McMaster University

Inspiring Innovation and Discovery

McMaster University

A Business Intelligence Vision and Implementation Strategy

Prepared in Consultation with the BI Committee and the Mosaic Steering Committee for the Mosaic Executive Committee

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Introduction

McMaster University has recently completed the implementation of a PeopleSoft enterprise-wide system for Student, Finance, Research Administration, and Human Resources data. The PeopleSoft EPM/OBIEE software for business intelligence implementation was purchased by the University as part of the ERP system bundle at the start of the Mosaic Project. The University recognizes the importance of evidence-based decision making and it made a strategic and conscious decision to implement business intelligence after the completion of the PeopleSoft systems implementation so that University executives and managers can access pertinent university information with ease and at their convenience. This decision is supported by the inclusion within the budget for the Mosaic Project, a budget set aside for the implementation of PeopleSoft OBIEE for business intelligence to support institution-wide reporting and analysis led by the Office of Institutional Research and Analysis (IRA).

This BI Strategy is developed to enhance the ability of McMaster University to make evidence-based decisions through a centrally managed, standardized set of reporting dashboards and analytics based on a trusted data source accessible by the university community in accordance with policies of security and privacy. The OBIEE tool will facilitate enhanced user presentation with "slice and dice" and "drill down" options built by a core IRA team working collaboratively with UTS and business analysts from Finance, Human Resources, Research Administration, and Campus Solutions and in consultation with business users and stakeholders. Best practice encourage making data users the central BI stakeholders with the technologists playing a support role. This approach ensures that BI projects meet business requirements.

What is business intelligence?

The term "business intelligence" is used broadly and has evolved today to become an umbrella term including methodologies, processes, architectures and technologies to improve decision making by using fact-based support systems. The key components of business intelligence are: data, people, process, and enabling technology. Therefore the term encompasses not only supporting technology from the user presentation perspective but it also spans the data warehouse system that focuses on architected data for retention and usage. BI also spans people and processes involved in data capture, data organization, data definition, data retrieval and presentation of data as information in a specified context. To have a good BI system, data quality, integrity and consistency are essential. At the heart of business intelligence is the ability of an organization to collect and organize data, and access accurate and timely information (derived from the data) to make appropriate decisions that support its vision, mission and goals in an efficient manner.

In contrast to ERP systems that are primarily designed for processing operating transactions and focus on single subject area, BI systems are multi-dimensional and synthesize data from multiple subject areas to facilitate better decision making. Business intelligence is about providing better business insights from analysis based on data from multiple subject areas and is not just a tool that delivers nicer looking interfaces to operational or transactional data.

Why does McMaster need business intelligence?

Like all organizations, McMaster University has massive quantities of raw data that need to be analyzed for trends, associations, predictions, baselining and so on to give insights and competitive advantage. A business intelligence system not only enables the raw data to be appropriately stored and organized in a suitable data warehouse environment but also modelled and architected such that the raw data is

turned into useful information. Firstly, a good business intelligence system will allow decision makers to access and use analyzed data or information to make fact-based business decisions that further institutional goals. Second, the University community will have a data environment with information based on defined and validated data, and have some flexibility and freedom within the business intelligence tool to query the data themselves for deeper insight through slicing and dicing the data. Third, business intelligence can provide advanced users the ability to mine the data directly for advanced modelling and predictive analysis to provide the University with competitive edge in a rapidly changing postsecondary education landscape.

Current Environment: Where are we now?

To date, all production data from Student, Finance, Research Administration and Human Resources are backed up and stored daily in the PeopleSoft EPM in the Operational Warehouse Staging (OWS) tables referred to loosely as the Central Data Warehouse (CDW) at McMaster. As part of the Mosaic Project, there have been a series of queries and reports developed using PeopleSoft tools and nVision to access transactional and operational data for functional business areas. Business users have also received training to access data within their functional business areas using PS Query through a portal. nVision will meet the needs of specific, well-defined and standard reporting requirements through developed queries. On the other hand, BI tools can provide flexible, exploratory, and predictive analysis to support quick but evidence-based decision making by University managers and executives.

In order to perform its business of strategic reporting and analysis for the University community, the Office of Institutional Research and Analysis (IRA) has been delivering to users at the University the bulk of its reports and analysis with cross functional and multi-dimensional data through the IRA Portal which runs on a simple business intelligence software based off small data marts. These data marts, developed prior to the existence of a central data warehouse, comprise manipulated data extracted from Legacy systems at a specific point in time over the years and are not connected to the CDW. They provide a limited range of data including Admission, Student, Enrolment, Retention, Time to Completion, Faculty, Courses, Grades, and Surveys. Prior to Mosaic, the Office of Institutional Research and Analysis (IRA) had limited access or connectivity to all university data and did not always have access to all data at the atomic level. To date, given IRA's mandate and responsibility, IRA now has access to all data from all functional areas that are stored in CDW and has started to use it to carry out its mandate to analyze, predict and report institution-wide data and information.

The IRA Portal was delivered as an interim solution with the intent to replace it with OBIEE. At the time of delivery, it was to serve a twofold purpose. The first was to acquaint a segment of the University with a BI prototype to show users some capabilities of a business intelligence solution, and the second to ascertain business requirements through feedback on the usefulness of reports delivered. The IRA Portal has a number of limitations. Firstly, the data marts are not consistently at the most granular level due to historical inaccessibility of granular data. Second, the data marts are not connected to the central data warehouse and therefore require additional steps to upload new information. Third, built as an interim solution, the IRA Portal was not sized for access by the whole university community. Fourth, the free BI software has limited functionality and features. For example, to customize a report, users still need to copy and paste parts of a report or export the report in its entirety into Excel to customize it for their own use.

Where to with BI?

With a CDW in place, this strategy aims to design the data within the PeopleSoft EPM to transform the University's raw transaction data from its sources into information for dissemination through dashboards, analyses, performance measures and drill-down reports through OBIEE, as well as, to enable advanced analytics and data mining.

The goals for a business intelligence environment for McMaster include:

1. Enhanced institution-wide analytical and reporting capabilities which include cross-functional information to meet the needs of the university through interactive reports and dashboards, in accordance with policies of security and privacy.
2. Capability will include "what if" analysis for various scenarios such as: a) impact of raising admission cut-off by 2%; b) number of seats required when admission Level 1 intakes are increased by x% for required cores in program Y? c) how would graduation rates be impacted if the university admits x% more credit transfer students? It is hoped that the nature of these analysis would progressively enable more complex scenarios as the software capability advances with time.
3. Use of a primary flexible, robust business intelligence tool with a wide range of functionalities that will support the university's information needs far into the future.
4. A shared common data vocabulary along with documentation of definition of all data items and transformation rules.
5. Users will be able to customize reports specific to their areas of responsibility through a selection of delivered parameters and filters. Power users will be able to build reports based on delivered marts specific to their areas of responsibility.
6. Use of Analytics including data mining and predictive analytics to provide competitive advantage and deeper insight.
7. Integration of survey, non-university and unstructured data with university data at later development phases for advanced data discovery and big data analysis.

Ultimately, the key purpose of this strategy is for the University to have useful, important information that is timely, accessible and accurate that enables planners and decision makers to make evidence-based decisions in key areas related to the University's core mission. Goals #1 to #5 are within the initial scope whereas goals #6 and #7 are longer term goals.

