A Report for the

University of North Carolina

Data Modernization and Integration Initiative Strategy and Implementation Plan

6 April 2018

Engagement: 330046753

Gartner

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Gartner

Executive Summary

1.0 Executive Summary

The University of North Carolina (UNC) launched the Data Modernization and Integration (DMI) initiative in December of 2017. The mission of the Data Modernization initiative is:

> *To provide the UNC System Leadership, the UNC Institutions and the Board of Governors with clear, timely, consistent, actionable financial and related data, which will enable them to guide the UNC System in meeting its strategic goals.*

This initiative is expected to achieve four significant outcomes which will benefit the individual UNC institutions, their students and staff, System Office personnel, oversight groups (the Legislature and the Board of Governors), and ultimately the citizens and taxpayers of North Carolina. These outcomes are:

- **Outcome 1: Improved Decision Making** — Provide reliable data that enables UNC Institutions, System Leadership and the Board of Governors to make informed, proactive decisions.
- **Outcome 2: Improved Process Efficiency** — Create operational process efficiencies by reducing the time, effort and resources the UNC System requires to find, validate and analyze information.
- **Outcome 3: Improved Operational Credibility** — Provide information management capabilities that improves UNC System organizational integrity and reliability.
- **Outcome 4: Improved Technical Foundation for Financial Data Reporting** — Provide a strong technical foundation for reporting financial data and integrate that reporting across the HR and Student pillars in the UNC System.

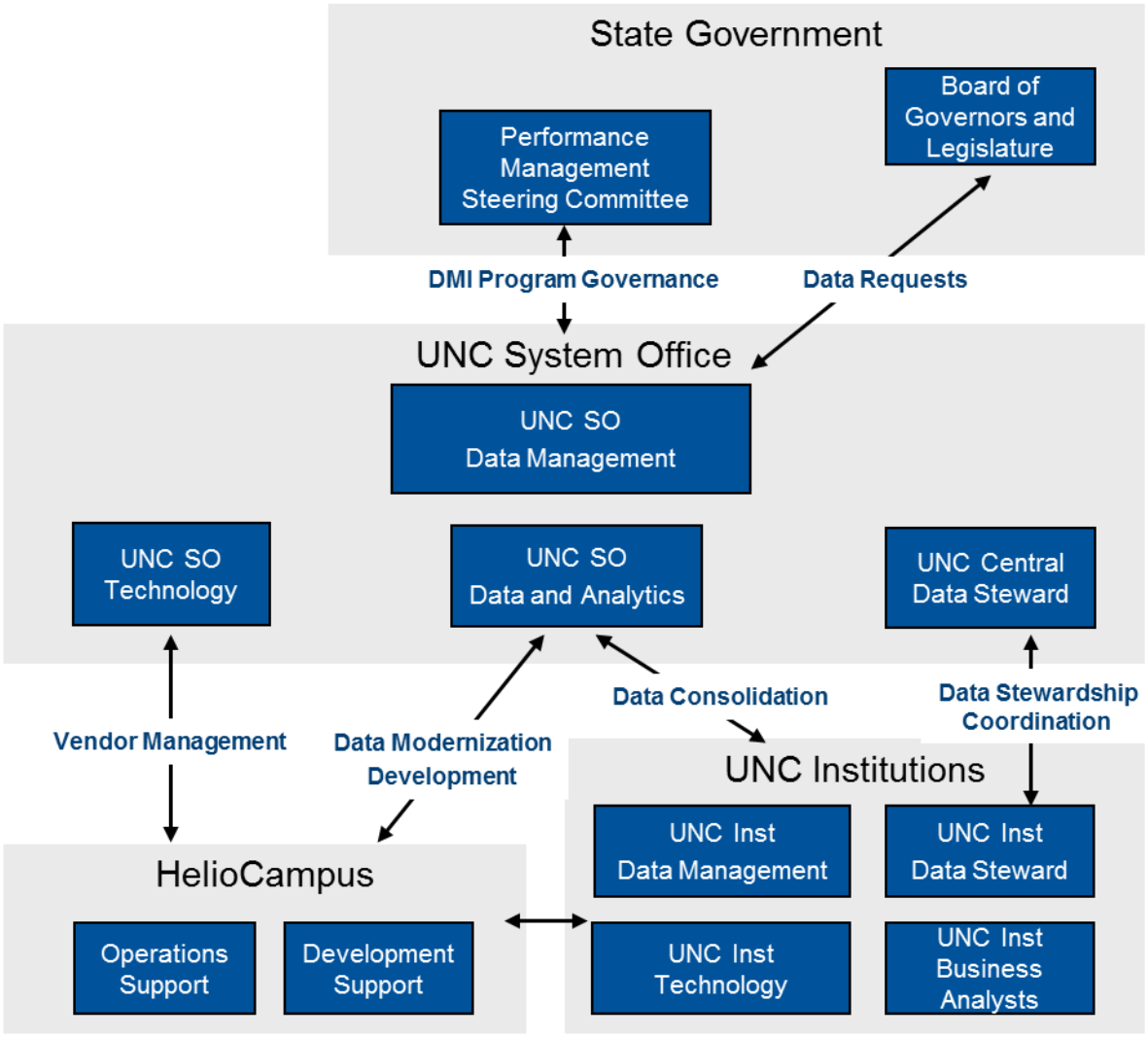
UNC spent the period from December 2017 through March 2018 developing a strategy and plan for achieving these outcomes. A wide range of UNC personnel were involved representing the System Office and key functional areas at the individual institutions, with Gartner Consulting facilitating the process and providing expertise. At the core of the strategy are four major recommendations:

1. *Create a Shared Governance Structure* — Managing data enterprise-wide requires a governance process in order to make and enforce decisions regarding processes, standards, and common definitions. The proposed governance process should be a joint effort between the System Office and the institutions.
2. *Define Clear Roles and Responsibilities* — On a day-to-day basis, the responsibilities for managing and processing information need to be clearly defined. All 17 institutions and the System Office need to ensure that these responsibilities are clearly assigned and are being carried out.
3. *Develop Consistent Standards and Processes* — The 17 institutions within the UNC System represent a wide variety of campus sizes, missions, student bodies and other characteristics. For this reason, they cannot be expected to perform all activities in the same manner. However, the information used for system-wide reporting and analysis needs to be comparable, and therefore the policies and procedures that apply to this data need to be consistent.
4. *Implement a Consolidation Model for Data Collection* — In order to minimize the impact on the institutions, they will continue to use their existing processes and systems for managing their own data. Each institution will be required to send a subset of their data to the System Office, mapped to a common coding scheme. The rationale for this approach is described in Section 4.0 below.

5. *Implement New Systems and Technical Architecture* — The systems used by the System Office to collect, aggregate, store, and perform system-wide analyses and reporting should follow a standard architectural framework. This will give the System Office appropriate flexibility and effectiveness, and will also make it possible for individual institutions to take advantage of these tools if desired.

