately, the system had to be flexible enough to detect and accommodate rapidly changing social and technological environments.

At this meeting the committee first considered a single, one-stop, customer services office that would deliver admissions, registrar, student aid and bursar services directly to the student.

> The delivery of services could be thought of in terms of strata: first level would be generalized to provide information, perhaps through computers and expert systems; second level would provide more detailed and individualized solutions, again through computerized systems and invisible offices; third level would provide services that are more personalized and involve direct human interactions (ISIS Strategic Planning Meeting, September 1988, p. 6).

Representatives from admissions, the registrar, the bursar, the graduate school, student aid, student services, undergraduate programs, testing and assessment saw that there was a need to make better use of information already in the current system, and a need to provide computer access for students to their own records relating to finances, academics, and organization activities as well as to provide information on courses, policies and rules, and campus events (ISIS Strategic Planning Meeting, September 1988, p. 7).

All of these comments and ideas created a report from the ISIS Strategic Planning Committee in December 12, 1988 assembled by Melander (ISIS Strategic Planning Meeting Report, December 1988). It became an action plan when Blythe wrote to Melander:

> You have captured the committee's deliberations very well and provided a "pot pouri" of issues and opportunities. After reading it several times, however, I am left with an uncertainty about where we go (with ISIS) from here. Somehow, I want the "pot pour" to be better defined; to be better shaped into an action plan against which I can justifiably allocate Management Services resources…..we are dangerously close to having ISIS lapse into a period of somnolence. What is it that we are proposing to do….and WHY? (Ken Blythe, internal communication, December 26, 1988).

Blythe also pointed out that every conversation concerning ISIS gave the impression that ISIS, as currently implemented, was flawed. ISIS was relatively fully developed by 1988, but the list of its weaknesses as presented in PSU archives was longer and more comprehensive than the list of strengths found. Melander, according to an interview with a senior administrator, tried to incorporate changes, but could not unless a full committee reviewed the recommendations made by Blythe (Melander, internal communication, January 12, 1989).

The ISIS Strategic Plan of 1989, written in 1987 – 1988, included general conclusions regarding the future of the Integrated Student Information System, and used those findings to develop recommendations about the goals and actions for the System (ISIS Strategic Plan, 1989). The primary conclusion was that the purpose, function and content of ISIS should be focused on the needs of the student. The faculty, academic units and administrative offices needed ISIS training and support. "The system needed to be flexible to allow retrieval of data, so ad hoc reporting, analysis and research could be done by anyone with access" (ISIS Strategic Plan, 1989).

The ISIS Strategic Plan of 1989 recognized that "the student system contracted for in 1982 [was] now complete….It [was] time to build on these successes and extended services to clients that have here-to-fore been outside the realm of the system. We are calling for transformation from an operational system to a strategic service system" (p. 3). The ISIS Strategic Planning committee was appointed by Dunham and composed of thirteen members with representatives from a wide range of offices that provided programs and services for students. These individuals had the authority and resources to support corresponding goals and objectives for future IT initiatives.

Penn State's strategic plan goals addressed questions that other higher education institutions were likely examining prior to the year 2000. The university undertook several activities to examine two basic questions: "What will be the information needs of students, faculty, advisors, academic administrators and researchers in the future? What technologies should be adopted and what systems should be developed to meet these information needs (ISIS Strategic Plan, 1989)."

Penn State stated in its strategic plan "that the world around us is changing very rapidly-socially, economically, educationally, politically and technologically—and these changes will have an impact on Penn State. If the University is to achieve and sustain its goals of educational excellence into the twenty-first century, it must strategically position itself to take advantage of unfolding opportunities and avoid threats in the external environment by building on its internal strengths and overcoming its constraints (ISIS Strategic Plan, 1989)." It is fair to speculate that other higher education institutions were also examining their environments and assessing internal IT systems and involved in a strategic planning process to assess external and internal factors that would have an effect on their students, programs, organization and operations in the decade leading up to the year 2000. Obviously, government and business entities had a more extensive history with technology program implementation.

The actions and objectives recommended for future ISIS development were summarized under five headings: content, access, architecture, training and governance.

> Strategically, the essence of the actions and objectives was to expand the content of the system, extend access to the system, enhance the architecture of the system in terms of networking software, computing power and communications, support distributed training programs and applications personnel across the network and modify the governance of the system to reflect expanded functions, extended access and enhanced networking (ISIS Strategic Plan, 1989, p. 4).

The content of the system primarily was to focus on how well the program served students as well as supported the offices and agencies of the university facing operational deficiencies. The system would provide students with access to the portion of the database identified as their own electronic portfolio, where they could update data in certain areas. Direct support of students was paramount, assisting them in their academic, co-curricular and career decision making and in their admissions, student aid, housing, bursar, registration and enrollment transactions. The updated ISIS would support administrative operations, reporting, research, modeling and forecasting.

The primary system objectives were to utilize emerging technologies to support the delivery of services. Users of ISIS needed to be trained and made aware of system capabilities in order for efficiencies and use of the system to be realized. (ISIS Strategic Plan, 1989).

These changes in processes impacted ISIS governance moving responsibility from centralized C&IS managed to decentralized University-wide operational offices that were expected to support their own functions and needs as they trained application users at all locations (ISIS Strategic Plan, 1989, p. 8). Management Services under the C&IS umbrella would continue development and operational maintenance of the system, while user offices would prepare and execute existing system modifications and adhoc reporting with their own staff, using ISIS data.

Management services strategic plan. As the ISIS Strategic plan was being produced, the Management Services group formed a subcommittee with SSC members to create the Management Services Strategic Plan for 1989-1990. (Student Systems Committee Meeting Notes, September 1988).

Registration. Fall 1988 registration and drop/add went "very very well"[86] according to Management Services and the registrar's office (URO) in the SSC Meeting on September 15, 1988 (Student Systems Committee Meeting Notes, September 1988).

> At the start of each fall and spring semester, the university's mainframes are pressed to the limit as students from all 22 campuses request a wide variety of computer related services (Blythe, 1992, p. 29).

Significant changes had been made in preparation for the period, and it was the first time PSU did not have an arena registration. Total dependence was placed on the Telephone Voice Response Registration System connecting to the ISIS database. MS and URO had built the telephone connection in 1987 and 1988. This connection, called Telephone Information Penn State (TIPS), allowed students to register and to access university policy and information. Despite the "very very well" comment, there was a self-described "ominous beginning" to the Fall Semester with a power outage on the Main Campus on the first day of registration, then general power outages across the campus system and a major database problem on the weekend of registration. Although response times on the express terminals were the best PSU had ever seen, terminal availability was a problem and response times on certain terminals were worse than usual. (Student Systems Committee Meeting Notes, September 1988).

Project backlog growing. At Student System Committee Meeting No. 96 on September 11, 1989, chaired by Dunham and Melander, the members voiced concern that even at the current level of resources allocated to ISIS, the backlog of inactive projects

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[86] Exact quote

was growing at an alarming rate and no staff reduction could take place. (Student Systems Committee Meeting Notes, September 1989).

Request for additional staff denied. On October 25, 1989, in the latest version of the Strategic Plan for Administrative Computing, 1990-1991, Augustson vehemently protested the request for additional personnel to support AIS activities in the development of IBIS and ISIS. In an internal communication he writes, “While it may be hard for many to realize, having the staff on board to have acceptable progress in the development of IBIS and ISIS to a preferable rate of implementation is a luxury that the University simply cannot afford at this point in time” (Augustson, internal communication, 1989). Augustson would not support any additional staffing needed to accelerate the development of IBIS and ISIS. There were other, more pressing, priorities. The University was simply going to have to deal with the system they had at hand. The Office of Telecommunications did not have support, there were not enough people supporting public school computer labs, so IBIS and ISIS were no longer a school priority. (Augustson, internal communication, 1989). According to multiple interviews with PSU employees including Augustson, no path existed to accelerate the development of the systems and make everyone “happy.” Despite the 500 project backlog Augustson reported there was “very little whining.” Academic units advocated for their “wishlist” projects, and Augustson, ultimately had to decide the IS priorities for the school. (G. Augustson, personal communication, November 7, 2016).

Coding language update. In 1990, the Undergraduate Admissions Office (UAO) as well as other departments with their own internal technology groups, were working on mission critical projects with Management Services. INFOSYS, the IT group for the UAO, was involved with a project to rewrite the code for many of its reports. The summer 1990 newsletter, BY THE NUMBERS,[87] for INFOSYS, reported that Software AG was eliminating support of the Natural 1.2 coding language[88] in its database software, and had introduced an improved version called Natural 2.0. The release of the new update required that every UAO program used to generate reports be rewritten in Natural 2.0. The newsletter warned that the transition to the new language would be a major undertaking and would "require some disruptions in standard services" (Marsh, August 1990). The institution's technology groups were busy throughout the Penn State System with this new upgrade. (Marsh, August 1990).

The decade ends. The decade of the 1980s had proved momentous for the development of IS at Penn State. University-mandated participation enabled PSU employees to contribute collaboratively to PSU's strategic information agenda and data processing operations. Upgrading technology, especially in student services, was recognized as essential to the University's future. EDS was hired but financial restraints and miscommunication led to problems for PSU and EDS. Employee and student dissatisfaction, deliverable delays, backlogs, organizational squabbles and technological shortcomings invariably triggered the end of EDS involvement at Penn State University. Augustson and others kept pushing the information system forward, leading, managing

[87] In Summer of 1990, a pamphlet called "BY THE NUMBERS", a quarterly newsletter from the Undergraduate Admissions Office Information Systems Section of PSU, was distributed in order to highlight the projects at PSU (What's New?), the significant progress being made (Status Report), and showcase individuals working on the projects (Faces). (PSU Infosys, By the Numbers, Volume I, No. 2/3, Ed. Franklin H. Marsh). The summer 1990 edition summarized activities for winter and spring 1990 for the Admissions offices throughout the Penn State System.
[88] Natural 1.2 coding language was used by EDS to write the SIS.

and administrating the new information system. All the effort expended by Penn State on developing student information services was about to become one of the most heralded student centered programs at any higher education institution.

Chapter IV. Pennsylvania State University Case Study (the 1990s)

This chapter covers the period of the 1990s to 2015. During this time, the university began to rely more on technology to provide stakeholders with a strategic information system and student academic services, specifically the advising process. The chapter highlights the history, culture and complexity of advising at Penn State. PSU grew its student information system to deliver extensive and accurate academic advising services. Undeterred by limited resources, employees worked on in-house solutions to increase the effectiveness of the student information system by revolutionizing academic advising into a computer-based system that could support all stakeholders. Withdrawal and late course drop were just two of the curated processes PSU teams re-engineered to eliminate bureaucratic tasks. In 2000, the student information system was released to great success. PSU continued to invest and devote the resources necessary to support its SIS. There came a point in 2008, however, where the system could no longer evolve because of costly advances in technology and the cost of fulfilling user requests, and PSU needed to terminate the once successful information system and devise a new solution to support the school's updated student services initiatives.

Student Information Systems and the 1990s, eLion

Penn State was still struggling in the 1990s to make the student information system accessible to its student population, and the institution was actively looking for upcoming technologies that would propel its computing into the next generation. OASIS (Open Access to Student Information System) and CAAIS (Comprehensive Academic Advising and Information System) were the two initiatives that drove student information system development at PSU during the decade. The Division of Undergraduate Studies (DUS), with the support of the Office of Administrative Systems and using Mandarin technology from Cornell University, developed a series of student-oriented computer modules for OASIS. The educational planning modules allowed students to review their academic summary of institutional and self-reported data, calculate their semester and cumulative grade-point averages, determine grades necessary to reach a target grade-point average, review their Freshman Testing, Counseling and Advising Program (FTCAP) test results, and look up their adviser assignments. Penn State also set out to create a computer-based advising system. Although PSU had many components of an academic information support system already in place, opportunities existed to combine these components and develop others, and in turn, to provide access in new ways that would greatly improve PSU's information services to students and advisors at all locations of the University. OASIS's modules were therefore incorporated into the CAAIS[89], and further developed to ensure accompanying individual advice and information through an interactive advising system. These two projects, culminating in 1999 under the umbrella, eLion, experienced five significant and overlapping organizational stages, each described in more detail below.

- 1990 - 1996, eLion Phase I –CQI, OASIS and the Mandarin Consortium, SSC reorganized
- 1994 - 1999 eLion Phase II – OASIS, Advising and the Web
- 1994, eLion Phase III – DUS, OASIS and CAAS, withdrawal and late drop modules
- 1995 - 1997, eLion Phase IV –OASIS and CAAS join forces; OASIS is renamed CAAIS

[89] CAAIS was originally CAAS, Comprehensive Academic Advising System

- 1997, eLion Phase IV – CAAIS grows presence on Web
- 2000, eLion Phase V – CAAIS renamed eLion, fully functional late drop/withdrawal released, Web registration goes live

PSU's approach to IS was strongly influenced by a challenge issued in 1992 by then Executive Vice President and Provost Dr. John A. Brighton[90] to assign a higher priority to quality improvements in AIS. By viewing computing in a new way and pursuing all future information system work by establishing criteria for evaluating new administrative system proposals with quality in mind, the University could turn AIS routine enhancements into instruments of continuous quality improvement (Augustson, internal communication to Kenneth Blythe, 1992). Continuous quality improvement, CQI, a principle where "everyone takes ownership of the improved educational enterprise and where high value is placed on teamwork, collaboration, and communication, supported the University community, the study of work processes and information-based decision making" (What is CQI? – Pennsylvania State University, n.d.). Brighton approved the creation of a new environment that utilized the CQI approach to enhance and ensure quality over complacence in computing at Penn State. (Augustson, internal communication to Kenneth Blythe, 1992).

Dr. Brighton wrote:

> The Administrative Information Systems (AIS) provides a potential source of continuous improvement in University processes. AIS affects the work habits of thousands of faculty and staff daily and facilitates the academic progress of each student. With its extensive involvement at every level of University administration, improvements could have resounding impact.

[90] The challenge was addressed particularly to committees: Committee for Administrative Systems Planning (CASP), the Student Systems Committee (SSC), and the IBIS Steering Committee.

> There are few comparable opportunities at Penn State to provide similar multiplicative advantage.
>
> I understand that the goal of AIS for the past several years has been a conversion of antiquated information systems to a more modern architecture and that some of that conversion work is still on-going. However, it appears to me that a sufficient amount of conversion has been completed so that we can begin shifting our attention to the goal of improving quality. With that in mind, I am requesting that you assign higher priority in the future to AIS projects that improve quality, reduce costs or reduce workload University-wide. (John A. Brighton, internal communication to J. Gary Augustson, November 2, 1992).

eLion Phase I –Mandarin Consortium and OASIS

In 1990, PSU joined[91] the Mandarin Consortium, Project Mandarin, a partnership between Cornell University, the Massachusetts Institute of Technology (MIT), and Apple Corporation (Belinc, 2003, p. 4; O'Brien, 1995). Originating at Cornell University in 1990 to create tools to build easy to use applications for computer neophyte university administrators, Project Mandarin[92] expanded to include tools to access data from information systems like AIS for stakeholders (Mara, 1994; Project Mandarin and the Macintosh, 1995). Project Mandarin used "computers, networks, and point and click interfaces to get information from databases into the hands of students, faculty and staff," helping to address common data problems faced by most schools (Craigshead, 1994). Apple Computer went on to echo the perceived benefits, stating that Project Mandarin allowed universities to "put information in the hands of the people who need it, and help

[91] The Project Mandarin effort at PSU was owned by the Office of Administrative Systems and the Office of Computer and Information Systems. PSU used already developed software in the Project Mandarin toolkit to tailor internally the functionality they needed for their student information system.

[92] "The dictionary defines mandarin as a high civil servant thought to exercise large undefined powers without publicity or political control. Mandarins were highly respected and highly educated figures in Chinese history." Cornell assumed "that many end users of Project Mandarin technology would be powerful and influential in the university community but not necessarily comfortable with computers. The definition of 'mandarin' seemed to describe this audience." (Craigshead, 1994).

them using it productively!" (Project Mandarin and the Macintosh, 1995, p. 2). Members of the Mandarin Consortium included nonprofit academic and research institutions. Annual membership fees ranged from $12,000 - $32,000 (Craighead, 1994) depending on the length of membership.[93] "By 1994, membership was up to 21 universities and growing steadily" (Project Mandarin and the Macintosh, 1995, p. 6). Members were licensed to use the product suite, including source code, documentation, support and consulting services. Members also had access to the Project Mandarin Software Library, a tool kit[94] of software applications, documentation, tips and techniques contributed to the library by consortium members. (Smith, 1994, Project Mandarin and the Macintosh, 1995; Craigshead, 1994).

The product suite contained the software components from Cornell's own student information system, "Just the Facts" (Craigshead, 1994; Mara, 1994). Six other universities were able to use the available software to replicate the system at their own university with differing features, while still giving students access to personal data. Consortium members could explore a periodic newsletter where they could share information with one another, had access to an email list-serve[95], and could attend an annual conference of consortium members and Project Mandarin workshops at Cornell. (Craigshead, 1994; Mara, 1994).

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[93] The fee was reduced by $1,000 per month for partial year memberships after an institution had been a new member for at least a year.

[94] The tool kit contained a range of products that could be used as stand alone applications to integrated custom applications. They were developed as modular entities so institutions did not need to implement the entire Project Mandarin suite to benefit from the technology.

[95] "List-serve is a method of communicating with a group of people via email." (https://www.mail-list.com/what-is-a-listserv/)

With Apple funding and MIT's security mechanism technology, Kerberos, the consortium developed the mainframe technology that universities needed to allow for student access to records (O'Brien, 1995).[96] Mandarin provided universities with access to their student data, security and a user-friendly interface (Hart, Hussey et al., 2006). Kerberos security enabled student information systems to be secure and guaranteed both student authentication and authorization[97] as students were "directly accessing and, in some cases, modifying their own records" (Wager, 1996). Project Mandarin's software components could be "reused, extended, combined and shared among Consortium members, dramatically reducing development time for new applications" (Project Mandarin and the Macintosh, 1995, p. 5). The software allowed universities to "open the door to information in legacy databases and centralized systems, and deliver it to end users through the kind of graphical user interface they've come to expect" (Project Mandarin and the Macintosh, 1995, p. 5).

PSU's Office of Administrative Systems (OAS) spearheaded the School's Mandarin Consortium partnership[98] (December 1992), and used existing Project Mandarin technology to successfully deploy OASIS in June 1994[99] (Belinc, 2003, p. 5; Hart, Hussey et al., 2006). Cornell Project Mandarin records show that OASIS's champion at PSU was the University Registrar, and project funding was supported by the

[96] Belinc (2003) claims that in-house development was much cheaper for PSU than external efforts were for its peer institutions who employed one of the original Big Ten Consulting Firms for their PeopleSoft implementations.
[97] "Authentication services verify the identity of the user and the server, and authorization services provide access privileges" (Smith, 1994, Apple Project Mandarin, p. 5).
[98] Pennsylvania State University was a charter member of the Project Mandarin Consortium. The Project Mandarin pamphlet (Craigshead, 1994) names the Director of Office of Administrative Systems at PSU the project owner, and the system's champion the University Registrar.
[99] OASIS was the precursor to eLion (Belinc, 2003, p. 5)

Director of the Office of Administrative Systems (Craigshead, 1994). Team members of OASIS included developers (application programmer, system programmers, and a microcomputer specialist), the project owner, and representatives from different university offices. Internal correspondence shows that Kenneth Blythe,[100] the right hand man of C&IS[101] director J. Gary Augustson,[102] was instrumental in bringing Mandarin to PSU. In an internal correspondence to the Student Services Committee on December 23, 1992 about PSU's progress with Mandarin, he wrote:

> While there has been general agreement at Penn State about the strategic value of having students access their own administrative data, our progress has been slowed in the past by technical difficulties. For some time, we have been collaborating with Cornell University on a promising project called Mandarin to overcome these difficulties.

PSU assembled a one-man team in December 1992 dedicated to Mandarin with the possibility of the assistance of others from C&IS. Blythe requested that Scott Smith[103] "step aside from his critical responsibilities to become the Mandarin Project Leader for Penn State" (Blythe, 1992). The team found success in a short time:

> This team has been assembled for fewer than five days and I am pleased to announce it has already broken new ground with the difficult technical impediments that we face. Yesterday, for the first time, I witnessed an Apple Macintosh microcomputer, with its graphical user interface operating as a client, access data for students over the backbone from the

[100] Kenneth (Ken) Blythe was the director of the Offices of Administrative Systems (OAS), http://www.psu.edu/ur/archives/intercom_1998/May21/BOT.html
[101] C&IS was Penn State's Office of Computer and Information Systems (C&IS). It would go on in 2002 to be known as Information Technology Services (ITS). http://www.psu.edu/ur/archives/intercom_2002/April4/its.html
[102] An article describes Augustson "Penn State's first and only chief information officer for the past 24 years." http://news.psu.edu/story/206012/2006/01/19/penn-states-first-and-only-cio-retire-augustsons-service-spans-24-years
[103] Aside from Scott Smith being PSU's Technical Representative, Project Mandarin Consortium to PSU Student Services Committee, his previous official title was not in the records, and persons interviewed simply described him as an IT employee.

> OAS mainframe operating as a server.[104] Although the experiment was limited and provides proof of concept only, it reveals sufficient ingenuity to be celebrated as a hallmark in administrative computing at Penn State. (Ken Blythe, internal communication, Mandarin, SSC, December 1992).

OAS used Project Mandarin software and technology to roll out OASIS applications on Mac campus kiosks, on school computer labs throughout the state and on personal student computers with Ethernet/modem network connectivity to OASIS (Hart, Hussey et al., 2006; Craigshead, 1994). The development schedule was approximately 21 months. "Security concerns and screen design (non-Project Mandarin issues) added significant time to the development process" (Craigshead, 1994). By mid-June 1994, students could access grade reports, class schedules, unofficial transcripts, personnel information and financial aid information (Wager, 1996).[105] No longer did they need institutional approval to act upon their college choices and careers. OASIS empowered students to retrieve personal information without involving university staff.

Cornell employee, David W. Koehler, said about the technology:

> Mandarin was "one of those ahead of its time products that was well received. Students loved it as they now had access to their own grades" (Koehler, 1999).

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[104] "Client/server is a term used to describe a computing model for the development of computerized systems. This model is based on the distribution of functions between two types of independent and autonomous processes: servers and clients. A **client** is any process that requests specific services from server processes. A **server** is a process that provides requested services for clients. Client and server processes can reside in the same computer or in different computers connected by a network. When client and server processes reside on two or more independent computers on a network, the server can provide services for more than one client. In addition, a client can request services from several servers on the network without regard to the location or the physical characteristics of the computer in which the server process resides. The network ties the servers and clients together, providing the medium through which clients and servers communicate." (http://profperry.com/Classes/OracleDBM/Client-Server-AppxF/AppendixF.htm)

[105] On June 16, 1994, Student System Committee (SSC) Meeting No. 138, 404 Old Main reported: "Oasis is now operational, a public kiosk is in place in the lobby of Shields Building." Although it was available in June 1994, there were no access accounts for students. In July the committee voted to wire the university for desktop ability (SSC Meeting Notes No. 139, July 21, 1994). On July 21, 1994, J. James Wager noted that two OASIS stations were in place, but student usage had been limited due to those two only locations. Students would have access to accounts by the Fall Semester.

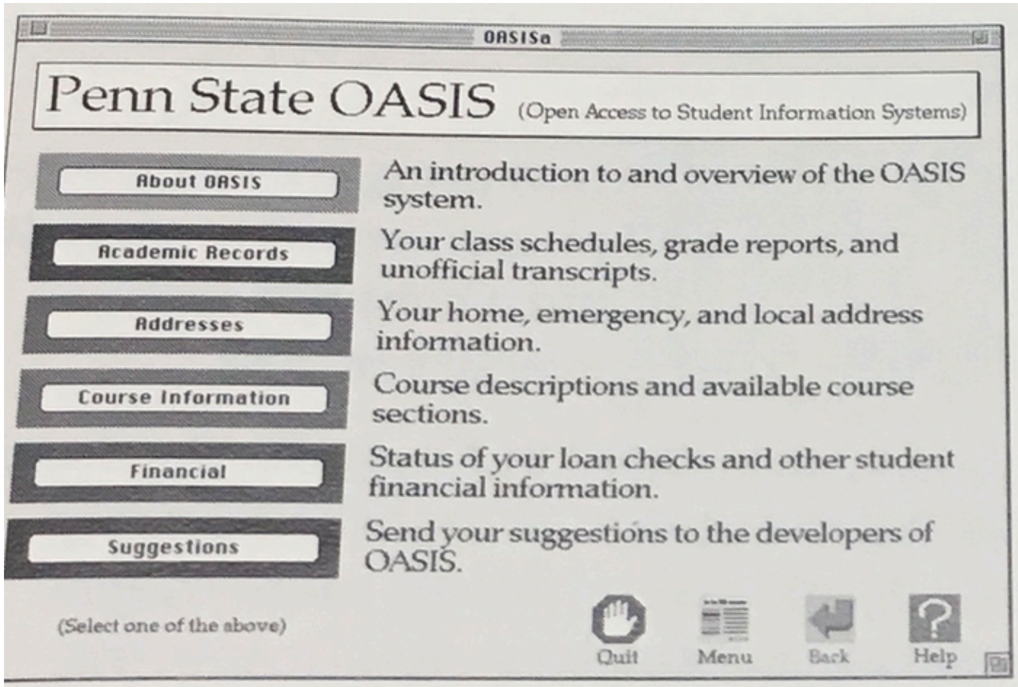

Figure 6. Penn State OASIS Web Screen. Image: Penn State University Archives.

Penn State (as seen from the image above) "designed a suggestion button on their OASIS interface and every suggestion was a positive one – in effect, 'give us more!'" (Smith, 1994, Craigshead, 1994, p. 10). Students reported that they were "very excited to have convenient access to their own administrative data" (Craigshead, 1994, p. 10).

The new system also reduced the workload for the Office of the Registrar at Penn State by providing more accurate information about students. The registrar's office was saved 10,000 record changes annually by giving students the power to update their own mailing addresses through a feature called "Change Your Local Address" (Craighead, 1994, p. 10). As many as 10 percent of the student addresses in the ISIS system were suspected to be incorrect (Craighead, 1994, p. 10).

The Student System Committee continued to meet regularly to ensure that ISIS was being used both as an operational tool and as a strategic enrollment planning tool.[106] Members of SSC would invite co-workers from their respective groups to provide updates to the Student System Committee. Frank P. Miller, registrar of York campus, was one such guest. He reported on the CAAS Phase I and II implementation schedules while SSC was working to ensure that release II of OASIS had begun with the intent to include registration and drop/add capability to support CAAS's development (SSC Meeting Notes, July 21, 1994).[107]

Student systems. August 15, 1994 marked the 12 year anniversary of the Student System Committee. The SSC was "140 meetings" old. The invitation to commemorate and recognize what had been accomplished during that time meant that the committee understood the significance of the meetings for the school:

> Now 12 years and many enhancement, mandatory, and correction projects later, the System has matured into a set of powerful and comprehensive support services for students, faculty, and academic administrative offices. An even more important role for the System is likely to emerge in the life of students, faculty, and staff at Penn State as new technologies provide for new and expanded services (Eugene Melander to SSC, August 15, 1994, email communication).

At the 140th meeting, SSC's plan was to hold off making any future enhancements to OASIS but to continue working on the program, concentrating on extending its overall availability to more locations. The SSC had intended a few more improvements such as a

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[106] (Student System Committee, 1982, 1994-1996 mp word document, page 5). By November 30, 1993, ISIS was available to college deans, department heads, Continuing education, and a variety of "operational offices" including the registrar, the bursar, student aid, undergraduate admissions, housing and the Graduate School. ISIS was being "used as an operational tool and as a strategic enrollment planning tool." Memo from Donald W. Leslie and Salvatore Meringolo, ACUE Representatives to the Student System Committee, To: ACUE Deans RE: ISIS SURVEY)
[107] SSC Meeting Notes, July 21, 1994

course adjustment function (drop/add); the development of a Microsoft Windows version of OASIS; setting up OASIS Penn State access accounts (SSC Meeting Notes, August 7, 1994)[108] for incoming Fall students, and devising methods to handle OASIS version control and installed upgrades (SSC Meeting Notes, August 18, 1994).[109] SSC purposely limited university and student access to OASIS. The product was still only available on two workstations, and there was a small summertime population. SSC also focused its efforts on building PSU's campus networks to support information systems and other technologies (SSC Meeting Notes, September 15, 1994).[110]

By 1995, the Student System in its broadest terms was "defined as the processes, databases, information systems, communications, and computing… distributed among units and locations of the university to support student-related services and programs. Specifically, the Student System included services necessary to accomplish: 1) enrollment, financial, and housing administration: operational and management activities in the administration of Admissions, Student Aid, Registrar, Bursar, Graduate School, and Housing and Food Services; 2) executive information analyses and decision support; institutional informational analyses for executive planning and decisions; 3) academic program and course administration: operational and management activities in the academic administration by colleges, campuses, continuing and distance education, and student affairs of credit, non-credit, and co-curricular programs and courses; 4) teaching and learning delivery systems and facilities: providing for academic transactions in the

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[108] SSC Meeting Notes, August 7, 1994
[109] SSC Meeting Notes, August 18, 1994
[110] SSC Meeting Notes, September 15, 1994

learning, teaching, testing, tutoring, advising and assessment of activities of students and faculty" (SSC ad hoc Group on Reorganization, August 18, 1995).[111]

Identifying the University-wide processes that formed the systems used to deliver student-related programs and services was paramount, as well as how to manage, budget and improve student related processes. Basically, the SSC needed student perspectives that went beyond the opinions of current committee members (SSC ad hoc Group on Reorganization Report, 1995). A more broad-based group from all areas of the Student System community was necessary to manage the future of the Student System with a charge from the Office of the Provost. SSC had realized that the group needed to be reorganized in order to bring the student system into the future (SSC ad hoc Group on Reorganization, internal email communication August 18, 1995).[112] Consensus proposed "one central resource of advice, information, and consultation about backbone connectivity and LAN development. The current process which requires users to deal with several different University administrative units was time consuming, cumbersome, and often resulted in extended delays in providing service" (SSC ad hoc Group on Reorganization Report, 1995).

By February 1996, SSC had met for almost thirteen years and the basic, centralized ISIS databases and operational systems constructed in the original 1980s mainframe architecture had finally been stabilized (J. J. Cahir and J. J. Romano, internal

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[111] Student Systems Committee Ad hoc Group on Reorganization Report (August 1995). Managing the future of the student system: Addressing organizational needs. The Eberly Family Special Collections Library, The Pennsylvania State University, State College, PA.

[112] Student Systems Committee Ad hoc Group on Reorganization Email (August 18, 1995). Email communication to John J. Cahir, John J. Romano, J. Gary Augustson, The Pennsylvania State University, State College, PA.

communication to Provost John A. Brighton, February 23, 1996). However, ISIS's technology was outdated, so the managerial emphasis[113] shifted towards discovering and improving processes to better address the needs of clientele by identifying and meeting the information requirements of students, faculty, and process managers and executives. As a result, SSC reorganized itself, redefined its mission and renamed itself the new Integrated Student System Steering Committee and Processing Teams (ISS) (SSC Meeting Notes, 1996).