Scope: What are the Business Needs?

The goal for a business intelligence solution is to cater not only to institutional information needs but also to the collective needs of Faculties. An understanding of this helped to define the scope and parameter of the BI project. In order to gain this understanding, a number of meetings took place with each of the functional representatives on the BI Committee, with a wider group of individuals within each functional group, namely, Finance, Human Resources, Research Administration and Students, and with each Faculty including the Dean, Associate and Assistant Deans, Directors of Administration and their direct reports who work with data, and the School of Graduate Studies.

To a large extent, the IRA Portal served as a starting point for discussions with Faculty representatives. The IRA Portal, albeit an interim solution to bridge the gap until a business intelligence solution was implemented, was built to provide information at not only the University level but also drill-downs to the Faculty and departmental levels. During these discussions, Faculty representatives mostly affirmed

the usefulness of the information in the IRA Portal and suggested changes and additions that would further meet their needs. Several Faculties also shared their lists of data and metrics that they repeatedly use for internal planning, external accreditation and other business purposes which will be incorporated into the initial implementation wherever possible.

The feedback and suggestions from consultations are captured by the following broad areas that emerge as primary areas:

1. Research Administration
2. Course and Student Enrolment
3. Grades, Retention and Graduation (Student Performance)
4. Academic Productivity
5. Student Financial Aid and Scholarship
6. Admission
7. Human Resources
8. Financial Affairs

Each of these areas will be displayed as separate dashboards, each comprising a cluster of reports, performance metrics and in some cases, analytics that draw on data or marts from more than one functional area. These dashboards when completed will provide useful information that covers a significant proportion of the University's mission and resources required to support its mission. To allow users to dive more into the data, there will be an array of appropriate dimensions provided to allow for filtering, slicing and dicing, and drill downs for further analysis by users.

Information displayed will include the current state, key performance indicators or metrics, historical trend, projections into the future, and an interactive "what if" functionality where applicable. The details of each subject area dashboard and of individual subject sub-component report may be out of focus now but such details can be sharpened prior to implementation and even post-implementation, after users have had an opportunity to use them for a season. The critical factor is preparation of the underlying data marts with relevant data from which each of these reports and dashboards can be created. The dashboards and reports would be set up to default to the level that matters the most to each area of business. To clarify, the University senior management would see a high-level summary of the information whereas managers' dashboards would default to Faculty or Department with the ability to drill down to the granular level, as appropriate. Appendix A provides more details on the Research Administration Dashboard gathered through consultation with stakeholders. Appendix B provides an example of a BI Dashboard on student performance.

Given the number of subjects and limited resources, the decision on the ranking of these subjects in terms of which subject will be built and launched first is reflected by the order of the subjects listed above. Subjects #1 to #5 are within the initial scope because they are mission critical and directly related to the core mission of the University, i.e. students and research, and they will serve as a solid foundation to begin with and on which to continue to bring in other areas not yet included. Criteria for determining the order include: cleanliness or stability of the data, availability of the data, mission criticality, availability of alternatives, degree of risk in not having the information, time criticality, and degree of fit of the Oracle out-of-box data marts.

Outside of Initial Scope

For the initial implementation of this BI solution, only data in the Mosaic implementation is inside scope. There were requests made to include data that are not currently collected or captured in the McMaster central data warehouse. Such requests would require a strategy to first capture and/or store the data in the CDW and would therefore have to be longer term projects. The initial scope of business intelligence at McMaster University will be limited to using the PeopleSoft data currently in or accessible to the CDW. The initial scope will establish the basic foundation and framework for data quality, data governance and data management on which McMaster can build to incorporate data beyond the initial scope. Also the transactional reports are outside the scope. Over the longer term, it is envisaged that the power of data analytics and modelling will be enhanced through statistical tools to support data mining, more advanced analytics, techniques and big data.

How to Get There: BI Framework

Implementation of a business intelligence solution requires an investment in data, human resources, technology and processes, to get the University to a place where the agreed set of information can be accurately deployed to users in a timely and efficient manner.

Data

Data is at the heart of business intelligence and analytics. Well-managed data offers endless opportunities for decision support. For data to be an asset to the University, it must be accurate, understood and useful to the mission of the University. To be usable, data must be presented in the context of the business and governed to ensure a trusted business intelligence environment. One of the goals of this business intelligence strategy is to establish a sound foundation of basic and practical disciplines in data governance, data quality and management so that later evolutions of BI and Analytics can evolve to higher levels of sophistication.

Data Governance

Business intelligence and data warehouse efforts have elevated awareness of the importance of data governance which has many aspects, the main ones being data quality, security, ownership and change control. The Mosaic Sustainment Committee is beginning to discuss enterprise-wide data governance at the ERP systems level. Governance at this ERP level will go a long way to support business intelligence by ensuring the quality of data in the OWS layer. There also needs to be data governance from the OWS all the way through to the layers within OBIEE.

Data Quality and Management

Data quality is the consistent and timely integrity of the data components that form the context of the information. Aspects of data quality include: determining appropriate business terminology and relating it to the fundamental data items; determining context; identifying the universe of values of each data item; organizing the data components into manageable structures; ensuring the proper domain values; profiling the data i.e. documenting the source, understanding the source conversions and data values; determining ownership, and documenting data-feed timelines; ongoing governance and security for current and historical versions. Identifying data stewards from the business and technology sides for an ownership role is critical to ensure data quality.

Data Dictionary

A goal of this strategy is to create a glossary of data vocabulary with definitions of terms used in the business intelligence dashboards and reports. Data quality cannot be achieved if different groups within the University define a term differently. Data vocabulary is the heart and soul of business intelligence and warehousing. Commonality of business terminologies must be determined, which means that data must be broken down into its underlying components. A definition must be set for each of these data components as well as the business item itself.

Since data in a warehouse system can be merged from a number of distinct source systems under a conformed definition, if values from either system do not conform to expectations, and ETL rules are used, rules and policies must also be created to guide the development efforts to understand the essence of the data within the DW/BI system.

Best practice is to first identify the data item, describe it, document it with values and examples, and identify its sources and usages. If a data flow perspective is required, show its path along with the processing rules and dependencies, including all timings. It is good practice to document data component definitions and use examples for clarity and communicative purposes in each and every instance. Every single bit of data must be looked into. As an example, if the sex type should be Male, Female, and Other and if it is discovered that sex type is actually Male, Female, Unknown, then a data quality issue exists and efforts must be guided toward rectifying the issue.

Security, Sensitivity and Privacy

Undoubtedly, the BI/DW system would be in a secure environment safeguarded against theft, corruption, catastrophe and unauthorized access. The main concern for BI is the question: who has access to what type of data and at what level of detail? This will have to take into account the role of each user as well as the sensitivity of the data. A goal of this strategy is to enable drill-down to the atomic case level but such capability will be limited to the specific group of individuals who require that level of detail where appropriate. Also the BI solution will be deployed after a set of rules concerning types and levels of data access has been established. The PeopleSoft OBIEE tool has security functionalities that would meet the University's needs.

Change Control

Since the BI solution is a downstream application, dependent on the source data, it can be drastically impacted by any change upstream. Change control including weekly communication of what is being developed or changed and what data is affected would have to be a critical part of a routine for all key individuals involved in the data warehouse and the BI solution.