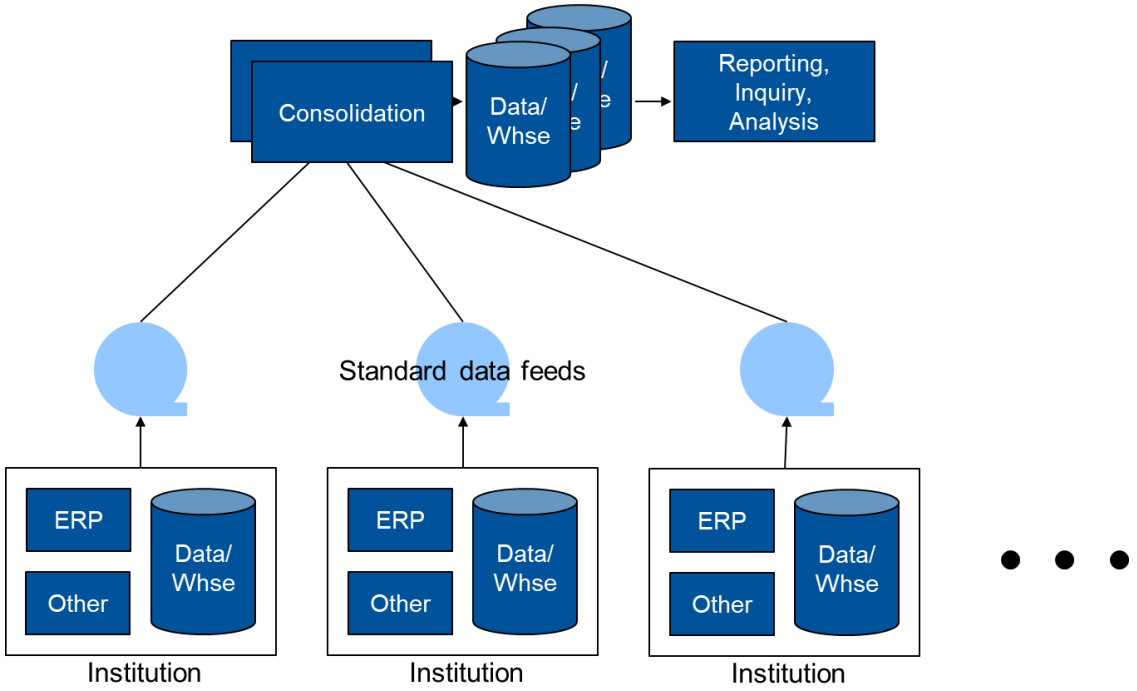
For the success of the Data Modernization and Integration initiative, it is critical that all parts of the UNC system work together to govern and manage the initiative itself, and the ongoing data management processes that will result. The following Figure 1 provides an overview of the roles played by various parts of the UNC system.

Figure 1. Overall Roles



The Consolidation Model mentioned in item 4 above was selected in order to deliver results quickly and economically while minimizing disruption for the institutions. In this model, the institutions continue to use their existing processes and systems, but also send data in a standard format and using standard codes to the System Office where it is aggregated to enable cross-institutional reporting and analysis. This model is described in simplified form in Figure 2 below.

Figure 2. Consolidation Model for Data Collection



Multiple projects will be required to implement these and the other recommendations developed during the Data Modernization Strategy and Planning effort. Eight major projects have been identified. They are estimated to require four years to fully execute as outlined in Figure 3 below.

Figure 3. Data Modernization Project Schedule

WORKSTREAMS	FY 18/19				FY 19/20				FY 20/21				FY 21/22			
	Q318	Q418	Q119	Q219	Q319	Q419	Q120	Q220	Q320	Q420	Q121	Q221	Q321	Q421	Q121	Q221
Establish DMI Foundation																
P1: Launch Program and Governance																
P2: Establish Information Request Process and Data Stewardship																
P3: System Office Support Organization and Software Tool Acquisition (as required)																
Finance Analytics (including finance-related data)																
P4: Financial Data Warehouse Architecture, Common Coding and Allocation Design																
P5: Financial Information Portal*																
P6: Financial Core Analytics Workbench*																
Extended Analytics																
P7: Integration of Portal and Workbench for Finance, HR and Student Data Marts*																
P8: Exploratory Analytics and additional Data Marts*																

*Workstreams that result in the development and implementation of Analytics Products include the work required to access, extract and integrate the required data from Institution systems and other sources and the full cycle of development, testing, infrastructure provisioning, implementation, training and change management required for successful implementation.

Key	
Initial Planning, Requirements and Sourcing Activities	
Design, Procurement and Development	
Roll out	
Post Roll Out Support	

While the full effort is projected to take four years, it is expected that UNC will start to see initial benefits from the early stages as new policies and concepts are applied to the existing environment. When the initial Financial Information Portal goes live after 2-1/2 years more significant benefits will be realized.

Projects such as the DMI initiative always come with challenges and risks. In order for the initiative to be successful, the relevant risks need to be mitigated, and key success factors put into place:

Risks

- The UNC System develops a strategy that focuses too much on answering individual questions from the Legislature and the Board of Governors and not enough on providing information to guide the UNC System in making long term strategic decisions and measuring progress-to-goal.
- The UNC System campuses will be hesitant to participate if they believe the data they provide will be used to cut their budgets, or to micro-manage their institutions.
- Gartner is concerned that, by itself, improving the ability to respond to external information requests may be an insufficient motivator for the campuses to undertake the expected levels of effort and disruption.
- Comparison of cost-per-unit data among campuses requires insights into the unique characteristics and context of the data, and may be misleading if not interpreted properly.
- In some cases, fundamental differences in the base data maintained by each institution may not allow for the collection, comparison or aggregation of all desired data. In other words: some questions of leaders will not be answerable regardless of how well this project is implemented. This creates the risk that the project could be perceived as a failure despite succeeding in meeting all stated objectives.
- Resources provided by UNC to any Data Modernization initiative could take resources from strategic initiatives at the UNC Institutions and the System Office. In particular, this project could divert resources currently supporting the existing data marts.

Success Factors

- A clear, system-wide vision for the Data Modernization initiative needs to be developed in collaboration between stakeholders in the UNC System Office, the 17 UNC institutions and the Board of Governors.
- Direct tangible and perceived benefits and directives need to be identified and communicated to the UNC institutions providing the data.
- The success of the Data Modernization project largely depends on the participation of the appropriate staff at each institution and the UNC System Office. There must be adequate staff and resources, and management structure to support this initiative.
- A comprehensive Organizational Change Management program is needed which focuses on the UNC institutions, the University of North Carolina System Office and System leaders including the Board of Governors, will increase participation and support of new data processes and structures, and updated governance.
- The Organizational Change Management program should also focus developing and increasing the understanding of the definitions and business context of the data from the UNC System to the University of North Carolina System Office and the Board of Governors.
- The University of North Carolina System Office leverages “Lessons Learned” from previous initiatives such as the Student and Human Resources Data Marts.

Introduction

2.0 Introduction

Gartner Consulting (Gartner) is pleased to submit this report to the University of North Carolina (UNC) summarizing the findings and recommendations of the project conducted jointly by Gartner and UNC to develop an overall strategy and implementation plan for the Data Modernization and Integration initiative.

This project was conducted as a series of workshops, with participants from IT, Finance and other functional areas representing all 17 UNC institutions and the System Office. While Gartner was honored to be asked to facilitate this process and we concur with the results, we wish to point out that the findings and recommendations contained in this report represent the best thinking and consensus of the UNC participants, and are not merely the recommendations of an external consultant.

Gartner understands that UNC intends to submit this report to the North Carolina State Legislature as part of their response to Section 10.6.(b) of the Appropriations Act of 2017. This section of the Act lists required content for UNC's submission. The following Table 1 indicates where each required item can be found in this report.

