Chapter XIV

A Case of Information Systems Pre-Implementation Failure:

Pitfalls of Overlooking the Key Stakeholders' Interests

Christoph Schneider, Washington State University, USA

Suprateek Sarker, Washington State University, USA

EXECUTIVE SUMMARY

This case study examines an often overlooked context of information system failures, that of pre-implementation failure. It focuses on an Information Systems Development (ISD) project at a large public university that failed even before implementation could get under way. Specifically, it describes the vendor selection process of a proposed computerized maintenance management system. While the managers in charge of the project took great care to avoid commonly discussed types of information systems failures by emphasizing user involvement and trying to select the best possible system they could afford, non-functional requirements, procedures as outlined in the RFP, and the roles of relevant but relatively "hidden" decision makers during the pre-implementation stage of the project were overlooked. This led to the termination of the project after an appeal was lodged by a software vendor whose product had not been selected for implementation.

ORGANIZATIONAL BACKGROUND

UMaint is the maintenance department of a large public university (BigU[1]) in the northwest of the United States. Currently, about 18,000 students are enrolled at BigU, a large proportion of whom reside on-campus. This makes BigU's main campus one of the largest residential campuses in the Pacific Northwest. In addition to the student body, about 7,000 faculty and staff work on campus.

UMaint's employees are responsible for the maintenance of BigU, the campus area of which encompasses more than 400 buildings and over 1,930 acres of land. In a typical year, UMaint handles approximately 60,000 service calls, and schedules and completes 70,000 preventive maintenance projects for 69,000 pieces of equipment.

The primary departments of UMaint are Architectural, Engineering, and Construction Services, Utility Services, Custodial Services, and Maintenance Services. These departments are supported by UMaint's Administrative Services. Architectural, Engineering, and Construction Services are involved in all new construction projects as well as all modifications to existing facilities. The Utility Services department operates the university's power plant and is responsible for providing utilities such as steam, electricity, and water. Custodial Services, UMaint's largest department, handles the custodial work for all buildings and public areas on campus. Maintenance Services is divided into environmental operations, life safety and electronics, plant maintenance and repair, and operations, and is responsible for the upkeep of the university's buildings and facilities.

The Administrative Services department encompasses units such as operational accounting, personnel and payroll, storeroom, plant services (including motor pool, heavy equipment, trucking and waste, and incinerator operations), and management information systems. This department handles all supporting activities needed to coordinate and facilitate UMaint's primary activities. Overall, more than 450 employees work for UMaint in order to support the university's operations. Please refer to Appendix A for the organizational chart of UMaint.

SETTING THE STAGE

The major challenges faced by UMaint arose from the state's tight budget situation and increased competition from outside service suppliers. In order to deal with these challenges, UMaint had to constantly strive to reduce costs and streamline operations. One major obstacle to providing services efficiently and effectively, as is the case in many universities and even business organizations, was UMaint's outdated information systems infrastructure.

This infrastructure consisted primarily of an outdated mainframe, in which the applications were written in Natural and the databases were hosted in ADABAS. Administrative functions were conducted using form-based systems that had been developed in-house. Over the years, the systems had grown with the needs of UMaint. In the absence of an information systems (IS) department that was internal (or dedicated) to the needs of UMaint, the growth of the systems in this area has been rather uncontrolled, leading to a variety of different applications, the majority of which were incompatible with one another. In order to perform accounting, inventory management,

maintenance, and project development functions, the employees had to work with over 100 different databases. This situation led to a huge paper trail, the need for multiple paper copies of documents and considerable redundancy of work, which in turn resulted in the lack of data integrity, a major hindrance to efficient operations. As one manager explained "*... [UMaint has] someone three cubicles down from another person replicating the same work, unnecessarily."*[2]

In the mid-1990's, UMaint's director and departmental managers (hereafter referred to as top management) decided to implement a computerized maintenance management system (CMMS) in order to consolidate the legacy applications into one integrative system. With this, UMaint hoped to be able to provide more efficient and higher quality service, obtain more timely and accurate information for top management, and reduce costs for the customers by eliminating the need for multiple data entry and simultaneously reducing the potential for errors associated with the maintenance business processes. Additional goals were to increase the accountability of the organization as well as to better maintain the university's facilities. Appendix B displays typical features of a CMMS.

In order to achieve these goals, UMaint formed an implementation team consisting of employees representing different levels of the organization. These were charged with initiating the CMMS project. In the first stage, the primary task was to gather information about different CMMS vendors. As the members of the implementation team conducted all project-related activities in addition to their regular tasks, many of them spent additional hours in the evenings to work on the CMMS project, often leading to dissatisfaction among the project team-members. Unfortunately, the personal sacrifices of the team-members proved to be in vain, since shortly thereafter, work on the project was halted due to lack of adequate funds. A timeline of the events is shown in Appendix C. The idea of introducing a CMMS however was never completely abandoned. In the year 2000 (after the Y2K crisis never materialized), top management again decided to make a renewed commitment to implementing a CMMS. After a new president had been hired to take on leadership of BigU, a new strategic plan was set up for the entire university; one of the goals was to "create a shared commitment to quality in all … activities", which included to "develop strategies that foster a university culture dedicated to adopting and extending best practices that promote an ongoing commitment to continuous improvement". As this goal was closely linked to the services of UMaint, Jack, the director of UMaint, was invited to be a member of the implementation team for this goal. Since Jack had been with BigU for a long time, he therefore enjoys high credibility and good relationships with higher management, but as in most large institutions, he is constrained by his budget and the strategic goals of BigU. With the introduction of a CMMS, UMaint would clearly help BigU in achieving this goal, thus, funding seemed much more likely, and consequently, an internal IS department responsible for providing information services and technical support for UMaint's information systems was created. The IS department was also charged with the project of implementing the computerized maintenance management system. Currently, the information systems department consists of an Information Systems Manager ("Frank") and two Computer Systems Administrators, in addition to several computer-savvy college students serving as Support Staff.