Data Architecture and Data Models

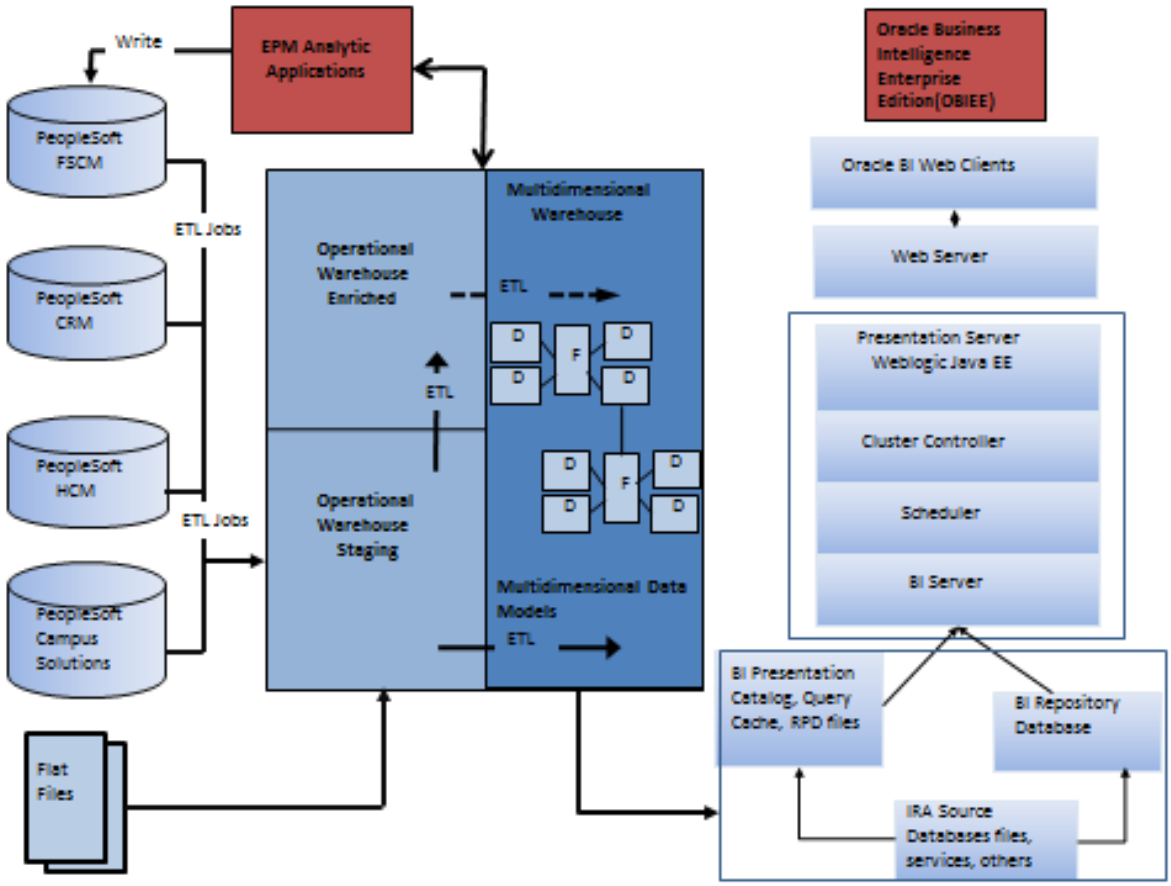
Data architecture deals with the sourcing and movement of the data to its target structures while data modeling deals with organizing and structuring the data into data models. For data to be usable in the development of business intelligence solutions, the captured or source data must be organized, defined and structured in such a way as to facilitate the querying and usage of the data. The Operational Warehouse Staging (OWS), which is already populated and in use at McMaster, acts as an entry point for PeopleSoft source transactional data into EPM. Transactional source data is loaded into the OWS with delivered ETL jobs that do not transform the source data. In the OWS, all table and field names and key

structures are the same as in the corresponding source table. The data in the OWS now needs to be organized or modelled for business needs before the data is usable for business intelligence.

One particular approach to organizing the data is to purchase a prebuilt business intelligence data model such as the PS EPM warehouses. The use of the delivered sets of data models in the EPM warehouses could save considerable development time and effort. Usually, the delivered models do not exactly fit but they can be used to kick-start the enterprise effort and save months of effort.

The PeopleSoft EPM purchased by McMaster University comes with data models that define the data and the relationships among data. The models dimensionalize the data into facts and dimensions in a star-schema format based on specific business processes.

PeopleSoft EPM and OBIEE



This strategy calls for using the delivered out of the box MDW tables and data models as a starting point where possible.[1] However it is important to note that, "*There is no complete out-of-the-box solution for a data warehouse system. No vendor knows exactly what your specific business requires to operate from*

[1] Delivered reports in Campus Solutions include: Student Recruiting, Student Admission Application, Class Meeting Patterns, Course Catalog, Class Scheduling, Instructor Workload, Student Career Term Record Management, Enrollment, Award, and Student Payments. Data marts delivered in Campus Solutions include: Admissions and Recruiting, Campus Community, Student Records, and Student Financials. The HCM delivered data marts include Workforce Profile and Compensation. Data marts delivered in Financials Warehouse include Procurement, Receivables, and Payables.

a reporting or analytical perspective, and no one can presume to know your source systems and all the data quality issues surrounding it. Therefore no out-of-the-box- solution is possible. Whatever purchased must be tailored in one fashion or another to properly fit your environment." (Labarge, R, p.254)[2] BI specialists in the field with Oracle experience and who have been consulted unreservedly share this view.

Resources and Roles

To date, the University has in place an OWS that contains data from four PeopleSoft source systems: Student, Research Administration, Finance and Human Resources. These systems support business intelligence by capturing and holding the data and making it available in time. The business intelligence portion supports the business through allowing business users to access the data at will by organizing and structuring the data into data marts. This section discusses the resources and roles for the development, implementation and deployment of the business intelligence solution to the University. Given that this work is complex and requires a high degree of expertise, consultants would be brought in to assist with the initial implementation. Note however that the strategy includes acquiring and retaining a skilled BI team to minimize the long term dependency on external BI resources.

McMaster Development and Implementation Team

The BI Development and Implementation Team at McMaster will take the data already loaded in the OWS through the MDW layers of the People Soft EPM and into OBIEE to develop and roll out reports, analytics and dashboards to the user community. Best practice calls for the BI team to be centralized. For this reason, the BI team will be small, centrally aligned within IRA, and staffed by experts who ideally have previous/knowledge of both BI and McMaster's current data or systems infrastructure. The team will be expected to work with a consultant implementation partner until they gain sufficient knowledge transfer and experience to carry out ongoing development and deployment independent of full-time consultants. The roles and expertise required of the BI core team include:

Project Manager/BI Business Analyst: responsible for managing resources, and the project plan to expected timelines. It is conceivable that the vendor consultant will have its own project manager while the University will also have a project manager to oversee each BI project included in the proposed in-scope subjects. This role will double up as the BI business analyst at the business requirement gathering stage of each project, and assists with BI report development. Managing business user expectations, listening to user feedback and building a strong collaborative BI team are also responsibilities of this role.

Data Architect/Data Modeler: responsible for modeling the data warehouse repository and the data marts logically and understanding the implications of the physical design. Industry experts suggest that if the data model is purchased, this role should be filled initially by or in conjunction with the vendor consultant and then transitioned to local resource as the model becomes more familiar. The goal would be to ensure knowledge transfer in this area to the BI team for further BI development as needs evolve.