Table 1. Required Items

Number	Description	Where Found in This Report
1	The challenges and specific goals of the project. In addition, the outcomes expected from the project shall be specifically identified.	Section 3.1: Goals of the Data Modernization Initiative
2	The management structure to be used in managing, operating, and executing the project. The report shall indicate whether a post-project completion governance structure is needed to provide (i) oversight for the systems created for each project and (ii) service of the systems for each project. The report shall also indicate whether any additional funds may be needed to maintain the Data Modernization systems created after initial completion and to maintain the ERP systems created after initial completion.	Section 5.2: Shared Governance Section 6.2: Estimated Costs
3	The sources and target for movement and transformation of data being sought to achieve the project's goals.	Section 5.5: Consolidation Model for Data Collection Section 5.6: New Systems and Technical Architecture
4	The proposed technical implementation plan for the project, including a description of the technical details of how the project will be implemented in the context of a specific set of vendor products and platforms. The proposed technical implementation plan shall also outline documented industry- and product-specific best practices.	Section 6.1: Projects and Timeline
5	A detailed schedule for implementation and completion of the project.	Section 6.1: Projects and Timeline

Background

3.0 Background

3.1 Goals of the Data Modernization Initiative

The need for a Data Modernization and Integration (DMI) initiative at UNC was recognized in 2017, and the initial strategy work was specified by the state legislature in the Appropriations Act of 2017. Stakeholders in the System Office, the 17 institutions and the Board of Governors face multiple issues as they seek to effectively manage the system and report to the state legislature. These issues include:

- Difficulty in efficiently compiling Financial Information across 17 unique institutions, each with a unique system and processes for reporting financial information. As a result assembling information for legislative or UNC Board of Governors requests is labor intensive, inefficient and largely takes place outside of the financial systems.
- Inability to effectively measure and compare financial performance across the UNC System. Institutional expenditure data is not comparable over time or across the system at a sufficient level of detail to analyze trends. In addition revenue streams are not easily tied to appropriate expenditures.
- The standardization of HR data being fed to the HR Data Mart and business practices behind that data feed requires evaluation and improvement.
- The wide variety of information requests from oversight groups, and the lack of their predictability, has several negative impacts:
  - The institutions and the System Office are both required to dedicate significant resources to responding to ad hoc information requests
  - The need to address metrics that change frequently tends to reduce UNC's focus on those metrics that consistently measure progress toward the strategic objectives defined in the Strategic Plan
  - The knowledge that metrics are not predictable can stifle innovation and entrepreneurship

UNC Leadership recognizes that the Data Modernization and Integration initiative is a requisite for execution of the 2017-2022 UNC System Strategic Plan. Specifically, Goal 6 and Goal 11 are the key strategic drivers for this initiative.

- **Goal 6** – Pursue and utilize increased operational and financial flexibility for the benefit of the educational, research, and public service missions of the University

  Metric: Increase operational and financial flexibility for the University and demonstrate its financial impact. This includes reductions in regulatory burdens and increases in financial reporting and transparency.

- **Goal 11** — The University will systematically focus on recruitment, retention, and development of the most talented and diverse workforce possible at all levels over the next five years.

  Metric: By May 2017, UNC General Administration will create an implementation plan (including the details of proposed data collection and metrics) to systematically measure, — at all levels — engagement, retention, succession planning, and investment in professional development in order to promote system-wide improvements in these areas.

The Board of Governors recognized that: “To achieve the gains called for in our Strategic Plan, institutional leaders need integrated information to make sound decisions. This requires transforming data systems that were designed to comply with federal, state, and accreditation agencies into sophisticated business intelligence tools.” To achieve this, four overall goals were identified for the Legislature:

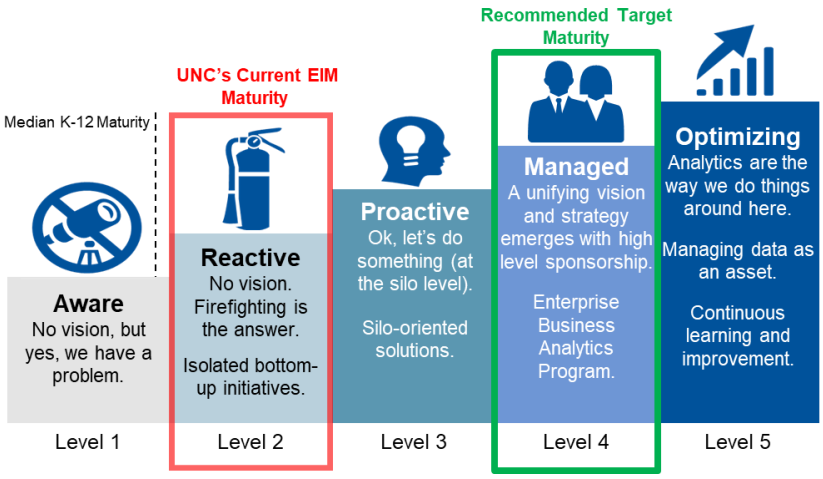
- Connect state appropriation and tuition revenue to particular courses or degree programs
- Help campuses better understand where improving graduation rates may yield strongest resource savings and target student performance strategies accordingly
- Provide additional financial transparency and insight into value by allowing comparisons across system by department or program
- Allow UNC to more quickly and accurately address legislative and BOG requests for information. Common information requests for the state cost of athletics, law schools, and medical schools could be addressed more quickly and consistently

3.2 Current State

Maturity Assessment

The project team conducted an assessment of the maturity of UNC’s current Enterprise Information Management (EIM) capabilities as they relate to Finance data, using a 5-level maturity model. Overall, UNC’s maturity in this area is Level 2: “Reactive.” Given the complexities of the system and the need for better information, UNC should be at Level 4: “Managed.” These levels are defined and UNC’s maturity is indicated in Figure 4 below.

Figure 4. Overall Assessment of the Maturity of UNC’s Enterprise Information Management Capabilities Related to Finance Data



This assessment of Level 2 represents an overall average. When UNC’s Enterprise Information Management capabilities for Finance are divided in to seven major dimensions, some are at Level 2, and others are at Level 1: “Aware.”

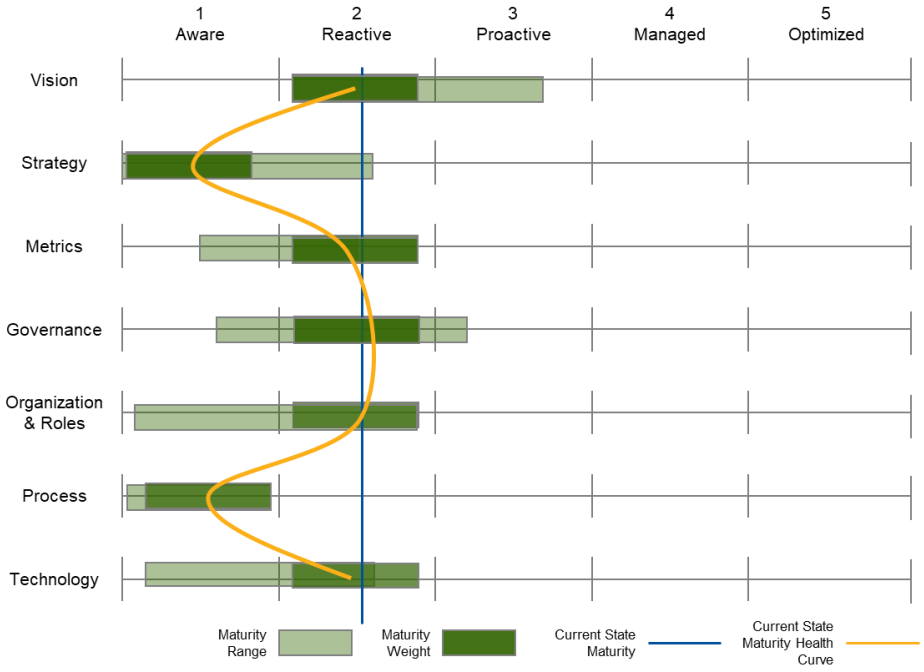
The seven dimensions are:

- **Vision** — Describes at a high level what the Enterprise Information Management program looks like, and how it supports the business vision

- **Strategy** — How the Enterprise Information Management vision will be realized
- **Metrics** — Measures the contributions of Enterprise Information Management
- **Governance** — Establishes the decision rights framework
- **Organization & Roles** — Forms structures to support Enterprise Information Management
- **Process** — Defines the processes needed to support Enterprise Information Management
- **Technology** — Provides the technology to support the Enterprise Information Management program

The following Figure 5 illustrates the maturity assessment for each of the seven dimensions. A number of factors were assessed, each being an indicator of maturity. The light green bars represent the range of maturities indicated, and the dark green bars represent the concentration of indicators that provide the overall score.