Top management was very excited about the project and had a good grasp on the project's potential implications for the organization, a factor that would help in the

selection process (West & Shields, 1998). Specifically, Jack (the director of UMaint) strongly believed that "*the selection of a CMMS will affect the way [UMaint does] business for the next 10 years.*"

In addition to serving UMaint, the CMMS was supposed to serve BigU's housing department and Central Stores. University Housing would use the system to support all maintenance related aspects of their operations, as well as to manage its warehouse, and Central Stores would use the system for all procurement-related activities. Several other departments played a role in the process as well; for example, the university's Budget Office allocated the funds for the project and was hence involved in the purchasing process. As the total amount budgeted for the purchase of the CMMS exceeded $2,500, the acquisition had to be made through the university's Purchasing Department in the form of a bidding process; furthermore, due to the administrative, rather than academic or research related nature of the project and the fact that BigU is a state university, unsuccessful bidders had the option of filing a protest with the state's Department of Information Services (DIS) after the announcement of the final decision. The DIS had the authority to review and override any decisions made by UMaint. Furthermore, acting as an outside consultant (Piturro, 1999), the university's IS department provided guidance to UMaint's IS department during the selection process. Please refer to Appendix D for a diagram displaying how UMaint fits into the university's structure; Appendix E shows the major stakeholders of the proposed system.

Given that upper administration was well aware of the large impact the system would have, everyone agreed to implement and routinize the "best possible alternative" for the proposed system. Due to the limited resources, developing an integrated system in-house was not seen to be feasible. Therefore, it was decided to purchase a system from an outside vendor. Even though highly customized solutions can be problematic in the long run (Ragowsky & Stern, 1995), both off-the-shelf packages and solutions specifically designed for UMaint by interested vendors were considered.

CASE DESCRIPTION

In the practitioner literature, there has been a limited number of articles on software vendor selection processes; most of these articles have offered somewhat simplistic implementation guidelines such as having sufficient human resources, securing commitment by top management, conducting site visits, or being aware of possible problems associated with customized software (e.g., Ciotti, 1988; Piturro, 1999; Ragowsky & Stern, 1995; West & Shields, 1998). In addition, few academic IS researchers have directed attention to critically examining the process of software vendor selection; consequently, normative rational processes (Howcroft & Light, 2002) are seen to guide systems acquisition initiatives (Please refer to Appendix F for a model of the software vendor selection process). Even fewer have empirically studied the vendor selection process (e.g., Gustin, Daugherty, & Ellinger, 1997; Howcroft & Light, 2002; Lucas, Jr. & Spitler, 2000; Weber, Current, & Benton, 1991). A recent meta-analysis found that in information systems development process, user participation can influence IS success (e.g., Hwang & Thorn, 1999). Consistent with these findings, noted researchers such as Land (1982) have explained that in the software vendor selection process, user input is seen as an important step in determining business needs, which is fundamental to implementing a

successful system. According to Land (1982), user participation can be consultative, democratic, or responsible, where responsible participation implies the greatest influence on the part of the users. At UMaint, one of the first steps in the vendor selection process was to inquire about experiences with a CMMS implementation at similar institutions. Frank briefly described the experiences other universities had:

I talked to a lot of schools [that had] been through [this process], read a lot of implementations, and saw where the weaknesses were; the weaknesses were people not getting involved, I spent some time over at [WesternU], looking at them and their implementation, and one of the biggest regrets and problems was they didn't get people involved.

Just a few years ago, WesternU, another large university in the Northwest region of the US went through a similar process and faced severe implementation problems, partly due to lack of stakeholder involvement with the project *from the very beginning*. On talking to WesternU, Frank found out that:

...they went through this a couple of years ago, and have a vendor and have implemented it and are still in partial implementation, and they said the biggest problem that they had is when they went to train people and so many people down at the very lowest level claiming not to know what is going on, or not to be happy with the system.

Knowing about the beneficial effects of user involvement (Hwang & Thorn, 1999; Land, 1982; Schwab & Kallman, 1991), top management tried to involve their employees from the initiation stages of the project. Joan (the Assistant Director for Administrative Services) recognized the fact that it would be impossible to involve all employees directly; therefore, she strived to *inform* as many people as possible, rather than ensure *direct* participation from every employee:

We obviously selected a core group to work on it because every one of 400 people can't be involved...I'm not sure if they have the need to say vendor A is better than C or D or E, it's more the idea that, okay, it's going to change what I do, am I comfortable with that idea and then as far as which vendor we choose, they're going to have to learn something new, no matter what. So it's more trying to get them the information... them knowing about it, knowing that it's coming, and giving input where they can. But it's...it's very specific what they're going to be doing, and I think it's really important for them to know that it's happening and feel comfortable with the idea.