ISS focused on developing a strategic vision and plan for an integrated and networked information system to support the decision making of students, faculty, and administrators of academic support processes. The steering committee was responsible for identifying core processes and assigning teams to improve information support of the four processes to deliver, manage, budget and improve student related processes (Student Systems Committee Proposal for an ISS Steering Committee and Process Improvement Team, January/February 1996).

eLion Phase II – OASIS, Advising and the Web

Influential groups of interested employees had pursued computer based student academic advising systems across PSU campuses (Hart, 2006 as cited by Hart, Hussey et al., 2006). The Smeal College of Business, funded by an IBM grant, had developed its own electronic advising system in 1993,[114] the College Registrar had begun offering

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[113] John J. Cahir and John. J. Romano

[114] The Smeal College of Business had an electronic advising program called EASy, described as "a delivery system integrating information from multiple sources across the University and within the Smeal College. EASy's goal was to provide user-friendly information and referral on educational planning topics. It was not designed to replace the University's statement of responsibilities for adviser and students" (The EASy Computerized System, internal

computer generated degree audits[115] as early as 1988,[116] and engineering advisors and faculty independently had developed PC applications to analyze their departments in areas of persistence and success (Hart, 2006 as cited by Hart, Hussey et al., 2006).

In June of 1994, the convergence of the advent of the Web and a critical mass of interested stakeholders became the impetus for PSU to develop OASIS as an online application. "The Web provided the momentum to allow OASIS to grow more rapidly and it quickly became very popular" (Belinc, 2003, p. 4). The OASIS web-based portal, renamed eLion in 2000, would become one of the most recognized Administrative Information Systems at Penn State (Belinc, 2003; The Pennsylvania State University Project LionPATH Website, 2014).

The success and popularity of OASIS was built on one of the major policy changes at the school; the student should be the heart of every decision made by the University (Bennet, internal communication, 2002). Around the time OASIS went live in mid June 1994, PSU tried to determine what pressures faced the institution, and launched "a comprehensive study which focused on the strengths and weaknesses of undergraduate education" (eLion Penn State University ComputerWorld Honors, 2002; Wager, 1994).

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document, November 10th, 1993, Undergraduate Programs, The Smeal College of Business Administration). The menu provided students primarily with information: Where to obtain advising services, how to enroll in a business major, ways to earn academic credit, etc. (The EASy Computerized System, internal document, November 10th, 1993, Undergraduate Programs, The Smeal College of Business Administration)

[115] What is a degree audit? Degree requirements. Students running the 'Degree Audit' module wanted different views. For example, "freshmen typically [wanted] to see a full audit of all degree requirements, while seniors typically [wanted] to examine only those (hopefully) few unfulfilled requirements." (Gary L. Kramer and M. Wayne Childs, Editors, The "e" Factor in Delivering Advising and Student Services, NACADA, Monograph Series, November 7, 2000)

[116] And by 1994, a number of higher education institutions had either purchased or developed in house online degree audit systems.

One acknowledged weakness during the period of 1994 to 1999 involved the advising process. When 1,197 PSU faculty members were asked to prioritize 38 recommendations for improving undergraduate education, they named improving advising as number ten (eLion Penn State University ComputerWorld Honors, 2002; Wager, 1996). PSU had received previous complaints from students about the school's lack of an up-to-date advising system. The students were in need of counsel from their advisors, some of whom were not available and others who were not assigned (eLion Penn State University ComputerWorld Honors, 2002) (Wager, 2005). The Assistant Vice-Provost for Enrollment Management and University Registrar, J. James Wager (2005), supported the initiative, asserting that a "student's ability to succeed academically and graduate involves working with numerous offices, faculty, staff, policies and procedures" (p. 10.5).

Advising at PSU (a history). Like other university processes, advising had changed over time. The concept of advising at PSU gained popularity in the early 20th century. The student advisory system was an historic and important undertaking by PSU President Edwin E. Sparks,[117] who persuaded faculty to advise 30 first year students in 1908 (Higginson, 1983; The Pennsylvania State University Report on Advising, 1982). An integral part of every PSU student's collegiate experience, the advising model has adapted to respond to the growing needs of students, faculty and the school.

Testing and counseling was incorporated into the advising model in the fall of 1956 when PSU's Division of Counseling introduced the Freshman Testing, Counseling

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[117] Edwin Earle Sparks, PSU university president (1908-1920)

and Advising Program (FTCAP) to provide a good academic start for freshmen and help students familiarize themselves and connect with the university, develop sound academic and career goals, and succeed academically and personally (Division of Counseling, 1958). The program focused on each student individually and centered around counseling interviews that were scheduled for all freshmen between the time of admission and first term registration (Wall,[118] 1974). The philosophy behind this program was that students are best equipped to set and reach educational goals if they have an accurate understanding of their academic strengths and weaknesses and the academic procedures and program opportunities of the University (Wall, 1974).

FTCAP was conducted at all campuses and in all colleges of the University and was required of every incoming baccalaureate and associate degree student.[119] Divided into two segments, the first testing and the second counseling and advising, FTCAP was an information system without computers meant to connect students and advisers to the many resources across the university (The Pennsylvania State University Report on Advising, 1982). Use of the program expanded so quickly that in the 1970s the program continued under a newly formed Division of Undergraduate Studies (DUS) to better inform and support students and faculty. Policies and rules for undergraduate students were further defined in 1979 (PSU 32-00 Advising Policy, 1979). DUS was responsible

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[118] "Dr. Harvey Wall was the director of the Division of Undergraduate Studies (DUS), an advising unit at Penn State University that enrolls freshmen and sophomores exploring a variety of majors and advanced students needing advising assistance with changes in their academic plans. Dr. Wall was the first director of DUS, which started in 1973." At his retirement in March 1986, the program enrolled 4,000 students. (Interview with Harvey W. Wall, NACADA Journal *7(2)*, 2009)

[119] Each student paid for the testing and counseling services as part of their enrollment deposit. In 1958, the fee was $17.50.

for three major functions: enrollment and advising; preregistration testing and counseling; and an academic information system (Wall, 1974; PSU 32-00 Advising Policy, 1979).

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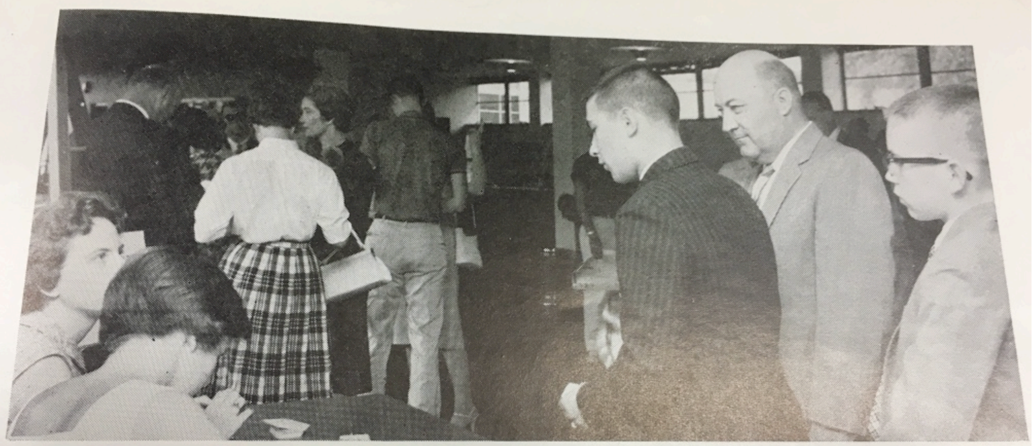

REGISTERING FOR THEIR DAY OF COUNSELING, an incoming freshman and his father receive name badges and information at the Counseling Desk in the HUB main lobby. At the right is little brother who came along to see how things are done at Penn State.

Figure 7. Photograph of incoming freshman registering for first day of counseling (Zeigler, 1960). Image: Penn State University Archives.

The effectiveness of the FTCAP was recognized by many U.S. universities that sent a steady flow of requests and visitors to Penn State aiming to establish an advising program similar to the school's FTCAP and an advising/enrollment division similar to the Division of Undergraduate Studies (Kelly, 1981). Using Penn State's DUS as a model the University of Massachusetts and University of Delaware successfully instituted testing, advising and counseling programs for freshmen. UCLA, the University of Houston, the University of Southern Maine, Syracuse University and the State Universities of New York also consulted with PSU to establish advising systems (Kelly, 1981). FTCAP was called the best public relations program developed by the University. It proved to students and parents that the primary focus of PSU was academic, and that the University was committed to providing the best possible advising for freshmen, helping families appreciate the academic demands and opportunities of the students enrolled at PSU (Kelly, 1981).

By the twenty-fifth anniversary of FTCAP, it was obvious the program had been a resounding success:

> Over the years it was estimated that more than 250,000 freshmen and their parents had participated in the program which was now conducted by the Division of Undergraduate Studies. The last several years have seen the return to Penn State of many of the original FTCAP participants; however, now they are parents who are attending the FTCAP along with their sons and daughters. These parents and other parents who have sent three, four or five children to Penn State have high praise for Penn State and they tell us that the existence of the FTCAP has influenced them to encourage their children to attend Penn State, rather than to apply to a university that offers no testing and advising program for new freshmen. (Kelly and White, June 1981).

TYPICAL OF THE MANY FAMILIES who accompany their freshman sons and daughters to campus for the day of counseling are the Marianos of Hazleton who are being greeted here by Dr. Arnold P. Goldstein, a counselor. They are: Albert Mariano, his daughter Rosemary, Mrs. Mariano, and little brother, Robert. Rosemary is enrolled at the Hazleton Campus.

Figure 8. Photograph of incoming freshman and their families for their day of counseling (Zeigler, 1960). Image: Penn State University Archives.

After students had been admitted to the University (Kelly, 1981), DUS contacted them, informing them of participation in a DUS program called the Freshman Testing, Counseling and Advising Program (FTCAP). DUS then sent to each student a testing appointment request card and an Educational Planning Survey (EPS) – a questionnaire developed by DUS to elicit some educational and academic responses as well as information regarding the student's academic ideas, plans, and concerns (Kelly, 1981). The "survey" asked students to respond to a variety of questions that were helpful during the individual counseling and advising interviews and included queries about study habits in high school, subject preferences, choices of major, knowledge and activities related to the choice of major, and expectations about college (Kelly, 1981). In the 1960s, and from their homes, students were required to complete the Strong Vocational Interest Blank, the Bernreuter Personality Inventory, and a comprehensive personal information blank developed by the Division of Counseling. By integrating the information in the "survey" with the "Profile of Academic Abilities," DUS advisers were well-prepared to discuss educational plans with freshmen and their parents.[120] Students were told that the collected data would be machine scored and used in a personal interview with a DUS adviser during FTCAP. Students sent back the tests and the testing appointment request card with three pairs of appointments of dates in order of preference. The scheduling card was then returned to the student with a reserved date for a visit. Pennsylvania resident students would report to one of approximately 40 testing centers near their homes on the assigned date for a day of testing (Hall, 1962, p. 75). Out of state students would take the tests on campus the day before their FTCAP session. Typically, students were tested early in the spring following the offer of admission. "For entering fall term freshmen, the advising and counseling activities of the program [began] in May and [ran] into August," but the program was actually run all year, prior to each start of the University's academic terms (Division of Counseling, 1958). DUS advisers at each campus administered aptitude and achievement tests in English, math, and chemistry (Hall, 1962).

When testing was completed, students and their parents were invited to attend a day of counseling and advising at the intended campus of enrollment. The one-day program was designed to interfere as little as possible with the work hours of parents and

[120] Office of the Vice President of Undergraduate Studies, Jim Kelly, unpublished internal document, January 8, 1981.

school schedules of the students (FTCAP Video, no date). The Counseling and Advising day began early at 8:30 am and typically ended at 3:30 pm. Some families had to get up at 4:00 am in order to arrive on campus in time for the beginning of Counseling and Advising Day (Kelly, 1981; FTCAP video, n.d.). The program days were intended to provide each freshman with a good academic start and were identified as the first stage of academic advising for all beginning freshmen. The FTCAP day could be "viewed as a funnel, with the most general information given at the beginning of the day, and slowly narrowing to the final event – the actual planning of the student's first-semester class schedule" (FTCAP video, n.d.). Parents and students were directed to the first meeting for a slide show, "Presenting the University to Freshmen," and oriented to the day's events (FTCAP video, n.d.). Depending on the size of the group, students and parents could or could not attend separate sessions, but they were given the same information. "Although the presentation [was] methodical, a deliberate effort [was] made to avoid creating an atmosphere of cold formality. Parents [were] encouraged to interrupt the presentation at any time with questions or requests for additional information" (Hall, 1962). The program started with an overview of the academic structure of the University – its colleges, campuses, majors, academic requirements and expectations (Kelly, 1981). The slide show emphasized that university programs, experiences, and philosophy were the same no matter which campus a student attended (FTCAP video, n.d.). Students then received individual information packets that contained a schedule of classes, Course Selector, the course catalog, and registration forms that students would use later in the day, along with a program of the day's events. A detailed explanation of the "Profile of

Academic Abilities" followed, when each student met individually with a DUS adviser to consider education plans and goals (Kelly, 1981). Points for this discussion arose from the EPS and Profile of Academic Abilities. Following the interview, freshmen attended a workshop session where they learned how to use academic tools such as the catalog, schedule of classes, Course Selector and TIPS (Telephone Information Penn State) as well as learning about dormitory life, financial aid and social activities (Kelly, 1981).

One of the last activities of the day was a meeting with academic administrators and advisers in the students' chosen college to learn about curriculum demands, faculty expectations and available educational opportunities. University personnel sat with students and parents[121] to discuss test results, evaluate student plans and determine a course of action in order to help freshmen "avoid some of the difficulties experienced by their predecessors." Each student met with a vocational information counselor, a career counselor, and a university representative (Division of Counseling, 1958).[122] Those who followed the "counseling recommendations had better grades after their first eight weeks in the University than those who did not" (Division of Counseling, 1958). The Counseling and Advising day ended with a meeting with an academic adviser where students planned courses, an academic program and pre-registered for their first term's

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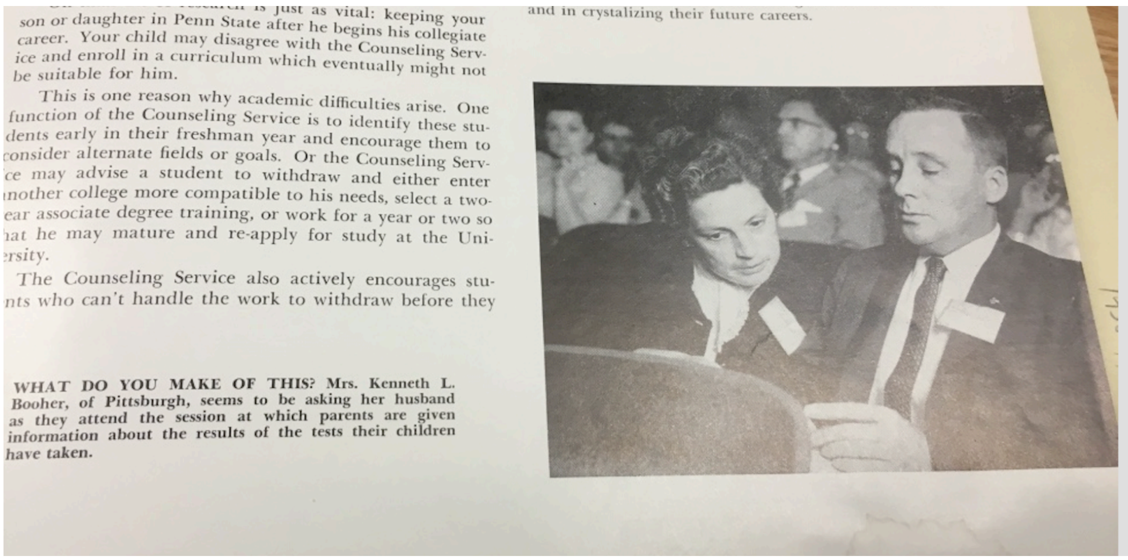
[121] The booklet stated, "During this day you and your parents (for we hope that at least one of your parents will be able to accompany you) will have an opportunity to evaluate carefully your educational and career plans and to find out whether you need extra preparation for college." (Division of Counseling, 1958).

[122] The vocational information counselor spoke with students about training requirements, job opportunities, salary ranges, and other characteristics of the careers students might pursue. A career counselor discussed the results of student tests, the value of their career choices, how likely they would enjoy the career they chose, the availability of alternate career choices, how difficult PSU would be for them, and what areas of mathematics, English and reading would require additional preparation (Division of Counseling, 1958). The representative of the University would discuss "housing, wardrobe requirements, social rules and regulations, educational costs, academic requirements, and other matters" (Division of Counseling, 1958).

classes. While a student was having individual advising sessions, parents would attend a conference with a DUS adviser sharing the student's "Profile of Academic Abilities," providing input on how to interpret it, and discussing course enrollment and career paths (FTCAP video, n.d.).


... is just as vital: keeping your son or daughter in Penn State after he begins his collegiate career. Your child may disagree with the Counseling Service and enroll in a curriculum which eventually might not be suitable for him.

This is one reason why academic difficulties arise. One function of the Counseling Service is to identify these students early in their freshman year and encourage them to consider alternate fields or goals. Or the Counseling Serv-ce may advise a student to withdraw and either enter nother college more compatible to his needs, select a two-ear associate degree training, or work for a year or two so hat he may mature and re-apply for study at the Uni-ersity.

The Counseling Service also actively encourages stu-nts who can't handle the work to withdraw before they

WHAT DO YOU MAKE OF THIS? Mrs. Kenneth L. Booher, of Pittsburgh, seems to be asking her husband as they attend the session at which parents are given information about the results of the tests their children have taken.

and in crystalizing their future careers.

Figure 9. Photograph of incoming freshmen parents review their children's test scores at a counseling day information session (Zeigler, 1960). Image: Penn State University Archives.

The entire FTCAP was completed before freshmen sat in their first college class. Having had the opportunity to revise their educational plans prior to the start of their first year, fifteen to twenty percent of entering freshmen changed their educational plans before starting classes (Kelly, 1981; Hall, 1962). After one or two terms of classes many freshmen returned to the DUS Advising Center to review their test results and to discuss new educational plans that may have resulted from their conversations with faculty or fellow students, or from general exploration of majors offered by Penn State (Kelly, 1981).

A DUS survey using data collected through FTCAP reported that the primary concerns of entering Penn State freshmen were academic, specifically, course scheduling, choice of major, and sources of academic information (Kelly, 1981). Contrary to popular belief, the incoming students cared more about their immediate academic life than about orientation activities, housing, money, extracurricular and social activities. The expression of academic concern among freshmen suggested that the freshman advising time was a critical year in a student's academic cover. Advising of first year students was considered different from advising upper classmen because as a group, the majority of freshmen were: undecided about their choice of major; knew little or nothing about their choice of major; participated in few activities related to their choice, and had thought about a major or career for less than a year. "In short, freshmen [needed] to find out more about the majors and programs offered by Penn State and in order to make an informed decision about a major they [needed] more and better advising than any other group of students" (Kelly, 1981).

Freshmen were assigned, therefore, to professional advisers, but after they declared a major, "the advising responsibilities were transferred to a faculty advisor within the student's major. Conceptually, this model [was] intended to maximize the different needs of the student at the time of admission and later upon entering an academic major." (Kramer and Childs, 2000). Originally a role only of faculty members, after 1958 advising included professional counselors, graduate degree candidates, and junior or senior undergraduate students (Hall, 1962; PSU 32-00 Advising Policy, 1979, p. 32). Advisers were supposed to "be prepared to carry out the following functions:

information giving, short-range program planning, long-range planning, conveying the purpose of the University and student referral where needed" (PSU 32-00 Advising Policy, 1979).

Comprehensive academic advising. In the unpublished internal document, *Toward a Definition of Advising* at the October 1987 DUS Advising Conference, PSU's advising model is described as "Comprehensive Academic Advising." The desired outcome of the advising effort was that students develop an individual, comprehensive and realistic academic plan. Penn State wanted the advising to encompass much more than helping a student select a major and insure the completion of requirements (Toward a Definition of Advising, 1987). Comprehensive advising was to be individual and realistic, where each student's plan reflected a personal set of interests, aptitudes and values that could be achieved. The adjective "comprehensive" was chosen because the ideal student plan included activities (academic and extracurricular, e.g., possible inclusion of a minor, involvement in an organization, participation in volunteer activities, part-time or summer employment, etc.) which a) helped the student discover his/her interests, aptitudes, and values, b) helped the student develop his/her interests, aptitudes, and values, and/or c) were consistent with the student's interests, aptitudes, and values.

> Comprehensive academic advising primarily focuses on a student's intellectual development. It takes into account the student's current stage of social and emotional development. At times it may create changes in these areas, yet it is not principally designed to effect the student's social and emotional development (Toward a Definition of Advising, 1987).

Complaints about the advising model. A significant amount of attention was focused on academic advising between 1972 and 1982 (Higginson, 1983). In 1972, the

University College Faculty Senate Ad hoc Committee completed an Advisory Report, which ultimately resulted in the creation of the Division of Undergraduate Studies (DUS) in 1973. From then on three standing committees of the Senate named subcommittees to study the role of the adviser and academic advising (Committee on Academic Affairs, 1973; Committee on Undergraduate Instruction, 1978; Committee on Academic and Athletic Standards, 1980). In May 1977, the President of the Undergraduate Student Government Academic Assembly reported data to the Faculty Senate about a study on academic advising conducted at University Park. During March 1980, members of the Administrative Committee on Undergraduate Instruction (ACUI), the Senate Committee on Undergraduate Instruction, Senate officers, members of the Commonwealth Campuses ADAA/ADRI Council, selected freshmen students, and invited resource persons gathered at University Park for a conference entitled "The Freshman Year: Creating a Staying Environment" (Committee on Academic and Athletic Standards, 1980; Higginson et al., 1983). Regardless of the attention that advising had received in the previous 10 years, no major changes resulted in the University's advising program with the exception of the creation of the Division of Undergraduate Studies (Higginson et al., 1983).[123] Problems

[123] It can be assumed that Freshmen Orientation and Advising has evolved at Penn State from the 1950s, since today there are 681 majors and options available at Penn State (https://dus.psu.edu/majorquest/). The program of testing and advising in the 1950s was present at Penn State through at least 1983 (on page 177, the quote by Kelly and White shows testing for Freshmen was ongoing). According to a PSU publication by Higginson et al, 1983, no major changes had transpired at that time. Since PSU records are restricted for 20 years after the date of creation, I was unable to find information on how testing and parent involvement changed from 1983 until the summer of 2013 when FTCAP was replaced with New Student Orientation (NSO). Since 2013, NSO at Penn State is a structured activity for first year students preparing for their Penn State careers (FTCAP evolves this summer into two-day New Student Orientation, 2012, http://news.psu.edu/story/143654/2012/12/18/ftcap-evolves-summer-two-day-new-student-orientation). NSO, like its predecessor FTCAP, provides students with the opportunity to attend advising and course registration meetings. All students are required to take the ALEKS Math assessment examination, and the SAT is used as a guide for English class placement. Students use a website, Starfish, to schedule academic advising sessions (Penn State Academic Advising Website, https://advising.psu.edu/). Parents are still welcome at Freshmen orientation, and they are provided

related to advising had not resulted due to a lack of concern from the school but from other factors, including the sheer magnitude of information that advisors and students needed to access concerning degree programs.

To clarify concern for advising, Provost Edward D. Eddy directed that DUS complete a comprehensive analysis of academic advising at Penn State. The study, *a Proposal for a New Approach to Pre-Major Advising at Penn State*, was conducted between January 1 and May 1, 1982 involving the entire University faculty, assistant/associated deans in all of the colleges, academic officers at every campus, 49 selected academic department heads, and 2,100 undergraduate students. The report found that the university 1) needed to make greater efforts to demonstrate the importance of academic advising in undergraduate education; and 2) should establish a centrally coordinated University-wide system of advising that consisted of distinct but integrated programs for three categories of students: beginning freshmen (prior to enrollment), freshmen and sophomores who had not entered majors, and students enrolled in majors. (Higginson et al., 1983).

The 1982 comprehensive analysis found faculty feeling uninformed and uninformative:

> Somehow, this University should have the manpower and dedication to do a good job advising…After many years I believe that the situation is still marginal to poor, as far as most Penn State undergrads are concerned.[124]
>
> --Faculty Member, 1982

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with the Parents Program website (parents.psu.edu) and the "Penn State Parents and Families Guide," which invites parent involvement and contribution. The website and guide provide details on academic life at Penn State and explain that access to student information is limited under FERPA.

[124] A proposal for a new approach to pre-major advising at Penn State, The Pennsylvania Division of Undergraduate studies, May 18, 1983, Linda C. Higginson, James J. Kelly, Harvey W. Wall, Eric R. White, John H. Wyckoff.

> . . . I'm really dismayed at how the system works. I was given no idea of what would be expected of me. What information has been forwarded to me about students has always arrived one term after the first time they come to see me . . . Most students did not expect to get any help from the advising system.
>
> --Faculty Member, 1982

And students felt alone:

> Having an adviser at Penn State has been the same as not having any at all. My adviser doesn't know who I am, or care for that matter. --8th term student, 1982

These growing pains were echoed in other advising reports produced by task forces formed by the University. According to the reports PSU did not value academic advising in undergraduate education because it did not have a centrally coordinating system of advising that could adequately accommodate PSU's growing student enrollment, curricula, building/land and institution complexities (The Pennsylvania State University Report on Advising, 1982; Higginson et al., 1983). Faculty reported that the advising training, materials, handbooks, policies and procedures available to them were not consistent across departments or concentrations. Forty-two percent of faculty did not receive initial training for academic advising, thirty-seven percent did not receive formal advising training, and forty-one percent did not keep records of meetings with their advisees. Students reported feeling that advising at PSU was primarily a form-signing activity (as did ninety-four percent of faculty) and they needed advisers who knew and cared for them and could provide adequate support (Higginson et al., 1983). The Undergraduate Student Government Academic Assembly and Council of Commonwealth Student Governments issued a report concerning Undergraduate Academic Advising in

May 1992, recommending that faculty advisors be abolished. Students wanted access to the Penn State information systems, and they asked for individual electronic files in which all changes, exceptions, etc. would be recorded and explained.

The use of undergraduate students as peer advisers was also not well received by students or faculty (Higginson et al, 1983). One student who had been awarded degrees from PSU in both the 1970s and 1980s stated in an interview that she would camp out for two days to find her advisor. She had a hard time locating her first year peer advisor, was a religious studies major, and was not looking at the degree requirements, rather at courses that she enjoyed. She did her own advising using the degree audit advising tool, "the blue book"[125] along with her student handbooks to review the requirements and fulfill the credits on her own (Interviewee No. 3, personal communication, March 2016).

When this story was recounted to a senior administrator, he stated that students could not schedule classes without advisors. "Advisors could be tyrants. They knew best, but they were not the best" (Interviewee No. 1, personal communication, March 2016). He also explained that prior to 1973 students did not have access to a course catalog but had to visit their local library to find one. Initially, the Division of Undergraduate Studies only ordered enough catalogs for its staff, but in 1973, there was confusion in the delivery process and 540 copies were delivered instead of the 40 copies

[125] The "blue book" is the nickname for "Penn State's Undergraduate Degree Programs Bulletin (The Blue Book)." I was unable to locate a copy of past Penn State Undergraduate Degree Program Bulletins; however, the current website for the "blue book," http://bulletins.psu.edu/bulletins/bluebook/, describes the bulletin as "a basic tool in academic program planning." It covers three major areas, General Information, Colleges, and University Course Descriptions. Although course descriptions are located in the student information system, the blue book provides students with information to plan for coursework, major and graduation requirements based on each college's and the schools' general requirements (Advising Tools Website, http://schuylkill.psu.edu/advising-tools).

needed for staff. PSU had never provided catalogs to incoming (Fall) freshmen and their parents, but in June they distributed the catalogs.[126] DUS realized two things. First, the catalogs served as a useful tool for students and parents in the pre-registration counseling program, and second, this was a sound "public relations service," demonstrating that Penn State does not grab student money and run, "that it is the kind of institution that takes seriously its educational and informational commitments to the students enrolled in the University, and to their families who pay the bills" (Kelly, 1981). The information that students and parents could hold in their hands about course and program descriptions proved invaluable. By providing students with catalogs and easier and ready access to course information, the school helped them understand the degree requirements for their incoming cohort for particular majors. (Interviewee No. 1, personal communication, March 2016).

In a Fall 1988 DUS Conference, a cartoon was circulated with the phrase,[127] "like Sherlock Homes, academic advisors are expected to know everything."[128] PSU had an advising tool kit containing forty-six items that represented only a fraction of the possible handouts, check sheets, curriculum guides, program descriptions, course descriptions, catalogs, brochures, handbooks, calendars, bulletins, memos and computer codes that constituted the information skeleton upon which advising was constructed at Penn State. In the late 1980s, an academic adviser at PSU needed to navigate more than one thousand

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[126] James Kelly, the Academic Information Program Coordinator wrote to Elwood Wagner, Records Officer, Internal document unpublished, September 16, 1974.
[127] Statements on Advising, DUS Fall Conference, October 1988
[128] The Penn State Advising Toolkit, Jim Kelly, October 1988, Advising Different Boxes Statements on Advising from Faculty – mp.docx

changes annually in the catalog; more than two hundred programs, majors, minors and options; continual revisions in curricula, course offerings, academic policies and procedures; an evolving education program, etc. One thousand pieces of discrete information were needed to meet the program, the course selection and the academic policy/procedure needs of students admitted to a typical Penn State freshman class.

PSU academic advisers felt unprepared to meet the demands of advising when their training had been minimal, and when necessary resources (handbooks, curriculum guides, etc.) were not readily accessible. They were alarmed over the sheer quantities of information for which they were responsible, struggling with keeping abreast of the constant changes and complexities of institutional policies, procedures and curricula (Mycek-Memoli, 1996).

Students and faculty also reported difficulty understanding degree audits, an advising tool that helped students determine which courses satisfied their degree requirements (Commonwealth Education System Student Satisfaction Survey, Spring of 1994). A manual degree audit was a worksheet that listed a student's fulfilled courses against the requisites of a selected degree, requiring that students and faculty alike had up to date information on the degree requirements in order to analyze a student's academic progress towards graduation (http://handbook.psu.edu/content/sample-degree-audit).

> My advisor showed me a degree audit that wasn't updated, so I took classes I didn't have to. I think a lot of the time advisors give wrong information (Szpara, 1994, p. 7).[129]

[129] *COMMONWEALTH EDUCATION SYSTEM STUDENT SATISFACTION SURVEY CONDUCTED IN SPRING 1994* //BOOYAH LOOK AT THE COMMONWEALTH EDUCATION SYSTEM STUDENT SATISFACTION SURVEY CONDUCTED IN SPRING 1994, Final Report Summer 1994: Results on Advising and the Academic Experience, by Michelle Y. Szpara).

> Used counselor on campus instead of advisor; advising "SUCKED"; took right courses because I went to a counselor instead of my advisor; friends who only went to advisors have had to make up a semester or a year; main complaint – advising. A student would be okay if he/she avoided advising—teachers need to be more "on the ball" (teachers were the advisors). I had a specific major (fishing and hatcheries science) but advisors should be informed if they are going to do any advising. (Commonwealth Education System Student Satisfaction Survey, Spring of 1994).