Figure 5. Maturity Assessment for the Seven Dimensions of Enterprise Information Management Related to Finance Data



In a healthy, evolving Enterprise Information Management program the dimensions at the top mature ahead of those at the bottom, creating a health curve that angles from the top right of the chart to the bottom left. The variation of scores indicated by the yellow “health curve” shows that in addition to being less mature, UNC’s Enterprise Information Management capabilities are not maturing in a coordinated fashion. Appendix A contains a detailed list of observations, organized by the seven dimensions listed above.

UNC Experience with Similar Challenges

In the past, UNC has implemented shared solutions to provide cross-institutional views of student data and human resources data.

- **Student Data** Mart – The Student Data Mart (SDM) was developed in 2014-2015 to provide clear pictures of student progress and supporting operations. It consists of a database managed by the System Office, and fed by the Student Information Systems at the individual institutions. The database contains student, course, instructor, application, program, awards, class meetings and financial aid data. In addition to building the database and data collection processes, the project "convinced 16 university registrars, admissions directors, financial aid directors, facilities managers, provosts, information technology and institutional research teams to examine data and business practices toward the goal of providing data that provide clear pictures of student progress and supporting operations."[1] As a result of this effort individual campuses are spending less time creating and manipulating data extracts and more time doing their own analyses. The System Office is now able to perform a variety of cross-institutional analyses of student-related data. The SDM also facilitated the current System Office predictive analytics pilot by providing a consolidated source of data.
- **Human Resources Data Mart** – Originally implemented in 2012, the Human Resources Data Mart (HRDM) collects summary human resources and payroll data from local Human Resources systems. It contains information on employees, positions, jobs, and labor-related budgets. Staff at the System Office and the institutions use this system to perform individual and cross-institutional analyses of employment and human resources at UNC. The utility of this data mart is constrained by the level of summarization of the data it contains and the time between updates. UNC Staff have been developing recommendations for enhancing the HRDM to address these constraints. In addition to benefiting HRDM users, these enhancements are also important to the success of the DMI initiative and the proposed mart for financial data.

UNC's experience with these two data marts demonstrate the viability of creating a database at the System Office that collects information from local systems at the individual institutions. The successes and the lessons learned on these projects will all be instructive for the DMI initiative.

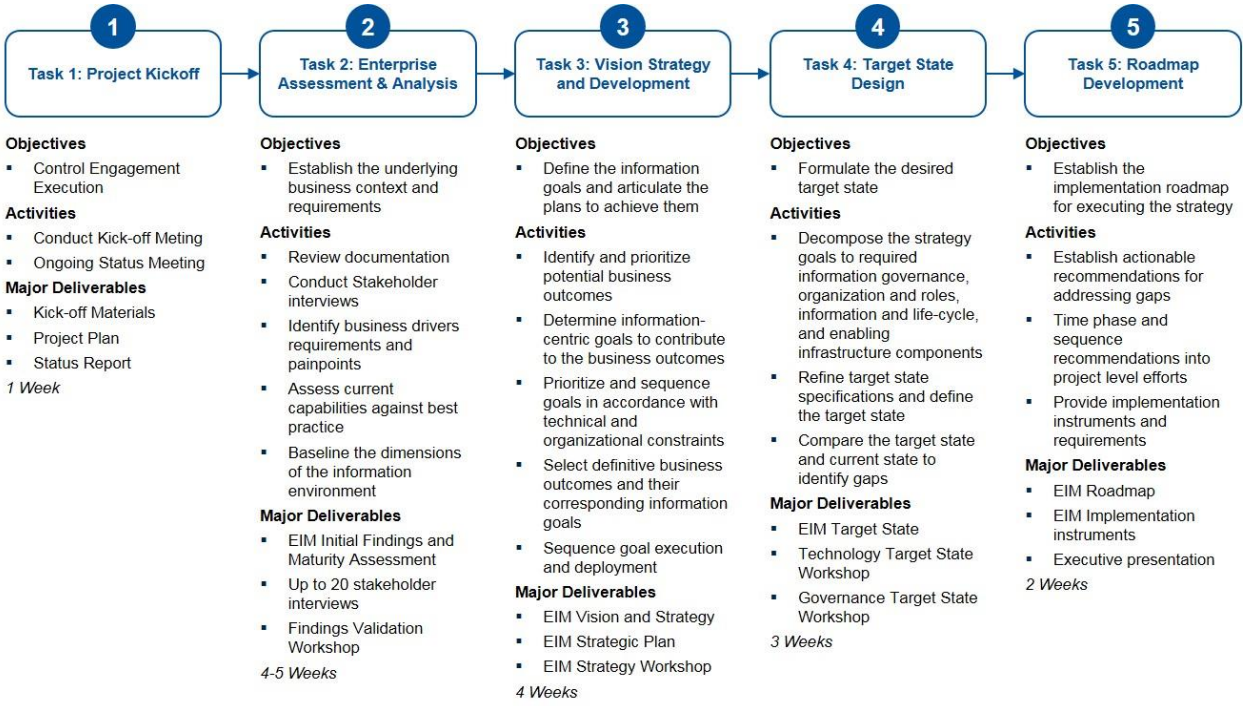
In addition to these data marts, several campuses are working with various vendors implementing predictive analytics tools. The System Office has launched a 9-university pilot of a predictive analytics tool.

3.3 Project Approach

In December of 2017 UNC began a five step process to build the Data Modernization strategy. These steps are outlined in Figure 6 below.

[1] "UNC Datamart" (whitepaper) 5 September 2017

Figure 6. Project Approach



Each of the five steps taken to create the Data Modernization strategy built on the previous step to create the roadmap that is included in Section 6.1 below.

The first step of the process began in December 2017 with the Project Kick-off and a meeting with the University CFOs. The goal was to describe the approach for developing the strategy to the CFOs and gain their input.

In Step 2, in January of 2018, the project team met with members of UNC System Office IT group, the System President, CFOs from the Institutions as well as key Chief Human Resource Officers, and key stakeholders in HR, Finance and Student areas. We used the information from these meetings to build an assessment of the current state of data reporting and analytics in Finance, HR and Student.

In Step 3 the team used the information from Step 2 to build a vision for the future and define guiding principles and steps to achieve that vision. The vision is the basis for creating a strategic vision and plan for the Data Modernization initiative.

