



Rensselaer

Rensselaer Polytechnic Institute

Data Warehouse Requirements Analysis and Prioritization

Findings and Recommendations

Final

DecisionWorks Consulting, Inc.
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| | |
|--|-----------|
| EXECUTIVE OVERVIEW | 3 |
| PROJECT APPROACH | 3 |
| HIGH-LEVEL BUSINESS REQUIREMENTS | 3 |
| SUCCESS CRITERIA | 4 |
| OPPORTUNITY PRIORITIZATION | 4 |
| PROJECT APPROACH | 5 |
| BACKGROUND | 5 |
| PROCESS AND PARTICIPANTS | 5 |
| BUSINESS REQUIREMENTS | 8 |
| HIGH LEVEL THEMES | 8 |
| CURRENT INFORMATION ENVIRONMENT | 8 |
| OPPORTUNITY MATRIX..... | 8 |
| ENROLLMENT ANALYSIS..... | 10 |
| STUDENT PIPELINE ANALYSIS | 11 |
| FACULTY WORKLOAD ANALYSIS | 13 |
| FINANCIAL ANALYSIS | 13 |
| CONTRACT AND GRANTS ANALYSIS | 14 |
| PROPOSAL PIPELINE ANALYSIS | 15 |
| FINANCIAL ANALYSIS - RESEARCH..... | 15 |
| GRADUATE FINANCIAL AID ANALYSIS..... | 16 |
| ALUMNI DEMOGRAPHICS AND TRACKING..... | 16 |
| ALUMNI CONTACT MANAGEMENT | 17 |
| HUMAN RESOURCES..... | 18 |
| FACILITIES MANAGEMENT | 18 |
| ADDITIONAL REQUIREMENTS..... | 19 |
| SUCCESS CRITERIA | 21 |
| OPPORTUNITY PRIORITIZATION..... | 22 |
| RISKS AND RECOMMENDATIONS | 25 |
| PROJECT MANAGEMENT | 25 |
| DATA ISSUES..... | 26 |
| ORGANIZATIONAL BUY-IN..... | 26 |

Executive Overview

Project Approach

Rensselaer Polytechnic Institute (RPI) wants to better leverage the wealth of information being collected by their operational source systems, especially student, research, financial, human resources, and alumni information. A high priority initiative that emerged from last year's performance planning was a data warehouse project to be led by the Division of Chief Information Officer (DotCIO). To ensure RPI is taking a requirement driven approach to building the data warehouse, RPI contracted with DecisionWorks to conduct a business requirements analysis project. The goals of this project were to identify data warehouse requirements and facilitate the prioritization of warehouse deliverables. RPI wants to make sure they're on the right track before expending resources and/or making significant investments.

High-Level Business Requirements

Portfolio managers across campus are interested in better leveraging data in support of the Rensselaer Plan. Portfolio managers envision an analytic environment that will improve their ability to support the new planning environment and enable them to meet Cabinet members' expectations that their decision-making process is supported by appropriate data. Regardless of functional organization, their requirements focus on improved, direct access to more detailed, more consistent, and more integrated information. Users are especially interested in integrated data spanning RPI's student relationships, grants, and financial processes.

The current analytic environment at RPI is very decentralized. It has spawned countless shadow systems to support portfolio managers' reporting requirements. There is a campus-wide lack of access to decision-making data. As a result, Rensselaer does not currently have an ardent analytic culture.

A number of analytic requirements or themes were identified during the interviews. Each of the following requirements is discussed in greater detail in the attached document:

- Enrollment Analysis
- Student Pipeline Analysis
- Faculty Workload Analysis
- Financial Analysis
- Contracts and Grants Analysis
- Proposal Pipeline Analysis
- Financial Analysis - Research
- Graduate Financial Aid Analysis
- Alumni Demographic Analysis
- Alumni Contact Management
- Human Resources
- Facilities Management Analysis

Success Criteria

Overwhelmingly, the most often-mentioned success criterion for the data warehouse was for an environment that is easy to use. The participants have a strong desire for a system that is intuitive and readily understandable to a typical campus user. The system should support slicing and dicing of data to enable a user to pose a question from many different angles. The data should be clearly defined for ready interpretation of the results.

The second most frequently mentioned success criterion was accessibility. The data warehouse data should be accessible to users campus-wide. The portfolios should not be dependent on an intermediary for access to decision-making data.

There were several other less frequently mentioned success criteria:

- The data warehouse needs to be responsive to ad hoc requests.
- The data warehouse needs to contain the “right” information. The data should be consistent, accurate, and timely.
- Finally, the data in the data warehouse should be credible. Portfolio managers should be able to utilize analyses from the data warehouse to make decisions with confidence and with the support of the Cabinet.

Opportunity Prioritization

On October 3, DecisionWorks facilitated a joint meeting with the data warehouse Sponsorship and Steering Committees to review and prioritize the requirements uncovered by the Requirements Analysis project. During this session, there was healthy discussion over the relative value, technical feasibility and prioritization of each opportunity.

During the meeting, each requirement was mapped onto a matrix. The business value and technical feasibility of each requirement was discussed. They were plotted on a quadrant based upon their relative organizational value and technical feasibility. Technical feasibility refers to the current “degree of difficulty” in implementing a data warehouse application at RPI relative to data availability.

A consensus was not reached on the initial data warehouse priorities in that session. Six requirements were determined to be high priority opportunities requiring further discussion. The Sponsorship and Steering Committees agreed to meet again at a later date to further discuss the prioritization issues and select an initial phase for the data warehouse project.

On October 18, the group reconvened and reconsidered the prioritization issues. DecisionWorks did not attend this session. It was agreed that both the student and finance related requirements are extremely important to Rensselaer. In the end, the group unanimously selected Financial Analysis as the highest priority requirement and the initial phase for the data warehouse project. The project goal is to deliver this capability in late summer 2002. The group did not prioritize the other requirements, leaving subsequent phases open for further discussion.