BI Administrator/Architect/Developer: installs, configures, deploys, and tunes BI tools and analytical services; troubleshoots BI tool problems and tunes for performance; develops multidimensional semantic layer and BI query objects for end users, and creates dashboards, reports, metrics and

[2] Labarge, R, 2011, The Data Warehouse Mentor. Practical Data Warehouse and Business Intelligence Insights

analytics. These individuals must be experts at using the selected BI tool which is OBIEE. This role produces highly visible deliverables at the front lines of the BI solution. The BI deliverables must be responsive, flexible and scalable to evolve with the ever changing environments of the users and stakeholders.

ETL Developer: to build the ETLs in development and production environments and data warehouse during the development/implementation phase including capturing data from the source system, transforming data as necessary, loading data and metadata into the database, and delivering the data from the data warehouse repository to the data marts. This role would create, modify and maintain the ETLs and the ETL technical documentation and other documents that describe the real data aspects, run-time routines, operational dependencies, and schedules, notification system, and flow diagrams showing interdependencies. When necessary, this role within the BI team can also double up as BI report developer. The selected consultant partner(s) would also bring this expertise to the team, along with guidance on templates for documentation and best practices.

Note that once the ETLs are developed and the BI solution is in operation, ensuring the ETL's are executed nightly becomes the operational responsibility of UTS.

Solutions Architect: responsible for putting in place the BI foundation which includes a set of standards, methods, software tools and hardware infrastructure that are set up before undertaking the first of a series of new or incremental BI Projects. This role is important because it puts the University in a state of readiness to start a BI project and allows for a smoother implementation. The individual in this role would work with UTS on hardware and software readiness prior to the arrival of a consultant implementation partner on the scene. This person will also assist the BI team on advising on best practices. This role or expertise could be provided by an independent consultant and could require up to 16 hours a week.

Support Members

The success of BI implementation will depend on collaboration and participation of a large number of University partners. BI deployments have many components and the time requirement for support members will vary from short periods of intense engagement to ongoing periods of short engagement. Support members include:

Executive Sponsors: The Mosaic Executive Committee comprising the University's Vice Presidents provides executive sponsorship and provides direction and guidance based on the University's strategic direction.

Mosaic Committees: The current Steering Committee comprising the 5 functional leads (Research Administration, Finance, Human Resources, Student, and Business Intelligence), Faculty of Health Science representative, and CIO meets once a month. This Committee will provide a forum for discussing cross-functional matters at a strategic level.

BI Committee: The current BI Committee will serve to get the BI implementation off the ground, including providing assistance and guidance on the BI strategy and implementation roadmap, preparation of an RFP and selection of the consultants. Once implementation is initiated, the BI Committee will be transformed into a more operationally focused oversight group.

Operational Committees: Whenever an operational committee focused on some aspect of the PeopleSoft or any other in-house applications already exists, the best practice approach is to add a BI resource to the existing committee. This approach is preferred to introducing new committee(s) focused solely on BI. The BI applications (reports, dashboards, and analytics) need to be treated as complementary to the operational and transactional applications that provide the data that BI builds on. With this integrated approach, there is a better chance of coordinated change control and less opportunity for redundant efforts and avoidable reworks.

Business Analyst/SME: The BI project will require participation of a business subject matter expert (the individual may differ according to which subject the project is focused on) who must have detailed knowledge of the business processes and business rules and how they generate or use specific data sets. This role works with the BI team to uncover the appropriate sources of data, to evaluate the condition of the data sources, to define appropriate logical models and assumes ownership of one or more data elements, and is the contact point for information about origins and revisions to those data elements. This role will participate in testing and will reside within each functional area. Depending on the subject, the BI project could require an average of approximately 10 - 14 hours per week. The actual time and labour requirement will be estimated as each project is undertaken. Note that variable time commitments are the reality. Most likely, this group's participation will be most intense at the beginning during requirements gathering, during analysis, and later, during testing and validation. These periods of high engagement could be punctuated by weeks during which almost no participation is required.

PeopleSoft Database Administrators: The expertise of the PeopleSoft System Administrators would be required to transform the data model design into a physical or optimized data model. This role will work closely with the BI team and the SMEs to uncover the appropriate sources of data for each BI area. Each BI project would require up to 60 - 80 hours per scope subject across the four month timeframe. Variable time requirements could range from intense weeks of 5 – 10 hours per week of engagement to weeks of zero engagement. Again, the actual time and labour requirements will be estimated as each project is undertaken.

Ambassador Users/Testers/Trainers: Before any BI solution can be deployed to the business, it needs to be tested and any defects reported to the BI Project Manager for rework. These persons because they become fully versed in the BI solution, can perform face to face training with the business users. They could also become the contact point for feedback and ongoing evolution of specific BI deliverables to ensure that BI continues to meet business requirements.

Stakeholders: The BI team will engage with stakeholders at various points in the project. The group will comprise representatives from across the University and the composition could vary by subject. Included will be representatives from each Faculty, and administrative areas of the University. The BI project could require on average 2 hours/week of their time.

Post-Implementation

The BI team will work on deploying subjects outside the initial implementation, respond to new requests related to subjects already implemented and work on improving the user experience. Working in the same office as analysts and statisticians within IRA, the BI team can leverage the in-house expertise to

test and refine analytical models to advance BI capabilities. Similarly the analytical team can leverage BI expertise and tools to speed up response time to requests for data analysis.

The BI team will need the ongoing support of DBAs and ETL programmers from UTS to maintain and operationalize the data warehouses and BI and Web Servers that BI is dependent on, run the ETL's, install patches, and other ongoing IT support. Also the team will need the ongoing support from the functional business analysts and the user community to keep BI current in terms of meeting new and evolving information needs.

Technology

Business intelligence technologies are integral components of the BI solution. As indicated earlier, the University at the start of the implementation of the Mosaic project purchased the PeopleSoft/Oracle EPM/OBIEE which is a business intelligence solution. Since that purchase, Oracle has announced its strategic BI platform to be OBIA. A review of the alternative BI offering of OBIA was conducted and McMaster decided to stay with EPM/OBIEE as its BI solution. Appendix C contains the details of the review and decision.

Process

This section describes the key organizational processes that must be part and parcel of the BI development/implementation to ensure success. These processes address activities focused on:

- Good data quality including data governance and data management.
- Helpdesk including user support, service level agreements, and associated escalation procedures.
- Project management including management of scope creep, user expectations and work plans
- Communications and marketing
- Change management and training
- Documentation of business requirements, metadata, taxonomy, change control, and procedures including testing, ETLs, backup and recovery, etc.

On an ongoing basis, existing processes would need to be adjusted or expanded to:

- Address business intelligence application requirements.
- Consider BI application as a potential solution to meet new or changing business requirements.
- Include a BI team member on existing operational committees.

In addition, a set of performance indicators will be developed to measure the success of BI.

Change Management

Good BI implementations recognize and address new behaviours related to the ownership, access and data sharing. Change management at this level addresses clear definition and adoption of new roles and responsibilities, implementation of data access rules and compliance monitoring. It also includes communication and marketing of BI goals and achieved benefits.