In Step 4, the vision and plan became the foundation for developing five major recommendations, each of which encompasses a set of detailed recommendations:

1. *Shared Governance* — Managing data enterprisewide requires a governance process in order to make and enforce decisions regarding processes, standards, and common definitions. The proposed governance process should be a joint effort between the System Office and the institutions.
2. *Clear Roles and Responsibilities* — On a day-to-day basis, the responsibilities for managing and processing information need to be clearly defined. All 17 institutions and the System Office need to ensure that these responsibilities are clearly assigned and are being carried out.
3. *Consistent Standards and Processes* — The 17 institutions within the UNC System represent a wide variety of campus sizes, missions, student bodies and other

characteristics. For this reason, they cannot be expected to perform all activities in the same manner. However, the information used for system-wide reporting and analysis needs to be comparable, and therefore the policies and procedures that apply to this data need to be consistent.

4. *Consolidation Model for Data Collection* — In order to minimize the impact on the institutions, they will continue to use their existing processes and systems for managing their own data. Each institution will be required to send a subset of their data to the System Office, mapped to a common coding scheme. The rationale for this approach is described in Section 4.0 below.
5. *New Systems and Technical Architecture* — The systems used by the System Office to collect, aggregate, store, and perform system-wide analyses and reporting should follow a standard architectural framework. This will give the System Office appropriate flexibility and effectiveness, and will also make it possible for individual institutions to take advantage of these tools if desired.

In this step UNC and Gartner also compared the options of creating a data mart for Finance and creating interfaces between the HR, Finance and Student data warehouses, or consolidating all UNC institutions on a single HR, Finance and Student software.

In Step 5, the team identified the projects required to implement the recommendations, creating a description for each and placing them on a timeline.

Options

4.0 Options

4.1 Description of the Options

In seeking to collect and correlate systems of record data from across multiple institutions, UNC faces the same challenge as other Higher Education systems. This same challenge is faced by any enterprise, public or private, that seeks to analyze data from multiple operating units.

For the purposes of this analysis, the term “systems of record” refers to the systems supporting the following functions, typically referred to in total as the “ERP” (Enterprise Resource Planning):

- Finance:
  - Accounting (general ledger, budgeting, commitment accounting, non-student accounts receivable, cash management)
  - Procurement (requisitioning, purchasing, receiving, accounts payable)
- Human Resources (employee records, payroll, benefits, talent management)
- Student (basic student data, admissions, course catalog, class schedule, class registration, grading, transcripts, transfer articulation, student billing and accounts, financial aid)

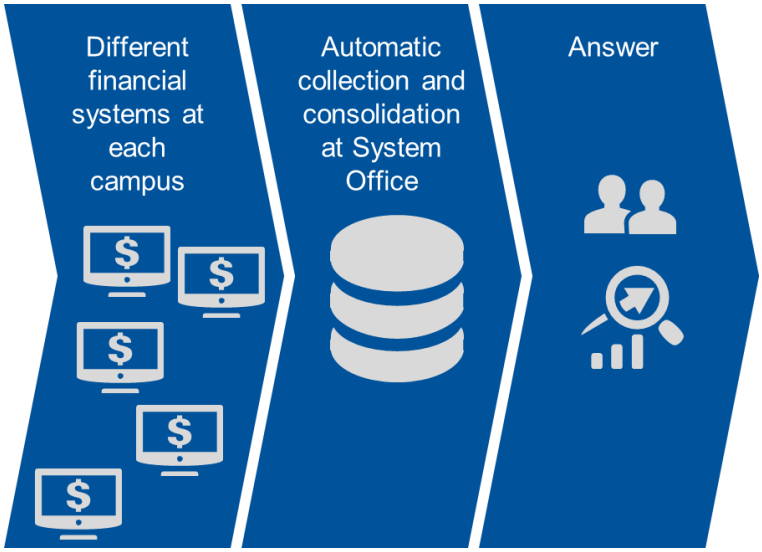
The scope of this analysis included Finance data and “related” data. In this context, “related” means summary quantity data from HR and Student (e.g.: number of employees, number of faculty, number of students, total credit hours) that can be combined with financial data to do “cost per …” calculations.

Option 1: The “Consolidation” Model

In this option, each operating unit (for UNC, each institution) has its own systems of record for finance and related data. In order to create the enterprise-wide view, each operating unit sends its finance data using a common format to a system that stores consolidated data in a single repository. This consolidated system is usually operated by the corporate headquarters, system office, or other shared or centralized function.

This option is described in Figure 7 below.

Figure 7. Option 1: Consolidation Model



At UNC, the Consolidation model would include the following characteristics:

- Individual schools maintain their current systems, processes, and schemes for coding transactions (i.e.: local charts of accounts)
- A standard process is defined for transmission of data from the institutions to the System Office
- Before transmission, each institution maps its data to common System Office coding scheme (i.e.: System Office Chart of Accounts)
- The System Office and the institutions agree upon a set of rules for allocating costs (e.g.: to students or to credit hours) for System Office purposes
- The collected data is stored in a shared repository, to which both System Office and institution staff would have access
- The tools used to access and analyze the collected data are available to both the System Office and institutional staff, and support both system-wide and institutional reporting

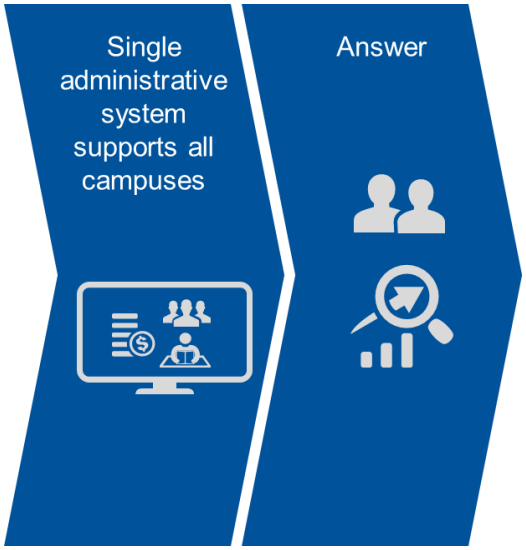
UNC already has experience with the consolidation model as it has been successfully implemented for other categories of data. The Student Data Mart and Human Resources Data Mart mentioned in Section 3.2 above both use this model.

Option 2: The Shared Systems of Record

In this option, the systems of record at each institution will be replaced by a single, integrated set of systems of record operated as a shared service. For example, there will be one general ledger system shared by all institutions, one shared purchasing system, one shared student system, etc. Each system will be able to segment the data so that each institution can work with only its own data. Each system will also be able to pull together data from multiple institutions for reporting and analysis.

This option is described in Figure 8 below.

Figure 8. Option 2: Shared Systems of Record



At UNC, the Shared Systems of Record model would include the following characteristics:

- Since the shared systems will use a common coding scheme and chart of accounts, during implementation all data from all 17 institutions will need to be extracted from the institutions' systems, cleansed of errors and inconsistencies, mapped to the common scheme, reformatted, and loaded into the common systems
- Wherever possible, all 17 institutions will have to adopt a common coding scheme (chart of accounts), processes and practices for processing their transactions; this will require re-training large numbers of staff at each institution, probably including faculty and students
- The shared systems will have to support sufficient complexity to handle the justifiable differences in processes that remain
- The System Office and the institutions will have to agree upon a set of rules for allocating costs (e.g.: to students or to credit hours) for System Office purposes, but the flexibility to let the institutions use different rules for local purposes will probably be limited
- The institutional staff that do local reporting and analysis will be required to use the tools that come with the shared systems; many such staff will require training on these new tools

4.2 Comparison of Options

The following Table 2 summarizes the relative advantages and disadvantages of each option.