Project Approach

Background

Rensselaer Polytechnic Institute (RPI) wants to better leverage the wealth of information being collected by their operational source systems, especially student, research, financial, human resources, and alumni information. A priority that emerged from performance planning last year was to initiate a Data Warehouse project to be led by the Division of Chief Information Officer (DotCIO). Recognizing the opportunity to better leverage the vast information available, the DotCIO spearheaded an initiative to develop a data warehouse. RPI wants to ensure they are taking a requirements driven approach to building their data warehouse.

In order to meet this objective, RPI contracted with DecisionWorks to conduct a business requirements analysis project to identify data warehouse requirements and facilitate the prioritization of warehouse deliverables. RPI wants to make sure they're on the right track before expending resources and/or making significant investments. The objectives of this effort were to:

- Identify and document the high priority analytic requirements.
- Gain organizational consensus regarding the initial project scope.

Process and Participants

Thirty-one interviews were conducted with forty-nine individuals representing a wide variety of portfolios across RPI. The interviewees also represented a vertical span of the Institute. The interviews focused on the vision, goals, performance plan objectives, and supporting information and analysis requirements of the participants.

The complete interview listing is detailed in the following table.

| Interview | Date |
|--|--------------|
| Schools/Departments | |
| Faye Duchin, Dean Button | September 10 |
| Joseph Flaherty, Sam Wait | September 10 |
| Mark Holmes, David Spooner, John Tichy | September 10 |
| James Watt | September 11 |
| William Baeslack | September 12 |
| Alan Balfour, Dale Masten | September 13 |
| Robert Baron | September 13 |
| Sandy Butcher, Rose Boshoff, Trish Lyons | September 14 |

| | |
|---|--------------|
| Student Records | |
| Sharon Kunkel | September 10 |
| Institute Advancement | |
| Margery Whiteman, Tim Gergich | September 10 |
| David Haviland, Dave Bohan, Terry Patton, Tim Gergich | September 14 |
| DotCIO | |
| Ora Fish, John Bradley | September 10 |
| John Kolb | September 12 |
| Deborah Rott | September 12 |
| Mark Sullivan | September 13 |
| Provost | |
| Gary Gabriele | September 11 |
| Deborah Nazon | September 11 |
| Tom Apple, Gary Gabriele | September 11 |
| Research | |
| Art Sanderson | September 11 |
| Pat Gray, Richard Scammell | September 13 |
| Finance | |
| Virginia Gregg | September 11 |
| Eileen McLoughlin, Helen Grzymala | September 14 |
| Professional and Distant Learning | |
| William Jennings | September 12 |
| Kim Scalzo | September 13 |
| Student Life | |
| Eddie Knowles | October 9 |
| Government and Community Relations | |
| Larry Snavley | September 12 |
| Office of the President | |
| Cynthia McIntyre, Charles Carletta | September 13 |
| Dr. Shirley Jackson | October 3 |

| | |
|---|--------------|
| Human Resources | |
| Curtis Powell, Cindy Price | September 13 |
| Enrollment Management | |
| Teresa Duffy, Glenna Ryan, Jack Mahoney | September 13 |
| Administration | |
| Mary Alice O'Brien, Ann LoPonto, Steve Schwan | September 14 |

The interview schedule was impacted by the external events of the week of September 10. As a consequence, Bud Peterson was unable to participate in the interview process. Following the interviews, the findings were consolidated and data warehouse opportunities identified. These opportunities were presented on October 3, 2001 at a combined meeting of the data warehouse Sponsorship and Steering Committees. This group reviewed the requirements and began the prioritization process of the initial phases of the data warehouse project. On October 18, this group reconvened and finalized the prioritization of the initial phase of the data warehouse project.

This document serves as the written deliverable from the Requirements Analysis Project. The finalized content will be shared with the Steering and Sponsorship Committees and interview participants to ensure a common understanding regarding the data warehouse's initial project priorities and direction.

Business Requirements

High Level Themes

Portfolio managers across campus are interested in better leveraging data in support of the Rensselaer Plan. Before delving into detailed descriptions of each requirement, there were several high level themes that emerged from the interviews. Although the users' specific needs varied by function, there was a common interest in the following shared objectives.

Portfolio managers envision an analytic environment that will improve their ability to support the new planning environment. Cabinet members expect the portfolio managers' decision-making process will be supported by appropriate data. It is important the portfolio managers have the proper analytic support to enable better, smarter decisions as they endeavor to attain RPI's aggressive growth goals. Portfolio managers find it difficult to determine and report the current status of their portfolio, let alone measure and track their success over time vis-a-vis the Rensselaer Plan. The entire campus is interested in improving the overall understanding of the Rensselaer community including students, faculty, staff, alumni and friends.

There is widespread agreement that meaningful opportunities exist for RPI to embrace more fact-based decision making. There is a significant amount of data captured across RPI, but little of this data is well leveraged for decision making. Historically, the portfolio managers have relied heavily on anecdotal evidence. The organization appears to be poised to embrace a shift from this anecdotal-based culture to a more centralized, analytic decision-making culture. This change is deemed a necessary cultural shift for RPI to successfully achieve its goals.

Current Information Environment

The current analytic environment at RPI is very decentralized and not well coordinated. There is a campus-wide lack of access to consistent and integrated decision-making data. In today's environment, data access and analysis are "just too hard." As a result, Rensselaer does not have a very strong analytic culture.

The current environment has spawned widespread duplication of effort. Countless shadow systems exist to support portfolio managers' reporting requirements. Data is frequently re-keyed from hard copy reports into the shadow systems. These systems exist at all levels: departments, schools, administrative areas, etc. Portfolios without a shadow system rely on a series of three-ring binders for most of their historical reporting and analysis.

Opportunity Matrix

The campus users at RPI are interested in further leveraging information to achieve their objectives. Regardless of their functional organization, their requirements focus on improved, direct access to more detailed, more consistent, and more integrated information. Users are especially

interested in integrated data spanning RPI's student relationships and financial processes, including research grants.

A number of analytic opportunities or themes were identified by business process during the interviews. The most commonly requested business processes are included in the matrix in Figure 1. For each business process, we identified the constituencies that indicated an interest in that process. The shaded boxes indicate the areas of higher priority for each constituency.