Success Factors

The following success factors help to ensure the success of BI:

- Establish clarity in data terminology and definitions – context within different departments will define even basic terms like “full-time” differently and a proper vocabulary must be developed to define and structure the data correctly.
- Build with business purpose in mind. Involve and consult with business and stakeholders at key points throughout the BI implementation to ensure their business needs are met and to ensure usage after build.
- Secure executive sponsorship and high level management support to keep the project high on people’s agenda.
- Hire seasoned data warehouse and BI consultants to assist in initial implementation and to enable local resources to gain the required experience and knowledge.
- Secure proper and sufficient internal resources and ensure they are well trained and have the skills to do the work.
- Work with quality data and be diligent about investigating and interrogating every bit of data because data quality is critical to BI implementation.

How to Get There: Implementation Roadmap

This section discusses the roadmap on how to initiate the BI project and get it on the road. It stipulates key guiding values and principles, the foundations that would be in place prior to implementation and the approach to implementation.

Guiding Values and Principles

1. Take a phased approach rather than a big bang approach to control expectations and ensure levels of success.
2. Initiate from a business perspective - discover needs, wants and wish-list items with a view toward the benefit to and for the University.
3. Thing Big, But Act Small – Plan the architecture strategy and deliver in small, controllable phased portions with focused deliverables.
4. Do what is right – do not take on poorly planned projects. Build based on the corporate data strategy and ensure integrity throughout the DW/BI solutions
5. Manage with a bias for action. Make things happen; find ways to resolve issues and help others to help you.
6. Commit to continuous improvement. Continuously work to deliver high quality and add value.
7. Minimize and manage project risks.
8. Use PeopleSoft delivered functionality wherever possible – think carefully before using a custom developed solution.
9. Engage University stakeholders in active participation in the solution implementation.
10. Implement upgrades/releases to keep the BI and related technology current.
11. Manage scope, budget and expectations closely and carefully.

Implementation Approach

The strategy calls for involvement of external expertise because the BI implementation is a large and costly undertaking and requires high level expertise at least for the initial phases. The goal would be to have ready a trained and local BI team to work alongside consultants on as many in-scope subjects one after another until the local team feels confident to do it on their own or until the BI project runs out of allocated funds whichever happens sooner. Since there is limited resources available, the order of the

subjects will be chosen based on complexity or degree of fit as ascertained by the data mart mapping exercise by the BI team. Also the degree of effort by the local team will increase after completion of one or two subjects so as to give the local resources the opportunity to have hands on experience under the guidance of consultants.

BI Foundation Preparation

The setting in place of a solid BI Foundation will ensure a smooth BI implementation. Aspects of the BI Foundation include: requirements gathering, analysis, security plan, naming taxonomy, quality assurance procedures, bug tracking, helpdesk plans, hardware readiness including storage and processing, enterprise architecture, design for resilience and recovery, and scalability), software and other operational matters.

Industry experts advise spending time on defining the solution with clear deliverables. To this end, IRA consulted and gathered business needs. From these business needs, IRA will complete the preliminary work of assessing the degree of fit of the out of the box marts to these articulated business needs for the initial phase of implementation. Prior to the arrival of the selected consultant vendor, IRA will have completed an initial mapping of all the data elements required, any data source gaps, which data marts contain the data elements and therefore should be populated with data and which required data elements are missing from the out of the box data marts and what modifications or extensions are required.

Local resources will be identified and trained so that they are prepared to work with the consultant vendors and can focus on gaining experience as opposed to learning the tools. In this regard, UTS will identify the appropriate DBA and ETL developer; IRA will identify the appropriate BI team Lead, BI/RPD programmer and BI Programmer/Report Builders; and the functional areas would identify the Business Analyst/SMEs. As BI Lead, IRA will have identified the stakeholder group(s) for ongoing consultation.

Phased BI Development/Implementation

Best practices show that a DW/BI project must be managed in a phased approach in order to control expectations and ensure levels of success. Given the limited budget available, and depending on consultants' cost it would be impossible to create dashboards and analytics to meet business requirements for the various BI subjects without investing in a central BI team that can carry on the development and implementation of BI after the consultant leaves. A phased approach would enable the centralized BI team to gain repeated experience while working alongside the consultants. With each additional project, the role of the BI team would increase while the role of the consultants would decrease until the budget runs out or until the BI team feels competent to do the development and implementation on their own.

Phase 1: Technical Infrastructure Build: prior to the start of the BI development/implementation, hardware and software installation will have initiated and completed to prepare and implement a capacity plan to support BI for the first 3 years and with scalability up to 5 years. With a phased approach, it is important to have a Solution Architect set up the technical infrastructure necessary for all the subjects areas envisaged in this strategy. A correctly set up BI foundation is at the heart of a smooth, successful BI implementation, as well as, a high performing BI solution. The Solution Architect could also help set up other important aspects of the BI Foundation.

Phase 2: Implementation of the first subject: a likely candidate is Research Administration because not only is the subject extremely important to all areas of the University, the data is also relatively stable. Given that it requires data from more than one source system, it is therefore a good subject for engaging consultants' expertise. The project should only span 3 - 4 months and whatever is ready, checked and tested should be rolled out. The anticipated dashboard for this subject need not be totally completed at the time of launch because it is very common for the BI team to continue to add new, as well as, change existing reports as part of the evolution of BI into a state of maturity for each subject area. Note that since the BI software will have to be installed, the first BI project will be longer by at least one month.

Phase 3: Implementation of the second subject: a likely candidate is Course and Student Enrolments because it is an important business area and the timing is better for this business area. The BI team after having had an opportunity to observe and work on the first subject can take a more active role to gain hands-on experience.

Phase 4: Implementation of the third subject: a likely candidate is Grades, Retention and Graduation, another important area to all Faculties. It is hoped that by this phase, the data in the Student system have had more than a year to stabilize and errors fixed. The information related to this subject is more complex to derive from the source transactional data and would be a good candidate for consultants' involvement. This subject may provide the BI team with experience for modifying and or extending the out-of-box data marts to meet the University's business requirements.

Phase 5: Implementation of the fourth subject: a likely candidate is Academic Productivity, an area that requires data from more than one system and modification and or extensions of the out-of-the-box data marts to meet the University's business requirements.

Phase 6: Implementation of the fifth subject: a likely candidate is Student Financials, an area that requires data from more than one system and modification and or extensions of the out-of-the-box data marts to meet the University's business requirements.

The remaining phases will be implemented with consultants' expertise within the allowable budget. Otherwise, these phases will be developed and implemented by the BI team over a period of time, working in collaboration with available support members.

RFP Development

The Requests for Proposals (RFP) will have to be prepared to select the appropriate BI consultants (where there is ability to handpick a small team of experts) or consulting firms (where the consulting firm brings in whoever they have). The structure of the RFP will align with the phased approach and make consideration for a separate RFP for Phase 1. The RFP will endeavor to stipulate McMaster's ability to control start and stop times. In alignment with the phased approach, a key RPF condition will be to negotiate a contract for one subject which upon successful deployment can be extended to cover subsequent planned phases, one by one, and subject to an increase of the use of internal McMaster resources and corresponding decrease in the use of consultants for each subsequent BI project. The RPF will stipulate successful knowledge transfer as a requirement and the ability of the BI team to successfully complete a BI project with minimal use of consultants during subsequent BI projects will signify fulfillment of that requirement.