Table 2. Comparison of Options

	Option 1: Consolidation Model	Option 2: Shared System of Record
Advantages	+ Minimizes disruption to the individual institutions + Fastest, most cost-effective path to objectives + Lower risk + Track record of success at UNC (i.e.: Student and HR Data Marts)	+ Positions UNC for broader process standardization and integration of institutions, *if* such is desired + Easier to move administrative staff between institutions and reuse skills + Slight increase in ability to share best practices and lessons learned across institutions + Single location for all detailed data down to the individual accounting line items
Disadvantages	– Incremental burden on institution finance staff to manage mapping and transmission of finance data – Most accounting-line-item detail remains at the institutions	– Extremely disruptive: impacts all 46,000 permanent employees and all 228,000 students[2] – Extremely expensive (10x) – Significantly longer implementation (2-3x) – High risk of project failure – Results not materially better

In reviewing these options, UNC participants concluded that the determining factors are related to the relative levels of disruption, cost and risk. The advantages of Option 2 are considered less impactful because there are no plans at this time to change the fundamental nature of the UNC System. The disadvantages of Option 1 are considered manageable. As a result, the recommended option is Option 1: the Consolidation Model.

[2] Employee count reflects permanent employees. UNC's temporary/contingent workforce (approximately 14,000) would also be impacted. Student count reflects 2016 total enrollment as reported by UNC's online InfoCenter.

Recommendations

5.0 Recommendations

5.1 Data Management Initiative Vision

To address the identified issues and address Goal 6 and Goal 11 from the strategic plan, UNC defines the overall mission of the Data Management Initiative as:

> *To provide the UNC System Leadership, the UNC Institutions and the Board of Governors with clear, timely, consistent, actionable financial and related data, which will enable them to guide the UNC System in meeting its strategic goals.*

The mission statement is supported by four critical *Guiding Principles:*

- Integrate Student, HR, and Financial data system-wide for timely effective system-wide reporting on progress to strategic goals
- Provide value to the UNC Institutions and support them in delivering strategic goals and a quality education to their students
- Execution of the UNC System Data Modernization strategy requires strong commitment and participation from all levels of leadership throughout the entire UNC System
- UNC System Office will leverage the system platform to coordinate and manage key initiatives

It is crucial that UNC have more consistency and predictability regarding the metrics being used and the information requests to which it must respond. The reporting and analysis goals of the Data Modernization initiative include:

Standard Reporting Goals

- Measure progress on strategic objectives (e.g.: retention, graduation rates, efficiency, tuition coverage of actual costs)
- Measure total system performance
- Compare campus performance where appropriate (e.g.: cost per credit hour)
- Data explains different institution contexts (size, mission, etc.)
- Agreed methods to do “cost per …” calculations
- Dashboards and supporting tools available to System Office and institution staff

Ad Hoc Analysis Goals

- Comparable data available across institutions
- Easily summed to support system-wide analyses
- Mapping rules support reconciliation back to local systems of record
- Data repository and tools available to System Office and institution staff
- Easy-to-use tools support most analyses
- “Power” tools support more sophisticated users
- Shared definitions enable system office and institution staff to discuss and understand alternative calculations and analyses

Overall, the Data Modernization initiative will deliver four key outcomes:

- **Outcome 1: Improved Decision Making** — Provide reliable data that enables UNC Institutions, System Leadership and the Board of Governors to make informed, proactive decisions.
  - ❑ O1.1: Improved ability to make decisions based clearly defined data and metrics
  - ❑ O1.2: Improved ability to make informed financial decisions to guide the UNC System

- ❑ O1.3: Improved ability to link HR, Finance and Student data to guide strategic decisions

- **Outcome 2: Improved Process Efficiency** — Create operational process efficiencies by reducing the time, effort and resources the UNC System requires to find, validate and analyze information.
  - ❑ O2.1: Reduced time to find and obtain required financial information
  - ❑ O2.2: Improved trust in the quality and reliability of core financial data
  - ❑ O2.3: Clarity of authority regarding management and use of data
- **Outcome 3: Improved Operational Credibility** — Provide information management capabilities that improves UNC System organizational integrity and reliability.
  - ❑ O3.1: Improved availability of reliable system-wide data for use in strategic reporting and planning
  - ❑ O3.2: Improved credibility and quality of official reporting
  - ❑ O3.3: Improved understanding of the business context of the data
- **Outcome 4: Improved Technical Foundation for Financial Data Reporting** — Provide a strong technical foundation for reporting financial data, and integrate that reporting across the HR and Student pillars in the UNC System.
  - ❑ O4.1: Create a data repository to provide financial reporting to System leadership on agreed to KPI's
  - ❑ O4.2: Develop integrations between financial reporting, human resource and academic data, which enable holistic assessments of System progress to strategic goals

The detailed recommendations developed by the project team to achieve these outcomes are grouped under five over-arching recommendations, which can be considered the "pillars" of the Data Modernization Initiative:

1. *Shared Governance* — Managing data enterprise-wide requires a governance process in order to make and enforce decisions regarding processes, standards, and common definitions. The proposed governance process should be a joint effort between the System Office and the institutions.
2. *Clear Roles and Responsibilities* — On a day-to-day basis, the responsibilities for managing and processing information need to be clearly defined. All 17 institutions and the System Office need to ensure that these responsibilities are clearly assigned and are being carried out.
3. *Consistent Standards and Processes* — The 17 institutions within the UNC System represent a wide variety of campus sizes, missions, student bodies and other characteristics. For this reason, they cannot be expected to perform all activities in the same manner. However, the information used for system-wide financial reporting and analysis needs to be comparable, and therefore the policies and procedures that apply to this data need to be consistent.
4. *Consolidation Model for Data Collection* — In order to minimize the impact on the institutions, they will continue to use their existing processes and systems for managing their own data. Each institution will be required to send a subset of their data to the

System Office, mapped to a common coding scheme. The rationale for this approach is described in Section 4.0 above.

5. *New Systems and Technical Architecture* — The systems used by the System Office to collect, aggregate, store, and perform system-wide analyses and reporting should follow a standard architectural framework. This will give the System Office appropriate flexibility and effectiveness, and will also make it possible for individual institutions to take advantage of these tools if desired.

The following sections address each of these 5 pillars.

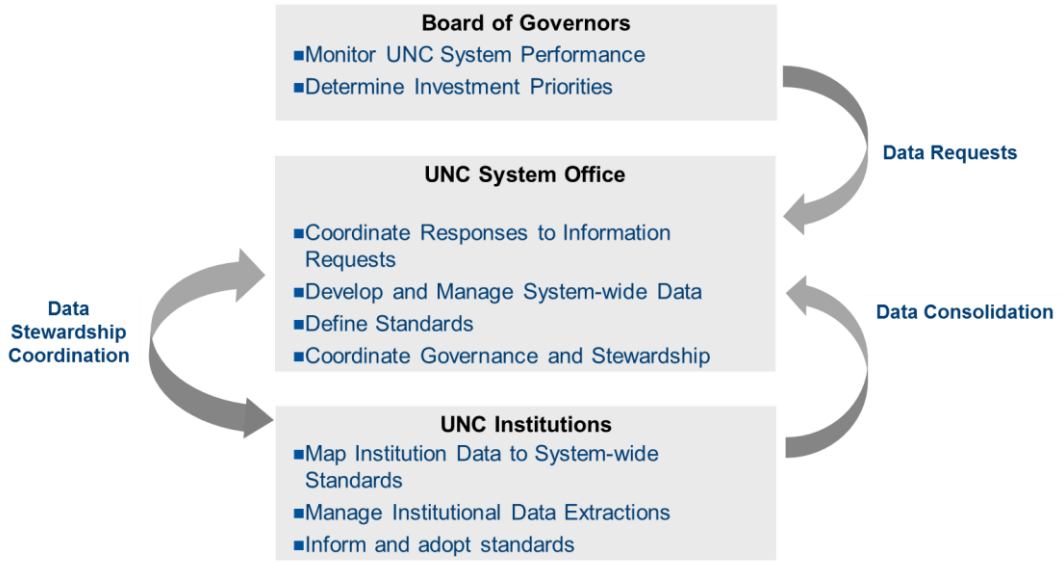
5.2 Shared Governance

The Data Modernization team found several issues with UNC's existing data governance capabilities as they relate to finance data:

- There is no clear link between the individual school and the System Office addressing the handling of financial data. There is no system wide governance process that tracks or maintains the definitions and quality of the financial data in use at the UNC Institutions.
- UNC has inconsistent data governance at the different Institutions. The structures and governance maturity levels varies by Institution. Also, the roles that participate in governance processes are not consistently defined across each Institution.
- There is no consistent governance of the data marts already in place other than working through the report requests that come through. Governance is more structured for the student data mart than the HR data mart.

To address these issues, the proposed governance model includes the System Office, the individual institutions, the contracted support organization (HelioCampus), and the bodies that oversee UNC, including the Board of Governors and the State Legislature. In order to provide consistent governance across all domains of data, the new model should encompass finance, human resources and student data, and absorb the existing policies, standards procedures, roles and responsibilities that exist for student and human resources data. The model is outlined in Figure 9 below.

Figure 9. Proposed Governance Model



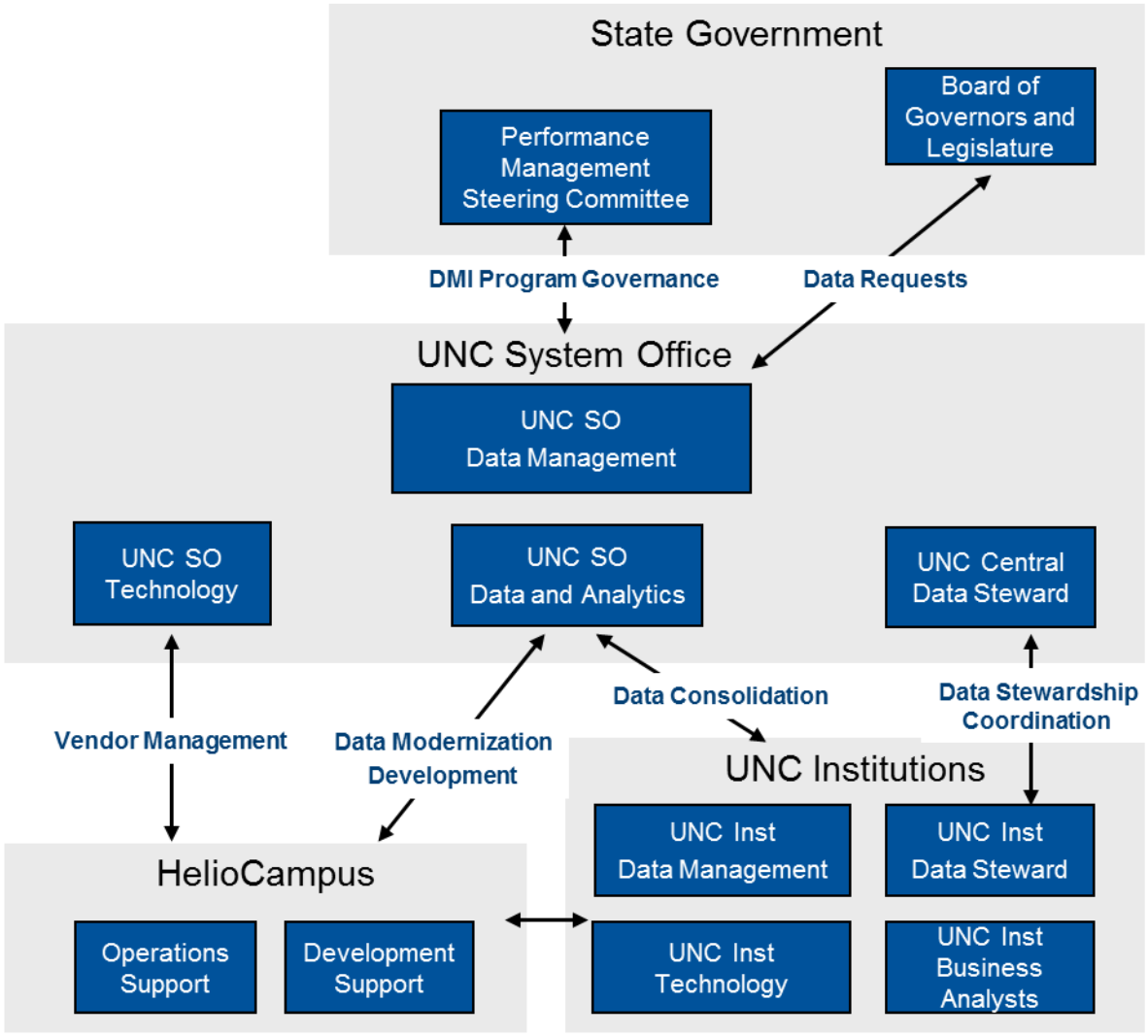
In summary, the proposed governance structure is:

- Championed by the UNC System President
- Led by the UNC System Office
- Includes select representation from UNC Institutional stakeholders
- Includes representation from Finance, HR, Academic Affairs and Technology

5.3 Clear Roles and Responsibilities

The overall roles that the System Office, the institutions and the Board of Governors play is detailed in Figure 10 below.

Figure 10. Overall Roles



Each component of this structure has specific roles and responsibilities:

- Board of Governors and Legislature:
  - ❑ Ensures the UNC System meets the obligations outlined in state law
  - ❑ Sets the state funding levels for the UNC System
  - ❑ Monitors the use of state funds; accountable for the performance of the UNC System in achieving outcomes associated with state appropriations
  - ❑ Sets the Key Performance Indicators used to measure effectiveness of the UNC System
- Performance Management Steering Committee:
  - ❑ Champions the Data Modernization Initiative
  - ❑ Sets the direction and charter for Data Modernization

- ❑ Determines investment priorities for Data Modernization
- ❑ Initiates the projects needed to achieve program objectives
- ❑ Ensures UNC System KPIs and data requests are provided to the Board of Governors
- ❑ Sets the Key Performance Indicators used to measure the effectiveness of the Data Modernization Initiative
- ❑ Monitors the Data Modernization KPIs and effectiveness of the Initiative

- UNC System Office Data Management
  - ❑ Publishes UNC System KPI reporting and data
  - ❑ Responsible for handling Data Requests from Board of Governors
  - ❑ Ensure Participation of UNC Institutions
  - ❑ Set System-wide Data Standards and Definitions
- UNC System Office Data and Analytics
  - ❑ Ensure Institutions map to UNC System-wide Data Standards and Definitions
  - ❑ Provide Data Analytics and Data Science services to UNC
  - ❑ Assimilate data context and data usage considerations into analysis
- UNC Central Data Steward
  - ❑ Ensure integrity of System-wide data
  - ❑ Coordinates new data or revisions to existing data definitions with Institutions
- UNC System Office Technology
  - ❑ Define technology standards, data platforms and architecture
  - ❑ Manage 3rd Party technology providers
  - ❑ Facilitate self-service capabilities for data analytics and reporting
- UNC Institution Data Management
  - ❑ Ensure Institution data is transformed and provided for data aggregation
  - ❑ Provide data context and explanation of unique characteristics of Institution data
- UNC Institution Business Analysts
  - ❑ Provide expertise on Institutional systems and data sources for data mapping and analysis purposes
- UNC Institution Data Steward
  - ❑ Ensure integrity of Institution data
  - ❑ Coordinates new data or revisions to existing data definitions with System Office
- UNC Institution Technology
  - ❑ Support Institution data analysis and use of data platform and service providers
- Contract (HelioCampus) Operations Support:

- ❑ Support UNC with high performance, high availability platforms for data storage, processing, reporting and presentation
- ❑ Liaison to UNC System Office and Institution for technology questions and requests

- Contract (HelioCampus) Development Support:
  - ❑ Support UNC programming of data structures, transformations and reports
  - ❑ Liaison to UNC technology developers for questions and requests

The following Figure 5 summarizes the comparative responsibilities of each component of the governance structure.