Each of these interrelated themes is described in greater detail below, along with typical analytic questions representative of the requirements. DecisionWorks' observations regarding the feasibility, issues and priorities of each requirement are also included. The feasibility of each requirement was ranked based on a scale of low, moderate, and high. Please refer to page 22 for a more detailed discussion regarding how the feasibilities were determined.

| BUSINESS PROCESSES | CONSTITUENCIES | | | | | | | | | | | |
|----------------------------------|----------------|--------------|-----------|----------------|----------------|----------|---------|-----------------|------------------|----|-----------------|--------------|
| | Schools/Deans | Dep't Chairs | Registrar | Institute Adv. | Provost Office | Research | Finance | Gov't Relations | Presidents Staff | HR | Enrollment Mgmt | Student Life |
| Enrollment Analysis | X | X | X | X | X | | | | X | | X | X |
| Student Pipeline Analysis | X | X | | | X | | | | | | X | X |
| Faculty Workload Assessment | X | X | | | X | | | X | X | | | X |
| Financial Analysis | X | X | | | | | X | X | | | | |
| Contract and Grants Analysis | X | X | | | | X | | X | X | | | |
| Proposal Pipeline Analysis | X | X | | | | X | | X | | | | |
| Financial Analysis - Research | X | X | | | | X | X | X | X | | | |
| Graduate Financial Aid | X | X | | | | X | | | | | | |
| Alumni Demographics and Tracking | X | X | | X | X | | | X | | | | X |
| Alumni Contact Management | X | | | X | | | | | | | | |
| Human Resources | X | | | | X | | X | | | X | | X |
| Facilities Management | X | | | | X | X | | | | | | |

Figure 1 - Opportunity Matrix

Enrollment Analysis

Enrollment analysis provides support for detailed analysis of student registration information. This includes class registration, grades, instructors and class location information for each student throughout their life at Rensselaer. This information will support an array of analyses:

- What does the student population look like? What is the demographic make-up? Ethnicity? Diversity? Incoming credentials? GPA?
- What classes are offered? When? By facility? How many students? At what times? Which days? Are we a four-day per week campus?
- How are our students progressing academically? Who's on track? Who's not?
- Which grad students have taken their qualifying exams? Are they on time? Who's at risk?
- What is our retention rate? By class? School? Department? Discipline? Ethnicity? Major?
- How are different affinities progressing? Which environmental issues ultimately impact performance? Residence? Student activities? Athletics? Community involvement?
- How many IT students took XYZ class? How did they do?
- How long does it take to get a degree in a specific major? What is the average time to degree?
- How many degrees are awarded by a given school or department? How long does it take? Undergrad? Grad?
- What is the average grade per class? How does this trend against previous offerings? Are we experiencing grade inflation? What is the grade distribution by instructor?
- Which students are candidates/participants in a given program? (e.g., female mentoring program)
- How many grad students are supported as RAs? TAs? Self-supported?

Much of the most interesting analysis of class registration information surrounds the demographic makeup of the student population. Enrollment analysis requires providing a rich set of student data to support a variety of insights into students including, but not limited to:

- Incoming credentials
- Incoming SAT scores
- GPA
- Total credit hours
- Discipline issues
- Gender
- Ethnicity
- International
- Co-op
- Company for distant learning and professional students
- Major/dual major
- Grad/undergrad
- Part time/full time

- Student activities such as athletics, groups, community involvement
- Residence – Specific dorm, fraternity, sorority, off campus
- High school
- School, department, campus

The registration information for each student needs to be available to support analysis in combination with this rich demographic student data including the registered classes, the instructor, credit hours, facility, and grades. This information will also support some of the more mundane reporting, such as timely class lists and a variety of ranking and advisor reports.

Currently, registration information is captured in Banner. However, it is not readily available to portfolio managers. Student Records allocates two of its staff members knowledgeable about this data to respond to campus requests for enrollment information. They utilize Access to provide the data. They feel this process is difficult and slow. It typically takes them a couple of days to respond to a request.

Improved analysis of enrollment data will help Rensselaer continue to provide outstanding and distinctive education. Portfolio managers will be able to better assess effectiveness and identify opportunities to improve academic programs. This capability will also improve Rensselaer's overall understanding of students, enabling enhanced support for first year initiatives. Today, it is difficult for a department to gain access to something as simple as a list of incoming freshman.

The feasibility of implementing this opportunity is very high. From a data perspective, it is the most feasible opportunity identified. The enrollment data is readily available in Banner. The data warehouse team is familiar with the data since it is the same data utilized in the data warehouse prototype.

Some student demographic data is not captured in Banner and is not readily available. Student activities data is captured at the student union, but not included in Banner. This data will require additional effort to incorporate. Likewise, community involvement data, program participation, and grad student exam data are not captured in a readily available source. The ethnicity data currently captured in Banner is self-reported and considered incomplete and inaccurate. There is another source of this data that is considered more accurate. This source (Office of Minority Student Affairs - OMSA) should become the owner for the ethnicity data captured in Banner to assure that RPI has a single, consistent point of capture for this data.

Student Pipeline Analysis

Student pipeline analysis is the ability to track a student's status from application through acceptance, enrollment, and registration all the way to graduation. For applicants, especially grad student applicants, this provides the ability to track an applicant's specific status (e.g., have their recommendations been received?). Combined with the detailed student demographic information described earlier, portfolio managers will be

able to analyze the characteristics of the incoming class early enough in the admissions process to adapt and change. For example, if there is an inconsistency between the incoming class's diversity mix and RPI's goals, there will be adequate time to react and put in place programs to reconcile this inconsistency. Typical analytic questions that might be posed:

- How many applicants do we have? Grad students? Undergrad? By school? Department? Discipline? Gender?
- Which grad student applicants have a key requirement that is missing or late?
- What is the discount rate of the incoming class? Is the discount rate above or below plan? Which applicants can we focus on to impact the discount rate? What decisions could we make to impact the rate?
- Where do our applicants come from? Grad? Undergrad?
- Who are the key recommenders?
- What are our most successful sources of grad students?
- What is the quality of our applicants? Of our incoming class?