Therefore, committees were formed in order to involve people from all departments. The Executive Committee was responsible for making the formal decisions while the CMMS Evaluation Team was heavily involved in ranking and scoring the different vendors. In addition to these committees, process teams were created; these were charged with analyzing the workflows in different areas such as accounting, human resources, scheduling, preventive maintenance, or engineering and design. The Executive Committee consisted of UMaint's Director, his two assistants, and the IS manager. Members of Central Stores and University Housing were only represented in the

Evaluation Team. In fact, the CMMS Evaluation Team included members of every department of UMaint, with members being nominated by their respective department heads. Of the 51 members, 16 were managers/directors, 18 were supervisors/leads, and 17 were line employees. The process teams consisted of line employees as well as managers. To ensure adequate say of individuals who actually get the work done, several teams were led by line employees. A requirement from the beginning was that "every supervisor, every manager has to be involved." The committee members were expected to "involve all of their people in some way." In this way, the project leadership hoped to have as many people as possible participating in the selection process.

The implementation of the CMMS was planned in three stages. The first stage involved the request for proposal (RFP) process; the second stage consisted of the decision-making process, and the third stage, the actual implementation.

During the RFP process, the different process teams had to analyze the various business functions. This phase was not completed as smoothly as expected, since some of the groups did not put in the necessary effort. This was seen as a big concern during the RFP process when:

...every area that was going to be involved was requested to go out and say what's important to them. And that's where they didn't participate as fully as maybe another group. Some groups did an excellent job of saying I need this, this, this, this, this. And this is the ranking, this is what we need, this is what we've got to have, this is what would be nice. And we may have had...I think it is mainly one area that just kind of didn't do that very well. And I guess how that will be affected as if they, after we've chosen, come and say, oh, I've got to have this...well, you didn't have it in the RFP, we, I, can't know what's important for you. So that would probably... and laziness maybe is a bad word, but I think that's...they're just not choosing their priorities. Some people realize just how important the process was and some don't realize it... and may be impacted.

As the IS group was concerned with choosing the best possible system for the organization, its members decided to start analyzing the business functions themselves. This helped the groups to get started in the RFP process. Frank described his experience with the process as follows:

[We] charged all the groups to come up with [the business functions]; that didn't work out too well, the groups really didn't do a good job putting it together, so what happened was, we put them together. Our group did all of them and then what we did, we took 'em back to the groups and said okay, here's the storeroom piece, here is what we think is your function, but we're the wireheads, we're not the workers, we don't know their business, but from working with them, and doing what we have been doing up to this point, we felt we could at least get the ball rolling.

Having started the process, the IS group saw some improvement in participation, and most of the groups seemed more actively engaged in the RFP process:

...so we gave them basically something to react to. And that helped a lot. Then people started coming up with a lot of ideas, a lot of changes, and we started getting more

participation that way.... These folks really struggled with coming up with something on their own.

Participation was not seen as mandatory by top management, therefore, the CMMS Decision Team tried to motivate the employees to participate as much as possible. However, they also had the option to exercise power in order to get things done. Since UMaint's executive director was a big supporter of the CMMS project, Frank (the IS manager) mentioned that:

I also have an ace in the hole with the director, who's willing to come at any point and lay the hammer down if somebody don't do what we need them to. We don't do that unless we have to, but if we get into that situation where there's a work group or a person who's simply just not going to pull their share. We're trying to work with them and we're trying to motivate them, and get 'em excited and get their involvement, but otherwise, we just have to take it to another level if it is too critical. It's a big project.

Finally, the mandatory and desirable requirements were put together and the RFP was deemed acceptable by the state's Department of Information Services after a few minor revisions. According to the RFP (please refer to Appendix G for the required structure of the proposals), three vendors were supposed to be invited to conduct on-site product demonstrations. In regards to the requirements, the RFP stated that the proposed CMMS system had to be able to integrate the large number of databases currently used to manage accounting, maintenance, inventory, and project development needs. Furthermore, Microsoft Project Server 2002, Sharepoint Portal and Team Services, as well as several Access Data Projects needed to be integrated into the proposed system. As UMaint already had an existing information systems infrastructure consisting of more than 130 workstations running a combination of Windows NT 4.0, Windows 2000 professional and Windows XP operating systems, no substantial changes in client hardware were desired; however, if additional hardware such as servers would be needed for the implementation, this would have to be covered by the budget initially allocated to the project. Furthermore, it was expected that the vendors' systems would be compatible with the operating systems of the existing workstations. Finally, it was not anticipated to allocate human resources in addition to the IS department's current staff to the support of the CMMS system.

While certain non-functional requirements,[3] such as security of the transactions or scalability of the database, were considered to be important factors, a proven track record of successful implementations was considered more important than a system using the newest technologies.