Even faculty seemed confused.

> "We don't train them (to use degree audit). Are we supposed to?" DUS Advisor, CED. (Commonwealth Education System Student Satisfaction Survey, Spring of 1994).

The report agreed that students should be given an audit every semester but cautioned that advising was not just the responsibility of the institution as PSU policy stated:

> You (the student are responsible for completing degree requirements and keeping your own record of these fulfilled requirements. Advisors can make suggestions and other guidance, but in the end you are responsible for implementing the action (Get the Most Out of Advising at Penn State, n.d.).

Students made the ultimate decisions, but advisors had to be prepared to provide current, meaningful advice and consultation. The paradox resulted in the "varying levels of frustration" seen in the advising surveys by both students and academic advisors (Kramer and Childs, 2000).

PSU was dedicated to providing quality advising programs and services to students and addressing the challenges that the advising process faced (Interviewee No. 1, personal communication, March 2016). Advising was central to Penn State's campus culture and involved more than just helping students select their courses. It was about helping students set realistic academic and career goals, adjust to college, succeed in college, and prepare for life after college. Report findings and feedback from the PSU community pushed PSU to build a centrally coordinated University-wide system of advising that could adequately accommodate PSU's growing student enrollment, curricula, building/land and complexities.

Penn State prided itself on being a student centered university whose whole community was engaged in learning and delivering programs and services that supported learning outcomes. The senior administration believed that learning needed to be at the core of how a student centered university defined itself (Interviewee No. 1, personal communication, March 2016). PSU's forward looking agenda meant that its advising program had to become about learning, discovery and engagement (Interviewee No. 1, personal communication, March 2016).

However, the growing and enormous range of college regulations, resources and opportunities of advising networks across higher education institutions meant that no one individual, faculty member nor administrator, could learn or be responsible for the knowledge possessed by evolving school advising networks, institution processes and the enormous range of options and opportunities available to students. PSU understood the changing growth and complexity of the higher education landscape and its impact on advising and the potential application of technology to academic advising. (Mycek-Memoli, 1996).

Division of Undergraduate Studies (DUS) and OASIS's charter changes. As a consequence of the internal pressures, the Division of Undergraduate Studies (DUS) was added to the OASIS development team in February 1994 as a new stakeholder with a goal to "improve the quality and accessibility of academic advising" (Belinc, 2004, p. 5; Wager, 2005, p. 10.14). The sub-goal of DUS was to establish stronger academic advising tools to guide students (Belinc, 2003, p. 5). The advising component of OASIS (eLion) came with a pledge to change the "traditional hierarchy experienced by previous generations" of PSU students by helping them "navigate complex administrative processes" (Wager, 2005, p. 10.3).

The policy for advising and automated comprehensive academic advising at PSU was "to ensure high-quality academic advising while protecting the rights and responsibilities of both students and faculty" (Wager, 1996, p. 140). Academic advisors could provide consultative advice to students but they had no administrative approval or denial powers. University policy or procedure would dictate administrative action. If a student proposed action that went against school policy and ignored input from the academic advisors, final decisions and their consequences were the ultimate responsibility of the student (Wager, 1996, p. 140).

PSU leveraged the technology used to build OASIS to improve academic advising services by providing student access to information that in the past only academic advisers could supply. Advances in the technology allowed PSU to address some of the criticism logged against its advising process, and propelled students to take an active role in their own educational planning. Through access to the mechanics of advising, degree audits, signatures and forms online, “wherever they are, whatever they need, whenever they need it,” students could focus on more meaningful explorations of their interests and needs (Interviewee No. 1, personal communication, March 2016).

When thinking about advising and technology at the university, Melander, Associate Vice Provost for Academic Services and committee member, wrote that he:

> envisioned a system that serves the student and adviser in the computer lab, dorm room or office. The goal [was] to maintain the one on one adviser-advisee relationship, [and] to free up time for quality conversation about choice and major, future plans and personal concerts. (Computer to advise computers, 1995).

Start of CAAS

“This is a project of major importance” - March 19, 1994, John Cahir

On March 29, 1994, Cahir presented a statement on “Advising on Undergraduates” to encourage effective advising among students, professional and faculty advisers and staff (Cahir and Romano, 1994). Administrators believed that successful advising involved accurate, timely information available through modern technology that was accessible to students and faculty whenever needed. The contexts of undergraduate education were as varied as student goals so PSU had the responsibility to provide factual information “and advice to assist students to reach their goals and advance the university’s own purposes” (Cahir and Romano, 1994).

eLion Phase III – OASIS to CAAS

The DUS, independent of OASIS, formed a new team of stakeholders in March of 1994. This cross-functional team, known as CAAS (Comprehensive Academic Advising System), included members from vital offices, such as the registrar’s office, the College of Business, the Commonwealth Campuses, and OAS.[130] In this initial stage of development, the CAAS project consisted of three teams: sponsors, collaborative design, and project design. Their objective was to determine how to deliver extensive academic advising services (Belinc, 2004, p. 5; Hart, Hussey et al., 2006); build on the "good work that has already gone into [PSU's] student information systems;" and "improve the university's advising outcomes in significant and visible ways" (Cahir and Romano, 1994). Charged by Cahir and Romano and led by Gary Hile, Director of Academic Records and overseen by Dr. Eric White, Director of the Division of Undergraduate Studies, the CAAS group was to develop the technology to enable these objectives (Benchmark Student Advising, 1995).

> If I had to give you a single name of where the seed of this idea [germinated]. Gene Melander started the advising system project. Gene is a visionary. It's just his nature. I worked for him very closely for many years. No matter what the issue was, he was always looking to the future…He was responsible for academic unit services. How do we make this stronger? How do we provide a better experience for our students? And he started to talk to the director of advising center, student aid, the registrar, the bursar. Once it was pulled together, Gene played a strong role in leading the development effort. (J. Wager, personal communication, November 8th, 2016).

To that end, Cahir and Romano, appointed a Collaborative Design Group consisting of Melander (Associate Vice Provost for Undergraduate Education),[131] Wager, and White to help establish and coordinate the CAAS project team. The Design Team

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[130] Dr. John J. Romano, Vice President for Commonwealth Campuses, The Pennsylvania State University, Dr. John J. Cahir, Vice Provost and Dean Emeritus of Undergraduate Education formed CAAS.
[131] Dr. Eugene Melander was at PSU from 1973-1999, Assistant Vice President, Associate Vice President, and Associate Vice Provost, Undergraduate Education.

would work with the CAAS project team and plan, implement and report on their activities in the project (Cahir and Romano, March 29, 1994).[132]

According to an internal document, the CAAS project team, with no funding or support staff and only the pledge that a winning conceptual design would be funded by Cahir, the Vice Provost and Dean for Undergraduate Education and Romano, the Vice Provost and Dean for Enrollment Management, initially met weekly for ninety minutes to gather existing advising resources from all 24 PSU campuses, and outline the project's vision statement, mission and target goals and agenda. Originally titled the 'Advising (whatever) team,' the group named the project and itself the Comprehensive Academic Advising System (CAAS) (Hart, Hussey et al., 2006, p. 30; Advising (whatever) team meeting minutes, May 11, 1994).[133]

> The leadership, Cahir and Romano were very encouraging. I don't want to take away credit from those guys. It was pretty much left to the steering group, the people who needed 90 minutes a week to make it or kill it. There was a strong feeling among that group that we need to make it. Growth was slow, there was more time than money invested. It was a challenge to coalesce around this idea. How do we focus this idea into a product? When we started rolling out actionable processes, people could begin to see this, and the support could continue to increase. Then the money started to loosen up. It was an interesting and challenging time. (J. Wager, personal communication, November 8th, 2016).

At the kickoff meeting on May 2, 1994, Melander, Romano's right hand man, made sure that the team had a "firm understanding of the importance of this project and

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132 The Project Design team was comprised of university staff from the following areas: Division of Undergraduate Studies (one administrator, one academic adviser, and one programs coordinator representing the Eberly College of Science); Office of Administrative Systems (one IT administrator); Schuylkill campus (one faculty member with teaching, advising and registrar responsibilities); Smeal College of Business (one academic adviser); and the Office of the University Registrar (one administrator, one degree audit expert, one IT staff). (Hart, Hussey et al., 2006).

133 In March 1995, CAAS would become known as the Comprehensive Academic Advising and Information System (CAAIS). The acronyms are used interchangeably here as the meeting notes sometimes refer to the system as CAAS or CAAIS; and the writing of this portion is not in chronological order.

the possibilities for opportunities of revolutionizing academic advising this presents to [PSU] . . . [and] challenged [the team] to be action oriented" (Hile, 1994). In the weekly meeting, unpublished internal communications found that the team struggled to determine the next steps and to define the immense project, described as "larger than life" (Hile, 1994). They found the project "time consuming," and just one more addition to the "so many other 'big' projects going on" at Penn State, but they felt it impossible to say no because the directive came from "upstairs and across campus" (Hile, 1994).

Their vision was to:

> provide a nationally recognized expert based empirically grounded advising system that is delivered by the latest technologies to supplement student/adviser relationships and to engage students in interactive inquiry of informed educational planning (CAAS meeting notes, July 6, 1994; CAAS Meeting notes, September 28, 1994).

A team of Penn State administrators, staff and faculty worked to develop the concept of a computer-based advising system crafted to support all stakeholders. Team members surveyed the community to identify critical advising policies, inventoried existing systems that supported advising at other higher education institutions, examined university advising policies, specifically Faculty Senate policies so as not to upset the school's faculty members,[134] identified criticisms of the current system of advising, reviewed all publications and information dispersed for academic advising, examined advising functions and processes, brainstormed the system name, and created a document that would provide encouragement as they developed the expert system.

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[134] A faculty advising group was named in order to include faculty input. Faculty members were nominated by Deans.

Some of the items listed in the document, referred to as "the Case for Creating an Advising System at PSU," included the points that the system was to: be accessible and easy to use; provide accurate, current information; incorporate a broad knowledge base; promote student/adviser interactions; be interactive, able to provide tailored responses based on student input; and permit updates to ISIS for certain processes.

Another document, *Designing and Implementing a Technology Project: A Case Study*, was to help define expectations and agreements for the new advising information system. Advice included: warnings about too high expectations, reminders that progress should be slow and steady, and that reporting to trustees and sponsors should be sparse and measured.[135] Contacting advisors would provide benefits and it was a "good idea to incorporate advising stories" (CAAS, 1994). The excitement was palatable.

> I believe our computer assisted advising group is making good progress, and if we are careful and creative we will produce the benchmark project for the entire nation. (Kelly, 1994, internal communication to J. Gary Augustson).

CAAS identified several advising models, advising studies, and outside sources for additional information, including the EASy model[136] in Smeal College; a software package, In-Touch developed by the Robinson Group, Inc.; and an Educational Testing Services Developer who was working on an electronic advising prototype.[137] PSU chose not to work with consulting companies or education firms like ETS on this project, not wanting "to provide [the companies] with the ideas to develop a commercial system using their vast resources, only to have them turn back around attempting to sell the

[135] Trustees and sponsors were expected "not to read reports" and "want production more rapidly" (CAAS, 1994).
[136] Typing of Smeal College model, EASy is correct.
[137] June 28, 1994, internal communication, Gary L. Hile, J. James Wager, June 1994 Status Report

system to us after we had helped with the development" (CAAIS Meeting Notes, July 6, 1994). The CAAS team also chose not to utilize any of the EASy Advisor work in PSU's SMEAL College because they felt that the EASy Advisor system was a maintenance nightmare (Ken Blythe, internal communication, January 24, 1995).

Development of advising functions. After gathering a fairly comprehensive list of the advising resources in the first meetings, the CAAS team recognized that the DUS Advising Handbook was the most thoroughly researched and prepared document on advising in the university, the cornerstone around which the academic information/academic advising components of the Comprehensive Academic Advising and Information System (CAAIS) would be built. CAAIS and the DUS handbook were linked from the beginning as the CAAIS standard was set to be one of accuracy and reliability. (Meeting Notes, December 10, 1996, internal communication, Gary Hile from James Kelly). CAAIS team members had to be informed and responsible for any document associated with CAAIS, assuring that data be accurate, current and complete.[138] Administrative units were contacted to ensure cooperation (August 1994 CAAS Status Report, Gary Hile, internal communication, August 1994).

Due to limited development resources[139] there was no expectation to respond to every advising scenario, so the teams budgeted the functions that would be available in

[138] August 1994 CAAS Status Report, from Gary Hile to. James Wager, Collaboration Design Team Liaison.
[139] At most higher education institutions, while there is an increased demand for services and support, funding for new technology investments is limited and outlays require approval and justification. The technical team typically has a backlog of requests. CAAS was working on building an advising system that would have additional functionality beyond what existed in PSU's student information system. The Comprehensive Academic and Information System (CAAIS) was a new technology initiative where CAAS members advocated which work was most valuable across academic units.

the interactive advising system (CAAS meeting notes, August 25, 1994). They looked at the withdrawal process, degree audit and late course drop. During this first stage, CAAS managed three concurrent activities: 1) developing a prototype of the overall CAAIS, requesting technical and financial support from the project sponsors, interviewing and hiring support staff, writing grant proposals, and addressing technical issues; 2) overseeing the creation and possible integration of advising related OASIS applications outside of the formal CAAIS project team structure, such as GPA, FTCAP, adviser assignments, and academic summary; and 3) designing the first interactive advising applications (summary of key academic records) that would include adviser assignment information, semester/cumulative grade-point average calculations and implications, placement test results for English, mathematics, and chemistry, late course drop, and the withdrawal process. (CAAS meeting notes, August 25, 1994).

The withdrawal process. Following a complaint about the inconvenience of leaving the school, Cahir and Romano requested and received a report on “The Withdrawal Process at Penn State” from members of the CAAIS committee (Bordi et al., 1994). The group gathered numerical data and interviewed university staff and students, soliciting, in particular, students who had withdrawn in the Fall Semester and had re-enrolled for Spring 1994.[140] Students reported time consuming requirements, such as having to visit several offices before the director of academic affairs would sign their withdrawal forms. Also, the staff advising students about withdrawal did not have all the necessary information. Generally, the report recommended that all campuses require

[140] Specifics are in CAAIS Screen Shots.

students to file only a one-page withdrawal form. Other requests for signatures could be eliminated because the ISIS data were available to all offices. One pamphlet only would be necessary to describe the withdrawal process and the implications for a student leaving a course. The necessary training and documentation would be provided to everyone advising students about withdrawing. Re-enrollment and withdrawal procedures would be linked and their functions located in one office, like the registrar's office (Bordi et al., 1994).

The withdrawal process appeared to be very complicated, from the initial CAAS meeting concerning withdrawal in July 1994[141] until its rollout on February 11, 1999. During September 1996 many of the team meetings were spent developing the basic framework for the CAAIS interactive withdrawal module. The fundamental design included a definition of the withdrawal action, alternatives to withdrawal, the time frame for withdrawal, eligibility to withdraw, general and student-specific implications of the withdrawal action, messages for students in a special student population (student athletes, honors students, etc.), and finally the completion of the withdrawal action (CAAIS September 1996 Monthly Report, 1996). Internal communications and meeting minutes suggest that the withdrawal issue was not a technical issue but rather one complicated by timing, especially in summer session. The CAAIS team had to prove the processes at all campuses before they could fix the withdrawal process. In February 1997 a CAAIS monthly Report said:

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[141] Comprehensive Academic Advising System Meeting Notes. (July 6, 1994). Comprehensive academic advising system (CAAS) meeting notes, July 6, 1994. The Eberly Family Special Collections Library, The Pennsylvania State University, State College, PA.

> The withdrawal development was slowed considerably due to the complexities of summer session withdrawal. Our challenge is to make the student aware of the courses that would be included in the process, those that were graded and not involved and those for which classes have not yet begun. The variety of options for the wide range of scenarios that would have to be developed could become very large and cumbersome to present. The changes to summer session course offerings resulting from the Plan for the Commonwealth could also increase the complexity of this activity. Therefore, the CAAS Project Team decided that for Phase I of CAAS, students will not be able to use the CAAIS Withdrawal module for executing summer withdrawals. We could instead, refer them to their academic adviser. (CAAIS February 1997 Monthly Report, 1997).

With this in mind, the CAAIS design team assigned personnel to re-engineer the withdrawal process in order to eliminate many consuming bureaucratic tasks. CAAIS design team personnel conducted interviews with college staff, campus registrars and students, finding that the academic units varied greatly in specific requirements that were placed on students to initiate a withdrawal (CAAIS Meeting Notes, June 21, 1996). A questionnaire was distributed to all DUS advisers in order to compile an "exhaustive list of reasons for student withdrawal and possible alternatives to withdrawal" that could be incorporated into the interactive advising module (CAAIS October 1996 Monthly Report, October 1996).

Meeting minutes show that the CAAIS Design Team was very thoughtful in the messages that were to be shown to students. The potential actions (advice) corresponding with reasons for withdrawal (CAAS Meeting Minutes, December 20, 1996) may have come straight out of an advising session. A questionnaire to DUS advisers requested information on reasons for student withdrawal, what steps were needed after withdrawal, and which department/campuses needed to be informed (CAAS Meeting Minutes, October 30, 1996). The withdrawal module would not become available to students until 1999.

Late course drop. Having identified critical advising processes in the summer of 1994, the team presented the CAAIS concept to the university community (including the Board of Trustees), solicited consultation and training in expert-design, developed an expert-systems protocol, and created a conceptual design for the project. The team selected one process, advising for late course drop action by defining the key information, and then concentrated on identifying the many design components and time frame necessary to make the advising activity operational online (CAAS minutes, August 17, 1994; Mycek-Memoli, 1996).

In the initial meetings of 1994, CAAS team members spent time flowcharting late drop while understanding the challenge of the task:

> Late course drop presents one of the most difficult situations for a computer-assisted advising system. It will be labor-intensive, time-consuming and difficult to use as a stand-alone demonstration. But at the most basic level, it would be a worthwhile effort to demonstrate that the system could integrate both OASIS and academic advising information from the DUS Handbook (CAAS minutes, August 17, 1994).

The interactive advisor helping students navigate late drop through the system was to be named (and modeled) after Associate Vice Provost Eugene 'Gene' Melander. An administrator who worked tirelessly on multiple projects at the university and always looked to serve the student, Melander was an informal advisor and back room worker who guided students through an oftentimes bureaucratic system. "Gene Says," was unanimously considered a great name for the "advising component" of CAAS. "We named Gene Says after Eugene because he was so instrumental in helping students maneuver university landmines" (Interviewee No. 1, personal communication, March 2016). In the screenshot of the first workup of CAAS, it is evident that INDEX is a link to the PSU advising documents, and "Gene Says" is the Interactive Advising Session.

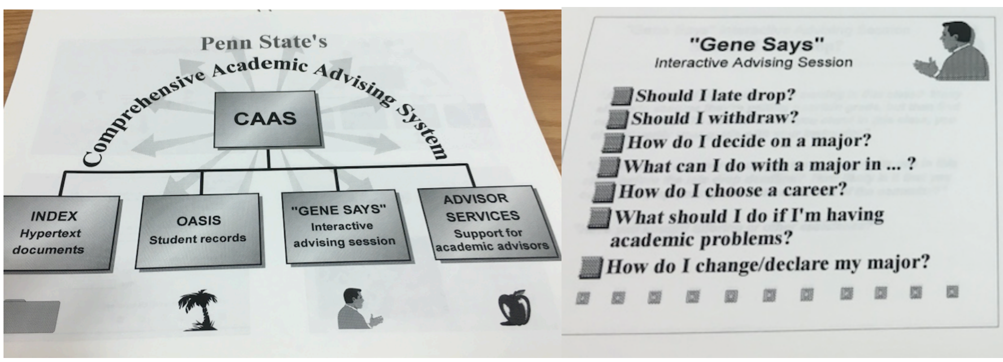

Figure 10. Mockups of CAAS and Gene Says screens. Image: Penn State University Archives.

By August 1994, the CAAS team had developed a model for a comprehensive academic advising system that had been designed with considerable attention to the seven questions/framework (shown above) outlined in the Advising Information System Project Plan written by Cahir and Romano. The model responded to the criticism of the then current advising system as identified from a review of the *May 1992 Report on Undergraduate Advising* and from the collective querying of advisers. The report detailed criticisms about the availability of advisers; the lack of consistent accurate information for students; the hesitancy of faculty to advise pre-major students; and the significant gap between the expectations of advisers and students. Facilitating the student's role and the adviser's role in academic advising, the system would be available initially through student computer labs and faculty workstations. (Hile, August 31, 1994).

As degree audit was a major instrument in identifying course relevance to academic decisions, it was included in the model.

The CAAIS conceptual design was presented to the project sponsors on September 28, 1994, and then to numerous campus groups in November, including professional advisers, faculty advisers, technical staff and administrative staff. Responses were overwhelmingly positive (CAAS Meeting Minutes, September 28, 1994; CAAS December 1994 Monthly Report, December 1994). CAAIS was expected to benefit the university community as a whole by presenting students and advisers with consistent, accurate and timely advising information. Allowing students to access their "virtual adviser" at their own convenience would not only empower students, but also centralize and summarize advising related information, freeing advisers from mundane tasks and increasing the time they could spend in quality advising (Mycek-Memoli, 1996). Sponsors Cahir and Romano sent a memo on November 29, 1994 congratulating all the CAAS team members on their progress. They endorsed the CAAS design, looked forward to further development, recommended that an operational pilot be delivered first, that the functionality of the system be enriched, and that extended access to the system include other student information processes (Cahir and Romano, 1994).

The CAAS team chose to forgo conventional development methods[142] and built the system expeditiously by establishing concurrent development teams to iteratively

[142] Traditional software development lifecycles move in a linear fashion where requirements, design, coding and installation can result in cost and time over-runs, if errors lead to corrections at any of the development stages. Concurrent software development has multiple activities such as requirements, analysis and coding happening simultaneously with different intensities so work can be done in parallel, and changes can be handled efficiently with fewer cost and schedule overruns (Johri, 2014).

design, test and deploy system services online (Wager, 2005, p. 10.11-10.12). The teams' guiding principle was to provide ease of operation so users could navigate the system without "getting lost". CAAS would provide current general and specific student information to students, advisers, the Penn State community and the general public. The system was to highlight the role of the student's academic adviser and promote communication between the student and adviser, as well as act as an interactive system for the completion of certain academic actions by students without administrative intervention. System development was to begin with a prototype of one component so as to permit implementation of critical components while development continued on others, and so the prototype module would serve as a blueprint for additional processes in which academic advising was an essential ingredient (Melander, August 4, 1994). The registrar, student aid, bursar and academic advising offices sponsored the development teams as they were the primary business units responsible for student services (Wager, 2005, p. 10.11).

Each team was tasked with providing virtual prototypes to senior university administrators, who offered $50,000[143] to create the archetype, train staff, and purchase specialized software if needed. After the prototype had been approved, four teams were created. The first team was responsible for determining application standards and presentation techniques, teams two and three addressed the development of the first student service applications, and the fourth team focused on the technical architecture

[143] On January 31, 1995, the CAAS team requested from the project sponsors $63,000 in staffing, general support of $19,000 annually over a three year development period, and server and hardware costs. In March, they received verbal commitment for the funding they requested. Four CAAS staff positions were staffed. The sponsors were slow in providing the funds.

(Wager, 2005). The goal of the system was to create "an expert-based empirically grounded advising and information system delivered by the latest technologies to supplement the student/advisor relationship and engage students in inquiry for informed educational planning" (Wager, 2005, p. 10.10). By streamlining the process internally, individual student services departments and staff were able to focus on student value-added activities for their departments (Wager, 2005, p. 10.10).

John Cahir, Vice Provost and Dean for Undergraduate Education wrote:

> There is always a lot of criticism that some of the advising is lousy. We are never going to solve the advising problem, but many students can do a lot on their own if they have the right information. (Computer to advise computers, on October 23, 1995).

The first prototype approved by the new group was the "late course drop," a "complex advising process that if successfully developed would provide the foundation for other services to be analyzed and developed" (Hart, Hussey, et al., 2006). CAAIS surveyed academic advisers system-wide, and then analyzed the gathered intelligence to understand and translate complex advising components into a tangible online system (Mycek-Memoli, 1996). The CAAIS team invited participation through surveys from students, advisers and staff who would be using the system. The feedback guided development and ensured production of a successful "late course drop" application. (Hart, Hussey et al., 2006, p. 30).

Progress occurred concurrently in some areas. During the development of the late course drop application, partial flowcharts were submitted to IT staff for analysis and programming. During the inspection by IT, the CAAIS project design team could develop a second interactive advising application for another complex process, withdrawal.

> When flowcharting the withdrawal application was partially completed, charts again were turned over to an IT programmer for analysis and programming of the application. Thus, the development of both the late course drop application and the withdrawal application progressed in parallel. Because both the analysis and the flowcharting of the withdrawal process were less complex than that of the late course drop process, the development of both applications was completed around the same time, even though the late drop application was under development longer. (Hart, Hussey et al., 2006, p. 31).

The late course drop and withdrawal applications were made available to students on February 11, 1999 (Hart, Hussey et al., 2006, p. 32).[144]

Computer security. The final OASIS Educational Planning Modules were put into production and made available to students in February of 1995. These included target GPA prediction, student academic summary, a look at future development, email comments and suggestions.

OASIS reduced the routine administrative burden of handling student requests, and at the same time, "[provided] a service that students like because they can take care of the request themselves from home, from their residence hall room, from a student microcomputer lab or from a conveniently located campus kiosk" (Computer & Information Systems Strategic Plan, 1995). Prior to OASIS's successful implementation

[144] The University Registrar's Office was authorized to add persons on a three-year basis to provide training in expert systems for the project team, and manager and programming support for the project, at an annual commitment of at least $63,000. The Division of Undergraduate Studies provided $41,000 temporarily to be deployed in building the system and hired a programmer; and it was requested that Cahir and Romano provide the $41,000 and additional commitment of $19,000 annually over a three year development period for server, hardware and operating budget. (EMA/U Ed Collaborative Design Group: E.R. Melander, J. James Wager, Eric R. White to John J. Cahir, John J. Romano, February 1, 1995). Cahir and Romano had asked each project team to share, with the umbrella collaborative design group and the sponsors, each project describing their activities and recommending support for the next stages of development.

students could not view or change their administrative records without the involvement of an administrative clerk or staff officer.

The additional user access called for new security measures. As more applications were distributed to desktops, education about and support for the responsibilities and technical means for computer security, Local Area Networks, and the greater University network environment became vital. C&IS understood that "without a viable and comprehensive user training program in security, computer and information systems would be unnecessarily at risk" (Computer & Information Systems Strategic Plan, 1995). This was particularly true in the case of UNIX, where the degree of security was related to the skill and training of the system administrator. PSU planned funds in 1995-1996 to develop and enhance training and education programs in computer and network security (Computer & Information Systems Strategic Plan, 1995).

eLion Phase IV –OASIS and CAAS, CAAIS

A year later in March 1995, after recognizing certain synergies with the OASIS technology as a delivery vehicle, CAAS joined forces with OASIS, becoming a single effort renamed CAAIS, Comprehensive Academic Advising Information System (pronounced "kaz") (Belinc, 2003) (Janesch, 1998).

Wager wrote about the expected cooperation.

> CAAIS Team – A notation has been made! No one has exclusive ownership of this project and it is not a closed club. OAS will be leading the main-line conversion of OASIS (Wager, internal communication, May 3, 1995)

With OASIS information capability CAAIS would provide students with direct access to their student information, and both students and advisers could log into the expert-based interactive advising component. "Rather than simply providing students with data from their own student records, CAAIS [integrated] student data with university policies and procedures and provided analysis, "advice" and decision-support to students, advisers and the university community" (Mycek-Memoli, 1996).

Increasing momentum. The process to flow and script the expert system was "painful" and "slow" as the team worked "through significant issues" (CAAS Meeting Notes, June 30, 1995). The equipment to run the system was very limited (June 8, 1995 CAAS Status Report, 1995). Job demands, vacations and business travel reduced member availability to complete CAAS agenda items. Interviewing for two open CAAS positions and achieving consensus also contributed to the work slowdown (CAAS Meeting Notes, June 30, 1995). The CAAS team held two extended five hour sessions and then scheduled five hour weekly sessions through June and July in order to increase momentum. Lunch was provided as an incentive for the team (June 8, 1995 CAAS Status Report, 1995).

Prototype delivery. The extra time paid off. In October 1995, the CAAIS committee was a year old and had produced a prototype proving that interactive advising was possible, and had three components available: (1) access to University Faculty Senate policies on courses; major requirements; and general information by computer; (2) access for students to personal information from course availability to schedule courses, degree adults, student loan balances and confidential information; (3) electronic mail (CAAIS October 1995 Monthly Report, 1995).

Sponsors, Cahir and Romano, wanted to better publicize the CAAIS project, as well as emphasize, especially to the Faculty Senate, that CAAIS augmented advising and was not intended to replace faculty-student interactions (Cahir, October 12, 1995). John Cahir wrote to Gary Hile, “We are already bragging about it, so you’ll undoubtedly be hearing from people who’ll want to know all about it. But that’s the price of fame. Thanks for making us all look good!” (Cahir, October 19, 1995).

Funding CAAIS. In an interview in October 1995 to the Daily Collegian, CAAIS committee members described how the program was going to make it a reality for students to drop a course through the web, despite this functionality not being yet available. They were creating hype about the coming future.

> A student wants to drop her Engineering Graphics 50 class, but her adviser is nowhere to be found. The late-drop deadline[145] is tomorrow and it is already 4:30pm. She sits at her computer and logs onto the advising web page, taking “a guided tour” through her options and the consequences of dropping the course. Then she drops the course right from her computer terminal. (Computer to advise computers, 1995).

[145] The last day a student could add, drop or change a course in the Registration Office.

Financial institutional support for the project dates from September 1, 1996 - August 31, 1999 was as follows: $87,000 for the academic year September 1996 - 1997, $90,480 for September 1997 - September 1998 and $94,099 for September 1998 - 1999. The University requested outside funding in total of $605,828, with $191,695 in year one, $199,362 in year two, and $214,771 in year three. Primarily the funds would cover salaries and wages, employee benefits, travel, materials and support. The CAAIS team made multiple attempts to fund the CAAIS initiative, developing funding proposals from October 1995 to August 1995. The proposals defined CAAIS as a project under development at Pennsylvania State University that, when complete would provide an expert-based, empirically grounded advising system that would supplement student-adviser relationships and engage students in interactive inquiry of informed educational planning. (Mycek-Memoli, 1996).

Of particular interest, according to an internal communication, was that no foundation as of October 1995 had accepted or funded the CAAIS proposal (Corporate and Foundation Relations, Office of University Development, 1995). The Corporate and Foundation Relations department of the Office of University Development researched an online prospect of foundations to determine possible sources of support for the interactive student advising system, but unfortunately very few turned up as possibilities. The University applied for grants from a few of the corporations PSU already had worked with closely to try and promote the idea. The project proposals for funding required prototype costs, and marketable components (Moellenbrock,[146] 1995). In addition to the CAAIS team, a different group from the university worked on funding. No match with a foundation or company had been found by PSU Director of Corporate and Foundation Relations according to the CAAS September 1995 Report distributed October 12, 1995.