Enrollment Management supports current campus request for access to undergrad applicant information. Data is obtained from Banner and maintained in an Access-based shadow system for analysis. This appears to be a satisfactory process for undergrad analysis and reporting. The process for tracking grad students is more decentralized and currently in a state of flux. Analysis and reporting of the status of grad students is currently problematic. Clear, consistent definitions do not exist between the Registrar, Bursar, and Admissions offices. The result is frequent discrepancies in reporting the grad student enrollment numbers.

Student Pipeline Analysis can help RPI achieve its goal of attracting highly talented students. It will enable RPI to improve its applicant tracking process, assuring a quality experience for each applicant. This is especially important for grad students where the current process is less effective yet future volume is anticipated to grow significantly. An improved understanding of the incoming freshman class will enable RPI to be more proactive targeting programs in support of the improved first year experience objective. The ability to analyze and understand the diversity of the incoming applicants earlier will enable RPI to make better admission decisions to positively impact RPI's diversity objectives.

The feasibility of implementing this opportunity is relatively high. Much of the data is readily available in Banner. However, there are two issues that increase the difficulty of this opportunity. In order to calculate the discount rate, financial aid data is required as an additional input. Also, the grad student application process is undergoing change as a result of an increased involvement of Enrollment Management.

This opportunity was included in the group of highest value opportunities needing further prioritization.

Faculty Workload Analysis

Rensselaer is currently reassessing its faculty workload management strategies. This assessment has highlighted needs for portfolio managers to assess and analyze individual faculty teaching workloads. It is important to address key workload questions:

- What is the actual workload by faculty member? By associate professor? Adjunct professor? TA? Tenured-track? Clinical?
- What is the average workload across the campus? School? Department?
- What is the workload by class offering?

Improved workload analysis will help Rensselaer support the development of a fair and equitable faculty workload. This should help enhance the overall educational offerings on campus. This capability will also enable the portfolio managers to better support the zero-based budgeting approach for course offerings, helping RPI achieve its objective of reinvigorating enabling activities.

The feasibility of this opportunity is relatively high. At its core, it requires essentially the same data required to support enrollment analysis. In addition, it will require more descriptive attributes to identify the load factors for each course offering. There is also the issue of how widely workload should be defined. Incorporating the ability to measure the impact of research and publications, in addition to coursework, will negatively impact technical feasibility of this requirement. This opportunity was included in the final group of high priority opportunities that the Sponsorship and Steering Committees revisited for final project priorities.

Financial Analysis

There is a compelling campus-wide requirement for improved access to detailed financial information. Emphasis on the new budget planning system and zero-based budgeting strategy has placed new and difficult analytic requirements on the portfolio managers. The finance managers help in this area, but do not substitute for the analytic capabilities required to support these new requirements. Portfolio managers desire an improved ability to support their decision-making regarding additional resources such as a class, classroom, faculty member, research faculty, research facilities, or staff positions. They also need access to actual and budget information to facilitate actual spending and budget variance analyses.

Typical questions portfolio managers face include:

- What is our actual financial performance? By cost center? By account? This month? YTD?
- How do our actuals compare to the budget? This month? YTD?
- How much of department XYZ's budget has been spent YTD?
- Do we have enough money left in account ABC to support expenditure Y?

Today, there is no effective means to gain access to detailed financial data. Data is made available in printed monthly reports from Finance. Portfolio managers find it difficult to access actual financial results, let alone the budget numbers. It is difficult to track expenditures against

budgets.

Implementation of data to support financial analysis in the data warehouse will provide the portfolio managers with more robust tools to support the new budget and planning processes and provide better control over their current spend rate. They will be better equipped to justify their expenditures, identify available budget monies, and react more quickly to negative variances.

It is important to note that the data warehouse can play an important role in the new budgeting process. The data warehouse can support the reporting and analysis required for budget planning, but the data warehouse is not the appropriate platform to support the budget building or input processes.

The feasibility of implementing this opportunity is moderate. The data is available in Banner and should be relatively accessible to the data warehouse team. However, implementing salary encumbrances in Banner is a key prerequisite to supporting this requirement in the most meaningful manner. This prerequisite pushes the feasibility of this opportunity to the moderate range. Finance and IT need to determine the appropriateness of the Banner encumbrance capabilities and undertake an implementation project for these capabilities before the data warehouse team can undertake this opportunity. Providing a total picture for planning will also require linking to Human Resources data to acquire position control data to help portfolio managers understand the budget impact of committed new hires.

Financial analysis was determined to be one of the highest priority requirements, in spite of the feasibility challenges described above. On October 18, financial analysis was selected as the initial phase for the data warehouse project.

Contract and Grants Analysis

There is a significant need across the schools for improved analysis of outstanding proposals and awards. Portfolio managers need analytic support to view proposals and grants in a variety of ways to understand their outstanding proposal activity and historical success rate, such as:

- What is our success/conversion rate? By school? Department? PI? Agency? Technical area? Center?
- How many Bioscience proposals are currently outstanding with NIH? What are their value and status?
- How many associate professors are writing proposals to the Department of Defense? What is our history with that agency and our success rate?

Currently, data is available on request from an Access database maintained by the Contracts and Grants Office. There is a need to resolve interdisciplinary reporting issues so portfolio managers can see the total results for their area regardless of where the grant is actually assigned.

Improved analysis in this area will help Rensselaer expand its research enterprise by enabling portfolio managers to focus on the most appropriate proposals by school, department, faculty, agency, technical area, etc

This opportunity is moderately feasible. The data does not exist in Banner. It is captured in an Access database in the Contracts and Grants area. There are activities underway to convert this process to the Banner system. Once this migration has been completed, the feasibility of this opportunity will improve.

Proposal Pipeline Analysis

Proposal pipeline analysis builds on the previous contracts and grants opportunity. There is a requirement to capture and track the lifecycle of a research proposal through various milestones, such as preliminary proposal, white paper submission, invitation to submit, full proposal, internal review steps, site visit, preliminary award, and award.

Enabling the portfolio managers to better manage outstanding proposals by faculty, school, department, agency, technical area, etc. should enable RPI to expand its research enterprise. Portfolio managers will also be able to assure that no proposals “slip through the cracks” due to lack of visibility. Likewise, portfolio managers will be able to ensure that proper due diligence and institutional control have been exercised on each proposal.