Using the mandatory functional requirements, such as the ability to track the status of each shop assignment, request materials for a work order from a "Materials Management" module, trigger notices to responsible persons for potential problems with contract processes, or track equipment maintenance labor history, the executive committee was able to screen out a large number of vendors that initially had responded to the RFP, bringing down the number of potential vendors to six. Following recommendations provided in the practitioner literature (e.g., Raouf, Ali, & Duffuaa, 1993; Weber et al., 1991), these vendors were scored by the CMMS Evaluation Team according to the CMMS

requirements, technical requirements and capabilities, and vendor qualifications. Initially, only one bidder provided the required cost proposal (which did not comply with the RFP), hence it was decided to eliminate this criterion in this stage of the process and to reassign the weights of the remaining criteria. Based on a comparison of the summary scores, four vendors were invited to present their products to the CMMS Evaluation Team according to a scripted scenario. The attendees at the demonstrations had the opportunity to score each vendor's product using a standardized scoring package. The scores given were to be used during the final decision-making; at this point, the vendors that were invited to present their products were asked to re-submit their cost proposals.

In addition to helping with the selection, giving the attendants of the vendor demonstrations the opportunity to score the products was seen as a good way to involve people and to get their "buy in". Most members of the executive committee believed that many employees "just want to be involved, just want to be important," no matter "if things go their way or not." According to Joan, the scoring could be compared to voting, where everyone's vote counts. However, in contrast to management's beliefs, many members of the process teams felt that their input did not count at all, which led to dissatisfaction with the process.

Furthermore, some areas felt "shortchanged" during the vendor demonstrations, having felt that their area has not been considered enough during the demonstrations. Another factor adding to the dissatisfaction with the decision process was a lack of feedback from top management. One administrative employee complained:

...they had us do all kinds of stuff. You know, questions we needed to ask, how everything flows, how it needs to be done.... I'm just a little nervous because ... we put a lot of input in, but we didn't get much information back, or how it would affect us.

Even though the process team members were intended to funnel down the information, the information flow did not take place as expected; indeed, many employees did not receive much information about the proposed system. This problem was of great concern to upper management, as information sharing was seen as critical to the success of the process. Frank stated:

And one of the biggest challenges this place has is the information distribution. The information does not go from the top to the bottom. The manager hears it at a Tuesday manager meeting; it may be six months until the employee hears it. It's really embarrassing, but it happens a lot around here. With a project of this magnitude and complexity, you can't do that. The information has to reach everybody at every time. So one of the tasks for us was, how do we get information out. So we developed the project information site....

The project Web site was developed to provide access to announcements about the status of the vendor selection, vendor scores and rankings, background information about the vendors, and the like. Even though the Web site was seen as pretty effective by the IS group, it did not help to effectively spread the information throughout the entire organization, as the Web site was only accessible to CMMS Evaluation Team members and Executive Committee members.

Since the IS team was in charge of the CMMS project, meetings with line employees were set up in order to provide them with information and solicit feedback. Nevertheless, many employees were unaware of the proposed system's impact on their work. Generally, they saw "other" departments as being impacted to a greater extent, and did not anticipate their own day-to-day responsibilities to change much. Many employees regarded the CMMS as a tool for the higher echelons of administration. This led to a lack of interest in participating in the decision process, which thereafter translated to the perception that their departments had been left out of the process. For example, an employee mentioned:

...I don't know how it will really affect me, unless they would get a couple of modules that would really help out ***back here****. It's my understanding that they're just doing administration modules.... I do know that administration,* ***at the other end of this building****, had a lot of input.... I don't know that it will probably help* ***us*** *at this point. (emphasis added)*

Antagonism between departments added to such perceptions. As the criteria established for the vendor selection process were viewed as relatively inflexible and determined a priori , many employees saw their area as "covered," and did not see the point of providing additional input into the decision process, many hoping that the IS department, consisting of acknowledged experts, would select the right system for them. One employee, for example, stated that *"our info tech group... they do have the knowledge to make something run right and I don't."*

The information systems department was well aware of its power arising from the myths of their expertise and magic representing systems professionals as "high priests" (Hirschheim & Klein, 1989; Hirschheim & Newman, 1991) to influence decisions of non-IT employees in UMaint. However, it consciously tried to limit the extent of influence IS professionals would have on the decision process:

...we didn't want to influence anyone's decision. ... this isn't supposed to be about us ... this is about their achievement, this is their product in the end, we're just charged with implementing it. They're the ones who gonna have to use it every day and live with it. We wanted it to be about them, and that's why we've been so big about having their involvement....

Nevertheless, being in such an influential position, the IS manager noticed the benefits of being able to influence people's decision, as he was trying to choose the most adequate system for the organization:

...in many ways, we put our hands on the wheel. Because we basically had to come to a decision that works. Everybody, they're just gonna do whatever we say. So we better make sure that what we're saying is really what is the greatest good for everyone ... and that's one thing that has been very confident for us that we have always been striving for the absolute biggest bang for the buck.... Whatever we could get. The most we could do.

Finally, a decision was made by the Executive Committee based on a number of criteria, which included the weighted scores, reference calls conducted by evaluation team members, and finally, consideration of the budget. Before the final decision was made, an informal vote (that would not influence the final decision) was held. Interestingly, the selection made was not consistent with the results of the vote. The vendor that ranked first in the informal vote was not considered for selection, since its product did not meet the budget criteria. The vendor that ranked second had the newest technology and offered a highly customizable product; however, it was regarded as being too risky, as universities were considered an entirely new market for the vendor and was thus dropped from the selection. The vendor that was finally selected ranked third in the last informal vote.