Planning modules. On November 1, 1995, DUS advertised educational planning available online through a series of handouts available to all members of the PSU community. OASIS was described as offering a:

> method for Penn State students to directly view, and in some cases, update their own administration data. EDUCATIONAL PLANNING is one module within OASIS and was developed as the first phase of the Comprehensive Academic Advising and Information System (CAAIS). Future development will allow students to access academic advising though WWW (Educational planning available online, 1995).

In November 1995, additional OASIS Educational planning modules were completed and available in beta online, including GPA, target GPA, adviser assignment and the DUS handbook (Educational planning available online, 1995).

CAAIS prototype module and IBM grant. Additional progress was noted in April of 1996 as CAAIS purchased preliminary development hardware and software, developed a prototype academic advising module, and employed technical staff to construct a beta version of the pilot module. The team had begun development of the full production system. (Mycek-Memoli, 1996).

The University featured CAAIS as one of the projects at the PSU CQI Expo, under the phrase "Advising in the 21st Century." The CAAS team was described as a

[146] George A. *Moellenbrock*, Jr. Director, Corporate and Foundation Relations.

Penn State CQI group committed to a customer-focused approach to identify improvement opportunities that "directly affected those [they served]" (p. 20 CAAIS announcements doc CQI). CAAIS team members described their project, discussed progress made, and shared what lessons they had learned. After an award luncheon, the CAAIS Team spent half a day at the Team Decision Center at Penn State's Scanticon Conference Center Hotel for August 1996. The team engaged in exercises to identify the strengths and weaknesses in the CAAIS project and focused on two primary topics: 1) what will CAAIS look like in five years? and 2) what can we do or how can we arrange our processes to make CAAIS more productive? (August 22, 1996 internal communication CAAIS Team Decision Center Session).

There was more good news. IBM called a CAAIS Team member on April 4, 1996 to report that the company had heard about the CAAS system, and that PSU should submit a proposal for a new IBM Grant program. The award would provide equipment for research and other programs but the deadline for proposal submissions was eight days away, on April 12, 1996![147] (Anne Mycek-Memoli, internal communication, April 4th, 1996). The University quickly revised and submitted previous rejected funding requests. On July 29, 1996, the proposal of Gary Hile, CAAIS "Team Coach" from the registrar's office and Anne Mycek-Memoli (CAAIS Technical Team Leader from the registrar's office) in response to the IBM Shared University Research (SUR) Program, *Comprehensive Academic Advising and Information System*, was selected for funding by

[147] According to Anne Mycek-Memoli (CAAIS Technical Team Leader from the Registrar's Office), Steve Willis from IBM called on April 4, 1996.

IBM. The grant provided equipment for an amount of $105,546 for the information system, and the CAAS unit added $22,000. In June, The Office of Administrative Systems (OAS) assumed responsibility for the CAAIS development and production servers. OAS agreed to provide the necessary hardware and software. Project sponsors budgeted and committed to the funding and development of CAAIS as a three-year project with possible additional funding at the end of the initial three years (CAAIS Meeting Notes, June 21, 1996).

Proposed meetings. The IBM equipment from the SUR grant arrived mid-September, and the machine software supported the degree audit, static web pages and a web search engine (CAAIS Meeting Notes, July 31, 1996).

To keep themselves on target team members decided that only one meeting per month would involve business matters; three meetings per month would be exclusive to the development of CAAIS modules; and one of the regularly scheduled meetings would be an extended four-hour session. Additionally, the team would not spend any meeting time discussing technical aspects of the system, hiring, software/hardware considerations or any issue out of their control (CAAIS Meeting Notes, August 26, 1996).

A list of the documents available to team members through the academic and advising references components included: University Undergraduate Advising Handbook, Faculty Senate Policies and Rules, University Catalogs for Baccalaureate, Associate and Graduate degrees; Schedule of Courses, current and future, College curriculum guides; and the Continuing and Distance Education catalog (CAAIS Meeting Notes, August 15, 1996).

eLion Phase IV, Web Presence of CAAIS

The beta version of CAAIS went online via the World Wide Web (http://caais.psu.edu) on Monday, November 18, 1996. (Comprehensive Academic Advising Information System Beta Version Rollout Announcement, 1996). Available at limited campus locations, it served approximately ten students simultaneously (Kramer and Childs, 2000). Beta CAAIS allowed students to access OASIS to check semester grades, request that semester grades be mailed, and view semester schedules. This milestone moved the project from the conceptual stage to reality. The weekly meetings and total cooperation of team members had borne fruit and proved the initial concept for the CAAIS project. Academic advising became one of the most heavily used student services and was cited as an essential component in the retention of undergraduate students (Mycek-Memoli, 1996). As a result, the project sponsors recommended that the project be continued and that the developmental pace of the effort be increased.

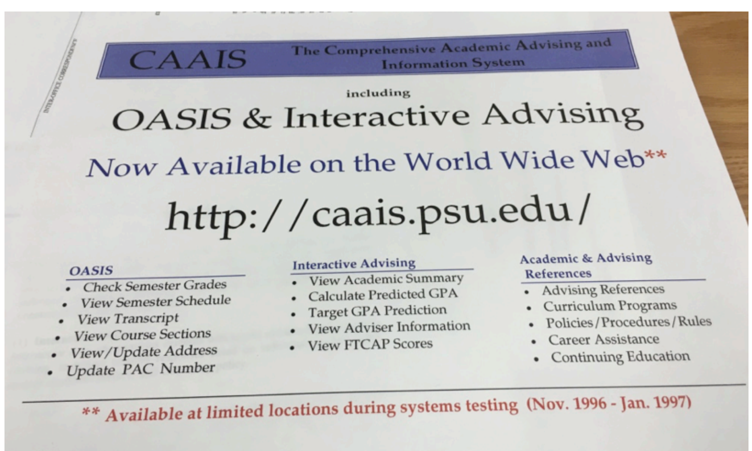

Figure 11. Pamphlet, OASIS and Interactive Advising Now Available on the World Wide Web, 1996-1997. Image: Penn State University Archives.[148]

[148] OASIS was available for limited systems testing, November 1996 – January 1997.

By 1997, CAAIS "decided to abandon the Mandarin development platform and convert all existing OASIS applications to a web format" and introduced new applications specific to advising under the online CAAIS umbrella (Hart, Hussey et al., 2006, p31).[149] Penn State's Office of Administrative Systems, together with the support of the SSC, began converting existing OASIS modules to web-enabled units, applying the same technology that the CAAIS project was using for development (Mycek-Memoli, 1996). CAAIS was still working by procuring and displaying data from ISIS, the Integrated Student Information System (Janesch, 1998).

"On March 31, 1997, the first CAAIS applications for students and for advisers were made available on the Web" (Hart, Hussey et al., 2006, p. 31). These applications were grouped under the categories of OASIS, interactive advising, and adviser services (Hart, Hussey et al., 2006, p. 31).[150] "When CAAIS was made available in March 1997, a deliberate decision was made not to publicize it widely so that the demand on its technology infrastructure could be monitored. The widely publicized, full rollout of CAAIS occurred early in the fall semester of 1997" (Hart, Hussey et al., 2006, p. 31).

CAAIS/OASIS applications provided students access to their academic records and course information including transcripts, degree audits, course descriptions and availability, address information and update ability, federal financial aid information and computer lab printing charges. Interactive advising provided a summary of key academic

[149] In Chapter 2, I discussed how registration services moved online at many academic institutions from the 1990s to the present day. At PSU, using software provided with Project Mandarin Consortium membership, OASIS was developed internally. However, that code was not compatible for the web, so OASIS applications were converted into a web format.
[150] "Ask Gene" was renamed to "interactive advising" for reasons unknown.

records, adviser assignment information, semester/cumulative grade-point average calculations and implications, target cumulative grade-point average calculations and implications, and FTCAP placement test results for English, mathematics, and chemistry.[151] Adviser Services applications provided academic advisers with student specific information and advising tools including a list of assigned advisees and key academic records, such as grades and their implications, placement test results and semester classification. (Hart, Hussey et al., 2006, p. 31; Undergraduate Academic Planner 1998-1999, n.d.).

Following these rollouts of CAAIS applications (including OASIS), training sessions were held at multiple campus locations for students, faculty, advisers, and staff assistants. The training sessions invited and used participant feedback to improve the applications.

[151] Placement test results for English, mathematics and chemistry made up the FTCAP scores.

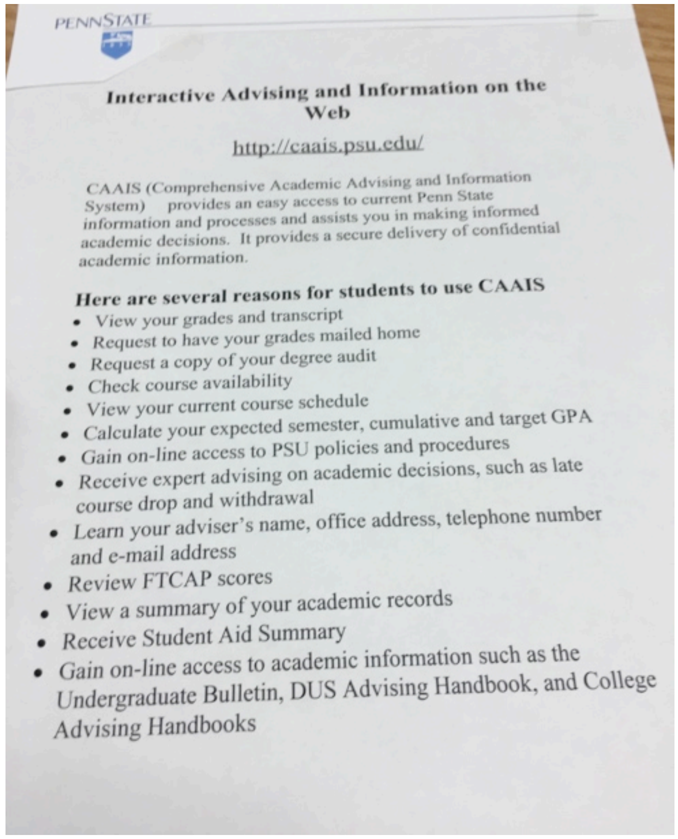

Figure 12. CAAIS Pamphlet,[152] n.d. Image: Penn State University Archives.[153]

The University pamphlet U.ED.EMA 98 -11, circulated to staff, faculty and administrators, described CAAIS as "an expert-based, empirically grounded advising and information system" that supported advising by responding to increased student demand for service, enabling students to assume more responsibility for their education plans. Access to 24- hour academic advising on demand, and consistent and accurate academic information, provided a single resource for students and advisers. The system addressed the academic complexities of curriculum, policy and procedures. It delivered information

[152] The CAAIS pamphlet was produced by the Office of the University Registrar, Division of Enrollment Management and Administration and Division of Undergraduate Studies, Office of Undergraduate Education.
[153] OASIS was available for limited systems testing, November 1996 – January 1997.

and services for adviser development as well as supported student retention through advising efforts. It also utilized communication technologies that were readily available to students, advisors, high school counselors, and the general public (U.ED.EMA 98 -11, 1998).

According to the 1997 CAAIS pamphlet distributed University-wide the project was delivered by World Wide Web (WWW) interface, accessible using any web browser that was HTML 2.0 or higher.[154] CAAIS provided real-time access to student records but was secure, requiring authorization to view confidential data (CAAIS pamphlet, n.d). The pamphlet identified the CAAIS project team, the CAAIS technical team, project sponsors John Cahir and John Romano and the Collaboration Design team. Late course drop and withdrawal were not yet options, but degree audit was available (Comprehensive Academic Advising System Pamphlet, 1997).

[154] CAAIS pamphlet seen above in footnote 120 is different from the U.ED.EMA 98 -11 pamphlet.

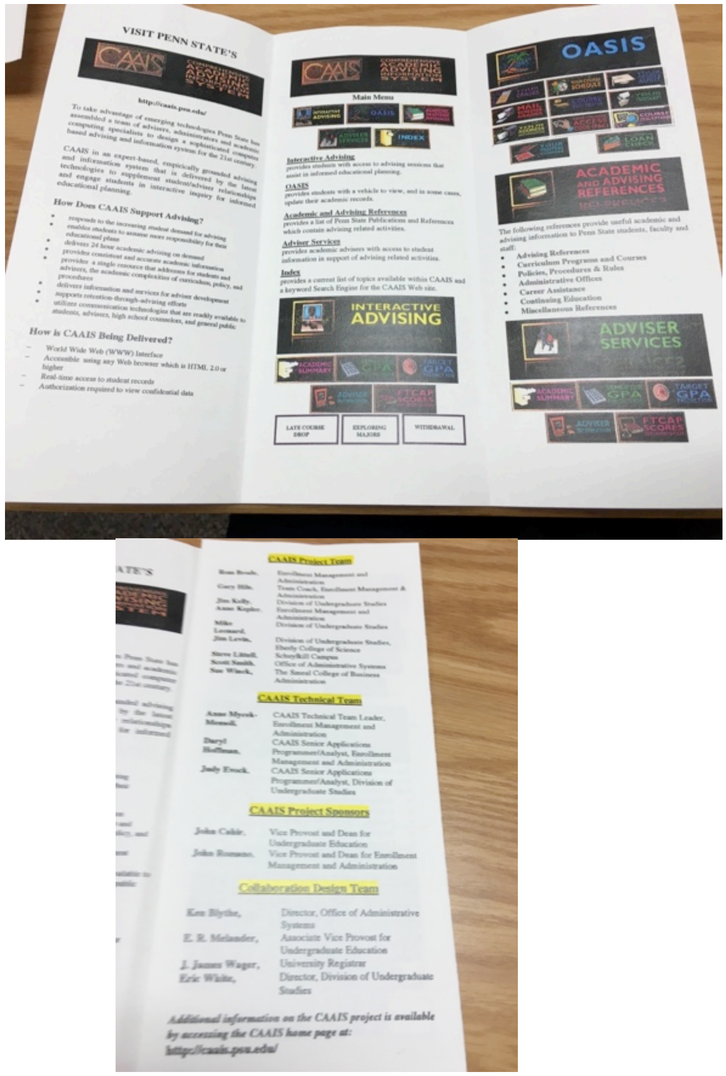

Figure 13. Comprehensive Academic Advising System Pamphlet, 1997.
Image: Penn State University Archives.

During 1997-2000, applications were developed to support student exploration of majors, list course preferences and report mid-semester grades. These additions, such as degree audit, transcripts, and grade reports, were further modified to provide access for academic advisers. By using the new tools students could now register online, drop and add courses, review financial aid applications, and request end-of-semester mailings of grades. The faculty could access class rosters. The program's index provided a keyword search within the CAAIS website application, a CAAIS directory of topics, CAAIS academic and advising references, and a Penn State web server search. Academic and advising literature provided links to online Penn State advising publications and references. These references included the University Undergraduate Advising Handbook, the undergraduate education, curriculum programs and courses, career assistance, continuing and distance education, administrative offices information, policies, procedures and rules and other advising references. Usage statistics reporting was also built into CAAIS applications. (Undergraduate Academic Planner 1998-1999, 1998).

Technological and maintenance challenges and web standards revealed that a more uniform navigation and web design system was needed (Belinc, 2003; Hart, Hussey et al., 2006, p. 33). OASIS still had to be converted from Mandarin to a web-based structure; programmers needed web-language training, and hardware and software limitations required expertise to improve the system performance of the OASIS CAAIS website. Wager (2005) describes these years as slow, but added that fiscal and emotional support from PSU leadership kept the project moving, and "an important part of the vision was to provide a set of services that would quickly scale to a very large (100,000+) population of users, which required that the system be standards based, uniform, self-documenting, and reliable" (p. 10.13).

To alleviate challenges, two additional teams were formed in 1997: the CAAIS technical management team to address hardware, software and system performance issues, and the CAAIS web design team to focus on web design issues and enforce web, CAAIS, and University editorial standards. Three new members joined the Collaborative Design team including a senior administrator from the Office of Undergraduate Education, the director of the Office of Student Aid, and a senior manager from the Office of Administrative Systems. “The Collaborative Design team also changed its name to CAAIS Steering Committee and assumed additional responsibilities for CAAIS governance including determining its future direction at the University” (Hart, Hussey et al., 2006, p. 31). However, because the scope of the CAAIS project had moved past its original vision as an academic advising system, the overarching goal of CAAIS had to remain the same, “providing comprehensive support for academic planning” (Hart, Hussey et al., 2006, p. 31). Furthermore, the bureaucratic requirements of the team grew with the creation of groups that were responsible for certain applications, and it became clear that CAAIS needed to be disbanded and renamed so as “to achieve better name recognition” and to usher in the new web navigation changes (Belinc, 2004, p. 5; Hart, Hussey et al., 2006, p. 31).

The November, 1999 development schedule of CAAIS shows that the DUS, OAS and the registrar were working on reviewing the system for accuracy, streamlining design, and finishing and working on the module, “Exploring Majors.” The program was still known as CAAIS (CAAIS Development Schedule, November 1999).

eLion Phase V – CAAIS becomes eLion, Web registration goes live

> After a yearlong trial, starting with the spring 2000 semester, Penn State introduced the web registration option for all students. We deliberately took a low-key approach and did not make any broadcast announcements to students. Quite frankly, we had some concern regarding our ability to scale this system properly. Despite our "non-announcement," students immediately began using this new service: eLion completed over 30% of the registration activity for spring 2000. Students recognized the benefit of changing the "registration event" to a "registration process" by allowing interactivity of course schedule, degree audit, tuition and fees, student aid, course prerequisites, and graduation. (Gary L. Kramer and M. Wayne Childs, Editors, The "e" Factor in Delivering Advising and Student Services, NACADA, Monograph Series, November 7, 2000).

The era of an antiquated arena style, multi-day registration was gone, replaced by a system students could use anywhere and anytime. Registration was altered forever and in "positive, efficient, and effective" ways. One enigmatic question remained. What was the value of the advisor's signature on the registration form, now that the registration form was gone? (Kramer and Childs, 2000).

On July 27, 2000, Penn State's CAAIS became one of 13 finalists in a nationwide competition promoted by the American Council on Education and the USA Group Foundation. The competition "[recognized] innovative programs in higher education that [promoted] academic excellence while containing costs" (Penn Staters - July 27, 2000, 2000).

In August of 2000, the student information system was renamed eLion,[155] and a multiple development team environment was created to ensure standard presentation and

[155] The name eLion was proposed by the CAAS steering committee as being more recognizable and easier to pronounce. The Nittany lion was Penn State's mascot. "The Nittany Lion Mascot is an essential part of Penn State's tradition and pride, which originated in 1904 during a baseball game against Princeton. Upon hearing their rivals' mascot, Harrison D. Mason announced that the Nittany Lion was "the fiercest beast of them all." Not only did Penn

technology, and to establish required student services (Wager, 2005, p. 10.11).[156] Furthermore, there was a concerted effort by PSU to design eLion to be self-explanatory without specialized training and manuals, while still ensuring personalized help to all users, and providing a repository for their comments and suggestions (Wager, 2005).[157]

> We were having good success with it. The biggest place where we failed initially was name recognition. There was a committee. Comprehensive Academic Advising Information System. Nobody knew what that meant. Students said you mean that thing on the Web. And someone said we need to rebrand this, and we did. And when we renamed it eLion, immediately students understood and said to get information, go to eLion. The rebranding was pivotal. eLion continued to flourish, and a lot of development took place in the user offices. We wrote a lot of student information, degree audit type of applications and bursar types of things. (J. Wager, personal communication, November 8th, 2016).

September 21, 2000, release of eLion. During registration later that month, eLion, "essentially the CAAIS applications with a new appearance and navigational scheme," was released to great success (Hart, Hussey et al., 2006, p. 34). When students were surveyed about their use of technology they responded that eLion was a close second in use to email (Wager, 2005, p. 10.11).

> During registration and the first four days of fall classes alone, students flocked to eLion. Monitoring results show that the number of distinct eLion functions, initiated solely by students and resulting in the retrieval of student data, totaled 347,741 during the five-day period from August 21 to 25. In addition, the system tallied more than 2.24 million web page requests as students returned to campus. During the same five day period, there were 30,612 distinct eLion functions performed and 42,798 hits for faculty and adviser-initiated eLion requests. (Kendig, 2000).

State win the game that day, but an image was created that would become both a symbol and legacy at the University for years to follow." http://www.gopsusports.com/spirit/nittany-lion-info.html

[156] The project was renamed eLion "to achieve better name recognition and align with planned presentation" (Wager, 2005).

[157] The cost of the project was not found in the research records.

From the moment of its initial release eLion became a successful support tool for the entire Penn State community. The usual monthly activity of about 390,000 transactions was performed by 40,000 students and 1,000 university employees. Activity was especially high at the end of the semester with grade reporting, transcript requests, and enrollment verifications. Start-of-semester activity was equally busy with registration, faculty class rosters, degree audit, student record updates[158] and graduation activity (Kramer and Childs, 2000).

During every semester since the implementation of Penn State's advising system, the number of students who withdrew from the university decreased. PSU felt that "because of improved and comprehensive advising, students [were] making informed decisions regarding the serious action of withdrawing" (Kramer and Childs, 2000).

As a third partner, CAAIS increased the quality of the exchange between students and advisors. Office hours no longer acted as a constraint, "telephone-tag" was eliminated, and the barrier to access resources and academic records was shattered. The student and faculty now had "complete, consistent, and accurate response to institutional policies and procedures" available at any time and from any place. They could review most questions prior to any meeting. (Kramer and Childs, 2000).

The operation details of academic advising had also changed, savings were realized decreasing some costs by the elimination of expensive forms no longer necessary to print, store and file. "The application of electronic publishing, information

[158] Student name changes, address changes, telephone number changes.

dissemination, and approval decreases administrative costs and process cycle-time" (Kramer and Childs, 2000).

During this period the University began working on the first of many services for faculty that would be delivered over the web using eLion. Prior to this point, faculty could print only class rosters on demand.[159] The first added service was the eLion Grade Entry application, which reengineered the school's process of collecting and recording end-of-semester grades. A partial development of this eLion faculty application was introduced to 18 invited faculty from several campuses and colleges during Summer Session 2001, and to 100 faculty by the end of Fall Semester 2001 (The University Faculty Senate Agenda - March 25, 2003, 2003). However, problems persisted, such as the inherent unreliability of "the printing, distribution, completion, collection, and scanning of more than 13,000 printed grade rosters from 24 campuses and 160 departments" resulting "in a crisis situation at the end of Spring Semester 2002" (The University Faculty Senate Agenda - March 25, 2003, 2003). By using eLion via the web, the registrar's office implemented a large-scale grade collection from all faculty members (and their grade entering staff) urging them to record their end-of-semester grades using the eLion Grade Entry application starting in the Fall of 2002. Undergraduate and graduate grades were no longer scanned but recorded "using online technologies, with specific emphasis on fully utilizing the web" (The University Faculty Senate Agenda -

[159] In Fall 2000, the faculty could print class rosters on demand ! (Gary L. Kramer and M. Wayne Childs, Editors, The "e" Factor in Delivering Advising and Student Services, NACADA, Monograph Series, November 7, 2000)

March 25, 2003, 2003).[160]

New problems came to light. "While the eLion grading application did not introduce any change to the registration process of independent study courses, the new grading practice did expose an inappropriate administrative practice that resulted in grading-related confusion from involved faculty" (The University Faculty Senate Agenda - March 25, 2003, 2003). Independent study courses, available in many disciplines, were listed as one single section. Multiple educators were listed "as instructors of record" for that single section and had the ability to approve students (The University Faculty Senate Agenda - March 25, 2003, 2003). "The resulting confusion was that as each of the involved instructors examined their grade rosters, they saw names of students that they had not approved" and they typically failed these non-approved students. Every instructor of record received email notification of any grade change by other independent study instructors. To rectify the confusion, the correcting procedure called for one independent study section per instructor with only that educator's students enrolled and approved (The University Faculty Senate Agenda - March 25, 2003, 2003).

In order to develop new applications and enhance others, the CAAIS steering committee was reconfigured as the eLion governance. Members represented each franchise specifying the responsibilities of the various eLion teams, established technical and web standards for current and future eLion applications, and "merged the web design team and the technical management team into a single operations team that was charged

[160] Faculty typically use their own version of eLion, eISIS, a portal that provides Penn State faculty and staff (not available to students) access to those administrative applications that have a web interface. These applications contain data on students who are currently taking, or have previously taken, courses at any of the campuses (Electronic Integrated Student Information System (eISIS), 2014).

with overseeing the technical and editorial management of eLion and making recommendations to the governance team regarding changes in the governance document" (Hart, Hussey et al., 2006, p. 35).

> Different offices and teams developing functionally different applications requires development standards to ensure applications operate in a consistent manner and remain student focused. If left to natural tendencies, organizations will develop isolated services controlled by organizational boundaries. CAAS development "[eliminated] such organizational silos providing that navigation and presentation among all applications remain consistent" (Kramer and Childs, 2000).

There was no expectation that the project would cease at any point in the future. As J. James Wager, then University Registrar reported in 1998, the SIS was a process for continually bettering operations and the University was working regularly to bolster the services offered by the system. Wager believed that the SIS project "may never really end" (Janesch, 1998). But, the *panta rhei, "everything flows"* (Heraclitus). Everything changes.

Death of eLion

As of November 21, 2013, eLion was being phased out at Penn State. The Board of Trustees voted to replace the entire ISIS[161] system at a cost of $64.6 million. The executive vice president and provost of the school stated that "the new student information system will be integral to the work and academic needs of tens of thousands of Penn State community members daily," as well as be a vital tool to "enhance Penn State's strategic data analysis capabilities" (Committee Recommends Approval of New Student Information System, 2013).

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[161] ISIS and eLion are used interchangeably at PSU.

This decision followed a 2008 memorandum to senior executives, marking the 25th anniversary of ISIS, coauthored by PSU's Bursar, Registrar, Admissions, Student Aid, and Graduate School departments, requesting a new student system (Busges, 2013). The authors proposed that a new millennium "called for a new system that was able to keep up with evolving technology and growing business processes" (The Pennsylvania State University Project LionPATH Website, 2014).

> Several of us having been meeting regularly with Ron Rash[162] to discuss the needs of our office with respect to ISIS. It is important to us that AIS maintain a clear awareness of ISIS and how it is serving our offices in the delivery of services to Penn State students and staff. Everyone knows that the processes of Bursar, Graduate School, Registrar, Student Aid, and Undergraduate Admissions Offices are critical and core functions that drive enrollment at Penn State. We have growing concerns about the capacity of ISIS to address new and emerging demands for how we serve our constituents today and into the future. The business processes of today are vastly different from those for which ISIS was designed 25 years ago.
>
> The issues and limitations our offices have been dealing with in adapting ISIS to our twenty-first century needs is rapidly leading to a degradation of services that we consider unacceptable. While these concerns have been made known to AIS by our offices over the years, we do not believe the University has adequately responded with the resources that are needed to address the deficiencies posed by the aging Integrated Student Information System at Penn State. (Griswold et al., 2008).[163]

The memo warned about shadow systems, where academic units were finding solutions outside of ISIS, and that ISIS was no longer the umbrella. The Housing and

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[162] Ron Rash was the Director of AIS. He says "I chaired a very active AIS advisory committee, I had 25 people. And I met with them monthly. The IT Directors from the campuses included: Ken Forstmeier, IT director for Research; Edie Hertzog, IT director for Budget Office; Kathy Plavkol from the AIS project management office for all of the administrative systems; Bob Quinn, Student Aid, IT director; Karen Schultz, Registrar; Cheryl Seybold – Outreach, IT director for outreach, World Campus." (R. Rash, personal communication, November 10, 2016).

[163] Griswold A., Rohrbach, A., Schultz, K, Sieminski R., Vasilatos-Younken, J. (June 9, 2008). Vision for Penn State Student Systems. Provided by Michael Busges, PSU Project LionPATH Enterprise Project Director.

Food sub-system, the College of Engineering, scheduling systems, scholarship databases at the Colleges of Liberal Arts and Engineering were all new information systems not integrated into the old because the legacy system was unable to accommodate the new technology (Griswold et al., 2008). “Although faculty were involved in the request for a new system through faculty advisory committee conversations, most of the impetus came from administrative offices (G. Spanier, personal communication, November 8th, 2016).

The academic units wanted a student system that was flexible enough to adapt quickly and easily as PSU changed the way it did business, thereby meeting the expectations of students, faculty and staff. Evolutionary and incremental changes were no longer enough. The team recommended a total system/replacement/rewrite approach. (Griswold et al., 2008).

A campaign by University Park Undergraduate Association’s Academic Affairs Committee (AAC) followed in 2010, agreeing that eLion had to be replaced. PSU students posted pictures online of eLion pages that were outdated or non-functioning. David Gray, PSU’s Senior Vice-President for Finance and Business asserted that “the current state of eLion is unsustainable, and the cost of failing to act on this plan [of replacement] is high” (Busges, 2013). Despite continuous updates over the years, PSU noted that the school’s 30-year-old SIS was built to reflect processes and structure in the early 1980s and no longer served the University’s needs.

Furthermore, PSU faced new environmental pressures. Student information systems offering uninterrupted access from anywhere at any time became the norm for most higher education institutions. Mobile web accessibility was the next wave of convenience for higher education institutions, and demand was growing in the PSU user community. This access had to be reflected in the new system named Project LionPATH (Busges, 2013; Eble, 2014). "Students and faculty demand 24/7 mobile access to administrative systems" (Busges, 2013). When eLion went down a few years ago, PSU students posted screen shots and complained about the system on reddit, a social media site where community members can text posts or direct links.[164]

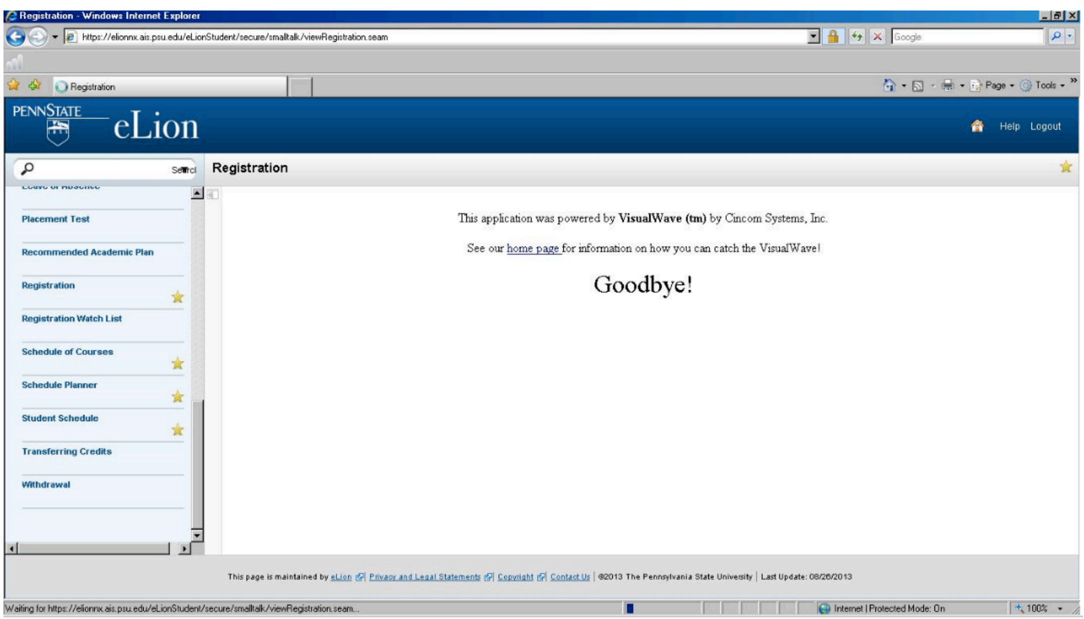

Figure 14. eLion portal screen. Image: Penn State University Archives.