Potential Project Risks

As with any project, there are many potential risks that must be identified, assessed and managed, but only a few key ones will be highlighted. Business intelligence and analytics is a new competency and is to be developed following several years of ERP implementation. Although implementation is completed, the ERP system still experiences unexpected outages and the ongoing work of delayed implementation and software upgrades still require resourcing. While the ERP systems continue to stabilize, the same key support resources required for BI projects are also continuingly pulled in different directions to work on stabilizing the ERP, unexpected system outages, new applications, and software upgrades, in addition to their regular responsibilities. The successful delivery of BI solutions identified depends greatly on active collaborative planning, scheduling and serious consideration of additional resources to deal with the demands of day-to-day business and departmental operations. To minimize the risk of over-committing and under-delivering on the ability to support the BI project, a calendar of "black-out" periods by business areas have been plotted (see Appendix D). These black-out periods are the times when their resources are stretched the thinnest and unavailable to support the BI projects. Given that the black-out periods are long and cover many months, it will not always be possible to avoid these black-out periods especially with consultants billing the University for their time and effort but the calendar will be used as far as possible to guide BI deployments. To further manage the risk of inadequate resources, some temporary resources to help alleviate some resource pressures have also been identified for each business area in a separate document.

Given that the BI budget will not be sufficient to implement all the subject areas, the BI team has to be a committed and highly skilled team to be able to complete all remaining subject areas, as well as, new and wider subjects, after the BI consultants depart. There is a potential risk that they may not be able to deliver on their own without the help of consultants. To minimize that risk, the BI team will be hired, trained and made ready so that they have the ability to work alongside the consultants and learn quickly. Once they acquire a sufficient level of skill, there is a real risk of them leaving McMaster for better employment opportunities. To minimize this risk, the BI team will be hired on a permanent basis from the beginning and carefully selected for their skills and competencies and their genuine desire to remain as McMaster employees. As well, there will be knowledge transfer to the rest of the IRA team so that someone there would be able to step up and fill the vacancy as soon as it arises. Several BI consultants have indicated that a BI team should have at least 5 members. Another potential risk is the BI team of four may be inadequate to begin with. The implication may be that each BI deployment may take longer due to inadequate resourcing.

Risks of outages and performance issues could occur if the BI foundation and infrastructure is not properly architected and scaled. To avoid this risk, this strategy includes the hiring of a Solutions Architect to work with the McMaster BI resources and where necessary alongside the BI consultants to ensure that the BI foundation is properly set up and will run efficiently and smoothly.

Success Criteria

Best practices and seasoned BI practitioners agree that success of BI needs to be measured and marketed. While success criteria will vary somewhat from project to project some general criteria and metrics typically fall under the two categories of added business value and improved operational productivity. Within each category suggested measurements include:

Added business value:

- More and new facts made available to support decision making
- Currently unanswered or partially answered questions can be answered
- New analytics available to support University decisions and enhance reporting
- Enhanced prediction and forecasting capabilities

Improved Operational Productivity:

- Faster access to data including simplified and streamlined information processing
- Accelerated decision making time
- Reduced iterations to get to the “right” number
- On time and on budget track record on BI Projects

More qualitative success criteria include things like:

- Greater trust in the data
- High rate of adoption and use of BI deliverables across a wide audience
- High demand for more reports and analytics
- Enthusiastic and voluntarily sustained stakeholder engagement

Implementation Roadmap

Activities	2015				2016												2017												2018		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Scope, Strategy and Roadmap (ongoing iterations)																															
Gather information requirements and priorities																															
Executive Approval of BI Strategy																															
Map requirements to available data in PeopleSoft																															
Identify gaps and implications																															
RFP and Partner Selection																															
Complete, approve and publish RFP																															
Review, evaluate responses																															
Select partner and negotiate contract																															
Selected partner get resources in place to begin Phase 2																															
BI Team																															
Establishment and Hiring																															
BI Team training																															
Phase 1 - Infrastructure (Technical & Organizational)																															
Engage Solutions Architect																															
Define Standards and Methods																															
Confirm SW components, certifications, patches																															
Define environments and hardware capacity																															
Define Operational elements (SLA, DR, Help Desk)																															
Order hardware																															
Install hardware (Dev, QA, UAT, Prod)																															
Phase 2 - Subject Area #1 (Research Administration)																															
Install software (EPM, DataStage, DW, OBIEE)																															
Configure, Build and load EPM Warehouse (multiple layers and ETL's)																															
OBIEE reporting on delivered dashboards																															
Confirm gaps discovered in IRA attribute mapping																															
Build EPM/OBIEE customizations and hierarchies																															
Customize ETL to fill gaps																															
Reload as required																															
Develop, test, UAT, document metadata, reports, dashboards and analytics and promote																															
Orient and train users																															
Repeat/iterate from confirm Gaps as often as necessary to deliver to meet business requirements																															

Activities	2015				2016												2017												2018		
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Phase 3 - Subject Area #2 (Course/Student Enrolment)																															
Confirm gaps discovered in IRA attribute mapping																															
Build EPM/OBIEE customizations and hierarchies																															
Customize ETL to fill gaps																															
Reload as required																															
Develop, test, UAT, document metadata, reports, dashboards and analytics and promote																															
Orient and train users																															
Repeat/iterate from confirm Gaps as often as necessary to deliver to meet business requirements																															
Phase 4 - Subject Area #3 (Student Performance)																															
Confirm gaps discovered in IRA attribute mapping																															
Build EPM/OBIEE customizations and hierarchies																															
Customize ETL to fill gaps																															
Reload as required																															
Develop, test, UAT, document metadata, reports, dashboards and analytics and promote																															
Orient and train users																															
Repeat/iterate from confirm Gaps as often as necessary to deliver to meet business requirements																															
Phase 5 - Subject Area #4 (Academic Productivity)																															
Confirm gaps discovered in IRA attribute mapping																															
Build EPM/OBIEE customizations and hierarchies																															
Customize ETL to fill gaps																															
Reload as required																															
Develop, test, UAT, document metadata, reports, dashboards and analytics and promote																															
Orient and train users																															
Repeat/iterate from confirm Gaps as often as necessary to deliver to meet business requirements																															
Ongoing BI Program Evolution																															
Define business related KPI's appropriate to BI solutions																															
Define BI program related KPI's appropriate to stage of BI solution deployment																															
Define and assign monitoring & followup roles and responsibilities																															
Schedule "regular" reviews of KPI appropriateness, benefit measurement and marketing processes																															
Review and adjust team and governance structures based on early experience																															

Appendix A: Research Administration

1. **Research Administration**: This dashboard will contain a series of reports and metrics related to research applications and grants awarded to McMaster University faculty members and their co-investigators, and related metrics.