Even though the vendor selected scored very high in terms of meeting the requirements, functions, and features, the decision found only partial support by many organizational members, including the IS department members. The IS group was not at all convinced that the product had necessary technological and functional capabilities. In a vendor review demonstration, an IS department member mentioned that the vendor's *"technology is severely outdated and does not offer any customization for the user."* Other departments also were not satisfied with the selection, with a member of the accounting team stating, *"...just the one that got chosen... we wished that it hadn't."* The storeroom, a very powerful unit of UMaint's administrative services department, shared the same thoughts: *"we were looking at [Vendor A] and [Vendor B]. These were what we thought were the two best, but other factors came into play in the decision making...."*

CURRENT CHALLENGES FACING THE ORGANIZATION

When the final decision was announced to the vendors, it was also not received too well by the vendors whose products had not been selected for implementation. One of the unsuccessful bidders decided to lodge an appeal with the state's department of information services. The members of the department of information services, who had not been at all involved during the selection process, took only a very short time to review the decision and mandate the termination of the project based on procedural errors. As contended by the unsuccessful bidder, the change in scoring criteria for the first stage could not be considered a harmless error, as vendors might have otherwise submitted different proposals. Furthermore, asking the vendors to re-submit cost proposals could be considered a "best-and-final offer" procedure, which was explicitly ruled out in the initial RFP. On the other hand, not asking the vendors for a renewed cost proposal would have led to the elimination of all vendors but one during the first evaluation stage, rendering the RFP process "just a paper chase" (Ciotti, 1988, p. 48). Making a new selection, as recommended by the State's IS department, would not only mean reviewing the original decision, but also reverting to the beginning stages of the project. In order to select a different vendor, the entire selection process would have to be started anew, including sending out a request for proposals, inviting candidates for product demonstrations, scoring the different products, and making reference calls. As this process

would most likely continue well into the following year, funding for the project was not automatically valid any more. UMaint would have to reapply for funding, and in light of the state's tight budget situation, getting funds for such a project a second time seemed highly unlikely.

As of 2003, no computerized maintenance management system was implemented at UMaint. Frank (the IS manager), reflecting on the sequence of events in the project, still remains perplexed about why the initiative turned out to be a disaster, despite all his and his colleagues' efforts to consciously manage stakeholder input and thus avoid failure, so he approached an IS academic to find out the reasons for the failure of the current project, how UMaint's current project could be "salvaged", and how similar problems could be avoided in future projects.

REFERENCES

Ciotti, V. (1988). The request for proposal: Is it just a paper chase? *Healthcare Financial Management, 42*(6), 48-50.

Gustin, C. M., Daugherty, P. J., & Ellinger, A. E. (1997). Supplier selection decisions in systems/software purchases. *International Journal of Purchasing and Materials, 33*(4), 41-46.

Hirschheim, R., & Klein, H. K. (1989). Four paradigms of information systems development. *Communications of the ACM, 32*(10), 1199-1216.

Hirschheim, R., & Newman, M. (1991). Symbolism and information systems development: Myth, metaphor, and magic. *Information Systems Research, 2*(1), 29-62.

Howcroft, D., & Light, B. (2002). A study of user involvement in packaged software selection. In L. Applegate, R. Galliers, & J. I. DeGross (Eds.), *Proc. of the 23rd Int. Conf. on Information Systems,* Barcelona, Spain, December 15-18 (pp. 69-77).

Hwang, M. I., & Thorn, R. G. (1999). The effect of user engagement on system success: A meta-analytical integration of research findings. *Information & Management, 35*(4), 229-239.

Land, F. F. (1982). Tutorial. *The Computer Journal, 25*(2), 283-285.

Lucas Jr., H. C., & Spitler, V. (2000). Implementation in a world of workstations and networks. *Information & Management, 38*(2), 119-128.

Managestar. (n.d.). manageStar — Products. Retrieved May 3, 2004: http://*www.managestar.com/facility_mgmt.html*

Piturro, M. (1999). How midsize companies are buying ERP. *Journal of Accountancy, 188*(3), 41-48.

Ragowsky, A., & Stern, M. (1995). How to select application software. *Journal of Systems Management, 46*(5), 50-54.

Raouf, A., Ali, Z., & Duffuaa, S. O. (1993). Evaluating a computerized maintenance management system. *International Journal of Operations & Production Management, 13*(3), 38-48.

Schwab, S. F., & Kallman, E. A. (1991). The software selection process can't always go by the book. *Journal of Systems Management, 42*(5), 9-17.

Weber, C. A., Current, J. R., & Benton, W. C. (1991). Vendor selection criteria and methods. *European Journal of Operational Research, 50*, 2-18.

West, R., & Shields, M. (1998). Strategic software selection. *Management Accounting, August*, 3-7.