Like other institutions, PSU aimed to modernize its administrative systems and services, and hoped to expand reporting and analytics, foster data-driven decision-making, and create the organizational capacity to implement large-scale change projects, support new technologies, and optimize their use (Busges, 2013). In addition, to insure student success, the school sought to implement an online student progress report that

[164] https://en.wikipedia.org/wiki/Reddit

could enhance mid-semester evaluations and timely interventions for students at risk, and re-engineer the billing system and student aid system to accommodate classes that were not semester-based (Penn State Undergraduate Education Strategic Plan 2008-2013, 2008, p. 9).

> When ISIS was first developed and implemented, there were no laptop computers, no Internet or World Wide Web, no cellular phones, no eCommerce, no World Campus, and very few nontraditional students with different needs for service. ISIS was designed to serve traditional age, resident instruction students with no differential tuition charges, and fewer federal financial aid regulations compared to today. Many of the processes implemented in 1983 are still in place today. As a result, new student service paradigms are being limited by those old processes and by a system structure that is less agile in this rapidly changing and more complex world of today. (Griswold, Rohrbach, Schultz, Sieminski, Vasilatos-Younken, June 9, 2008, memo).

Part of the impetus to change, to replace, the student system was the creation of a Core Council led by Provost Erickson to look at the World Campus and the future of distributed education. PSU's World Campus is the school's online accredited college degree and certificate program. The Core Council's directive was included in a letter that stated, "We expect you to have 50,000 students in five years and drive a tremendous amount of revenue for the university" (R. Rash, personal communication, November 10th, 2016). "Those additional 50,000 students were registered and as a result the school needed a new student system. The system Penn State had originally built was based on students that lived in dormitories. All of the sudden, we had 25,000 students in Asia." (R. Rash, personal communication, November 10, 2016).

Despite requiring some work by university employees, the new integrated system was not expected to be homegrown. "Although we had 80 programmers collectively, we couldn't keep pace with what other developers [at other companies] were creating" (R. Rash, personal communication, November 10th, 2016). CedarCrestone, a consulting company, and Oracle PeopleSoft Campus Solutions, an IS software company, were slated to quarterback the project. Communication between all three groups was vital, as members participating on the project would work at a university building that required additional renovation funds of $4 million. (Committee Recommends Approval of New Student Information System, 2013).

Examination of the Project LionPATH website shows that the administration is emphasizing transparency and has developed an effective administrative structure to direct and evaluate the progress of information system implementation. The website includes the following statement imprinted on the margin of each web page:

> The new student-centered information system will foster **transformative thinking, increased efficiency,** and **agile delivery** of excellent and consistent services to Penn State students, faculty and staff. The system will enable **robust strategic planning** and **data-informed decision-making** across the University. Penn State will leverage best practices and adopt uniform business processes in support of the diversity of education delivery models and needs of the University community. (The Pennsylvania State University Project LionPATH Website, 2014).

Increased efficiency and agile delivery are well known requisites for success that should be fairly easy to implement in a modern world. Transformative thinking, however, proves to be more difficult at any time and in any age. PSU expects excellence of effort from all members of its community, recognizing that all participants must be served.

Despite technological and financial challenges, PSU invested the resources necessary to build its information system throughout the 1990s and the 2000s. The culmination of these efforts, eLion, was influenced by the university's directive to support students, as well as by its organizational structure and technological aspirations. The new SIS Project LionPATH will similarly rely on the collaboration of university stakeholders for success in updating processes and improving the delivery of student services. If the most important stakeholders, the students, are served well and transformative thinking abounds throughout the University environment, Penn State will have fulfilled its mission and secured a viable roadmap to continued technology renovation where student success is the practical, and ideal, goal.

Chapter V. Practical Results and Foreseen Challenges

Students and Registration

An undergraduate, class of 2020, wrote that she had never held a handbook with class listings (Interviewee No. 2, personal communication, 2016). This simple fact shows how registration had changed for students and PSU alike over the last thirty years. No longer did the University maintain its academic record in a ledger book, with each page representing a class roster, nor did it complete transcripts by hand. This had been workable only when students all followed the same curriculum. Until application technology became available, an adjustable ledger had been needed due to the introduction of electives and majors and minors. Punch card and microfilm technologies stored student academic records and allowed the registrar to access those records on a mainframe database. (Interviewee No. 1, personal communication, March 2016).

The information system project provided PSU with an opportunity to step back and consider workflows and needs, as well as identify the policies necessary to preserve and provide access to electronic records in an academic setting. The student information system incorporated all core student university processes, reduced redundancy over time, provided a blueprint of workflow processes for institutional memory, and gradually lessened the institution's burden for maintenance, retrieval and presentation of student records. (Interviewee No. 1, personal communication, March 2016).

For students, registration changed in some ways, but remained a stressful time in every semester. There were advances however. Students no longer had to wait in line at Rec Hall and engage in registration at a specified time. Gone were early morning start times for students whose last name started with A, typically as early as 8 am. Although eLion still used registration times, students registered online at certain staggered times depending on their seniority in the school. They were no longer required to report to a campus location. Students could use any device connected to the internet to register for classes.

Students accessing eLion would log onto the system at their preregistered time, select the registration option for the appropriate semester and enter course numbers one at a time, hoping eLion would not time out or the course seats be taken by the time they pressed "add courses" to schedule. (How to schedule courses, YouTube, n.d.).

Students were no longer responsible for submitting to the registrar's process, completing a multitude of hand written forms in the registration deck, including a permanent home address card, campus living information, religious preferences and a diploma card. One student noted the benefit of eLion stating, "so while it might be annoying that you have to enter your password every time you try to add a course on eLion, at least you aren't writing your student ID number till your hand cramps" (Foley, 2016). eLion provided students with options beyond registration including advising, accessing financial information, grades, graduation information, major/minor information, personal profile, and policy documents. They could verify academic status, pay tuition bills, review the academic calendar and exam schedules, drop/add courses, examine the course watch list,[165] review degree audit, request a leave of absence, and take placement tests.

[165] The course watch list is a type of waitlist for seats in fully enrolled classes.

Students were required to enroll in twelve credits to have full time status. Using eLion they could schedule three or more credits at the same time. Dropping a course prior to the end of drop/add period required a student simply select the course and click the drop button. If students missed the add/drop deadline, they would encounter additional consequences, including speaking with their advisor. Prior to eLion, students had not had the option to drop their courses without approval.

eLion and Student Ownership and Complaints

Students at Penn State turned to eLion to support their academic careers on their own terms, using tools like degree audit, and registration; the course watch list; bursar functions; and advising. Students appreciated eLion's ability to view their pending and future financial aid and tuition charges, payments and bill due dates. Degree audit, described as "the road map" to one's college career and a guide throughout a student's time at Penn State, was very well received. In one school newspaper, a student journalist wrote, "It is possible to never meet with your advisor if you use the audit as much as I do" (Greene, 2012).

The registration component of eLion, as with other online registration systems, provided students with the convenience to schedule from anywhere at any time, and with an option to purchase class books and materials from the eLion portal once enrolled.

In 2012, the University worked hard to update web services. "From a redesigned eLion[166] to the new psu.edu, Penn State [had] realized that [technology was] the way to attract tech savvy students and keep current students from getting too irritated with

[166] The redesigned eLion in 2012 included a student watch list for courses.

stagnated services"[167] (Greene, 2012). Penn State also implemented m.psu.edu, a mobile site version of the school's home on the web in 2012 (Greene, 2012).

Student newspapers, however, reported continuing student disappointment with the University's attempts to introduce more current technology services. Even with the new options and functionality of eLion, students clamored for more convenience, similar to that found on technology websites they used personally. Students hoped for a more modern look and feel than what existed on the outdated portal pages of eLion. A formal report issued in 2010 by the University Park Undergraduate Association Academic Affairs Committee found that students wanted personalized entry to the system with details related to their personal academic standing at PSU. They did not want to access the general eLion page. Furthermore, they considered the use of multiple screens poor design. For example, students had to navigate through multiple windows on their computer when registering for classes, searching through the schedule of courses in one window to find course numbers, and then typing those same course numbers into another window of eLion to register. Students also did not appreciate that the registrar, bursar, financial aid and advising offices were organized alphabetically in the eLion portal instead of by common functions. The image below shows how the eLion functions were listed in alphabetical order.

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[167] The original quote was: "Over the last year Penn State has done a lot of work to bring its web services up to date. From a redesigned eLion to the new psu.edu, Penn State has realized that the way to attract tech savvy students and keep current students from getting too irritated with stagnated services. Penn State has also realized the immense pull that mobile technology has on students. m.psu.edu is the mobile site version of Pen State's "home on the web." Some features of the mobile site are more impressive than the full version, while others fall short.

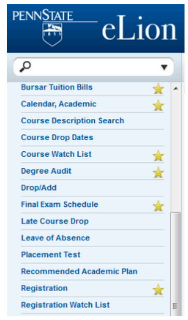

Figure 15. eLion portal screen, 2012. Image: Penn State University Archives.

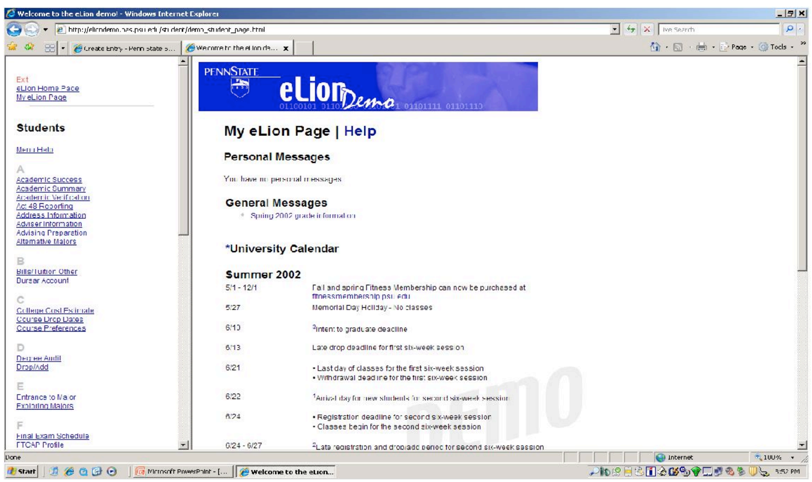

Figure 16. eLion portal screen, 2002. Image: Google images.

Student disappointment spread to other functions. When the degree audit function was not updated in timely fashion, students who depended on eLion were lost. They also wanted better explanations from their virtual advising sessions, and fewer memos**.** (2010 Report of the Registration Processes Review Commission, 2010).

Degree audits, as well as GPA prediction tools were seen as too slow, and students felt they were wasting time by waiting for pages to load and by having to login to various steps of the registration process. Students reported the system was not user friendly and difficult to read. They wanted a more intuitive interface that did not require a tutorial to use. The school had posted YouTube videos online to help students use eLion. (How to schedule courses, YouTube, n.d.). Students also preferred that course descriptions and syllabi be part of the registration system, so that planning for future courses would be manageable. Along those lines, the students felt eLion lacked a planner utility to allow users to create electronic templates for the assembly of multiple four year schedules by clicking and dragging courses for rearrangement into different possibilities. (2010 Report of the Registration Processes Review Commission, 2010).

eLion and the Reemergence of Student Community

Figure 17. eLion portal screen, 2013. Image: Google images.

eLion's failings did give students a sense of community as they used social media to commiserate. On September 19, 2013 when eLion crashed on the first day of senior scheduling, the program began to trend worldwide on Twitter.[168] One alumnus posted his disbelief to the twitter trend online, noting that students were complaining about registration wait times from the comfort of their own rooms as opposed to waiting in

[168] A worldwide trend on twitter means eLion was one of the most discussed topics via twitter at that time, with its own hashtag #eLionGate 2013. (Horne, 2013).

arena registration lines. The immediate worldwide attention and documentation of registration difficulties was new, although student discontent was almost a tradition. A yearbook from 1978 described "registration – a hassle, but not the horror veterans make it out to be" (La Vie, 1978, p. 006). Similar entries in later yearbooks recounted how students referred to their registration experiences as an inside joke. "When all else fails at registration, remember, Domino's Pizza Delivers" (La Vie, 1983, p. 78). At homecoming in 1986, among the sixty-eight creative float and mad hatter entries, individuals appeared dressed as computers in long lines, making fun of computer registration. "Crowds along College Avenue roared their approval" (La Vie Yearbook, 1986, p. 82).

Students were destined to keep waiting. Instead of enduring long lines during arena registration (after online registration became available), however, they waited alone at their computers attempting to login to eLion and schedule their courses. Rarely spending their first weeks on campus searching for an advisor, students used a virtual advisor that could help them make a decision online. Some comradery was lost. Socially, arena registration had been both an individual and a group activity. With the shift away from arena registration to individual computer registration, the process became more about mechanics. The social interaction was still there, students could voice their displeasure about the registration system in student newspapers or on student council and with each other, but the conversations did not take place at the registration terminals.

With the advent of social media, students could again share their registration experience and bond over the system's shortcomings. Social media enabled connections in student life, providing a medium for real time communication, as if students stood next to each other in arena registration instead of sitting at computers. Access to the experiences of others with eLion provided a sense of community where frustrations and possible solutions could be shared and explored. Where once students discussed the registration experience with the nearest person in arena registration, the same conversation shifted from Rec Hall and moved online.

Furthermore, eLion allowed students to get involved in the process of registration itself, petitioning the administration, and working on applications to give users the functionality they wanted in the system.

Prior to 2010, when students applied to courses that had reached full enrollment, they were simply locked out and had to revisit eLion until they got lucky and a course opening appeared (Enrolling in a course that's full, n.d.). To increase their chances, some students paid for the notification of available seats from private third parties like Course Sniper or Lion Schedules, services that notified them when "hard to obtain courses" became available (Upgrades improve schedule, 2010; New eLion Feature: Course Watch List, 2010).

One dedicated process of eLion also provided this functionality for its students under the name, Course Watch List. If the classes a student wanted to attend were full, the application allowed only those courses onto a watchlist after a student's schedule date. Notifications of any potential openings were electronic and students then needed to login to eLion and attempt to schedule the section, engaging in a "24/7 race against a number of students to get the next available spot" (Abrams, 2016).

One student referred to eLion's Course Watch List as his "nemesis" (Abrams, 2016). Jay Adams, a fellow student, agreed and found that the watch list was a "really slow and cumbersome process with the notifications it was supposed to send out, having to login, and copying and pasting the course ID." In response, Adams created an application that would enroll students for course selections as seats became available. Students would select the courses they wanted and provided their Penn State login information for eLion. In the case that multiple students wanted to enroll for the same course, the program would place students on a "first come, first served" basis. Five thousand PSU students downloaded this free application (Abrams, 2016).

Another student, Vendant Tiwari, created the app, *My Links at State*, for mobile phones. PSU students could access all University websites and eLion services (including University Health Services, a GPA calculator, webmail, and a schedule of courses) from one location to a mobile phone. In six months, the application had been downloaded 6,000 times. (Reed, 2015).

Students and LionPATH

LionPATH, eLion's replacement, referred to by many students "as their favorite $66 million student information system," changed the way students did business with the University (10 differences between LionPATH and eLion, 2016; Civian, 2010). Some changes meant to simplify student lives and address the shortcomings of eLion, however, frustrated users.

Figure 18. LionPath, 2016. Image: Google images.

Students were unhappy enough with LionPATH[169] that they created an online petition using website change.org to be delivered to President Eric J. Barron. Scheduling a course in LionPATH had become a four-step process, and students had come to depend on degree audit and GPA prediction, two features that were not yet available with the new system. Students wanted a return to eLion, and LionPATH to be released only when fully functional and "working flawlessly" (Al Ali, 2016).

Michael Busges, the director of PSU's Enterprise Management Office, met with the school's student government agreeing that LionPATH was underachieving but stated, "You kind of have to use it whether you like it or not" (Norton, 2016). His comments were reported in the Philadelphia Business Journal, in an article that included student tweets showcasing displeasure with the new system. Tweeted complaints were (and are)

[169] LionPATH came out in January 2016. "LionPATH — the university's new student information system that came at a $66 million price tag — made its debut last week. Unfortunately, it was an underwhelming one. While the new system does seem to make scheduling easier, this is overshadowed by things such as poor design and difficult navigation" (Klodowski, 2016).

accessible to account holders with memberships that follow PSU related social media[170] accounts like twitter. The publication reported some student comments:

"LionPATH is truly the bane of my existence."

"Well, scheduling was the most stressful experience of my life, THANKS LIONPATH !"

"If you figure out how to do LionPATH, Penn State should just automatically give you a degree" – student's father

"LionPATH has easily taken three years off my life in just one evening."

These complaints about student programs were not new. Once it had been arena registration that was the object of derision, next, students complained about online registration when eLion was first implemented and now students, having grown dependent on the functionality that eLion had provided for over twenty years, were wary of the shortcomings of LionPATH.

The "student" information system at Penn State became a true reflection of its name when the University placed students and their needs in the center of all transactions. This momentous shift in University culture, the emphasis on the student and not the institution, transformed thinking, allowing change, big and small, to impact the entire school community.

[170] Tweets can also be accessed by the public as long as the accounts are public (open on the World Wide Web).

Environmental Shifts[171]

At PSU, the environmental shifts have come from the student and faculty communities. Through the use of survey questions and by listening and providing opportunities to department stakeholders to design their desired technologies PSU administrators learned the “language, symbols, behaviors, norms, and values [needed] in order to effectively lead and communicate with constituents” (Gaudiani, 1996; Bensimon, 1990). They used their understanding of culture and processes in order to identify environmental shifts, and guide, help and define their institution. By letting student, faculty, and staff constituents know that they were heard, faculty and the academic community were more willing to accept PSU’s vision because it was collectively the vision of the institution's constituents. The project was a strong example of community building, reinforcing the perception that every stakeholder had a voice.

PSU became aware of campus symbols and cultures, creating community buy-in, but did not need to understand the culture of its specific departments in order to reshape goals and values. Instead, PSU combined increasingly diverse and sophisticated special interest groups, with the registrar, student aid, bursar and academic advising departments (Hage, 1980). Their responsibility was to determine how IT resources were to be reattributed with the one condition that those resources were allocated to support student centric activities and systems. (Belinc, 2003; Wager, 2005).

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[171] Bolman and Deal have a useful way of categorizing the four factors that precipitate change from a structural point of view. These four factors cited are 1) environmental shifts, 2) technological shifts, 3) organization growth, and 4) changes in leadership (Bolman and Deal, 2008, p. 84).

Technological Shifts and their Impact on Students and Faculty

PSU understood the need to identify and define the evolving digital needs of students in accordance with academic policy and in line with institution responsibility to construct information systems which enable departments, personnel and students to conduct their business digitally across all campuses. This was not easy. PSU had to define its own position while critically examining and involving stakeholders for strategies to grow and develop SIS capacity and benefits for the school.

Penn State examined the technology necessary, joined a consortium, and shifted from ineffective technology partnerships. The school recognized that technology was simply a delivery vehicle, but because of the large amounts of money necessary to purchase an SIS, committed to building its student information system in an agile and cost effective manner.

For twenty years eLion had a positive impact on students. With the system's aging, however, student and personnel complaints escalated, threatening to infect the entire school. After incorporating feedback that mirrored the needs of advisors, faculty and students, PSU was able to scrap eLion, aiming to fulfill the expectations of constituents and contribute to LionPATH's institutional success.

Direct access to data and student services through eLion allowed students to view their information far beyond the college's service area. Moreover, the advising component assisted not just students but also aided advisors and faculty in crafting actionable plans that supported student performance, retention and persistence. As students are stewards of their own success, they are responsible for harnessing technology to broker informed decisions that will increase their productivity, help them make the right choices and achieve graduation and career success. eLion had "some innovative features to assist students with academic decision-making" (von Munkwitz-Smith, 2005, p. 46). The academic success application was an online questionnaire that students answered, learning what potential difficulties could interfere with their academic success and what actions could help them achieve their goals. Students also had the opportunity to access online support to prepare for adviser meetings, choose a major and identify majors that did not require courses they would like to circumvent (von Munkwitz-Smith, 2005, p. 46). eLion recognized that students are "distinctive individuals with different backgrounds and learning styles" and by accessing their information easily online, they became partners in their academic career, working with the institution, faculty and advisors towards the common goal of graduation (Touzeau, 2005, p. 43).

The structure of the advising system at Penn State aided both academic adviser and student. The school was committed to strengthening the value of the advisor position now that actual registration did not require a physical sign-off by an advisor or delivery of student specific data as had once been the case (Wager, 2005). The advising portion of eLion not only evaluated student progress, but annually rated each advisor and the elements of programs (Gordon, 2007). "Assessments are based upon how many students graduate, how many students leave the University, and the number of times a student might change majors after transferring from the division of undergraduates" (Gordon, 2007, p. 209). The institution became aware of patterns in data collected annually on a cohort, such as graduation or point of departure, majors, the number of times a major changed, and the number of actual graduates (Gordon, 2007). Another positive aspect of the eLion advising system was that faculty and academic community alike became well-informed about university resources, procedures, and concentrations (Gordon, 2007). Both faculty and employees were positioned to consider and support the student experience.

Institutional success for eLion applied to PSU faculty as well as to students. Faculty members were positively impacted by the introduction of the eLion Faculty Grade Entry application, eLion's first faculty service. Participants were provided with education and training. A 2003 memorandum clearly states that "from the very start of this [grade service] implementation, it was recognized that to be successful, thousands of Penn State faculty and staff would need to clearly understand the upcoming change and the implications this change would have on the grade submission procedures" (The University Faculty Senate Agenda - March 25, 2003, 2003). Actual demonstrations of the eLion and ISIS procedures were placed online and received 250,000 visitors. There were multiple college, campus, and department based information meetings involving staff from the registrar's office and members of the faculty. Presentations were made to the Senate Committee on Admissions, Records, Scheduling and Student Aid. The registrar's office fall conference, which included staff from all college campuses, reinforced the prior presented data (The University Faculty Senate Agenda - March 25, 2003, 2003). The registrar also provided staff during the holiday break "available to receive and respond to e-mail and telephone inquiries related to grade collection" within

24 hours (The University Faculty Senate Agenda - March 25, 2003, 2003). The steps taken to understand the anticipated changes were not only vital to the success of eLion but should prove to be building blocks for future projects.

Organizational Growth and Operational Impacts

The traditional hierarchy experienced by previous generations of Penn State students was tedious and time-consuming. Students had to visit various departments in order to get their registration, billing, advising, and other related activities completed. The registrar and the Admissions Department maintained records that were not accessible to each other. In order to promote organizational success for eLion, some elements of the implementation had to become further decentralized. Individuals from each office acted as representatives of their own interests. This approach was effective, facilitating and creating the structure and environment necessary to craft an autonomous and self-managing group, separate from the parent organization. (Wager, 2005).

Furthermore, each student services department focused individually on the student process and hosted applications with different functionality. The idea of shared responsibility, born of autonomy, was a new concept and therefore design and implementation of eLion could not be easily defined or structured. Success depended on the assembled team responsible for designing and implementing the initiative, and to the fiscal patience of PSU administrators. The working structure of this team, and its ability to act cohesively with the support of upper management, proved essential.

Operational change for the faculty occurred when grade reporting went from paper to electronic. The ability of faculty to record final grades through the grade entry application securely proved an economic benefit to the school. Mailing printed grade reports was no longer necessary. The number of telephone inquiries and self-addressed postcard mailings from students to educators was reduced. (Teaching and Learning in Undergraduate Education at Penn State, 2004, p. 7).

The student aid process became user friendly, simpler and clearer for students and staff due to eLion. There had been a 10 percent reduction of staff in the 1990s but high quality service to students was maintained even though the number of students seeking aid increased. (Teaching and Learning in Undergraduate Education at Penn State, 2004, p. 8).

PSU identified key stakeholders and their responsibilities by listening to the concerns of constituents, and by seeking out the technology that could best achieve the requested goals. Following the initial implementation of eLion, however, PSU would examine the process from the student perspective rather than the institution's internal administrative viewpoint. Key stakeholder units were given the opportunity to establish their own decision-making process and agenda in terms of the services their unit wanted online. Each application in PSU was presented by a key stakeholder business unit, okayed by administration, and supported financially. It was up to each stakeholder to create the technology and train the staff involved. The stakeholders only directive, beyond creating unit services, was to establish student-centric services (Wager, 2005). As Wager (2005) stated, ownership was not of import at PSU, value was found in the service, in satisfying student needs.

Teamwork

> In the 1990s, Penn State is doing computing as it ought to have been done in the 1990s: with teams. In 1982, administrative computing was the responsibility of one office, central administrative computing. This has changed. Now central administrative computing shares the responsibility for administrative computing with user offices throughout the university. Administrative systems are now designed by Joint Application Design (JAD) teams, including representatives from central computing and user offices working together. This teamwork results in broad-based support and appreciation for the applications that are implemented. Rather than "we vs. they," teamwork is working together for the good of the university. (Blythe, 1992, p. 30).

PSU found that with the spread of technology, there appeared a spread of computing expertise. Multiple teams and consistent teamwork across academic units represented a recognition of this fact. In 1985, Penn State "established a User Initiative Committee to see what could be done to remove barriers that were preventing other offices from using computers effectively. The committee found that there were policies, procedures, training and security barriers that had to be fixed in order for end-user participation to flourish. These barriers were eliminated, to allow non C&IS staff to play as large a role in designing, programming and testing of administrative applications as the central office does." (The Office of Computer and Information Systems Strategic Plan, November 1985).

PSU was able to maintain people's work ethic and enthusiasm for the project despite the many task forces involved with information systems. PSU encouraged its staff to accept these challenges and guide the student information system implementation.

One interviewee explained that it had to do with PSU's general culture and the element of respect. "The concept of respect is embedded within the very popular cheer at

Penn State that says – “We Are --- Penn State!” (Interviewee No. 1, personal communication, March 2016). He also referenced a quote from the Student Affairs Undergraduate Education department that “a community is a collection of people who have chosen to live, work and learn in proximity to each other. Community implies certain rights and responsibilities. Chief among these is the right to be respected and the responsibility to respect others” (Interviewee No. 1, personal communication, March 2016). The network of administrators that built the information systems at PSU truly believed that the Penn State community was a group of scholars and learners who had a “unique opportunity to participate in the greatest human experiment possible.” PSU attracted people who shared common interests and who wanted to pursue a common goal. Organization meetings were more than just exercises for task groups, they were valuable meeting grounds to foster innovative ideas and social contacts.

During the committee work, employees dealt with ambiguous task assignments and critically assessed information streams. They worked together to define problems, set boundaries for their tasks, and identify parameters for their success.

Success for the student information system meant that PSU staff constructed solutions and tools to enhance student access to information, integrating knowledge across academic units and community members and enhancing PSU’s learning environment. The individuals who worked on this project reflected a theme of concern, stating, “I care about students.” Staff wanted to help students get through college, protect the system, and be congenial to students’ needs. (Interviewee No. 1, personal communication, March 2016).

Ownership of product, or process was described as not being important at PSU. Committee members were more interested in having a functioning product than taking ownership (Interviewee No. 1, personal communication, March 2016). The staff was not trained to be soloists with their name on the work, so there was no barrier, structurally or culturally, to collaborative work. "There was no overall grand design. PSU was blessed with good people, personnel that were interested in systems and thoughtful about what they should do." (Interviewee No. 1, personal communication, March 2016).

The culture of PSU included a concept of networks and places allowing people to interact with one another, ranging from the men's bathrooms to each other's offices, where a number of decisions/meetings took place. (Interviewee No. 1, personal communication, March 2016).

"The network at PSU was either lucky or knew how it was done. Everyone felt responsible for the outcome and felt strongly about serving the PSU student population. You would hear people say at retirement parties, *I really liked the job, but I really liked the people I worked with*." (Interviewee No. 1, personal communication, March 2016). "People really mattered," he explained, and "there was good talent." Furthermore, staff members saw each other as friends, rather than as workers in hierarchical relationships. (Interviewee No. 1, personal communication, March 2016).

Team meetings were successful because everybody had a say. There was an open atmosphere, and if anyone did not like something, there was an opening to speak, but ideas had to be full and well thought out. One employee remembered that he and his boss would go into every meeting a good 15 minutes ahead of time. They would sit across from each other and decide who was for them and who was against them, so wherever antagonists sat, the employee and his boss would try to encourage and support their position through triangulation. (Interviewee No. 1, personal communication, March 2016). PSU supervisors were all about "how are WE going to approach this project, not I, no one did a project alone" (Interviewee No. 1, personal communication, March 2016).

Furthermore, senior leadership, as embodied by Dunham, supported a culture of excellence. Dunham, one employee stated, "was the consummate administrative politician. He knew exactly when to call in the president or the provost to apply just the right pressure to get things done in the school." (Interviewee No. 1, personal communication, March 2016).

Upon Dunham's retirement, Spanier said in a Penn State press release:

> It is simply impossible to list all of Bob's accomplishments. Bob has played a central role in virtually all of the important changes that have brought about the evolution of Penn State into a university of national prominence. His work in redesigning the Commonwealth Educational System will have an enormous impact on students for generations to come. He has made higher education better in this state, and along the way made an enormous number of friends. (Senior Vice President Robert E. Dunham Announces Retirement, 1997).

Administration

The centerpiece of PSU's new program effort was to increase access to student data. Administrators had deemed manual practices inefficient, and found that an information system was indispensable for data reports and manipulation. Their goal was to ensure academic units had the right data in user-friendly and interpretable ways by using technology as a tool. However, despite hiring consultants, implementing task forces, querying the community for feedback, they missed identifying some of the real problems that caused issues in the implementation.

PSU was in the midst of significant change. The University needed to integrate a variety of data disparate systems. PSU had no history of past implementation efforts or similar large scale efforts elsewhere to serve as a resource for understanding the present systems.

Leadership and Communication

The administration at PSU contacted stakeholders, established teams, provided training sessions and informed the school community often and with purpose. Training and message were very important to the success of PSU's IS implementation. The eLion group had an all-channel network where multiple connections existed enabling anyone to talk to anyone (Bolman & Deal, 2008). "Information [flowed] freely [and] decisions [required] touching multiple bases" (Bolman & Deal, 2008). Although the mission was ambiguous, online articles and presentations show clearly that team members were energized by the task that leadership had entrusted to them. The creation of something new for the University made the ambiguity of the new initiative directive tolerable (Bolman & Deal, 2008).

The team's plan for expanding eLion to include additional student services was intentional and explicit. PSU's administration involved others in the undertaking by developing "a carefully orchestrated sequence of events" (Cheever, 1982). These included identifying, meeting with and surveying key constituents, analyzing their survey responses, and feeding back the collected data to PSU's academic community in a systematic way (Cheever, 1982). Redesigned and redeveloped eLion pages were based on consumer feedback. The information collected by DUS acted as a "basic input to decision making" (Mintzberg, 1990). In 2002 eLion had "over 30 discrete services to students with additional services being added every month" (eLion Penn State University ComputerWorld Honors, 2002).[172] As the PSU leadership delegated roles to all stakeholders, all the stakeholders felt empowered and involved. There was no doubt of financial and administrative support for all concerned.