   A. Facts displayed in this dashboard will include:

   i. Project applied
   ii. Project awarded
   iii. Award start date
   iv. Award end date
   v. Award title
   vi. Opening balance
   vii. Ending balance
   viii. Amount applied
   ix. Amount awarded
   x. Amount received in year
   xi. Amount received annually
   xii. Sponsor
   xiii. Other Sponsors 1, 2, 3
   xiv. Sponsor classification (corporate, federal, provincial, municpal, not for profit, etc)
   xv. Sponsor program (varies by Sponsor)
   xvi. McMaster cash contribution
   xvii. Principal investigator
   xviii. Other investigators

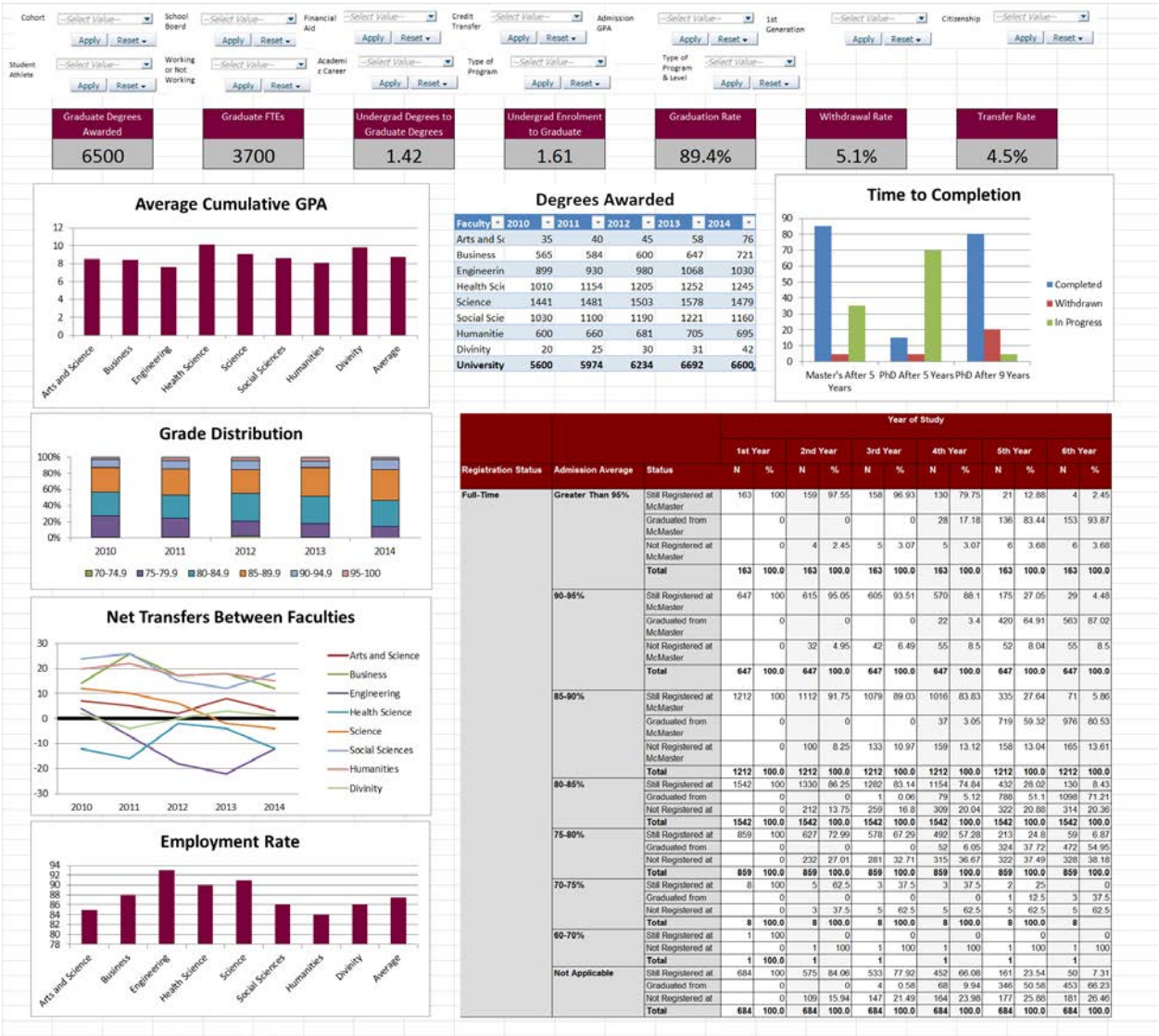
   B. Metrics will include:

   xix. Research dollars awarded/FT Faculty FTE
   xx. TA dollars funded by Research/FT Faculty FTE
   xxi. % TT Faculty with international partnerships (and national partnerships)
   xxii. % TT Faculty with research awards
   xxiii. % TT Faculty with Tri-Council awards
   xxiv. % collaboration with another Faculty at McMaster
   xxv. % research applications that were successful
   xxvi. % with student RAs – undergraduate vs graduate

   C. The dimensions available for slicing, filtering, drilling, and aggregating the data will include:

   xxvii. Key sponsor
   xxviii. Department
   xxix. Faculty
   xxx. Partner institution
   xxxi. Principal investigator
   xxxii. Country of investigator
   xxxiii. Institution of co-investigators
   xxxiv. Projects in deficit
   xxxv. Time period

Appendix B: Student Performance Dashboard



Faculty	2010	2011	2012	2013	2014
Arts and Sc	35	40	45	58	76
Business	565	584	600	647	721
Engineerin	899	930	980	1068	1030
Health Scie	1010	1154	1205	1252	1245
Science	1441	1481	1503	1578	1479
Social Scie	1030	1100	1190	1221	1160
Humanitie	600	660	681	705	695
Divinity	20	25	30	31	42
University	**5600**	**5974**	**6234**	**6692**	**6600**

			Year of Study											
			1st Year		2nd Year		3rd Year		4th Year		5th Year		6th Year	
Registration Status	Admission Average	Status	N	%	N	%	N	%	N	%	N	%	N	%
Full-Time	Greater Than 95%	Still Registered at McMaster	163	100	159	97.55	158	96.93	130	79.75	21	12.88	4	2.45
		Graduated from McMaster		0		0		0	28	17.18	136	83.44	153	93.87
		Not Registered at McMaster		0	4	2.45	5	3.07	5	3.07	6	3.68	6	3.68
		Total	**163**	**100.0**	**163**	**100.0**	**163**	**100.0**	**163**	**100.0**	**163**	**100.0**	**163**	**100.0**
	90-95%	Still Registered at McMaster	647	100	615	95.05	605	93.51	570	88.1	175	27.05	29	4.48
		Graduated from McMaster		0		0		0	22	3.4	420	64.91	563	87.02
		Not Registered at McMaster		0	32	4.95	42	6.49	55	8.5	52	8.04	55	8.5
		Total	**647**	**100.0**	**647**	**100.0**	**647**	**100.0**	**647**	**100.0**	**647**	**100.0**	**647**	**100.0**
	85-90%	Still Registered at McMaster	1212	100	1112	91.75	1079	89.03	1016	83.83	335	27.64	71	5.86
		Graduated from McMaster		0		0		0	37	3.05	719	59.32	976	80.53
		Not Registered at McMaster		0	100	8.25	133	10.97	159	13.12	158	13.04	165	13.61
		Total	**1212**	**100.0**	**1212**	**100.0**	**1212**	**100.0**	**1212**	**100.0**	**1212**	**100.0**	**1212**	**100.0**
	80-85%	Still Registered at	1542	100	1330	86.25	1282	83.14	1154	74.84	432	28.02	130	8.43
		Graduated from		0		0	1	0.06	79	5.12	788	51.1	1098	71.21
		Not Registered at		0	212	13.75	259	16.8	309	20.04	322	20.88	314	20.36
		Total	**1542**	**100.0**	**1542**	**100.0**	**1542**	**100.0**	**1542**	**100.0**	**1542**	**100.0**	**1542**	**100.0**
	75-80%	Still Registered at	859	100	627	72.99	578	67.29	492	57.28	213	24.8	59	6.87
		Graduated from		0		0		0	52	6.05	324	37.72	472	54.95
		Not Registered at		0	232	27.01	281	32.71	315	36.67	322	37.49	328	38.18
		Total	**859**	**100.0**	**859**	**100.0**	**859**	**100.0**	**859**	**100.0**	**859**	**100.0**	**859**	**100.0**
	70-75%	Still Registered at	8	100	5	62.5	3	37.5	3	37.5	2	25		0
		Graduated from		0		0		0		0	1	12.5	3	37.5
		Not Registered at		0	3	37.5	5	62.5	5	62.5	5	62.5	5	62.5
		Total	**8**	**100.0**	**8**	**100.0**	**8**	**100.0**	**8**	**100.0**	**8**	**100.0**	**8**	
	60-70%	Still Registered at	1	100		0		0		0		0		0
		Not Registered at		0	1	100	1	100	1	100	1	100	1	100
		Total	**1**	**100.0**	**1**		**1**		**1**		**1**		**1**	
	Not Applicable	Still Registered at	684	100	575	84.06	533	77.92	452	66.08	161	23.54	50	7.31
		Graduated from		0		0	4	0.58	68	9.94	346	50.58	453	66.23
		Not Registered at		0	109	15.94	147	21.49	164	23.98	177	25.88	181	26.46
		Total	**684**	**100.0**	**684**	**100.0**	**684**	**100.0**	**684**	**100.0**	**684**	**100.0**	**684**	**100.0**