ENDNOTES

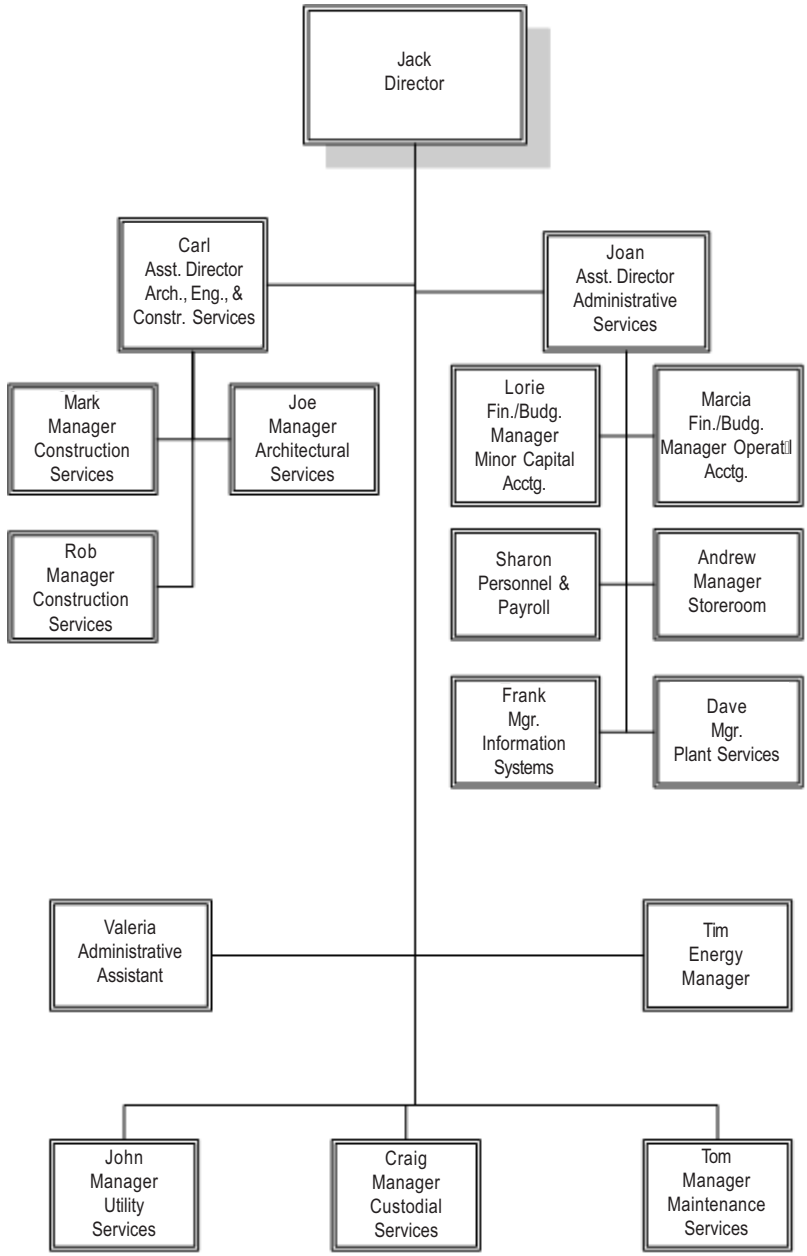
1 Names of the university and its divisions have been replaced by pseudonyms. Further, the identities of the employees of the university and other stakeholders of the system have been disguised to ensure confidentiality.

2 For the sake of authenticity, the quotations have not been edited.

3 i.e., technical or infrastructure related requirements such as scalability or technical potential for the future

APPENDIX A

Organizational Chart of UMaint



APPENDIX B

Typical Features of a CMMS

Work Order Management

- Receive and route web-based work requests.
- Obtain approvals as part of the workflow if necessary.
- Receive alerts on critical issues in your workflow.
- View a comprehensive list of work in process — work plans, schedules, costs, labor, materials, assets and attached documents.
- View overdue work, or sort work orders on a place, space, asset or engineer basis.
- Set-up predetermined workflow processes or create them on the fly, assigning work orders to available personnel.
- Link related work orders.
- Send clarifications that are tracked in the message history.
- Attach documents, including drawings, specs, and more.

Asset Management

- Click on an asset to launch a work order.
- Maintain all critical asset information.
- Do preventive maintenance.
- Track and get alerts on asset contracts or leases.
- Track assets, costs, histories and failures.
- Link assets to a work order, place, space, project or contract.
- Drill down in your organization to locate assets.
- Get reminders and alerts on any element of the asset.
- Attach documents, such as diagrams, to the asset.

Inventory Management

- Receive minimum/maximum alerts on inventory levels.
- Allow employees to request or order products.
- Add any products to a service delivery, e.g., a new computer for a new employee set-up.
- Kick-off automatic purchase orders to pre-approved vendors.
- Track Bill of Materials, SKU, price, stock, description, vendor and transaction information.
- Connect inventory with specific budgets to track exact costs.

Project Management

- Kick-off new projects with a few clicks.
- Monitor project schedules and milestones on real-time interactive Gantt charts.
- Track budgeted vs. actual spending on a project-by-project basis.
- Manage resources by viewing project analyses.
- Issue service requests within projects and build into Gantt charts.
- Draw relationships between projects, people, places, things, contracts, POs, inventory, vendors and more.
- Attach and share documents.