The technical feasibility of this opportunity is very low. No proposal milestones or status information is captured in any system at Rensselaer. Implementation of an operational system to capture proposal status information is a prerequisite to implementing this opportunity.

Financial Analysis - Research

Accounting for interdisciplinary and center-based research in a manner that will allow portfolio managers to analyze total research dollars is very important. Without this ability, a department/school cannot obtain a full view of its research dollars. This opportunity is very similar to the financial analysis opportunity, with the additional ability to also analyze the financial aspects of detailed, grant-level data. . This includes the ability to integrate and include all sources of research monies – grants, foundations, gifts, and corporate grants.

- How many grants do we have? By school? Department? Faculty? Technical area? Agency? Center?
- Where are we on the contract? How much have we spent?
- What’s left? Do we have enough dollars to support this grad student?
- Which contracts expire this year?
- What is total amount of research in a school/department regardless of interdisciplinary issues?
- What’s been paid/billed?
- Does a particular professor have adequate funding?
- What is an individual faculty member’s spend rate?

Currently, individual schools can't report their actual research dollars, let alone track their progress against aggressive research growth goals. They lack the simple ability to determine if grants are up or down compared to last year. This information is only available by individual grant. Portfolio managers need to be able to measure their activities at aggregate levels such as school, department and PI. This is only possible on a manual basis by doing a grant-by-grant review of the data. There is a critical need to resolve interdisciplinary reporting issues so portfolio managers can see the real research results for their area, regardless of where the grant is assigned. Currently, there is no link between the contracts and grants data and the research accounting data. Integration of these data sources is important to increasing consistency.

Understanding research spending by school, department, faculty, agency, technical area, etc. is a fundamental requirement to assure proper institutional control of research monies. Analysis of past and active grants will provide a reservoir of information critical to managing and expanding this significant source of funding.

This opportunity has a moderate technical feasibility. The data is available in Banner, but the salary encumbrances issue discussed earlier in the financial analysis requirement needs to be resolved before this opportunity can be implemented in the data warehouse. Even with its moderate feasibility, this opportunity was deemed as providing a very high value to RPI and included for consideration in the initial phase of the data warehouse project.

Graduate Financial Aid Analysis

This opportunity provides the ability to analyze sources of graduate support. This capability will enable Rensselaer to better understand:

- Which students are supported? At what level are they supported?
- What is graduate support spending by school? Department? Student? Technical area?
- Which grad students are under-supported? Self-supported?

This opportunity has a moderate feasibility. Most of the data is available in Banner. Modifications have been made to Banner to provide additional support for graduate financial aid. The data captured by those modifications is required. This opportunity was deemed to have a moderate value. It was not grouped in the initial cluster of high value opportunities under consideration for the initial phase of the data warehouse.

Alumni Demographics and Tracking

There is a desire to have a campus-wide ability to analyze alumni's current demographics. The compelling question regarding alumni across campus is "Where are they now?" Portfolio managers are interested in the current company or agency an alumni is affiliated and the current position they hold. They want to better understand:

- Where have they gone? What company? Agency? By school? Department? Major? Technical area?
- What are they doing? What position do they hold?
- How long have they been there?
- What are their successes?
- What are their accreditations?
- Are they in a position to help RPI attract new students or grants?

Today there are a limited number of shadow systems in schools and departments that attempt to track this information.

Campus access to this information will help RPI achieve its goals of enhanced vitality of its communities. It will enable departments and schools to improve the alumni connection to Rensselaer. Alumni can be recruited to assist in grad and undergrad recruiting. This information can also be utilized to identify alumni opportunities for networking for research grants in efforts to expand Rensselaer's research enterprise.

Obviously, alumni demographics are of keen interest to Institute Advancement for development activities. They need access to an even greater set of demographic data including financial wherewithal and giving history data that cannot be made available campus-wide for confidentiality reasons. Institute Advancement is looking to understand alumni giving capability and their inclination to give. The goal is to identify and develop the "sleepers" in the alumni community that can become greater supporters of Rensselaer in the future.

The feasibility of this opportunity was determined to be relatively high. Although the current alumni status data captured by Institute Advancement is self-reported and therefore inconsistent and incomplete, it is felt that it does have value. Capturing this type of demographic information has not been a primary focus for alumni data collection efforts in Institute Advancement. This opportunity was determined to be of moderate value. It was not included in the set of opportunities to be considered for the initial phase of the data warehouse project.

Alumni Contact Management

Institute Advancement is seeking a comprehensive contact management environment for alumni along the lines of a customer relationship management (CRM) system. This opportunity also requires the demographic alumni data discussed above. In addition, it captures data regarding each contact made with alumni regardless of the individual at Rensselaer making the contact. A rich CRM environment would eventually provide Institute Advancement with a very capable operational and analytic alumni platform.

Improved management of all campus contacts with alumni will improve Institute Advancement's development capabilities, help identify candidates to move to Rensselaer's top tier of givers, and provide a opportunities to enhance the vitality of RPI's alumni community.

From a data warehousing perspective, the technical feasibility of this opportunity was deemed to be low. This effort is only partially a data

warehouse initiative. The more appropriate time to implement these capabilities in the data warehouse will be after the implementation of new processes to capture the contact information.

Human Resources

There were several themes that emerged surrounding Human Resources. The first is a need for improved faculty and staff demographic analysis. Portfolio managers are interested in better understanding the faculty and staff community:

- How are our faculty and staff composed? By positions? Gender? Ethnicity? Martial status? Length of service? Age? Do they have children?

A number of questions arise in the consideration of fair and equitable faculty compensation that need to be more carefully considered:

- What are the various faculty teaching styles?
- How much money does a faculty member bring into RPI? By tuition? Research? Other sources?
- How many publications or research papers has a faculty member published? What is their prominence? Student assessments?

There is also interest in improved visibility to open positions and position control information:

- What are the open positions? Is it still open or has it been filled?
- What are the requirements?
- Who's on the search committee?
- What is the impact on the budget once a position is committed?

An improved understanding of faculty and staff human resources information will enable RPI to move in directions to improve its diversity and compensation capabilities.