Task forces reviewed processes. As seen from meeting minutes, employees had ample opportunity to discuss issues in group meetings or more formally by using interoffice memos. Not all possible changes seen during the process design were a priority. User participation helped define what was critical.

Some of the work flows that were already in place did need to be redefined and simplified for EDS, but the processes themselves were not changed. The manual system could not be completely replicated in an automated process, and solutions needed to be found for cases that could not be programmed.

A new job position was created to oversee technology work at PSU. J. Gary Augustson became the Chief Information Officer (CIO) and represented a change in a social sphere around computer data systems. Augustson had the final authority and oversight over different subsections of the information system. These subsections were treated as realms apart, each overseen by separate central office departments. Augustson then hired Kenneth Blythe who could "translate" among the various views, explaining

[172] These included services such as advising, registration, withdrawal and access to student data.

technical limitations, and helped "address people problems around technical work" (Interviewee No. 1, personal communication, March 2016). Blythe understood what was needed at an administrative level to facilitate IT around campus.

PSU's implementation work did not stop once people had access to the information system. The school's senior leadership felt strongly that collecting data on whether the system was working and being used successfully was vital and would help adapt implementation strategies over time.

With the departure of EDS PSU's early attention to norms and bureaucratic structures supported the project by having established a strong sense of team work among the academic units. A testament to the team was that the user group continued to meet after the design was completed to see how design changes could be adapted over time. The group met even after the information system had been introduced and provided ongoing and useful feedback.

PSU's primary strategy for program introduction was to deploy one-time training of campus personnel. Advertisements in the school newspaper and staff circulars became the secondary strategy. PSU was very attentive to the social side of data systems and available media to set social expectations about the system across campus.

The trainings gave the student information systems a sense of importance and legitimacy. The strategic planning brochure was used for CAAS, and everyone was surveyed about campus data needs. PSU was coordinating, packaging and exporting a unified message.

The University looked beyond technical use of the data system, knowing that the implementation was not just a technical event but a social endeavor dependent on student use processes. The Student Systems Committee actively understood when designing the system that each academic unit had unique parameters (employee and department histories, bureaucratic structures, norms), and that the units had set up their offices in a specific way to conduct their work. Administrators assuaged staff concerns about the new system by acknowledging unique system parameters and the promise of a reduced work burden upon completion of the student system. (Interviewee No. 1, personal communication, March 2016).

In 1980, technology work and expertise was housed within the C&IS department. However, as the information system was implemented, PSU redesigned its bureaucratic structures towards better supporting technology use by creating technology departments within each academic subunit. Admissions had its own technology group, as did the registrar's office and so on. These teams enabled the development of CAAIS. Each group was able to donate a level of technical expertise understanding clearly the connection between what was available and what their offices intended the new system to do.

The Future: The Death of eLion

These same teams understood when the system could no longer support their needs. However, after the different departments authored a memo in 2008 in support of a new SIS, it took five years for eLion to be retired. According to an interview with an administrator focused on SIS, "sticker shock," the high cost of replacing the system was even higher as the old program reflected university processes and structure in 1980 and no longer served university needs. "You can drive a Toyota Corolla from 1991 but it eventually goes away" (Interviewee No. 3, personal communication, March 2015).

Senior administration asked the departments to document their issues with the legacy system, so departments received funding to hire consultants and a vendor by 2010-2011. In 2012 an RFP for requirements allowed the project manager to be hired and the project started in early 2014. The new information system is a ten year project that has been funded by the entire institution. The University Board of Trustees and David Gray,[173] PSU's Senior Vice President for Finance and Business and the Treasurer, voted in two thirds of the cost of the project at $98 million (Interviewee No. 3, personal communication, March 2015). Having served as Vice President for Information Services and CIO of the University of Massachusetts System, Gray provided further funding and direction for PSU's new system.

PSU has appointed a 45 person team from all over campus that is housed in a newly purchased building, consciously assembled as a dedicated team to work through this 10 year project. Since the unit heads, (registrar and bursar) could not dedicate 100% of their time nor move from their locations, they formed the steering committee. Associate unit heads lead the team and there are 24 campuses represented in the new building. (Interviewee No. 3, personal communication, March 2015).

[173] David Gray started his career in the Pennsylvania State System of Higher Education in administrative leadership positions, including the Assistant Vice Chancellor for Financial Management and the Vice Chancellor for Information Technology. He is also an alumnus of Pennsylvania State University.

The senior administration states that the long implementation process for Project LionPATH will bring campus wide rewards due to a commitment to make "student life better". eLion was the front end of an old legacy system and, according to Interviewee No. 3, was entrenched in the institution's campus culture. As with eLion, branding has been a big piece of the new information system. When the project began, very few people had heard of LionPATH, but today about 90% of people know of its implementation (Interviewee No. 3, personal communication, March 2015).

The new eLion is about transformative thinking, which according to senior leadership takes advantage of data and accessibility, making certain that data is central so that the administration can make optimal decisions about academics/program expansions.

An interesting detail about the new information system is that the CFO and Provost are the sponsors of this project, not the CIO. The CIO left part of the way through this project, so the information systems development is not under IT. The registrar's office has its own IT group and every college has its own IT shop. The financial budget at PSU is larger than that of some small countries. (Interviewee No. 3, personal communication, March 2015).

A single threat to the smooth functioning of information systems at PSU has come when one person with widespread knowledge leaves. Although PSU's 30-year implementation project may have been recorded in the archives, it was not well documented by staff in terms of how it should actually work and what to do when it fails. There is now a position for training and documentation on the new team.

With Project LionPATH, PSU will no longer depend on homegrown applications. At the beginning of this new project sponsors stated that they had low tolerance for employees unwilling to change. If you are unwilling to change, the message was, than PSU is not for you. "David Gray was speaking to a group of people, and people were afraid of losing their jobs, so one person asked, *will I have a job in five years*, and David Gray said, *well let me ask you a question, are you willing to learn new things?* The staffer said *yes*, and David Gray said *then yes, you will have a job, because you must be adaptable to stay here*" (Interviewee No. 3, personal communication, March 2015).

Penn State continues to enhance the life of its students and faculty in 2016, building applications where online communities and the student population can flourish.

Chapter VI. Insights from PSU Case Study

Using the research questions as a guide, an analysis of PSU's student information system development experience can explain the basis for its institutional success. The evolution of the Penn State system went through several significant milestones, each advance built on previous achievements. The creation of the new student information system changed existing structures, processes and practices for PSU students, faculty and administrators. The school's student-centric culture, leadership and commitment to student services allowed the institution to respond, address, manage and guide change during the implementation of a student information system that provided student access and advising resources online.

This chapter examines the case study through the lens of the three research questions that guided this investigation. They were:

1. What major technology developments transpired in PSU's information systems from 1980 to the present day, and what was the process by which they came about?

2. What significant changes to PSU student and faculty behaviors and culture occurred as a result?

   Subquestion 2.1. What can we learn and what do we need to know about the ways student and faculty use IS in order to provide effective IS services?

   Subquestion 2.2. Is this knowledge applicable to students and faculty nation-wide and in all types of institutions?

3. What insights does the PSU case study provide to academic administrators

responsible for IT changes?

Subquestion 3.1 Does the case suggest that certain conditions are important for successful IT change?

Subquestion 3.2 Does the case suggest a certain type of leadership or governance is necessary to complete an IS implementation and sell it to the community?

RQ 1: A Case Study of PSU's Information Systems from 1980 to the Present Day

The case study in Chapters 3 and 4 provides a detailed account of the development of PSU's information system. The case describes the reasons that changes were undertaken, identifies the people involved, the processes followed, and the important decisions made. The case is based on extensive review of archival materials and interviews with main actors.

RQ 2: Significant Changes to PSU Student/Faculty Behaviors/Culture

The second research question asked what significant changes occurred in student and faculty behaviors as a result of the changes in their student information systems. PSU's SIS was responsible for major changes in the university's approach to student services and in student and faculty access to and use of information. The new technology enabled a cultural shift in how student data was viewed. Whereas, previously, data existed to serve specific institutional needs, the new SIS provided Penn State employees the opportunity to focus on how best to serve the student population. For students, this meant new access to information that allowed them to take responsibility for their own academic progress. For faculty, the availability of easy access to accurate information aided them in their advising and teaching.

Students. A major change for students was the focus on the student experience rather than on student data. As compared to the original depersonalized system, the new information system involved and empowered students to solve personal advising issues and participate in their academic process. By June 1994, students could access grade reports, class schedules, unofficial transcripts, personnel information and financial aid information. Students were happy to have access to their data. The registrar was happy his department had more accurate information about students, having had 10% of student addresses incorrect in the past. Students were now responsible for updates as they had ownership over their data and the means to fix any errors. Student advising changed, moving beyond helping a student select a major or insuring the completion of requirements. Students became aware of acceptable use policies at the institution, and used the student centric activities and services to their advantage. The huge changes to student expectations in terms of the timeliness of their operations and 24 hour availability were immediate.

Overall, students were very satisfied with their student experiences, including advising, registration and access to information using eLion. PSU's SIS was an essential tool, aiding student satisfaction and experience.[174]

Information systems also changed how students interact with their fellow students

[174] I am unable to speculate if students are more committed to the institution than they were in the past. Penn State alumni are generally very active ("We are Penn State") and committed to their institution for a number of reasons superseding technology, however, the ease of today's student/institution interaction and communication points to added commitment on both sides.

and faculty. Students were given the gift of time. Instead of having to travel all over campus (especially in the winter) to different departments separated by a quarter of a mile or more at Penn State, students could transact their business with the university, including registering for courses, using integrated information systems. Students had access to information systems from their own computer and later on their mobile devices.

> One stop philosophy has had a big impact on students and administrators. From the student perspective, easier, bigger, faster. From an administrative perspective, it's probably more efficient, more effective…Example scenario that you are facing as a student [under the old system]. You have applied for student aid. But it has not been processed yet. You also have a scholarship that you are receiving as a cash payment but you don't know if the check has arrived, and you are hoping to register for classes and finish your Ph.D. this semester. How are you going to answer all of those questions? How come I'm not in my registered class? You haven't paid your bill. So you go to the Bursar office, and they say you are not registered because you have not paid your bill. But you have received student aid and student scholarship. You don't know anything about this, and you haven't received the scholarship check. The Bursar office now directs you to Student Aid to review your package. (J. Wager, personal communication, November 8, 2016).

Penn State provided an efficient virtual one-stop through eLion. Under the one-stop concept, students were given easy access to all the facts, figures and answers. But this convenience was not without some losses. Registration had always been the one social construct that brought students, administrators and back office employees together. As Romano recalled:

> I know what arena registration was like. I participated in it as a graduate student. Arena registration was a social happening. Students would come together after the summer was over. There were marriages, engagements, hugs and kisses of students who had not seen each other for three months. You can find in Penn State lore that there were students that met other student friends in arena registration that ended up getting married because it was a social occasion. It was also a social occasion for the faculty and

> staff of the academic departments. Staff got to know their neighbors next to them, and commiserate about how hot it was. All those bonds, those linkages to each other, formed relationships that have stood the test of time to this day.
>
> Students stood in 10 minute and 15 minute intervals in order to enter the arena. In snow storms and rain, students would stand outside, in messy situations, until they were able to go in, complete their registration, their religious preference card and all the other cards. There was a lot of craziness about those systems. eLion eliminated part of that. And there was a part of that that was very sweet. When you are in a mess, you could turn to the student next to you and say, *What jackass created this system?* And they would develop a friendship about this. (J. Romano, personal communication, November 11, 2016).

Romano still has lunch with employees where "we remember so fondly four times a year (fall, spring, etc.) when we would gather together in the middle of some gym in order to make the registration system for the university work. As much as the students moaned and groaned about the registration evil, students missed that opportunity. They would see each other after a time again and rekindle friendships" (J. Romano, personal communication, November 11th, 2016).

PSU also understood that students faced complicated lives with circumstances that must be understood when providing effective services through the information system. The interactive advising system needed to make a difference in students' lives. Romano (2016) stated "We have 90,000 students, there are 90,000 very unique circumstances in their lives. When they are facing adversity, students don't make the best decisions. We wanted to help them figure out how to be retained in the university" (J. Romano, personal communication, November 11, 2016).

Prior to eLion, withdrawal was a paper driven process, with a form that students needed to complete before they went to five or six offices and picked up signatures. The intention was that before the advisor, dean, or academic counselor would sign off, there would be a discussion and someone would say to the student, "you are doing okay here," but like so many processes it did not work and became an exercise of gathering signatures. As students separated from the university, there could have been a conversation that would stop them, but it did not happen. The process had broken down. (J. Wager, personal communication, November 8, 2016).

eLion provided students with computerized discussions[175] offering them academic advice that would show the students other options than withdrawal. A student could ask eLion, *I'm not doing well in history*, and eLion would show the student other options than withdrawal. This led withdrawal rates at Penn State to drop by 30% in its first year (J. Wager, personal communication, November 8, 2016).

Faculty. Faculty members are the users and creators of the academic data of students. The tasks of advising, teaching, grading and planning courses require current and accurate student data and course enrollments. As the case showed, prior to the development of the SIS, faculty did not have the information to deal with PSU's growing student enrollment, curricula and other complexities. eLion changed all this, providing consistent material on advising, policies and procedures across departments and concentrations. Faculty no longer needed to navigate through more than one thousand changes annually in the catalog, nor know the 1000 pieces of discrete information needed

[175] These computerized discussions, were computer exchanges made by software, not "discussions" with a person as we typically think of them. In other words, one can infer that the student was able to get much more information with which to make a decision but there was no personal advising.

for a typical Penn State freshman class. “eLion became a very important tool for faculty to use. When they were sitting with the student, they were working from a base of information rather than opinion” (J. Wager, personal communication, November 8, 2016). Faculty members were able to strategically leverage Penn State resources that reflected current processes and information to help them advise students alongside the management of their own Penn State careers.

RQ 2.1: Ways students and faculty use IS. PSU’s case demonstrates that higher education administrators need to understand how students and faculty use information systems in order to provide effective information system services. Penn State’s SIS was a forerunner in providing students with an online advising portal to enrich their experience at Penn State. The advising portal facilitated a dialogue between students and their advisors and faculty members. It intentionally empowered students with a process to offer support, resources and appropriate assistance when needed.

At each step along the way, PSU leaders strove to understand the student perspective. They thought about the fact that students and faculty would be using the system from geographically dispersed campuses. They focused on the various uses of the information and the users. They decided to build their own system rather than purchasing a ready-made product so that they could ensure that their IS was tailored for their own needs and priorities. They recognized that the technological changes would require faculty to adapt their practices, and this would not necessarily be easy for all. In order to develop and implement the new IS successfully, they had to understand their own university well.

Understanding the student experience. In an interview for this study, former president Graham Spanier noted the importance of understanding the student perspective. "You cannot just sit in the ivory tower and dream up things that students want or need. You have to really talk to the students and be aware. Have focus groups, do surveys" (G. Spanier, personal communication, November 9, 2016). Every year for seventeen years, Spanier moved into the student residence halls at the beginning of the academic year, living there for move-in weekend with student roommates. At the end of the weekend, he would provide PSU with his observations. He recognized that the students differed from year to year, commenting:

> And one thing I paid attention to was IT. What were they bringing with them? Laptops? Desktops? Did they have iPads? One year they came with iPods and iPads instead of stereo speakers. Whatever it might have been, we needed to pay attention to that. (G. Spanier, personal communication, November 9, 2016).

Spanier was quick to point out that young students are "adaptable and resilient." They tended to know what PSU offered, and what they needed. The school's leadership perceived what was going to be the next innovation, could present it to students, and adapt it according to their needs. At PSU, the student-centric information systems became the supporting structure of this traditional educational experience. "eLion was the envelope in which there were all these little resources that students could click on and get the information" (J. Romano, personal communication, November 11, 2016).

PSU understood that universities needed to know the importance of quality to students who use information.

> Students do not enroll at a particular school because they have the best student information system. They are enrolling at schools because of the quality of the program, the quality of the faculty, and for other personal reasons. Students don't come because of the great technology. But once they are enrolled, they are living in this monopoly. They are making decisions and students have to live with those decisions made by the registrar. Where the monopoly changed at Penn State was because eLion became student centered. It was focused on student success, that was the driving factor. (J. Wager, personal communication, November 8, 2016).

Accuracy, accessibility and security are needed for university stakeholders.

> Students and faculty alike need to have high trust that the information is accurate and secure. They need to know that their institution is in compliance with law and policy, in regard to FERPA. The system needs to be accessible to those with handicaps (blind students). You cannot have built a wall too high. And this is in the day of PCs and Macs, we are not talking about mobile. (J. Harwood, personal communication, November 10, 2016).

Accommodating different campuses. Understanding the different needs of students across an institution's many locations is also important to providing effective information services. Penn State's IS were built to accommodate the university's virtual and physical campuses that were geographically dispersed. Students at Penn State were allowed to move from one campus to another. As PSU's traditional educational experience evolved to include distance learning and traditional brick and mortar students attending classes on campus, the university had to understand differing processes and review campus issues. "We had to be very creative to adapt our information systems to adapt this for the students and the faculty," Spanier noted. (G. Spanier, personal communication, November 9, 2016).

Building their own. Early in the process of examining its IS, PSU faced a decision that many institutions must consider, whether to invest in homegrown technology development or purchase a ready-made product. PSU based its decision on its understanding of its particular needs. Dr. Spanier noted that PSU examined "how we operated, how we implemented general education. We made the decisions based on our needs and our educational priorities rather than conceding that we would have to do things in a particular way just because the off the shelf systems said you had to do it a particular way" (G. Spanier, personal communication, November 9, 2016).

> The other thing that accounts for our student information system evolution is the fact that for decades, PSU kept coming to the conclusion that there was no other university like ours, that we needed to get it done ourselves. There were no off the shelf products that were going to work very well given the specialized needs of the university, including our IT leaders and the folks who oversaw them, degree audits, admissions, counseling, advising, records. We were in a position that, because of our unique structure and requirements, it just made sense for us to do it ourselves. And for decades we found doing it ourselves was less expensive than hiring out for-profit companies to do it. We were not willing to make ourselves fit into the systems of Oracle [example of a company provided off-shelf information system solutions]. For all of our history we were very unique. Every university in the country was going in the other direction, and other schools in the big 10 spent tens of millions of dollars [on non customized information systems]. We were still evolving to meet our special university needs. (G. Spanier, personal communication, November 9, 2016).

Due to PSU's strategic planning, its in-house technology allowed the university to be innovative in a way an off-the-shelf product could not, because available programs were not designed to address specific PSU needs.

Faculty. Another starting point in developing an effective information system is awareness of faculty needs. In the PSU case, some measures that were adopted required changes in faculty behavior that were mildly disruptive and, at times, frustrating. As Romano noted, "It wasn't always peaches and cream. We get used to doing things our own way. You get some natural resistance there" (J. Romano, personal communication, November 11, 2016). Spanier stated: "I always said we don't need every faculty member to jump on board with all these things. We need a critical mass of people to pull it off" (G. Spanier, personal communication, November 9, 2016). Faculty behavior also changed in terms of personal involvement directing technology change.

> You have to have faculty input because if you don't have appropriate faculty and administrative advisory committees, they can derail things. The University can say it is adopting a new system. And a faculty member can get up and say we are not doing that and put the kibosh out of it. It may be a committee of the Faculty Senate. But, it's very helpful to have their support and say you have done the faculty consultation (G. Spanier, personal communication, November 9, 2016).

Historically, according to Spanier, faculty behavior changed because as the university implemented new systems, faculty members felt the need to get with the program to adopt new technologies to allow them to do some things differently. For example, if they wanted to submit grades electronically, they had to learn the information system process. "Most of the grumbling came from the faculty," Spanier claimed. "Every year there was something new they had to learn (submitting grades, flagging students that hadn't shown up for class, putting their course syllabus up, having homework, papers submitted electronically). Faculty had to adapt. Some faculty were set in their ways, and were not as comfortable making the changes. They are smart people so they all eventually did. However, faculty who have grown up with IT, they are about as savvy as the students." (G. Spanier, personal communication, November 9th, 2016).

As the technology evolved at Penn State, faculty members who wanted to be early adopters took advantage of the efficiencies information systems could provide them. Dr. John Harwood was one such early adopter and a change agent, driving faculty to use the system. As he explained, “Very few faculty would have been interested in the full scope of eLion. Faculty would never see the Bursar or Admissions, but they would see and be interested in course roster stuff, information on relevant parts of the student experience in their roles of advisers.” (J. Harwood, personal communication, November 10, 2016).

Harwood led the change for everyone at PSU to have email. “We needed to democratize it so every human being at PSU had an account. The first strategic plan for academic computing gave every student, all students from all disciplines on all campuses, a unique user ID that they would use for their work at Penn State, and then we could hang all kinds of services in the eLion in the SIS space around the fact that students had this unique identifier, including email. (J. Harwood, personal communication, November 10, 2016)

> We got engaged in a dance where we wanted to fuel expectation and satisfy it. Wouldn’t it better if information were freely available to students, to faculty, to advisers? We didn’t quite deliver on that, still can’t, but that was the goal (J. Harwood, personal communication, November 10, 2016).

The faculty realized benefits of access and efficiency.

> Simply the convenience of having accurate, real-time rosters at the beginning of the semester was fabulous. That was a fabulous step forward. Having timely real time access to class rosters made the beginning of classes for faculty much more efficient, less stressful. (J. Harwood, personal communication, November 10, 2016).

Ease of use was as important to faculty as to students.

> Faculty are very hard to engage on these things (becoming experts on student systems). They aren’t going to do it. They want to do things that are very quick, easy and don’t require a lot of thought. By providing personnel at PSU to explain things to the faculty, *it didn’t change a paradigm, it reduced friction, it made some pedestrian things easier*. We really engineered things to make things smooth and easy. Faculty at Penn State use IS only if it benefits them in an easy

manner. (J. Harwood, personal communication, November 10, 2016).

RQ 2.2: Nationwide application for students, faculty and institutions. Although information systems vary in complexity and sophistication, PSU's student, faculty and institution experience is applicable nation-wide, since it demonstrates the value of an information system that is designed to support students and academic processes. Student information systems that are blended together with academic advising assist both students and faculty. Self-service model information systems provide students not only the information they want, but information that helps inform their decision making. Although students are empowered with access to information about their academic records, depending solely on an information system can limit their making sound decisions. Despite these risks, institutions know that student records are the basis for good institutional decision making, and even institutions with good information systems need to evolve to a student center focus.

PSU's experience shows that institutions can develop the experience to adapt the processes over time in responses to changing situations (e.g. growth and the needs of student body and faculty). PSU's IS process began because a widespread change was needed. There was a guiding vision of unified information, and clear values and goals that were articulated at the onset. Among these values was that an inclusive process was important to ensure that the new system met the needs of the stakeholders it would serve and would be seen as legitimate. The inclusion presented organizational and logistical challenges, but ultimately PSU prevailed and moved forward to evolve its information system. Inevitably, given the very different cultures of business and academe, organizational tensions appeared both within the university and with the external consulting group employed to build PSU's IS. The University worked through these, and eventually went out on its own to complete the project.

One nationwide lesson for higher education institutions interested in undertaking an IS implementation is that financial resources are essential. At many higher education institutions, their very survival is at stake with budget challenges and the need to recruit students. A new millennium calls for a new system to be able to keep up with evolving technology and student services practices.

All information systems vary in complexity and sophistication. They are not all the same. PSU leadership had clear goals and timeline, and was intentional in providing directives. The IS strategy, according to Harwood, was not just to meet expectations but to increase them (J. Harwood, personal communication, November 10, 2016). PSU's culture of innovation and acceptance of change came from a high level of stakeholder engagement. Although proximity between leaders and employees is not always possible, transparent communication allowed stakeholders to understand the needs of students and academic units using the student information system. The cooperation of the departments was imperative to the success of the IS implementation. If the units had acted as independent silos competing with one another, their knowledge could not be applied to building the IS.

Penn State demonstrated that using external consultants can become fraught with issues. The consultants hired did not understand higher education, and PSU did not understand what the consulting firm was there to do for the school. Institutions need to change their process from within, not just replicate their process. Experts and users cannot engage in a we/they scenario. Institutions have to balance their need for experts and lessen the resentment for those experts. They also must be sensitive to the needs of their stakeholders, not just the students, but every individual involved in the information system process. The faculty is required to provide input, support, and legitimacy. Front-line and back office employees should be involved in the IS process bringing their own value-creating knowledge. PSU's number one asset was its culture and people. The case study emphasizes that institutions need people who are service oriented, and that they need to use their communication channels to support interaction within their organizations. A culture of innovation and acceptance of change can be built at most institutions by promoting a high level of stakeholder engagement.

Policy and decision-making often required that all academic units come together to support ideas for future work. PSU employees were engaged and were active participants in the guiding plans and priorities of the information system project. With intention, leaders spoke extensively about the vision they had for the student information system. Employees were able to understand the institution's strategy to build an information system because they had a part in creating it. They were invited to contribute their own ideas and empowered to participate in the process, and provided thoughtful and innovative solutions in line with available resources.

Acceptance of change was another theme that emerged from the PSU case study. Leadership led and inspired Penn State employees. Each PSU stakeholder shared ownership of the progress wanted for the SIS. Engaged employees adopted new important roles, creating content themselves and acting as ambassadors, thought leaders, and storytellers. Augustson said that the best ideas came not from the IT group but from the people using the product, speaking from their own experience.

RQ 3: Academic Administrator Insights

> System implementation efforts offer extraordinary challenges to information technology professionals and the organizations impacted by the implementations. A successful implementation can reap vast rewards in organizational strengths and efficiencies. A failure can drain an organization of people, funds and vitality. (Vaughan, n.d.)

The implementation of a new information system requires vast amounts of time, money, and hope. How can an institution ensure that these investments "reap vast rewards" rather than end in failure? For academic administrators undertaking this work, the PSU case offers insights in how to make an effective IS implementation more likely.

First, the PSU case illustrates the importance of institutional values and culture in implementing change. From the outset, as noted earlier in this chapter, a focus on students, and orientation to student services, provided the underlying motivation for the IS development and served as the operating principle for its design. Additionally, an emphasis on the value of data in decision-making emanated to every organizational level from the top tiers of the university administration. PSU was clear about why it was undertaking this effort, and this sharing of knowledge served to direct people's work ethic and enthusiasm for the project, especially when there were so many different task forces and priorities involved with the information system development. External partnerships were also critical in the development and implementation of the PSU information system. Finally, technical skills were important but not sufficient for success. The ability of key leaders to forge good working relationships among the many stakeholders was critical to the success of the IS implementation.

At PSU, it was never about the technology, but about achievement. As Wager noted, the "main thing" was "focusing on student service and on faculty and staff success." The importance, he said, was "what you do to make a positive difference in people's lives. The technology that you use to make that happen is almost secondary. It's not about the technology, it's about the value delivered." (J. Wager, personal communication, November 8, 2016).

A statement by Romano, when reflecting on his 42 year career at Penn State, embodies the sentiment expressed by every administrator interviewed.[176]

> There were so many things I was proud of [in my 42 years at Penn State]. My very best moments were helping students succeed to accomplish their degree, chart their success . . . helping students with whatever adversity they faced so they could meet their requirements.

During the implementation of the IS, Penn State employees consistently strived to improve the student experience. Employees were willing to work on these projects because of the institution's culture and leadership.

According to Spanier, the culture at Penn State was that of "people first":

> My way of looking at it, is it's all about the people. Penn State is a university that over the years in some ways operated more like a family business than a major corporation. A lot of people at Penn State, people who spent their entire careers here, loved the University, the community,

[176] Prior to his position as Vice President for Commonwealth Campuses which was the equivalent according to Dr. Romano of being a Chancellor, with "19 chancellors reporting to him beyond University Park, what some people refer to as the main campus of Penn State" (personal communication, November 11, 2016). Romano served from 1993 to 2005 as vice provost and dean for enrollment management and administration at Penn State. Before being named vice provost, he served as campus executive officer at Penn State York, and he was an Associate Dean of the College of Liberal Arts at Penn State.

> raising their families here. Working at the University was a privilege, and doing things to make the lives of our faculty and students easier motivated them. We did not pay exorbitant salaries. We did not have high salaries. There was a lot of satisfaction. These are people who spent 30-40-45 years making those improvements. (G. Spanier, personal communication, November 9, 2016).

Spanier clearly articulated his values to students, faculty, executive leaders and employees. He said that "it wasn't really a hard sell." Employees at Penn State adapted to the use of information systems quickly because they were service oriented and that made it easy for them to "get into the modern era." Spanier's administration also offered support by assigning three or four individuals to provide IT support for administrators. Instructional programs, "little seminars at the university level," were also a source for administrators. Dr. Spanier added that "if you were a busy executive type person, they would give you an individual lesson at your work station." (G. Spanier, personal communication, November 9, 2016).

Capital expenditures on technology had stayed stagnant for almost a decade before Spanier arrived. The IT technology enabled Penn State to process the information the school had already gathered to make informed decisions, and was a vehicle to support Penn State's initiatives. Spanier believed questions could be answered, and decisions made, by using data.

> I was a great believer in information. Having information was very important and powerful to make wise decisions. I wanted access to databases to answer all kinds of questions. We had data we could pull up on trends at the university on course demand, all the different databases, and I would often pull something up to get an answer to a particular question. Technology allowed us to do more with less. We made those databases available, taught people how to use them, made them user friendly. They all evolved over time. People who developed them, took

> pride in making them readable, up-to-date, with no bugs. People had assignments of being in charge of certain aspects and being in charge of the databases. We put out a lot of reports using those data. (G. Spanier, personal communication, November 9, 2016).

Furthermore, Spanier stated that although it was expected that information systems would change the president's office, the impact was "profound." "I always was an advocate for upgrading our technology and staying up with current trends" (G. Spanier, personal communication, November 9, 2016).

As Chancellor of the University of Nebraska-Lincoln from 1991 to 1995, Spanier had worked with staff who refused to use computers. They had spent their careers using a typewriter and "they were not going to use a word processor. When I came to PSU there was a lot more [desktops at] Penn State, and so we equipped everyone with a computer on their desk. We made very heavy use of email communications." (G. Spanier, personal communication, November 9, 2016). At Penn State technology was becoming part of the mainstream.

> Things evolved in data technology nationally in the 1990s. What I found at Penn State, was a great willingness among people like Gary Augustson. He was the kind of guy who got excited about new ideas. When the concept of wireless came up, he came to tell me … this you could do now. We could put up cell sites and have wireless communications. Now being able to sit on the lawn of Old Main and do my work. It was possible. We were early adopters. People like Gary (were among the 3 or 4 people nationally who were promoting advances in technology). John Harwood was an English professor who got very interested in using technology for instruction and research purposes. (G. Spanier, personal communication, November 9, 2016).

The involvement of academic administrators with similar values and beliefs about the new system contributed to the success of the eLion implementation. As Romano noted, the work on the student information system and eLion reflected his values and those of his team.

> What we were trying to do in every instance is figure out how to efficiently help students (get information about student aid, efficiently manage the admissions process). We did develop a degree audit system through the registrar's office. Once we had the system developed, we dedicated a whole staff member to manage it because degree requirements change all the time. eLion came later. We found a way to co-mingle them together. Jim Wager was a principle in the development of eLion. He might be credited for coming up with that concept. He was my registrar at the University. (J. Romano, personal communication, November 11, 2016).