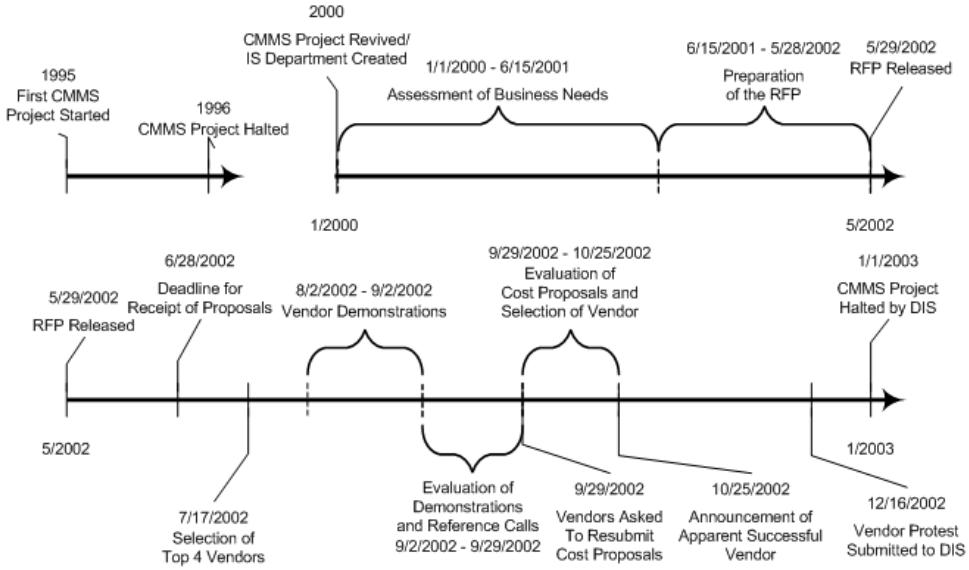
Procurement Management

- Route POs and invoices automatically.
- Receive approvals and responses automatically.
- Set amounts that require approval and workflow automatically obtains it.
- Integrate with financials.
- Automate all procurement of services, independent contractors, vendors, etc.
- Create and broadcast requests for proposals.
- Track and compare all out-bound and in-bound proposal and bids.
- Negotiate online with vendors.
- Attach proposals to people, places or things as well as projects and contracts.
- Send proposals out in workflow for review and approval.

Adapted from: ManageStar (n.d.)