The technical feasibility of this area was deemed to be low, primarily due to open questions regarding how effectively information is captured in the current human resources systems environment. Other than the inclusion of position control data to support the financial analysis requirement, Human Resources was not deemed to have a high priority for inclusion in the initial set of data warehouse initiatives.

Facilities Management

Several portfolio managers (not a campus-wide requirement) are interested in an improved ability to manage facilities. There are two major areas of interest: scheduling classrooms facilities each term and understanding the availability of research facilities as proposals are developed and grants awarded. For example, there may be an opportunity to bid on a \$10 million research program that will require 10,000 square feet of space with certain facilities.

- What space is suitable? Is it available?
- What might have to move to support the effort?
- If something is moved, what is the domino effect?
- Which facility requirements can we fulfill with existing capital equipment? What are we missing?

- What is our overhead rate for the proposed space?

Improving the facility management analytic capabilities will enable Rensselaer to maximize the value of its available space and facilities. It will help provide for the most effective use of classroom facilities, enhance the educational experience, and help expand the research enterprise in a cost effective manner.

The technical feasibility of this requirement was determined to be high. The facilities and facility ownership data is available in a system that can provide the data to the data warehouse. Effective classroom management will require aligning the enrollment data with the facilities management data to effectively match supply with demand. This requirement was not included in the set of requirements considered for the initial phase of the data warehouse project.

Additional Requirements

There were a number of other analytic requirements discussed during the interview process. Most of the additional requirements documented in this section were only requested by a single portfolio and lack campus-wide leverage. During the combined Sponsorship and Steering Committee meeting these requirements were not included in the initial set of data warehouse priorities.

These additional requirements are included for completeness. Many of these requirements were discussed very briefly; thus there may be very little supporting detail. Technical feasibility issues were not evaluated for this group of requirements.

Teaching Evaluations

Students provide feedback on each course through evaluations. Changing accreditation requirements are becoming focused on this area. It would be beneficial to have this information readily available to support the accreditation process. Analysis might include:

- What is the student feedback? By course? Section? Department? School? Faculty? TA?
- Combined with faculty workload information, it would be interesting to understand the relationship between workload and performance.

Currently, due to the difficulty gathering this data, it is only feasible to evaluate this information about once per year. This information would be valuable for faculty assessments and feedback.

Patent Licensing Tracking

There is an increased focus on leveraging the financial value of the patents that Rensselaer owns. It would be advantageous to analyze the patent information to discover unrealized value:

- What are the outstanding patents the Institute owns? Which patents have been licensed? Who owns the license?
- How much have we received in licensing from these patents?
- What patents have been licensed but we are receiving little or no royalties?
- What can we do to better leverage this opportunity?

Purchasing Analysis

Purchasing needs better access to detailed purchasing data to support vendor management activities, contract negotiations, and more effective cost control efforts. Currently, little of this information is readily accessible.

Purchasing Card Analysis

Likewise, there is a need to support analysis of the detailed data resulting from purchase card usage. In some cases, a significant amount of spending detail is hidden behind the purchasing card. The details behind the purchasing card don't flow into financial system.

Campus Cards

Campus cards are used across campus and various detailed usage data is captured in several systems that might provide interesting analytic views for access control and food service.

Career Development Center Analysis

A few portfolio managers mentioned an interest in better understanding the effectiveness of the Career Development Center and determining if there are opportunities to improve its capabilities. They are interested in understanding:

- How many students use the Career Development Center?
- How many interviews are scheduled? By company? Student? School? Department? Grad? Undergrad?
- How many companies are offering interviews?
- How many students are actually hired as a result of involvement of the Career Development Center?
- How many resumes has the Center helped write?

Course Material Tracking

The Distance Learning Center has a need for improved tracking of course materials to its teaching locations:

- What are materials required for each course?
- Are materials available for class?
- Have they been shipped? Where are they?
- Are they on track to arrive as needed?

Capital Projects

Rensselaer has several major capital projects underway. Analysis capabilities to support and control these efforts were mentioned.

Freshman/Senior Survey Analysis

Rensselaer needs to develop a strategy and capacity to capture and analyze incoming freshman and outgoing senior surveys for accreditation purposes.

Success Criteria

The Requirements Analysis participants were each asked to define one or two success criteria for the data warehouse project. The most frequently mentioned criteria are discussed below, in sequence based on their frequency.

Ease of use

Overwhelmingly, the most often-mentioned success criterion was for an environment that is easy to use. The participants have a strong desire for a system that is intuitive and readily understandable to a typical campus user. They are interested in an environment that provides templates for common, frequently required analyses, but will also allow access to required data in an ad hoc manner. The system should also be flexible. It should be easy to slice and dice data to support analysis of a question from many different angles. Finally, the data should be clearly defined and documented in a manner that allows a portfolio manager to readily interpret the results.

Accessible

The second most frequently mentioned success criterion was accessibility. The data warehouse data should be accessible to users campus-wide. The portfolios should not be dependent on individuals in other organizations for access to decision-making data. The data should be available through a Web-based capability to foster accessibility.

Responsive to ad hoc requests

The next most frequently mentioned success criterion (but mentioned far less often than the first two) was that the data warehouse needs to be responsive to ad hoc requests. Specifically, campus users need to be able to formulate their own ad hoc requests without going through an intermediary. When submitted, the results of the request should come back in a timely manner.

Consistent information

The data warehouse needs to provide a uniform view. Data should be consistently defined across portfolios. In addition, the data warehouse need to contain the “right” information. Definitions of the right information varied by individual and therefore might focus on student, financial or research data. Regardless of their focus, portfolio managers insist that the data should be consistent, accurate, and timely.

Used to make decisions with confidence

The data in the data warehouse should be credible. It needs to be consistent across campus. Portfolio managers should be able to utilize analyses from the data warehouse to make decisions with confidence and with the support of the Cabinet. Ultimately, the confidence in these analyses should reduce the need for shadow systems.

Opportunity Prioritization

On October 3, DecisionWorks facilitated a joint meeting with the data warehouse Sponsorship and Steering Committees to review and prioritize the requirements uncovered by the Requirements Analysis project. During this session, there was healthy discussion over the relative value, technical feasibility and prioritization of each opportunity.