External partnerships. Another insight the PSU case study provides to academic administrators responsible for IT changes is the importance of external partnerships. Penn State's environment was unique, pulling together people to collaborate internally and externally. IT leaders Gary Augustson and Ron Rash[177] understood the value of business relationships and strategic partnerships and built them intentionally. In addition to Rash and Augustson, other university leaders valued relationships with vendors, and built those relationships to better protect Penn State's position. "We invested time for the advantage of the University, more than just a product or price for tomorrow." (R. Rash, personal communication, November 9, 2016).

According to Rash, collaboration and professional business relationships were two conditions important for IT change. Having been employed at IBM when EDS and Software AG were deployed to build the student information system, he "watched the university throw out IBM software to bring in Software AG." He then realized that he

[177] Ron Rash was PSU's Senior IT Director for Strategic Initiatives in 2000 – 2016. He had been PSU's IBM vendor in the 1970s and 1980s.

had to take on a more active role to understand vendor intent and accountability in order to answer the question of whether continued cooperation was advisable and in the best interests of the University. As a result, when Rash was employed by PSU, he became the president of Software AG's user group[178] for seven years, knowing that he would be invited to meet with senior executives annually in Germany. At these meetings he tried to determine where they were going as a corporation, reviewed existing products and those products in development and drew conclusions about the value of reliance on Software AG. He "became involved to protect Penn State's position." (R. Rash, personal communication, November 9, 2016).

A technology partner of products and services, according to Rash, needed to meet at least three conditions: "The product needs to be of value to the university (needed by the university), it has to be reasonably priced (not best priced) and the service model needs to be excellent (excellent service). The conversation needs to be had at a very senior level, and if you have a relationship, it provides a lot in dollar and cents." (R. Rash, personal communication, November 9, 2016).

> An institution should only have one of three strategic partners, where a senior executive of a university sits down every 6 months with two employees in a technology partner's firm: a senior executive and the senior director of research. The 6 month review should cover the things they can do together: research, products, opportunities for student employment. If you can sit down with senior people at the University and a senior executive from a supplying company, and create a list of things we are going to work on together, not necessarily publicly, that is a strategic relationship. (R. Rash, personal communication, November 9, 2016).

Rash warned that if institutions do not value the time it takes to build relationships that

[178] Ron Rash made his involvement with Software AG's user group part of his PSU responsibilities.

can collectively get work done and construct strategies; if they do not meet regularly with departments or vendors; and if they insulate themselves, dispatching only technical people to meetings, then they would not produce a product or service with value for University constituents (R. Rash, personal communication, November 9, 2016). The real key is collaboration among the executives and decision makers.

> The strategic planning committees at Penn State were not composed of technical personnel, but people from PSU's business units. Penn State's environment was unique in terms of pulling together people to collaborate. Gary Augustson was an important part of building strategic relationships with external parties. Gary Augustson brought in tremendous leverage, even at things like football games. Gary would bring in senior executives from technology offices into the press box of the football games, including Michael Dell. One of the five senior vice presidents of the IBM Corporation would be in the press box, and Gary would introduce them to the president. So when contracts needed to be reviewed, that relationship was in place. (R. Rash, personal communication, November 9, 2016).

Having good relationships and technical skills for IT personnel. The success of Penn State's information system development and implementation was made possible because of leaders who possessed excellent technology and relationship skills. Throughout the case, the importance of relationships is evident, especially at moments when different agendas or perspectives caused friction.

Blythe was mentioned as someone who recognized that outstanding technology skills and more importantly good relationship skills were needed to be able to have useful technology conversations with coworkers (R. Rash, personal communication, November 9, 2016). Rash also noted that IT administrators at universities had trusted individuals on staff who will provided honest input. To him, this was an important component of their success.

> When you run a large organization and you have very busy executives with their own vision and priorities, you need 2 or 3 people that are an extension of IT. My deputy director and I were interchangeable. It is important to have … trusted staff, that you can have an egoless relationship with. Where they can tell you if you are way off and do not have a fear Ron will be upset. Gary was an expert. He treated his senior directors that way. (R. Rash, personal communication, November 9, 2016).

RQ 3.1: Conditions for IT change. The case illuminates certain conditions that are instrumental in successful IT change. Penn State's "can do," student centric culture was paramount to its success. As noted throughout this section, those involved in the IS development were unanimous in their belief that Penn State's achievement was not about technology, it was about the value add, and at PSU the "value add" was about making students successful. The clear mission centered on students and their needs. The case also shows the importance of people above and beyond technology, the need for appropriate financial resources, and the critical nature of team work and faculty involvement. Finally, this chapter discusses the role of the chief information officer and the leadership necessary for success in this position.

Importance of people. During an interview in 1986, then President Jordan and Provost Richardson said that although the hardware was an important part of the academic computer strategic plan, PSU's emphasis on people was even more significant. PSU's plan stressed the need to have people in every college and within various disciplines who provide informed support to the disciplines on the ways in which computing could be applied to those disciplines.

PSU's teams were essential for the successful IT change. Penn State assembled the teams to support IT initiatives, and supported their work to gain their commitment.

Although Penn State is one university, geographically dispersed, Dr. Romano stated that the community was extraordinary. There was a feeling of being all in it together. Every registrar was a part of the registrar system at University Park. They hooked together as one, trying to determine how to overcome the challenge of distances, and find ways to enable student progress through the various processes.

Spanier did not originate Penn State's culture, but he and other leaders like Augustson, and Romano supported it.

> I didn't invent it. It was there . . . Very collaborative. Very people focused. From some level you set an example from that top . . . You choose people who have that approach. You choose your deans and associate deans, and hire people who think along those lines, so it always has permeated the culture. The student centric approach, the can do approach, being innovators, providing national leadership. (G. Spanier, personal communication, November 9, 2016).

There was an intentional recognition that students needed to be placed first, and that "that focus emanated from the top" (J. Wager, personal communication, November 8, 2016).

> We had strong leadership support. Augustson and Spanier were two key factors. Spanier was very student focused. Augustson was a tough CIO, very demanding, very supportive. This support continued through the advising structure. Penn State has an advising unit, FTCAP, this is a very important unit. The success came from the support of the leadership and different units. There was this coalescing of intentionality. People wanted to do this. The technology itself was secondary. We had some really wonderful developers who did some really good stuff, but it wasn't some silver bullet that a new technology emerged that made this happen. It was because of the focus and desire to improve student services that made this happen. Technology was just the vehicle. (J. Wager, personal communication, November 8, 2016).

The culture at Penn State put students first, was positive for stakeholders and sparked enthusiasm for challenges. Harwood did not know how PSU built culture but he did acknowledge the school's culture of cooperation.

> I would say as a platitude, culture trumps strategy. A lot of folks have a lot of fine strategies but they are insensitive to culture. The technology stops when the funding runs out. In the glory days of 1980s and 1990s, PSU culture had fearlessness not recklessness, a very high degree of collegiality. We would work across silos, and we were all in it together. I never had a fear of taking on new and hard things. I never had a fear of being let down by other units or having to watch my back. (J. Harwood, personal communication, November 10, 2016).

Wager similarly stated, "I inherited an environment that was positive about making things happen" (J. Wager, personal communication, November 8, 2016). This doesn't mean they didn't "fight." When EDS left, and PSU had to create an information system that supported their needs, disagreements abounded.

> [As to] Gary Augustson, we were great colleagues but we fought like dogs to invent the system to work better, trying to manage the number of students accessing the system. The student information system got better and better, but there were times students [and others] were frustrated with this new system because it was not working conveniently.
>
> The collegiality, though, it was there in spades. We were all pulling in the same direction to help the university transform itself from a very efficient and effective mainframe and move into a distributed system where the actual dropping and adding would occur through a department telex terminal, dumb terminals that were set up all over the university and they allowed you to tap into the central mainframe in the university and that would be done electronically. (J. Romano, personal communication, November 10, 2016).

Importance of financial resources. The development of the IS at Penn State was not inexpensive. One of the conditions of effective IT change is sufficient financial resources for the project. As Spanier noted when reflecting on IT change:

> There needs to be some appropriate level of financial resources. I remember when I was chancellor at Nebraska in 1993/1994. We wanted to do benchmarking and look at the next level of IT and we brought in

> Gary Augustson as an external consultant. I remember Gary Augustson shocking me with the percentage of the university budget I needed to invest in IT to go where we needed to go in Nebraska. He was bringing in his Penn State experience where the funding had been more adequate. You have to have a certain level of resources. (G. Spanier, personal communication, November 9, 2016).

Penn State was fortunate to be able to have the necessary funding to develop eLion. But the willingness of leadership to allocate this funding depended on the interest and commitment of senior leadership to this work. As Spanier noted:

> You have to have people at a high level of responsibility who have a vision, a set of principles, where people can see the institution is committed to this area, and what kind of priority they have. I often talked about IT in speeches, all the time about IT being a priority. That is what people needed to hear from the president. It also needs to be heard from the Provost and Vice-President for Finance and Business. Those are key key[179] positions. (G. Spanier, personal communication, November 9, 2016).

Teamwork and culture. The PSU case demonstrates the centrality of teamwork in IT change. Teams were prevalent throughout the development and implementation of the new information system and contributed greatly to its success. PSU relied on these teams for support to gain commitment and active participation, especially when there were so many other big projects going on at Penn State. The teams were deliberately structured to engender success.

> James Wager, Eric White and Eugene Melander were part of the eLion Design Group that coordinated the project team. They believed that there were unique ways to get through Penn State. There are people who I didn't know who said yes, I'll help with that. We put together teams who tried to make things happen to make things better, who believed, I can make things better. (J. Romano, personal communication, November 10, 2016).

[179] Dr. Spanier intentionally said "key" twice.

At PSU, the emphasis of teams may have, in part, been the result of the University's interest in Continuous Quality Improvement (CQI). As Wager explained:

> The University was heavily engaged in the continuous quality improvement philosophy. The Provost of the university was the champion for this…There were a number of CQI teams that were created across the University (college admissions, physical plant). This feeling, this philosophy, this approach, pulling teams together, utilizing team decision making was an important and good place for everyone. With this environment, when this team came along, they were going with the flow, they were not building something brand new.

Specifically, as the process related to the development of eLion, Wager reports:

> It was pretty much left to the [eLion] steering group, the people who needed 90 minutes a week to make it or kill it. There was a strong feeling among that group that we need to make it. When we started rolling out actionable processes, people could begin to see this, and the support could continue to increase. Then the money started to loosen up. (J. Wager, personal communication, November 8, 2016).

Harwood believed that PSU's leadership had a philosophy, and that that philosophy came first, followed by the funding, then the system functionality, then the project management. "We then gathered all the stakeholders and required them to play as part of the team" (J. Harwood, personal communication, November 10, 2016).

> We had a philosophy of technology development, development support, taking care of users. I spoke with faculty, administrative aids, the back office, and I kept them happy and engaged. Every department had a scheduling person, and we helped them succeed and made them a hero in a non cynical way. (J. Harwood, personal communication, November 10, 2016).

Faculty involvement. The many voices that contributed to the IS effort converged into a single vision and understanding of PSU's mission to develop a student centric information system. Faculty involvement in IT change is an important condition for its success. One sees in the PSU case that faculty were helpful with conceptualization, but also provided political support and legitimacy of the system.

Harwood stated that the longevity of leaders at Penn State contributed to the success of the IS implementation because they were willing to look to faculty for potential input that brought strength to the effort.

> We had very stable leadership for a very long time. This was true at the highest levels, long time president, CIO, Provost. This could have led us to complacency but it did not. People doubled down, very low turnover. And we groomed future leaders. We looked for faculty for potential. Gary Augustson asked me, how would you like to be our first faculty fellow, working as a leader in both administration and faculty. (J. Harwood, personal communication, November 10, 2016).

While a faculty member, Harwood was invested in supporting technology. “[Leadership] said go get them [new technologies, projects that would benefit PSU] and I did” (J. Harwood, personal communication, November 10, 2016).

RQ 3.2: Leadership required for IS implementation. In IS implementation, leadership and governance matter. People interviewed for this study at Penn State reported that the information system implementation succeeded because it had a community of leaders who led by example. Penn State leaders valued innovators, communicators and visionaries. Spanier cultivated relationships with his academic deans using structured meetings and office visits, specifically with a group he called the ACUI, The Administrative Council on Undergraduate Instruction (may now be known as ACUE).

The Administrative Council on Undergraduate Instruction was a group of associate deans in charge of undergraduate education, headed by the Vice-President for Education (that would be Dunham and Melander). The group would talk about what Penn State needed to change. "What's next; how do we improve the situation for students; what worked and what didn't work; what do we need to modify a form for example online" (G. Spanier, personal communication, November 9, 2016).

> [The ACUI members] were the most important council at the university that I met with regularly. They were on the front line with students, solving their problems and they knew what the issues were. And I would go to them sometimes and say what about this, what about that and make certain changes. (G. Spanier, personal communication, November 9, 2016).

The ACUI was the social and organizational construct that Spanier used to influence and support the notion that PSU's organizational culture accepted ideas and embraced change. It also had an impact on information system design and implementation, and enabled individuals to gain support and buy-in from various constituencies and stakeholders impacted by certain changes. Dr. Spanier explained the importance of the group saying:

> The ACUI are critical. If you are the associate dean of the college of human development and you have 4000 Penn State students and it's your job to make sure they have the education they need, courses they need, graduate on time, you have to listen to those folks for what needs to happen to get the job done. (G. Spanier, personal communication, November 9, 2016).

Leaders at Penn State were not dictatorial and respected the chain of command. It was rare for a final decision maker to be needed on certain decisions, but Penn State leadership understood that a committee could not decide certain things. It was clear who had the final say. It was the president, the provost and the IT leadership.

> You need somebody who is in charge. Someone who is the final adjudicator. We are going to do A not D. Decisions have to be made. A committee in the end cannot decide certain things. We are going to go with this vendor, this programming language. We are going to allocate this amount of money, and they are going to be doing these five things. When these things fail, it's because it's not clear who is in charge. Or the person in charge is a dictator or has no respect. There were not many instances that something came to me. I could put it on a president's council meeting, it sounds to me that we should do solution number 3, but I don't ever recall making a decision because an agreement couldn't arise from different groups. (G. Spanier, personal communication, November 9, 2016).

Spanier spoke of the importance of incoming presidents understanding information systems at their higher education institutions.

> It is an extremely important area to pay attention to. They have to become knowledgeable about it. Or have someone around them, or a VP or Provost or a chief information officer that they can rely on very heavily. It's one of those areas. IT generally is one of the great risk areas for data breaches, identity theft, systems going down…It can be an area of great frustration, turmoil and great risk…It's a great mystery. Presidents need to have some level of insight about it. (G. Spanier, personal

communication, November 9, 2016).

The impetus to replace eLion came from the administrative officers. At some point in 2008, the staff felt that a new student system was needed. Many felt comfortable approaching administration at Penn State with their request for a new system that was able to keep up with evolving technology and growing business processes (The Pennsylvania State University Project LionPATH Website, 2014). The faculty advisory committee was also involved in that discussion. Dr. Spanier said:

> We talked about it a LOT. There were a lot of places [offices, meetings, informal places] where those discussions took place. I tried to foster a climate where people could bring up any wild idea or complaint, any suggestion and it would be taken seriously. Penn State wasn't a place where people were afraid to speak or people wouldn't listen. People like Jim Wager, Warren Haffner (one of the great people that ever worked on Penn State). You could be in a meeting with Wager and Haffner and come in with an idea and say we need to do this. And they would take it up to the next level. It's going to go cost X. We never said no to a reasonable request. I never said NO to a reasonable request. It would have been easier for them to stay with the old system. (G. Spanier, personal communication, November 9, 2016).

Internal memos demonstrated that there was mutual respect and celebration of successes. Romano and Cahir congratulated the early eLion team on its progress, and when asked if this was a part of his leadership style, Romano reported:

> I believe the thing that makes any organization work is the people that inhabit it, you have to treat them with respect, understand the circumstances that they produce their work, look them in the eye and express with integrity and respect that we would not be there today without the work and effort they provided.
>
> I didn't say that by memorandum alone, one on one and speeches. You either believe it or you don't. I believed it to my core, I did it, I said it, I acted on it. I didn't make these things work well, we did. I believe that deeply. That's the way you make a system work.

Repeating advice he had given his son Romano cautioned leaders who were stressed or in fear of the magnitude of their assignment.

> Keep doing the things that allow you to get you where you are you today. Recognize the good work that people have done. They have enabled you. Don't change that pattern. People who . . . do their jobs … will reflect positively on you. I went to work every day with angst and a little bit of anxiety and sleeplessness when I had a big speech. I relied on the fact that you accomplish your good deeds not by what you say or do, but how you treat the people you work with and the company. People believed me that I was authentic, and I was. (J. Romano, personal communication, November 10, 2016).

An employee of his, Wager, once the registrar, and a previous Vice Provost of PSU, described Penn State's leadership style, as a "servant leader."

> You are in a position of leadership and what you do is going to make a difference. But it's not about you, it's about serving those who are following you. That is a personal philosophy of mine. A lot of people felt that way at the time. You need to leave your ego at the door when you step in the door. (J. Wager, personal communication, November 8th, 2016).

The leadership necessary to improve student services was not expected to come from within the technology ranks. Technology did not drive change at PSU. Change was spearheaded by the individual units and their leadership. The method in which services were delivered in higher education administration and the registrar's office changed because of strategic vision and entrepreneurship. All employees had the opportunity to lead at Penn State in order to make IS implementation happen. (Wager, It's Not about the technology; J. Wager, personal communication, November 8, 2016). This was also true of the eLion student information system.

One thing notable about PSU is that until recently, support from the Board was not essential for the student information system initiative as information technology was not a regular agenda item at meetings. Primarily, the Board considered the continuing investment of people and money required to acquire and support a full range of campus IT resources and services. These needs existed "only at a very general level," until risk management issues became a priority. (G. Spanier, personal communication, November 9, 2016).

> Only starting in 2010, did we get information technology as a regular agenda item for Board of Trustees. Until that time, [there was a] once a year report at a Board of Trustees meeting. An agenda item occasionally in the finance committee. The board would learn about our enhancements to IT but through reports to other things. We would do a report on computer labs. John Romano would give his annual report on admissions, and a section on that would be on eLion. The board did not get into approval over specific IT matters. (G. Spanier, personal communication, November 9, 2016).

Board involvement became necessary when the PSU SIS replacement cost $97 million. "The ability to adapt to emerging technologies and the need to meet student and faculty expectations are two of the reasons the University is moving to replace its student information system, according to a report presented Thursday (September 18, 2013) to the Finance, Business and Capital Planning Committee of the Board of Trustees" (Tweedy, 2013). Although it is not clear if information systems became standard agenda items for the Board of Trustees, in February 2017, at the first official Board of Trustees meeting of 2017, Penn State Executive Vice President and Provost Nicholas P. Jones reported about Penn State's new student information system, LIONPATH and thanked Board members for their continued support.

It appeared from the transcript of his speech that he had to account for his original statements that the implementation was going to be a model to other institutions. Instead PSU had encountered challenges, and as the executive sponsor of the project, Jones apologized for the issues experienced by some LionPATH users.

> Everyone involved with Project LionPATH has remained focused on delivering optimal results and superb service. And, were it not for their unwavering commitment, we might have faced additional challenges. Conversion of any major legacy database system is a tremendous undertaking, and everyone's hard work throughout the multi-year process impeded and even neutralized potential complications. (Jones, 2017).

Provost Jones (2017) explained that PSU was forming a new group, the LionPATH Development and Maintenance Organization, to address issues with the new system. "We have heard students' concerns, in particular, and we are addressing them."

Jones used his experience with Project LionPATH to introduce a new challenge for PSU. "Change is hard at first. And yes, it can get messy in the middle. But in the end, bold change-oriented processes enable us to achieve extraordinary results that have positive impacts across the University" (Jones, 2017).

The Value of a CIO, Analysis of Gary Augustson

The case also suggests that a certain type of IT leadership is necessary to complete an information system implementation and sell it to the community. IT leaders must be able to understand the cultural and political dimensions of their institutions; receive clear authority from senior leadership to lead change, even when that change may not be well received by all; create and motivate teams; build coalitions and be open about problems.

Augustson received the information system initiative from PSU through a directive from the president. Inheriting consultants and establishing university-wide committees, he held full responsibility for the AIS project. His position was critical to making this technology initiative successful. He was required to not only plan, organize, align resources and goals as a manager, but inspire as a leader, and pull it together by involving and deploying others with governance.

Augustson himself says, “I didn’t have any higher education background, I didn’t have a staff. We didn’t have a clue how complicated it was, but I inherited an environment that was positive about making things happen.” He continues, “I contributed to the right environment. I didn’t build it alone. The creation of this position elevated the position of IT in the university.” (G. Augustson, personal communication, November 7, 2016).

Working with enlightened leaders in a confident environment. Despite the inherent difficulties, Augustson calls these the golden years of his career. He had a positive relationship with Provost Cunningham, who played a “key role in negotiating the agreement with EDS and keeping the ball rolling.” His first week in office, Augustson asked Cunningham’s personal assistant where the Provost would be at 7pm that night. After she told him, he replied, “Well I have a lot of decisions to make today that aren’t going to make people happy and he is going to get a lot of phone calls.” Augustson felt empowered to make those decisions even though as he put it, “The first year I had responsibility without authority. I had this project but I didn’t have responsibility for any of the organizations supporting the project." It was as he described it a "confident environment." (G. Augustson, personal communication, November 7, 2016).

Augustson understood the cultural and political dimensions of his institution from the onset. Knowing that the President was retiring and the Provost was moving on, he carved out an advantage for himself within this time. Augustson instituted the first traditional IT group. "I moved from a staff of 4 or 5 people, and I created one of the first integrated data communication groups (voice, data, communication.) A colleague of mine said, but he was a friend of mine, you see, *Well you can stop bitching, Gary, you now own Academic Computing and Administrating Computing*." Fearing disruption, the CFO said, "We haven't missed a payroll in 30 years, I hope this doesn't change." University leaders were not mad at him, Augustson insists, because the reorganization was necessary to complete the original directive, to build the AIS for PSU. (G. Augustson, personal communication, November 7, 2016).

Less than a year after Augustson's first day as head of the IS initiative, President Bryce Jordan and Provost Bill Richardson became the new leaders of PSU. Augustson describes them as "enlightened leaders" that empowered their employees to achieve by "creating an environment of success." Everyone recognized the importance of the project. "There was confidence in me, and confidence in the leadership in the university." (G. Augustson, personal communication, November 7, 2016).

Being the change agent. Jordan told the CIO, "You don't have to worry about pleasing anyone but me." Augustson recites one exchange where Jordan told him that he didn't know why the CFO[180] didn't like Augustson but not to worry about it. The relationship with Jordan went two ways, Augustson explained, "I told him when he was wrong." This attitude empowered him to be what he needed to be in order to lead and manage technology at his institution, at a time where very few senior academic technology officers were using technology and had little knowledge of technology. "I was the change agent," he admitted. "I was the guy with the metal bar, running down the cage." (G. Augustson, personal communication, November 7, 2016).

Furthermore, Augustson realized that PSU's organizational culture accepted ideas and could change. Since PSU employees were pioneers in the new area of information systems, there was not much resistance to IS change, with the exception of some resistance to EDS. "No one wanted to be told by EDS how to do things. You don't know my business as well as I know it. You don't understand higher education. And clearly EDS did not. They were clearly not people who understood the nuances of higher ed. Lowell's (Lowell Starling from EDS) job was to get it done as fast as possible and get out before they [EDS] lost money." People felt EDS employees had attitude and made promises they hadn't kept. (G. Augustson, personal communication, November 7, 2016).

"I understood that I had the people and the responsibility to make it happen. It was an environment of change. Transition of leadership can create disruption and uncertainty but we made progress" (G. Augustson, personal communication, November 7, 2016). The engagement of a few respective people, including President Jordan and

[180] I was unable to find the CFO's name during this time period.

Provost Richardson, helped Augustson mobilize support and proved indispensable to the success of PSU's IT initiatives.

> The current environment at Penn State is fraught with extremely weak leadership. The difference in having a strong leader is very powerful. I was extremely lucky, I came without any baggage. I didn't own the consultants, and the Provost and leaders were all committed to making the EDS project happen. The seven years working with (President) Bryce and (Provost) Richardson were the golden years of my career. (G. Augustson, personal communication, November 7, 2016).

Leading and managing the SIS initiative strategically. A great deal of customization was necessary for the PSU student information system, and it required that Augustson get support and work effectively with the personalities, politics and culture at PSU. The involvement of the user community in designing the information system was important for success. Augustson believed that other academic administrators trying to implement a large-scale SIS should "engage the stakeholders and help them help you make the key decisions. Take them on the journey with you. Don't just start and get the input to start the journey, but take them with you on the journey." He added that the criticism of the new PSU system stemmed from the fact that the user community had not been involved with its design. "They just re-implemented what we did three years ago. They didn't do enough to put the [user/personal] touch into it." (G. Augustson, personal communication, November 7, 2016).

Augustson and his team did "put the touch into" the new system. "We were creating a model," he said, warning that technology should not be treated like a cost line item. "We in IT did not know how the bursar did things, so the design process had to go into the hands of the users with IT support. IT could not design it." PSU did not treat its employees as a cost-line item. When the forty-five people working in the registrar's office answering telephones were no longer needed because of the technology, PSU supported the registrar's recommendation to turn those positions into technology support staff. Augustson says, "We would encourage the distributed unit to hire the leader from our organization." (G. Augustson, personal communication, November 7, 2016).

Selecting the key players is an important first step in meeting the challenge of a project implementation. Augustson built a good team to support his policy initiatives. He attributes some of it to the incredible work ethic of the people of Central Pennsylvania, who are proud of the area and proud of their abilities. For Augustson a lot of that pride "was inherent in the organization." He remembered that "there was an awful lot of support in the distributed unit. This was not a forced march." Groups and departments were motivated to work together because Provost Dick Cunningham had explained the school's deadline with a three to four-year contract. Then when "EDS left town" PSU needed to finish the student information system, as quickly as was possible. Users accepted the system albeit with complaints because there was no question that it was for the best of the school. They could not keep growing without an investment of time, talent and resources in technology. "There was a commitment to get it done – we've invested this money." (G. Augustson, personal communication, November 7, 2016).

Furthermore, the president and provost were known for supporting employees that were "four levels down." Leadership talked about the technology initiative, and people knew that the administration was in their corner. Employees felt that their input was of value. One day President Jordan sat in on a presentation by the IT group and he slammed his hand down on the table and said, "That's the best damn presentation I have ever seen." Augustson believes that Jordan said it so no one would dare attack the presentation and to demonstrate his support for the IT work. (G. Augustson, personal communication, November 7, 2016).

PSU leadership supported Augustson in building his team with the people he wanted, and he had the power to offer jobs to employees. One example was his hiring Ken Blythe, a "key player" on his team.

> When I was running a data center for the Office of the Secretary, and my boss came up to me one day and said, *You are one of the two best employees in the federal government*. And the first thing I said was, *Thank you very much sir*, and the second thing I said was, *Who's the second employee?* And that second employee was Ken Blythe. I went out and hired him when I was CIO. Ken was working in Bahrain. I went to Bill Richardson, he was a good friend, and I asked, *one of my applicants is in Bahrain, can we fly him in from Bahrain?* Bill Richardson said, *Okay Gary, but can you try to get all your interviews done on one flight . .* because you know flights to Bahrain were expensive. (G. Augustson, personal communication, November 7th, 2016).

Augustson understood the importance of empowering his teams and recognized the strength of his IT team's knowledge because his team members were "in the trenches" (Johnson). "My job is to keep the road clear and gas in their tanks, politics. I have no technical ego. I believe a CIO who tries to hold on to technical expertise will fail. You hire smart people, you hire good people."

Building coalitions. Augustson self-describes his leadership method as a "very aggressive style, very decision oriented" but believes that he had to rattle the cage in order to make change happen, and he "wasn't afraid to do that." He admitted that, "I can be very in your face, but I don't necessarily operate that way." Indeed, Augustson actively built support and mobilized a critical mass of acceptance for his initiatives through coalition building and cultivating relationships with people on his team and around Penn State. As he points out, his team was spread out in half a dozen buildings around campus. He would go to other people's offices for one on one conversations and have hallway conversations with the President. Team members would serenade employees on their birthday, organize and attend golf tournaments, and go to lunch together (a practice that continues to this day, even as this group of IS employees is retired). (G. Augustson, personal communication, November 7, 2016).

Communicating widely. Augustson focused on communication in order to build credibility, trust and respect in his department, his work and his leadership. He traveled every year to all the different departments and campuses to get to know the Deans on their home turf. He would start by saying, "Hi, I'm Gary, how are we doing?" to learn how was his department performing in support of this particular Dean's concerns. And they would tell him, "You know, Gary, you are the only person from Old Main (PSU's main campus) who comes to this campus every year." (G. Augustson, personal communication, November 7, 2016).

Augustson was trying to build initiatives both internally and externally. He would meet with half his staff, and with all the staff, trying to open lines of communication to learn what people needed. He held monthly lunches with 12 people in the organization that he called "climate lunches." "One of my guys would pick the people. And we went through the organization 3 or 4 times in a year. They were very powerful input vehicles.

There was very little whining, very little bitching, a lot of communication." (G. Augustson, personal communication, November 7, 2016).

Confronting the rough edges and the "Oh My Gods". Augustson and his team at PSU faced challenges throughout, especially when EDS departed and PSU was left with an incomplete student information system. "We were half-way across the lake, we didn't want to stop swimming now," he stated. "There were rough edges and oh my gods" (G. Augustson, personal communication, November 7, 2016). The University had a lot of work to finish. Despite this, PSU was eager to complete all the information systems.

Specific to the student information system, Augustson admitted that "there were performance issues. The scaling was the biggest issue and that was the big lesson" (G. Augustson, personal communication, November 7, 2016). For Augustson "there were no drop off the cliff moments. We were designing it" so he expected performance issues. (G. Augustson, personal communication, November 7, 2016). Even if he did not remember specifics, it appeared from internal documents that Augustson was able to turn the development crisis from a disadvantage into an opportunity and create value from the crisis and make strong points about his agenda. The 1984 External Assessment Group reviewing AIS came down hard on MS, recommending an IT director replacement. Augustson used this crisis opportunity to delay work on AIS, to review the problem areas that were still unresolved and to allow a Task Force to review the project. The establishment of this task force, and the case history indicates that the CIO most likely intervened from day one of the precipitating event, taking responsibility, and speaking honestly, steps necessary to head off or contain a crisis (Baker, 2003). Augustson's openness about the issues faced by his institution emphasizes the necessity for a leader to build consensus and to remain on the cutting edge of technology (Berinato, 2003). During a time of crisis Augustson recognized the importance of acting like a politician and engaging in political diplomacy by communicating organization and school needs with both technical and non-technical participants. “I was open about things. Everyone knows you have a problem. That was reasonable to do.” (G. Augustson, personal communication, November 7, 2016).

“No one had ever dealt with 40,000 or 50,000 students,” Augustson explained. When Penn State went to phone registration, students put the phone registration number on redial. There were 100,000 calls a minute to the student registration system, and as a result Penn State “dropped dial tone all the way back to Harrisburg.” There was total dial tone silence. “Bell could not drive the switch in their lab the way Penn State did it,” so there was no way to know how 40,000 or 50,000 students would impact an information system or a telephone registration system. It had never been done before. (G. Augustson, personal communication, November 7, 2016). Later, Dr. Spanier assessed the reliability of the student information system. “There were a couple of times we had a hitch, where it went down for a critical time. But most of the time it worked great. And [students] adapted to it” (G. Spanier, personal communication, November 9, 2016).