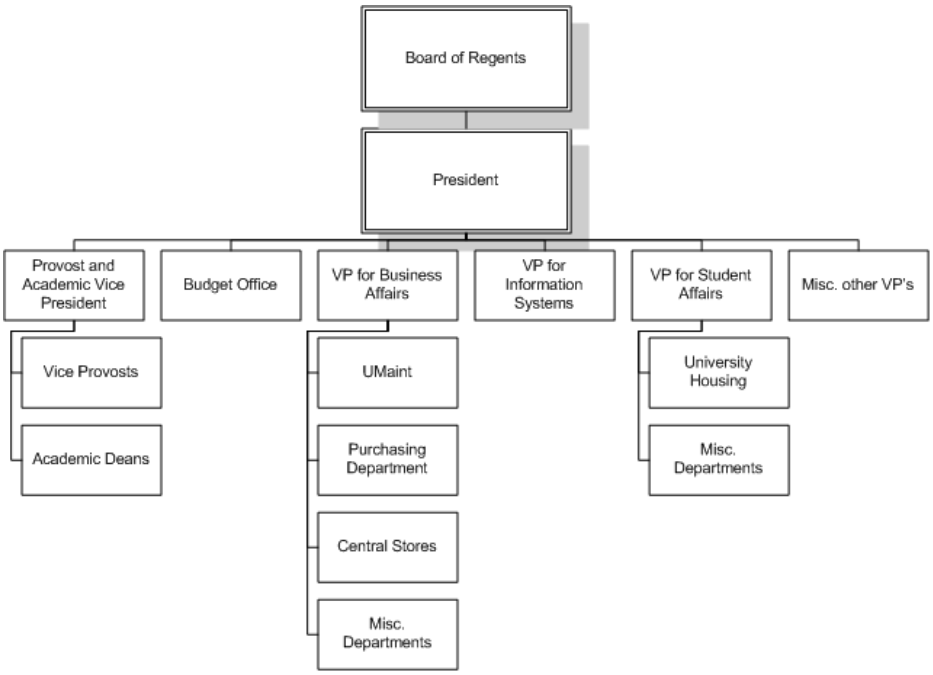
APPENDIX C

Timeline of the CMMS Project



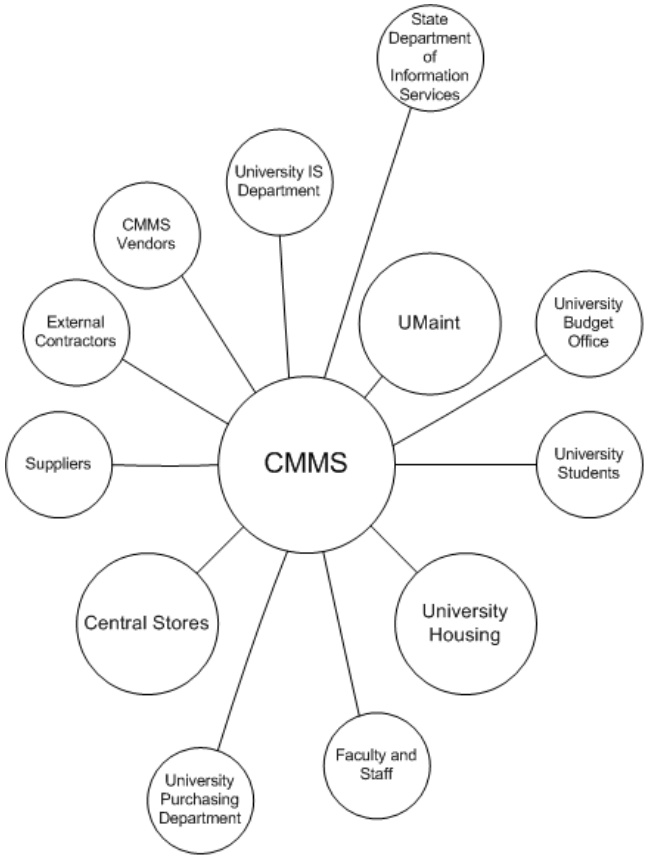
APPENDIX D

Organizational Chart of BigU



APPENDIX E

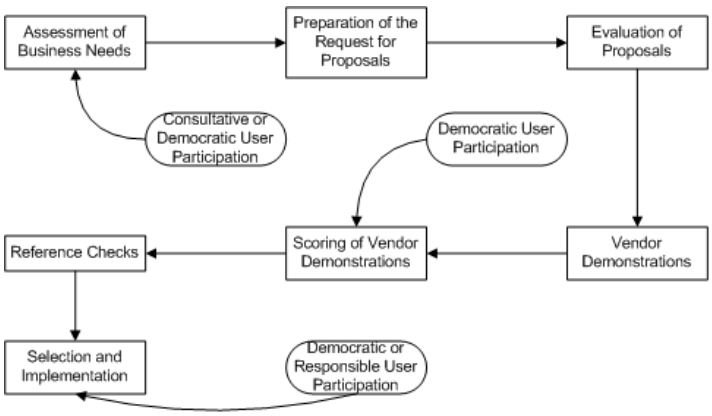
Stakeholders of the Proposed System



Adapted from West & Shields (1998) and Land (1982)

APPENDIX F

Vendor Selection Process



Adapted from West & Shields (1998) and Land (1982)

APPENDIX G

Contents of the Proposal

1. Proposal Contents

The sections of the vendor proposal should be as follows:

Section 1 Transmittal Letter *(signed paper copy must also be included)*
Section 2 Administrative Requirements *(see 3)*
Section 3 CMMS Requirements, Functions and Features *(responses in Attachment x)*
Section 4 Technical Requirements and Capabilities *(responses in Attachment xx)*
Section 5 Vendor Qualifications *(responses in Attachment xxx)*
Section 6 Cost Proposals *(responses in Attachment xxxx)*

All vendors must use the RFP templates and format provided on the CMMS website.

2. Section 1 - Transmittal Letter

The transmittal letter must be on the vendor's letterhead and signed by a person authorized to make obligations committing the vendor to the proposal. Contact information for the primary contact for this proposal must also be included.

3. Section 2 - Administrative Requirements

This section of the proposal must include the following information:

a) A brief (no more than three pages) executive summary of the vendor's proposal including:
   1. A high-level overview of your product and the distinguishing characteristics of your proposal.
   2. Indicate the number of universities using the system as proposed. "System" is defined as the vendor's current version of the software with all the functionality proposed in the response to this RFP.
   3. Describe how closely the proposed system matches UMaint's needs.
   4. Discuss what attributes of your proposal offer BigU a distinguishing long-term vendor relationship.

b) A specific statement of commitment to provide local installation for the system.

c) A specific statement warranting that for a period of five years after acceptance of the first application software, that all application software will continue to be compatible with the selected hardware and system software, and will be supported by the vendor. This does not include the database software and hardware to be selected by BigU.

d) For proposal certification, the vendor must certify in writing:
   1. That all vendor proposal terms, including prices, will remain in effect for a minimum of 180 days after the Proposal Due Date.
   2. That the proposed software is currently marketed and sold under the vendor's most current release only (or be added within six months)
   3. That all proposed capabilities can be demonstrated by the vendor in their most current release of the system.
   4. That all proposed operational software has been in a production environment at three non-vendor owned customer sites for a period of 180 days prior to the Proposal Due Date (except in cases where custom or new functionality is designed for BigU)
   5. Acceptance of the State's Department of Information Services (DIS) Terms and Conditions.

4. Section 3 - CMMS Requirements, Functions, and Features

Section 3 responses of this RFP contain mandatory and desired features for specific CMMS application modules. This requires coded responses only.

5. Section 4 - Technical Requirements and Capabilities

Section 4 responses of this RFP ask the vendor to identify the computer system software environment for the CMMS, and to provide additional technical information regarding system interfaces, hardware requirements, and application flexibility/enhancements. Answers to these questions should be provided with both narrative and coded responses.

6. Section 5 - Vendor Qualifications

Section 5 responses of the RFP requires the vendor to provide information about the vendor organization and customer base; and to propose support capabilities in terms of design, installation, data conversion, training, and maintenance of the proposed system. This information is to be provided in narrative format.

7. Section 6 - Cost Proposal Instructions

Section 6 of the RFP contains the formats and instructions for completing the cost proposal. Section 6.2 (Instructions) requests five-year summary costing for:

a) Application software (including upgrades and customization).
b) Software maintenance.
c) Services (installation, training, interfaces, project management, conversions, etc.).