The participants in this session were:

- Virginia Gregg, VP for Finance
- Dave Haviland, VP for Institute Advancement
- Eddie Knowles, VP for Student Life
- John Kolb, CIO
- Art Sanderson, VP for Research
 - Represented by Kenneth Gertz
- John Bradley, Interim Director IACS
- Ora Fish, Data Warehousing Project Manager
- Gary Gabriele, Vice Provost
- Sharon Kunkel, Director and Registrar of Student Records and Financial Services
- Leonard Wesolowski, Acting Controller.

During the meeting, each requirement was mapped onto a matrix (see Figure 2). The business value and technical feasibility of each requirement was discussed. They were plotted on a quadrant based upon their relative organizational value and technical feasibility. Technical feasibility refers to the current “degree of difficulty” in implementing a data warehouse application at RPI. Technical feasibility was ranked based on a scale of Low, Moderate, and High:

- **Low** – The required data is not currently captured electronically within Banner or any other RPI system or would require a significant rewrite or replacement of a current operational system.
- **Moderate** – The data exists electronically in Banner or another RPI system. Some prerequisite system changes may be required. The data warehouse team does not have experience with the data.
- **High** – The data exists electronically in Banner or another RPI system and the data warehouse team has worked with the data during the data warehouse prototype project.

The matrix developed during the discussion on October 3 is shown in Figure 2. The opportunities are abbreviated as indicated by the codes below (e.g., (EA) equals Enrollment Analysis). Please refer to the Business Requirements Section for a detailed description of each opportunity.

Enrollment Analysis (EA)
Student Pipeline (SP)
Faculty Workload (FW)
Financial Analysis (FA)
Contracts and Grants (CG)
Proposal Pipeline (PP)
Financial Analysis - Research (FR)

Graduate Financial Aid (GF)
 Alumni Demographics (AD)
 Alumni Contact Management (AC)
 Human Resources (HR)
 Facilities Management (FM)

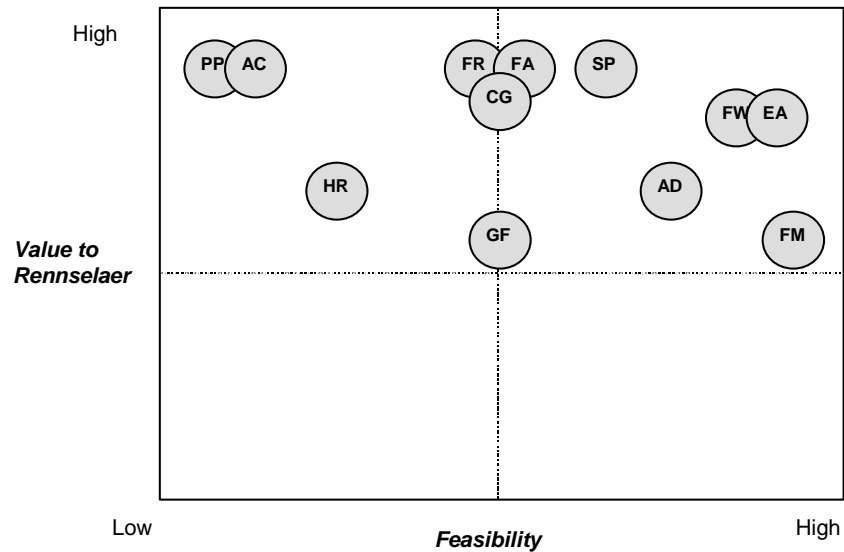


Figure 2 - Matrix: Business Value Relative to Technical Feasibility

Due to conflicting schedules, it was not possible to reach a consensus on the initial data warehouse priorities. The requirements were placed into two major groups. Six requirements were determined to be high priority opportunities requiring further discussion.

High Priority – Require Further Discussion

- Enrollment Analysis (EA)
- Student Pipeline (SP)
- Faculty Workload (FW)
- Financial Analysis (FA)
- Financial Analysis - Research (FR)
- Contracts and Grants (CG)

Not as High Priority

- Proposal Pipeline (PP)
- Alumni Demographics (AD)
- Alumni Contact Management (AC)
- Human Resources (HR)
- Graduate Financial Aid (GF)
- Facilities Management (FM)

While several of the high priority opportunities have feasibility challenges making them more difficult to implement than others, the value considerations were so significant they continued to be considered for the initial phase of the data warehouse project. The Sponsorship and Steering Committees agreed to reconvene at a later date to further discuss the prioritization issues and select an initial phase for the data warehouse project.

On October 18, the group reconvened and reconsidered the prioritization issues. DecisionWorks did not attend this session. The six high priority requirements were broken into two clusters:

Student Cluster

Enrollment Analysis (EA)
Student Pipeline (SP)
Faculty Workload (FW)

Finance Cluster

Financial Analysis (FA)
Financial Analysis - Research (FR)
Contracts and Grants (CG)

At this meeting, it was agreed that the student and finance clusters are both extremely important to Rensselaer. In the end, the group unanimously agreed that the Financial Analysis opportunity was of the highest priority and will be the initial phase for the data warehouse project. The goal is to be able to deliver this capability in late summer 2002. The group did not further prioritize the remaining requirements, leaving subsequent phases open for further discussion.

The group indicated that it understands the risks and trade-offs associated with starting with financial analysis as the initial phase:

- The finance area is more complicated than the student area.
- The data warehouse team is not as familiar with the finance data as with the student data.
- The salary encumbrances functionality needs to be incorporated into Banner by Spring 2002 to be included in the first phase.
- The budget office will be included in two major projects in a short period of time.
- Faculty workload analysis will not be available in the data warehouse to support the 2003 planning and budgeting cycle.

Risks and Recommendations

It is apparent from the Requirements Analysis that there are significant opportunities to leverage information for more effective decision-making at Rensselaer. However, this initiative faces several challenges related to:

- Project Management
- Data Issues
- Organizational buy-in

Each of these risks is outlined in this final section, along with recommended strategies to mitigate them.

Project Management

Constructing the RPI data warehouse is a big project. There are a large variety of business processes involved in the project, a variety of user constituencies to be supported, and a wide variety of analyses required.