Advice to other administrators. Auguston's advice to other academic administrators trying to implement a large-scale SIS is similar to that given in an interview with President Oswald in 1984. There were cautions to expect to spend a lot of money, involve users, celebrate successes, and to be open and honest about shortcomings. In addition end-users should tell the world how the SIS changed their lives. Testimonials from IT personnel were not as meaningful as those from the registrar. “You need to build the environment so they tell the stories that support your work’s mission.” (G. Augustson, personal communication, November 7, 2016).

Academic administrators should “pick their battles” but “have thick skin.” Augustson spoke from experience. “You are going to have detractors.” President Jordan showed Augustson a letter once that said, “You don’t know it but the AIS system is a piece of shit.” The CIO insists that implementation professionals have backing from the decision makers of the school. “Don’t try it if you don’t have leadership support. They need to be on board.” Universities that ran the best IT, such as Indiana University, were successful because their leadership worked well together. (G. Augustson, personal communication, November 7, 2016).

Augustson was not deeply involved in the development of CAAIS/OASIS. True to his IT leadership philosophy, he explained that “Subject Area specialists were put in charge of the system – more Romano.” However, he believed in the power of leadership in academia, saying that, “I see environments where change is being made and I know it will fail because of poor senior leadership. As long as there is poor leadership there is no path to success.” Absence of good leadership for Augustson was “easier to quantify than the presence of good leadership.” More lessons are learned from working in a bad environment than in a good one. Bad leadership includes leaders who have no vision, no courage to do the right thing, who are deceitful and have no clue from a strategic view where they want to take the institution. (G. Augustson, personal communication, November 7, 2016).

CIO J. Gary Augustson was an effective PSU administrator who guided the University through the successful implementation of a student information system. At times controversial, he was nevertheless respected, ever admired for his work ethic, intelligence and leadership abilities. If bad leadership had no path to success, his good leadership opened paths to progress.

Conclusion

Barrat (2003) jokes that writing about IT is similar to capturing a snapshot of a marathon with no guidelines, no clear course, and new competitors jumping in at peculiar times (p. 379). Information systems are complex. They exist across offices, involving multiple constituencies at all higher education institutions. Size, resources, leadership and culture are elements that can affect outcomes. The complexity of student orientation, advising or registration at a small private liberal arts college like Haverford (1,000 enrolled students) will be different than at a multicampus public institution like Penn State (80,000 enrolled students). The size of the institution indeed adds to the complexity of its operations and information systems. Larger institutions, however, also have assets not available to most small schools. Penn State had resources of money and time that the university could invest to build a successful information system in different phases over three decades. The inherent differences of a well-resourced institution versus a financially strapped one, like a smaller college that is having a hard time making a go of it, meant that Penn State was able to hire outside consultants with up to date expertise. The University could build an information system initially, examine the system EDS consultants had designed, and then rebuild from scratch when the old student information system no longer served the needs of the institution.

However, this case history of Penn State shows that resources are not only financial. Without the leadership and articulation of a vision, without expert management and emphasis on people, progress is more difficult. Even some of the most well-resourced institutions have not been at the forefront in this area. At Penn State, the leadership was in place, and people advocated, communicated, and respected each other. This commitment of leadership to invest Penn State resources and personnel into information systems was honest and complete. The culture of Penn State revolved around helping students, and acknowledging long-standing people at the institution who had fostered progressive relationships. However, the case history of Penn State is limited as it is the study of one institution. It is not intended to serve as a universal blueprint, but as a study that can highlight some of the successes and challenges that any institution large or small faces with changing technology.

The key steps to a successful IS implementation are far from simple. They require committed leadership and a student-centric culture. They depend on people who can create, support, and motivate teams and can build coalitions across campus. They require reaching out to others to identify problems; meeting with key constituents and canvasing their opinions; analyzing these responses; and sharing what has been learned with all. Transformative thinking is necessary in order to accept new challenges and find solutions. PSU's experience demonstrates that the path to change is not easy, but must be faced and completed, because the central benefit, the success of students, is the ultimate goal of all higher education institutions.

Appendix A

Penn State Research Sources

The principal motive of this investigation at PSU was understanding the origins of information systems at the institution, its key players, a study of their influence and key decisions to build a home-grown information system. An informal search of PSU's eLion system provided a plethora of information about PSU's journey into IS ending with its final IS product, eLion. The specific lines of research were as follows:

1. A study of eLion functionality that won PSU national accolades from a variety of sources including Computerworld. These accolades can be found in technology magazines, internal PSU newsletters, including the Penn State Intercom, and PSU's own accolades web page. I examined and organized the importance of these technical accolades based on the significance of the companies and technology journals that awarded them.
2. A study into the purpose of PSU's IS with a focus on what implementers were trying to accomplish.
3. A study of the collaboration of three administrative areas of PSU: Enrollment Management and Administration, IT services, and Undergraduate Education. Some of this information was available through public sources, like Computer World, and in newsletters written by PSU employees to other institutions about their experiences.

4. When studying complaints posted on student blogs and newspapers, I discovered a student organization's report on student problems with eLion and the recommended alternatives for replacement.
5. A study of the key players was compiled from published public interviews and from interviews solicited from current and recently retired employees. Furthermore, a study of key players involved in the information system implementation from publicly published and private interviews, and progress reports to PSU's Board on technology strategic planning goals and outcomes that include information systems, provided details on how PSU shifted policies, practices and structures in reaction to the growth of information systems at its institution.
6. A study of technical data on eLion provided me with an introduction to the Penn State Data Warehouse. I was interested in how much legacy mainframe technology PSU had to utilize and determined what key decisions were made, so that I could be informed about both the origin of the IS and have the technical knowledge to discuss the IS in depth. Online power points and in-house technical documents from IT provided the knowledge, i.e. the software development cycle, how PSU approached IS in order to assure the information system's functionality was used and understood by all.
7. A study of eLion (and its predecessor applications) services for faculty and students is well documented online through FAQs, student pamphlets posted by Administrative Information Systems, a unit of IT services (how to use eLion, who

has access, etc.), and faculty FAQs. I have also located program evaluations of eLion in two published books and reviewed PSU Faculty Senate minutes to deduce and document faculty experiences with eLion. As an example, Faculty Senate minutes from 4/2003 speak of educator needs and how eLion met those needs. Another example, when the Senate Committee on Faculty Affairs of Penn State attempted to update its academic freedom statement, HR64, it revealed that the statement was last revised in 1987, a time of rare email use, no online courses, and no World Wide Web. This later example highlights how information systems necessitated updating school policy (Penn State Senate Committee on Faculty Affairs Appendix D, 2010).

8. The website senate.psu.edu posts all faculty agendas and meeting minutes online. I have made cached copies of these on my hard drive in a Sente database with proper documentation and screenshots of time stamped pages for future access. I have culled eLion's history from a variety of sources, and I have created my own timeline in terms of organizing, finding overlap in stories and identifying discrepancies addressed in interviews.

9. The study of the end of eLion has been made possible by PSU's decision to be as transparent as possible in its efforts to garner community support for the school's next costly IS. PSU's website press release offers some detail into costs to make the case for a new IS, Project LionPATH (eLion's future replacement). The website also provides specifics about the decision to end eLion and thus includes

further material that can be used to question key personnel about eLion's implementation and particular lessons learned.

10. Penn State's strategic plans for information technology are in digital form with the exception of a few I have requested directly from the authors. I have also located a master plan for administration information systems at PSU dated March 2007, and progress reports written by PSU to the Board on IT strategic planning goals and outcomes that include information systems data, as well as strategic plans (1997-2002) from the Office of Computing and institutional self studies prepared for "the Middle States Association of Colleges Commission on Higher Education (9/23/2004)."
11. A review of journal articles that discuss how online information systems have impacted registrar operations and student services organizations at other institutions allows me the insight to find similarities or dissimilarities at PSU.
12. The study of Cornell archives on Project Mandarin, whose technology PSU used to build its information system technology system, eLion, showcases common institutional challenges.

Appendix B

Qualifying Paper Research Sources

To identify important technological changes during this thirty year period for my qualifying paper, I drew upon a wide array of literature. This literature included primary source materials such as university handbooks, college newspapers, presidents' reports and book chapters written by IT professionals. Library catalogue, database and archive searches also provided relevant material from journals, newspapers, and websites. The standard definitions (see Appendix C) I used in my research are culled from books or encyclopedias of computers, computer science and computer history and trade journals.

I also reviewed literature on the history of computing and information processing, management and governance of technology in schools, compilations on student services and cases on technology practices in higher education. Critical publications and websites that guided the writing of my qualifying paper include: the archives of Pennsylvania State University, Dartmouth College, Harvard University, Cornell University and Carnegie Mellon; the Charles Babbage Institute (CBI) at the University of Minnesota; Hawkins (1989), McClure (2003), Oblinger (2003), Baldwin (1998), Bates & Sangra (2011), Kornives et al. (2003), Hossain et al. (2002); and readings from the newspaper, *The Chronicle of Higher Education,* the journals *Educause* and the *Communications of the Association for Computing Machinery*. Systematic large-scale surveys conducted by the Higher Education Research Institute at UCLA and the U.S. Department of Commerce Bureau of the Census also informed my qualifying paper research.

Appendix C

Dissertation Paper Proposal Definitions

For the purpose of this research, in order to better understand the topics of email, information systems and WWW, the following basic definitions for key terms will be used.

Definitions

Electronic mail systems

Electronic mail systems (email) permit the exchange of electronic messages and files from one network enabled device to another. Early mail systems allowed for exchanging electronic messages and files both asynchronously (similar to email today) and synchronously (similar to instant messaging today). Since today's email operates over computer networks such as the Internet, users and their computers need not be online at the same time. Email is accessible using a software program that can be installed locally on a computer or by using a web browser on the WWW.

Information Systems

Information systems (IS) are computerized applications and databases that are used to organize, collect, store, process and manage the flow of information in order to support operations and decision making (Hossain, Patrick & Rashid, 2002). "Operational activities are those processes and actions that must be performed to maintain an organization's level of performance on a day-to-day basis" (Luftman, 2009).

Enterprise resource planning systems (ERPs), used interchangeably with information systems throughout this paper, refer to any university owned systems that provide administrative processes and services to the university community, including admissions, financial planning (payroll), management and institutional research, general administrative services, financial aid, physical plant operations, library services, student records, food service management and medical record keeping (Chachra, 1984; Gillespie & DiCaro, 1981).

A web browser and an Internet or network connection are needed in order to access an ERP system from anywhere (Hossain, Patrick & Rashid, 2002).

The World Wide Web

The World Wide Web (WWW), created by Tim Berners-Lee in the early 1990s, is a mix of software and protocols that facilitate the communication of computers across the Internet (Baron, 2003). 8.44 billion individual, institutional or commercial web pages form the backbone of the WWW, and contain links (hyperlinks) to other pages, documents and resources in a variety of formats (texts, sounds, videos, images, etc.) (WorldWideWebSize.com, 2012). The WWW is viewable using a web browser like Internet Explorer or Firefox.

Protocols such as Berners-Lee's Universal Resource Locators (URLs), the universal computer HyperText Mark-up Language (HTML), and Hypertext Transfer Protocols (HTTP) allow for navigation of resources on the Internet using web browsers. For example, viewing a college website requires that the URL of the academic institution's web page be entered into a web browser (e.g. college.edu). The browser from a web server requests a page using the HTTP protocol and if the request is granted a browser interprets the HTML into a structured document (World Wide Web Consortium, n.d.).

Appendix D

Interview Recruitment Letters

Letter Requesting Interview to Pennsylvania State University Student, Faculty or Staff Using an Acquaintance's Introduction

Dear (Name of PSU participant),

My name is Maria Pantazis, and I am a doctoral student exploring the emergence and development of information systems at Pennsylvania State University. I am working under the direction of Professor Judith McLaughlin at the Harvard University Graduate School of Education (HGSE).

(Name of Acquaintance) recommended I request your participation in a study I am conducting to examine, understand, and highlight the challenges that (students, faculty or staff) face when (using/participating in an implementation/leading and managing information systems) in higher education settings.

My business background is in corporate and higher education technology. Prior to enrollment as a doctoral student at HGSE, I worked for 15 years in various industries, for employers such as SAP, Textron Systems and Deloitte Touche Tohmatsu, and Harvard University, focusing on computer information systems and software development.

My study will require you to engage in a voluntary thirty-minute to one-hour interview. The interview questions will be specific to your experiences leading and managing technology policy at your institution. The interview will be confidential, and the subsequent findings will be anonymous.

Thank you in advance for your time and consideration.

I look forward to hearing from you.

Very truly yours,

Maria A. Pantazis

Sources:

Recruitment/Introduction Sample Letter from Northwestern University (http://www.research.northwestern.edu/oprs/irb/social-behavioral/documents/Recruitment-IntroductionLetter.doc)

Rubin, Henry J. and Irene S. Rubin. Qualitative interviewing: The art of hearing data (2nd ed.). Thousand
Oaks: Sage, 2004, p94-97.

Letter Requesting Interview to Pennsylvania State University Student, Faculty or Staff Using an Online PSU Directory or University Article

Dear (Name of PSU participant),

My name is Maria Pantazis, and I am a doctoral student exploring the emergence and development of information systems at Pennsylvania State University. I am working under the direction of Professor Judith McLaughlin at the Harvard University Graduate School of Education (HGSE).

I obtained your information from the PSU website to request your participation in a study I am conducting to examine, understand, and highlight the challenges that (students, faculty or staff) face when (using/participating in an implementation/leading and managing information systems) in higher education settings.

My business background is in corporate and higher education technology. Prior to enrollment as a doctoral student at HGSE, I worked for 15 years in various industries, for employers such as SAP, Textron Systems and Deloitte Touche Tohmatsu, and Harvard University, focusing on computer information systems and software development.

My study will require you to engage in a voluntary thirty-minute to one-hour interview. The interview questions will be specific to your experiences leading and managing technology policy at your institution. The interview will be confidential, and the subsequent findings will be anonymous.

Thank you in advance for your time and consideration.

I look forward to hearing from you.

Very truly yours,

Maria A. Pantazis

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Recruitment/Introduction Sample Letter from Northwestern University (http://www.research.northwestern.edu/oprs/irb/social-behavioral/documents/Recruitment-IntroductionLetter.doc)

Rubin, Henry J. and Irene S. Rubin. Qualitative interviewing: The art of hearing data (2nd ed.). Thousand Oaks: Sage, 2004, p94-97.

Appendix E

Interview Consent Agreement

Study Title: A Case Study on Information Systems at PSU
Investigator: Maria Pantazis

Please consider this information carefully before deciding whether to participate in this research.

Participation is voluntary
It is your choice whether or not to participate in this research. If you choose to participate, you may change your mind and leave the study at any time. Refusal to participate or stopping your participation will involve no penalty or loss of benefits to which you are otherwise entitled.

What is the purpose of this research?
To demonstrate the strategic importance of information systems (IS) in higher education, and understand and highlight the challenges that institutions face when leading and managing IS policy in higher education settings. We are asking you to participate because the research will use interviews of The Pennsylvania State University faculty, students and staff to construct carefully the history of information systems at PSU.

How long will I take part in this research?
You will be asked to participate in one interview via telephone. The interview will take approximately thirty minutes to one hour. You may be recontacted for additional information or clarifications after your interview. If you are, your participation would be completely up to you. If you would prefer that we refrain from re-contacting you, please intital below:

Please do not re-contact me following the study: ____________

What can I expect if I take part in this research?
You will be asked to participate in one interview via telephone to answer questions about your experiences working with information systems at PSU, particularly as your position as student, faculty, staff or technologist relates to using information systems at your institution. With your permission, your name will be used so you can give your perspective and be represented fully in the case. You may also choose to remain anonymous.

Time required
The interview will take approximately thirty minutes to one hour.

What are the risks and possible discomforts?
No risks are anticipated.

Are there any benefits from being in this research study?
This is a chance for you to share your practical advice, success stories, disappointments, and experiences with information systems in higher education, and sharing your role in PSU history.

Will I be compensated for participating in this research?
You will not be compensated for participating in this research.

If I take part in this research, how will my privacy be protected? What happens to the information you collect?
If you wish to remain anonymous, I will use pseudonyms for your name and university department affiliation. At no time will the data I collect contain any information that can be used to easily identify you or your affiliation. My notes from our interviews will not be destroyed at the end of the study. I may use the responses for future projects on information systems in higher education. The electronic copies and transcribed notes from my interviews will be kept securely in a protected directory on my personal computer to which only I will have the password.

Participation and withdrawal
Your participation is completely voluntary, and you may withdraw from the study at any time without penalty. You may withdraw by informing me that you no longer wish to participate (no questions will be asked). You may also skip any question during the interview but continue to participate in the remainder of the study.

If I have any questions, concerns or complaints about this research study, who can I talk to?
If you have questions or concerns about this research, please contact the researcher for this project, Maria A. Pantazis, maf804@mail.harvard.edu. You may also contact the faculty member supervising this work: Professor Judith McLaughlin, Gutman 436, Harvard Graduate School of Education, (617) 495-3447, judith_mclaughlin@gse.harvard.edu.

Whom to contact about your rights in this research, for questions, concerns, suggestions, or complaints that are not being addressed by the researcher, or research-related harm:
This research has been reviewed by the Committee on the Use of Human Subjects in Research at Harvard University. They can be reached at 617-496-2847, 1414 Massachusetts Avenue, Second Floor, Cambridge, MA 02138, or cuhs@fas.harvard.edu for any of the following:

- If your questions, concerns, or complaints are not being answered by the research team,
- If you cannot reach the research team,
- If you want to talk to someone besides the research team, or
- If you have questions about your rights as a research participant.

Statement of Consent
I have read the information in this consent form. All my questions about the research have been answered to my satisfaction.

SIGNATURE
Your signature below indicates your permission to take part in this research. You will be provided with a copy of this consent form.

____
Printed name of participant

____ ____________
Signature of participant Date

Appendix F

Interview Protocol Template

Below, please find a general list of questions I hope to ask study participants. This interview protocol will be further customized for each individual as I hone in on the areas of expertise and perspective that each person can provide.

What is or was your role at Penn State?

What were your duties during the Penn State implementation? (designer, user)

What issues did you see as important that arose along the way, as Penn State built its information system, eLion?

How many years of work related IS experience do you have ?

How many years have you been employed by or have been a student at Penn State?

What is or was your experience with information systems at Penn State?

Have you ever experienced any major failures with the eLion system? Do you know what may have precipitated those failures?

Have you ever experienced a technical disaster? Please describe what happened. Who was involved? How was the crisis resolved?

(To an administrator/staff) Did Penn State consider input from students, faculty and personnel prior to its IS implementation? Was the input from one group weighed equally against the others?

(To an administrator/staff) How did you garner support internally from senior institution officers to support your information system initiative?

What lessons were learned in the process of implementing an IS at Penn State?

What recommendations might you have for those taking part in this kind of implementation process?

Are/were you satisfied with the information system, eLion, at Penn State? In what ways? In what ways could it be improved?

How would you define information systems (IS)?

Has IS helped you in your current role or past role at Penn State?

How does Penn State use IS to enhance the life of (students, administrators, faculty)?

In your opinion, how is eLion part of your institution's campus culture?

Is there enough training in the information system for students? For faculty? For personnel?

Appendix G

Index of Abbreviations

ACUI	-	Administrative Council on Undergraduate Instruction
ADIS	-	Alumni / Development Integrated Services
AIDA	-	Administrative Information Decision Aid
AIS	-	Administrative Information Systems
CAAS	-	Comprehensive Academic Advising System
CAAIS	-	Comprehensive Academic Advising and Information System
C&IS	-	The Office of Computer and Information Systems
CQI	-	Continuous quality improvement
DUS	-	Division of Undergraduate Studies
EDS	-	Electronic Data Systems
FTCAP	-	Freshman Testing, Counseling and Advising Program
IBIS	-	Integrated Business Information Systems
IS	-	Information System
ISIS	-	Integrated Student Information System
MS	-	Management Services
NACADA	-	The National Academic Advising Association
OAS	-	Office of Administrative Systems
OASIS	-	Open Access to Student Information System
PSU	-	Penn State University
SIS	-	Student Information System
SSC	-	Student System Committee
SSN	-	Student System News
TIPS	-	Telephone Information Penn State
URO	-	Registrar’s Office

Appendix H

Key Players

Penn State EDS Implementation Team Members

Augustson, J. Gary	1992	Director of Computer and Information Systems, Special Assistant to the President	CIO for 24 years Appointed July 15, 1982, retired January 19, 2006
Barron, Eric J.	2016	PSU President, 2014 – present	
Blythe, Kenneth	1992	Director of the Offices of Administration Services, Worked on Project Mandarin	Right hand man of Gary Augustson
Brush, L.M.	1974	Senior PSU Administrator	
Brighton, John A.	1992	Executive Vice President and Provost, 1991 – 1999	
Brughel, John F.	1984	Director of the Office of Student Aid	
Busges, Michael	2013	Project Director, Project LionPATH, 2013 - present	
Cahir, John	1994	Vice Provost and Dean for Undergraduate Studies	
Cartwright, Carol A.	1987	Member of Penn State faculty, 1967 – 1988	University Scholars Program, President Emerita Kent State University
Cunningham, Richard G.	1982	Vice President for Research and Graduate Studies	
Dickason, Donald G.	1984	Dean of Admissions	
Dunham, Robert	1982	Vice President of Academic Services, Chairman of the Student System Committee, Senior Vice President and Dean of the Commonwealth Educational System	38 year career at Penn State, 1959 – 1998
Eddy, Edward D.	1982	Provost, 1977 – 1983	
Ericson, Rodney	1995	Provost, 1999 – 2011 PSU President, 2011 – 2014	

Garban, Steven	1986	PSU Board Member, 1988-2012, Senior Vice President for Finance and Operations/Treasurer Emeritus of Penn State, 1986 – 2010, Controller, 1976 – 1986	Referred to as CFO by Gary Augustson, 1958 captain of PSU's football team
Gray, David		Senior Vice President for Finance and Business and the Treasurer, 2012 - present	
Haffner, Warren R.	1982	Registrar	
Harwood, John T.		Associate Vice Provost for Information Technology, 2010 – 2016, First IT Group Faculty Fellow	Faculty member and administrator at PSU since 1980
Herron, James M.	1971	Records Officer	
Hile, Gary	1994	Director of Academic Records	
Jordan, Bryce	1984	PSU President, 1983 – 1990	
Kelly, James	1981	Vice President of Undergraduate Studies, Academic Information Program Coordinator	
Kenepp, P.L.	1982	Director of Academic Information Systems	
Levinson, Adam	1984	Chairman of the USEC; Undergraduate Student Government President	
Marooney, Kevin	2006	Vice Provost for Information Technology/CIO, 2006 – 2015	Successor of Gary Augustson, 28 year career at PSU, starting in 1988 as a research programmer.
Melander, Eugene R.	1984	Associate Vice Provost for Academic Services	Romano's right hand man, 26 year career at PSU, 1973 - 1999
Miller, Frank P.	1994	Registrar of the York Campus	
Moellenbrick, George	1995	Director, Corporate and Foundation Relations	
Mortado, Loren M.	1983	Working Group Chair of the Bursar Group	

Mycek-Memoli, Anne	1996	CAAIS Technical Team leader, Registrar's Office	
Oswald, John	1981	PSU President, 1970 – 1983	
Rash, Ron	2016	Director of AIS, 2000 - 2016	
Richardson, William C.	1984	Executive Vice President and Provost, 1984 – 1990	President of John Hopkins University, 1990 – 1995
Romano, John	1994	Vice Provost and Dean for Enrollment Management and Administration; Vice President for Commonwealth Campuses, 2005 - 2010	42 year career at PSU, 1968 – 2010, retired, returned 2012 - 2013 as Interim Chancellor
Schultz, Gary C.	1982	University AIS project Manager, 1982, VP of Business Affairs, 1995 - 2009	40 year career at PSU 1971 – 2009, held administrative roles in business operations, finance and technology
Sevensky, Edward	1984	Admissions	
Sheeder, Richard	1983	Project Manager of AIS	
Smith, Scott	1992	IT Representative, Mandarin Project Leader	
Sodergreen, Richard	1984	Associate Registrar	
Spanier, Graham	2003	PSU President, 1995 – 2011	Member of Penn State faculty, 1973 - 1982
Sparks, Edwin	1908	PSU President, 1908 – 1920	
Thompson, Tom	1982	President of the Undergraduate Student Government's Academic Assembly	
Wager, James J.	2005	Director of Registration and Schedule, 1983 – 1992, University Registrar, 1991 – 1999, Assistant Vice Provost of Enrollment Management 1999 – 2006	32 year career at PSU, 1974 – 2006
Wager, Edward	1981	Records Officer	
Wall, Harvey W.	1973	Director of the Division of Undergraduate Studies, 1973	

		- 1986	
Wheeland, Keith	1984	Assistant Director of Management Services	
White, Eric	1994	Director of the Division of Undergraduate Studies	
Williams, Roger	1984	Executive Director of University Relations, 1984 - 1985	
Z, Mike	1986	The SIS was "dependent" on this person at PSU	Unable to ascertain Mike Z.'s identity.

Non Penn State Contributors

Goldstein, Phil	2010	External Consultant for IS Assessment
Hart, Mileage A.	1973	President of EDS
Koehler, Dave	1999	Cornell Employee, Mandarin Project
Starling, W. Lowell	1984	Senior Employee EDS
Viguers, Katherine	1984	EDS Programmer
Wyatt, Joseph	1981	Vice President for Administration at Harvard University, Consultant for PSU, wrote the RFP

Appendix I

PSU Registration Forms

PSU registration forms included:

1. A Permanent Home Address Card: The student listed their permanent mailing address, and where they claimed residency.
2. A card entitled "Statistical Information": This was for male undergraduate students only, as it detailed Selective Service Information.
3. A News Bureau Card: This piece of paper asked for the campus living information of students, as well as their parents' information.
4. A Personnel Card: Similar to the News Bureau Card, this card asked the student's plan for housing.
5. A Religious Preference card: This card was totally voluntary, and just asked what religion, if any the student professed. It also asked if the student participated in any campus religious groups.
6. A Diploma Card: This one was only for seniors, so the University could prepare for the big day at the end of the semester. (Foley, 2016)

Appendix J

PSU Futuristic Logical Design Features

On January 26, 1983, the logical design of the new SIS was accepted by the University and by over 70 working group and Student System Committee members. The logical design included some futuristic sounding things such as: acceptance of payments from "soon to be" students; bills that interfaced with aid and load accounts, and billing requests (for a specific college or campus). Student account transactions were automatically reported to the financial system and delinquent accounts flagged. The housing subsystem would have a conference record section to reserve rooms for up to two years for special conferences. Students could choose from up to seven meal options and duplicate contracts and advanced housing fees were acceptable. The academic records subsystem would include an online textbook request capability with direct reporting to the bookstore and automatic production of book orders. Academic holds moved online with automatic checks to authorize registrations, graduations, etc. Expectations were high. (Student Systems Committee Notes, January 1983).

Transcripts would be produced online with proper authorization. Registration and preregistration would allow users with proper permissions to register for specific courses. Degree audits could be produced both online by users and in batch mode by administrators. (Student Systems Committee Notes, January 1983).

Financial aid would have features to support the aid process, monitoring aid for athletes, tracking all correspondence with students, verifying application data during the year, reviewing and ensuring federal guidelines were met, and producing operation and year end reports. (Student Systems Committee Notes, January 1983).

The admissions subsystem was geared to both the graduate and undergraduate admissions subsystem and included the ability to build prospects of student data from a variety of sources for Undergraduate Admissions, Graduate Admissions, and Commonwealth Campus. Prospective student information would be automatically associated with data collected when an application was received. Various reports would be produced to support marketing and recruiting efforts. Special admission applicants could be easily identified and monitored for appropriate consideration. The system design called for the automatic production of correspondence to applicants for such items as missing information, admissions options, and special programs. Any part of the applicant record could be updated online. The functionality of the sub systems seemed to overreach the reality of PSU's circumstances. (Student Systems Committee Notes, January 1983).

Appendix K

Excerpts from the President's Statement and Charter on AIS Data Administration at Pennsylvania State University

> The Administrative Information System (AIS) is being developed in order to serve the information needs of all units across the University. With the introduction of integrated databases, the tasks of data administration must be clarified: system wide planning and policies must be developed; data management and information processing concepts must be researched, developed and implemented through communications and training; data access and security within the system must be managed; data availability to end users must be facilitated; and liaison must be provided to ensure effective communications among system participants.
>
> AIS data administration objectives at Penn State are derived from the goals for the management of data as an institutional resource: data are to be accurate, complete, accessible, and secure; information systems are to be coordinated, consistent, efficient, protected, flexible and accommodating. Based on these goals, the objectives of AIS data administration are to:
>
> - Provide planning and strategic information in support of AIS system and database design and development;
> - Increase the effectiveness of integrated AIS development; assist in developing and enforcing programming, testing, and documentation standards for the AIS;
> - Build a vocabulary for describing AIS data and system resources to ensure consistency in usage and interpretation of data;
> - Develop and maintain information about data for the AIS database;
> - Ensure the accuracy, completeness, security and timeliness of the AIS and databases;
> - Provide system support for appropriate access to AIS databases by information user offices;
> - Make information about the AIS data and system resources available to operational and informational user offices. (President's Statement and Charter on AIS Data Administration at Penn State, October 15, 1986, p. 1-2).

Appendix L

Meeting Notes and Documents Discussing the Strategic Future of ISIS

The planning document prioritized clusters of events that could require ISIS to be restructured for effectiveness. Some of the cluster of events also prioritized as high included:

> (Under the heading *restructuring for effectiveness*)
> 2. Support for higher education will continue to reflect the principle — the student as benefactor should pay major portions of costs. Federal and Commonwealth support will not increase beyond growth in the Consumer Price index.
> 5. As the faculty becomes more computerized, mail, forms, class lists, counseling notes and grade reports will be done electronically.
> (Under the heading *invisible student services*)
> 7. By the year 2001, students will not be required to stand in line for routine academic services.
> 8. By the year 2001, most admissions, financing, counseling and advising services will be supported by expert systems.
> 9. Degree entitlement will soon be determined by an enhanced degree audit system, with exceptions approved by the Dean's Office.
> 10. Soon the two second response time on the mainframe computer student system will be the norm. No transaction will run more than 20 seconds.
> 12. Computers are going to be used more and more to manage the delivery of student services.
> (Under the heading *educational consumerism*)
> 14. Technology will continue to grow as the central and dominant factor in the economy.
> 18. By the year 2001, financing products will predominate in student aid packaging in order for institutions to compete in the market place for students.
> 19. By the year 2001, registration and drop/add will be a year-round activity so that schedules will be set well before the beginning of the semester. Prerequisite checking will be accomplished during course registration.
> (Under the heading fourth *generation user initiatives*)
> 21. Computer technologies will promote decentralization and connectedness - of computer power and database. While mainframes will multiply, they will serve more in networking and distributing roles.
> 22. Competitive decisions, in the future, will be based on simplified ad hoc analysis of administrative data. (ISIS Strategic Planning: Cluster of Events, June 1988)

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