Appendix C: Business Intelligence Technologies

A. PeopleSoft EPM/OBIEE vs Oracle OBIA/OBIEE

Oracle has two different platforms for BI and both come with OBIEE which is used for user presentation. The first platform is the PeopleSoft EPM warehouses with pre-packaged cubes for Campus Solutions and delivered with the IBM WebSphere DataStage ETL tools and prepackaged ETL jobs. The other is OBIA which is Oracle's strategic solution that also comes with out-of-the-box cubes but uses an Oracle ETL called Informatica. While both PeopleSoft EPM and Oracle OBIA use OBIEE for user presentation, the structure of EPM and OBIA are completely different. OBIA comes with data architecture to support all of Oracle's ERP offerings including JDEdwards, Siebel, etc. At the time of the purchase, the PeopleSoft EPM had more out-of-the-box cubes for Campus Solutions, and was thought to be the more appropriate system.

In early 2013, Oracle announced that it would stop supporting EPM/OBIEE after 2018. In Spring 2014 when this issue was raised for decision, prior to the population of the McMaster CDW with HR and Student data for the Go-Live of HR and Students, the University reviewed and confirmed its decision not to upgrade to OBIA but to stay with EPM/OBIEE. To date, all Student, Finance, Research Administration, and HR production ready data are stored in the CDW (i.e. the OWS tables of the EPM, earlier referred to as the CDW – see Current Environment) and hundreds of queries have been and continue to be developed against the CDW. Moving to OBIA now would require a complete reload of the central data warehouse into OBIA and rewrite of existing queries which would delay BI implementation by at least another six to twelve months. If it did not make sense to upgrade to OBIA back in Spring/Summer of 2014, it makes even less sense to move to OBIA now. Oracle salespersons while they encourage the move to OBIA just because OBIA is Oracle's strategic direction, they concede that the effort would be significant now.

In addition, given that most of the subject matter required is in Campus Solution, the offering of out-of-the-box cubes in EPM is stronger than the offering in OBIA. There are very few OBIA deployments and none in the postsecondary education sector with enough experience to be a strong reference for OBIA at this point in time. There are still many universities in the world that have the EPM system and Oracle has not given us examples of any EPM universities converting to OBIA. While McMaster needs to prepare for a conversion to OBIA at some point down the round, given where we are now, that point in time does not need to be in the short term but could be at least eight to ten years down the road. Note also that the OBIEE software continues to be used and McMaster will be able to benefit from its upgrades and new features even while it stays on the EPM system.

B. Alternative BI Technologies

Should McMaster University implement this PeopleSoft BI system that has been purchased or adopt another before we embark BI implementation. Choosing the right BI technology is important. Is the PS EPM/OBIEE technology the right one for McMaster? Note that the EPM warehouses are delivered with an open reporting platform which enables the University to use OBIEE or any third party reporting tool.

PS EPM/OBIEE is probably the right combination of technology because it is an enterprise-wide system and would leapfrog McMaster as a fore-runner to provide the enterprise-wide BI facility matching the chosen path of the enterprise ERP implemented. Its enterprise-wide platform and OBIEE user presentation with a rich array of functionalities are well suited to enable McMaster to build a robust data foundation and governance discipline on which to build its BI program to meet the University's

evolving analytical and reporting requirements well into the future. The alternative would be for McMaster to implement an assortment of specifically purposed tools but this option could encourage a proliferation of data and reporting silos and require significant data reconciliation effort.

Secondly, PS EPM/OBIEE comes with a significant number of out-of-the-box data models and reports. While these components rarely meet all the requirements, they can be used as a starting place from which to make extensions and changed to meet requirements and thus reduce the level of effort necessary otherwise. Third, there are currently over 100 vendors offering business intelligence tools, and mergers and acquisitions continue to consolidate existing vendors while more new ones emerge with more advanced features. Even though the PS EPM/OBIEE lacks features such as data visualization and advanced analytics, Oracle, considered a "Tech Titan" by BI experts will only continue to expand the BI functionality of its products and will likely out-live many alternative BI vendors. For example, Oracle has its own data visualization tool in beta testing, to compete with Tableau, which is currently leading the way in this area. Fourth, implementing a designed and integrated enterprise level data and technology architecture like PeopleSoft EPM/OBIEE to support business intelligence initially will position McMaster, if required, to add on future leading edge BI tools and technologies without having to create a new infrastructure related to data management.

Appendix D: Identified Black-Out Periods

INSTITUTION & FACULTY BUSINESS AREAS	CALENDAR YEAR 2016 - BUSINESS WORK LOAD BLACK OUT PERIODS TO CONSIDER IN BI IMPLEMENTATION PLANNING																																															
	JAN				FEB				MAR				APR				MAY				JUNE				JULY				AUG				SEPT				OCT				NOV				DEC			
STUDENT																																																
Records																																																
Scheduling and Exams																																																
Financial Aid and Scholarships																																																
Admissions																																																
GRADUATE STUDIES																																																
Records																																																
Graduate Scholarships																																																
Admissions and Recruitment																																																
Graduate Student Life																																																
Thesis																																																
HUMAN RESOURCES																																																
Cyclical																																																
Ad hoc (non-cyclical)																																																
FINANCIAL AFFAIRS																																																
System Support																																																
Student Accounts and Cashiers																																																
All Other																																																
RESEARCH ADMINISTRATION																																																
Cyclical																																																
Ad hoc (non-cyclical)																																																
FACULTIES																																																
Finance staff and managers																																																
UTS INFRASTRUCTURE AND SOFTWARE UPGRADES																																																
Cyclical																																																
Ad hoc (non-cyclical)																																																
IRA																																																
Cyclical																																																
Ad hoc (non-cyclical)																																																