Recommendation: Establish a phased data warehouse design, development and deployment plan.

It is nearly impossible to tackle everything at once. The team should identify project “subsets” to phase the overall design, development and deployment effort. Each phase should be:

- **Meaningful** - The scope of effort should be large enough to result in a deliverable that provides meaningful business value. You shouldn't tackle a problem so trivial that it won't garner respect from the organization.
- **Manageable** - The scope of effort should be small enough that the size of the project team, the amount of data involved and the communications requirements are “reasonable”, especially given the resources allocated. You don't want to tackle the galactic, especially during the initial implementation. Typically, the early phases of a data warehouse initiative correspond to a single business process, such as cycle billing or transactions.

Recommendation: Clearly define and maintain initial project scope.

Selecting the first data warehouse project is a critical decision point as you want to ensure a “win” for the users, as well as the project team. Aggressive goals were recently established for Rensselaer. We recommend selecting an initial project to specifically address these new objectives. While an initial project will be defined and selected, the project's scope will need to be further honed through detailed requirements and data analysis. Likewise, functionality and capabilities outside the boundaries of the initial project must also be clarified.

Once the initial project phase is defined, it is critical that this scope is maintained. Unfortunately, as organizations begin implementing data warehouses, the scope often grows. Data warehouse project teams are typically very focused on servicing their users, however this makes them

vulnerable to “scope creep” as discrete, minor user requests are identified. It’s important to remain flexible, however the timeline is certain to be impacted with scope enlargement. Delivering on short-term requirements and commitments is critical for everyone involved.

Recommendation: Build a strong data warehouse team.

Rensselaer has begun building a data warehouse team. The current resource plan needs to be fully implemented. The data warehouse project will require strong project management skills. The project team will evolve into a natural workgroup, including other technical and business resources as appropriate.

Data Issues

During our cursory review of the underlying data required to support the business requirements, we discovered several data availability concerns. Some key data is simply not available within RPI’s current operational environment. Salary encumbrances are not currently supported within Banner. The initial data warehouse effort to support financial analysis is dependent upon operational changes being made to support salary encumbrances. Similar issues exist for position control data. Contracts and Grants data is in the process of being migrated to a new platform. Several data elements requested regarding student life are not captured in any system including student activities, program participation, and community involvement.

Recommendation: Allocate time and resources to address data complexities.

The biggest challenges for most data warehouse projects tend to be data-related. In general, the effort required developing the data management processes (extraction, transformation, and loading) is typically more demanding than anticipated. Adequate time and resources, including key subject area experts, must be allocated to these tasks, especially with the first implementation when key processes and infrastructure are established.

Recommendation: Focus on ease-of-use during the initial project.

It is critical that this initial phase of the data warehouse focus on the portfolio managers and their requirements. The key to a user-friendly system is the simplicity of its underlying design. Rensselaer’s users have typical decision support inquiry needs; they want to slice and dice the data in endless combinations, asking questions today that they’ve been unable in the past. These activities are possible only if the underlying data has a simple dimensional structure that is intuitively obvious.

Organizational Buy-In

While portfolio managers want improved access to information to support their decision-making, it is unclear whether they have fundamentally bought into the current data warehouse initiative. Rensselaer has evolved to a very decentralized reporting and analysis environment.

Many portfolio managers have developed their own shadow systems they may be reluctant to relinquish. The current culture is not strong analytically.

Recommendation: Involve portfolio managers and users early in the project.

As we mentioned earlier, the data warehouse should be built and deployed in manageable, yet meaningful phases. It's important that user input be strongly considered when sequencing these phases. Naturally, people respond better when they are part of the decision-making process, rather than having the decisions dictated by others. "Involvement" can take many different forms, from validation of a strawman plan to full participation in a cross-functional session. The appropriate approach depends on organizational and cultural considerations.

Recommendation: Maintain business management and user involvement.

The success of a data warehouse is largely dependent on user acceptance and system usage; keeping users involved and meeting their requirements dramatically increases the probability of acceptance and usage. The most successful data warehouse projects are "user driven", not just "user oriented".

Sponsorship and Steering Committee commitment is not enough to ensure the user focus necessary for a successful data warehouse. The appropriate "drivers" within the portfolios also need to be actively involved as day-to-day sponsors of this initiative. Their involvement ensures that the data warehouse remains in sync with their objectives and strategies. Their vision and expectations of their organizations is key input to the design process. "Driver" commitment is visible and will greatly influence the ultimate users. Finally, the drivers will be a key resource when the team needs to make difficult design or implementation trade-offs.

Recommendation: Focus on communication and expectation management.

The team needs to establish a comprehensive communication plan for the data warehouse going up, down and across the organization.

The "who, what, when, and why" regarding the data warehouse must be communicated to the portfolios in a non-technical manner, using their terminology. The message to users needs to be concise and concrete, focusing on the "wins." There's no need to deluge them with documentation. If possible, interaction and an exchange of ideas should be encouraged when communicating with users rather than just providing a one-way presentation.

Communication is absolutely critical to managing user expectations. The team should honestly describe the project scope, deliverables and planned availability dates to users. Likewise, it is important that users understand the time they must invest throughout the project for user design reviews, application template specification, education, and so on.

The first opportunity to communicate with the portfolio users is to close the loop with the participants in the initial Requirements Analysis. However, user communication is not a one-time event. Regular meetings and newsletters are examples of communications that can be used to “spread the word.” It is important that communication receive priority throughout the project.

Finally, consideration also needs to be made for the marketing of the data warehouse. Information sharing with users should become the cornerstone of the project’s internal “marketing plan.”

Recommendation: Anticipate and appreciate the data warehouse’s evolution.

Last but not least, it’s important to remind everyone on an on-going basis that developing a data warehouse is an evolutionary process. Unlike traditional systems development initiatives, change should be viewed as a sign of success, not failure. It’s impossible to ascertain all current and future decision support requirements and then deliver the “ultimate” data warehouse in one phase. The data warehouse will evolve as portfolio managers, RPI’s environment, and information/analytical needs evolve. The Cabinet, committee members, portfolio managers, users, and the DotCIO organizations should be continuously reminded to anticipate and appreciate this evolution.