Table 3. Governance Roles and Responsibilities

	Decision-Making Entities	Decision Domains: Establish UNC System KPIs	Define Roles and Responsibilities	Set Data Modernization Program Priorities	Define System-Wide Data Reporting Model	Establish Standards, Platform and Architecture	Ensure System-Wide Data Quality	Define Institution to System Data Mapping	Ensure Institution Data Quality	Ensure Platform Quality and Availability
System Office	Board of Governors	A	I	A			I			
	Performance Management Steering Committee	R	A	R			I		I	
	UNC SO Data Management	C	R	C	A	A	A	I	I	A
	UNC SO Data and Analytics	I			R	I	C	C	C	
	UNC Central Data Steward				C	I	R	I	C	
	UNC SO Technology		C			R				R
Institution	UNC Institution Data Management	C	C	C	C	C	C	A	A	
	UNC Institution Data Steward	I			C	I	C	C	R	
	UNC Institution Business Analysts				I	I		R	C	
	UNC Institution Technology					C				C
Cloud	HelioCampus Operations Support					C				C
	HelioCampus Development Support					C				C

Responsible	The entity is responsible for executing the activities related to the referenced decision domain (Plan, Develop, Propose, Implement and Execute)
Accountable	The entity is the owner of, approves and is held accountable for activities related to the referenced decision domain (Approve, Release, Publish, Monitor, Control and Verify)
Consulted	The entity has important information relevant for activities related to the referenced decision domain (Advised by, Asked, Confirmed by and Reviewed)
Informed	The entity is to be informed and kept abreast of progress and results of activities related to the referenced decision domain (Briefed, Advised, Educated, Notified, Informed)

One of the most important roles the Data Steward. The role of the Data Steward at the UNC System Office and the UNC Institutions should be formalized, clearly defined and aligned. The Data Stewards at UNC serve several important roles:

- Data Stewards provide a communication link between the UNC Institutions and the UNC System Office
- As Institutions create new programs or metrics, the Data Stewards at the Institution and the System Office are responsible for communicating any new values or impact on the data to each other
- The Data Stewards should regularly review policies and standards for any needed updates
- Data Stewards are also responsible for communicating and maintaining data policies and standards, and monitoring for compliance

Data stewardship is a business role. In other words, Data Stewards belong in the various functional departments, not in the System Office or institution IT organizations. The primary duties of Data Stewards include:

- Assessment of the current state of data fidelity, security, privacy and retention within the data area they are responsible for

- Enforcement of activities to ensure target goals for data fidelity improvement and adherence with all other types of data governance policies
- Identification of optimal approaches for resolving data quality or consistency issues to achieve targets
- Working within and beyond their immediate area to implement change in support of the adoption of data governance policies
- Monitoring and tracking ongoing data fidelity (for example, quality and consistency) levels and other metrics which assess the adherence of data and people to data governance policies

Data stewardship responsibilities are in addition to regular work duties. It is important to keep in mind:

- Stewards are not the "owners" of the data, but rather, are trustees, ensuring that adequate quality is maintained so the data can effectively support business processes. Stewards are identified in the governance policies with specific attributed information
- Stewards represent a particular business unit, function or Institution and focus on a subset of the data landscape (for example, a subset of a particular data subject area, such as “student," or a part of “revenue"), or the critical data within a specific business process
- Stewards work in a collaborative fashion with each other (the Data Steward's group)
- Stewards escalate issues exceeding their personal scope to the broader data stewardship group
- Stewards are not empowered to allocate resources and funding toward data fidelity improvement projects, but make representations to leadership for process improvements and activities that may warrant IT-led impact assessments and/or system changes

Successful data stewards possess appropriate experience, knowledge and skills:

- Multiple years of exposure to (directly working within) key business processes in multiple business units/functions
- Understanding of the end-to-end data life cycle requirements of key business processes
- Exposure to data quality, records management, security and privacy concepts, best practices, and tools/technologies is advantageous
- In-depth knowledge of Higher Education and key UNC business processes
- Understanding of how data is used within business processes and its impact on desired business process outcomes
- Awareness of the security, privacy and quality requirements for critical data entities
- Experience with data analysis techniques
- Solid project management skills, to guide both point-in-time and ongoing targeted data quality, retention, security and privacy improvement projects

5.4 Consistent Standards and Processes

5.4.1 Standards

Clearly documented data standards ensure a common set of definitions and frameworks between the UNC System Office and individual UNC Institutions, and thus enable the analysis of cross-institution data. Data Standards will make it easier to integrate data across functional HR, Finance and Academic functional areas, and provide a more holistic view of key student success metrics and progress to goal for cross functional and Institutional strategies.

Developing these common standards for finance data will make it easier to create the structure needed to store data and reduce the time it takes to report key metrics to the Legislature and Board of Governors.

Standards will also help reduce the time required at both the UNC System Office and Institutions to respond to ad hoc data requests while reducing the amount of staff time at the Institutions to respond to requests.

Standards help the organization in the following areas:

- **Confidentiality**
  - *Privacy*: Various Policies for information privacy specify privacy requirements e.g., for anonymizing personally identifiable data. These policies often mandate adherence to legal requirements.
  - *Sensitivity*: Not all information in the enterprise warrants the same level of sensitivity; organizations must treat some categories of information differently from others. Information is categorized in accordance with its sensitivity. This type of policy mandates the need for making decisions based on the use of information assets, so that the right level of controls, access and risk management can be applied.
  - *Security*: Access rights to information assets are crucial for minimizing risk. Information security policies focus on who and what can access information. Clear mandates for segregation of duties and the principle of least privilege are included in such policies.
- **Integrity**
  - *Quality*: Information quality is a key concern for organizations, and poor-quality data creates significant risk and challenges. This policy type specifies the required levels of validity, completeness, accuracy and so forth for the information to have optimal risk and value to the enterprise.
  - *Standards*: Enterprises should also develop policies that address issues such as terminology; modelling and metadata (what required metadata is collected, and how information models are created and shared); and the technology used to store and manage information assets, including the technology to facilitate the development and enactment of all policy types.
  - *Ethics*: Ethics policies specify what things the organization will do and (even more importantly) will not do with information to prevent violating the trust or privacy of customers or other stakeholders.
- **Availability**
  - *Retention*: Information assets can lose value over time and even become a risk to the enterprise after reaching the end of their useful or legally required life span.

Retention policies, which support governance across the information life cycle, specify when information assets must be archived and how, how long they must be retained, and when they will be disposed of.

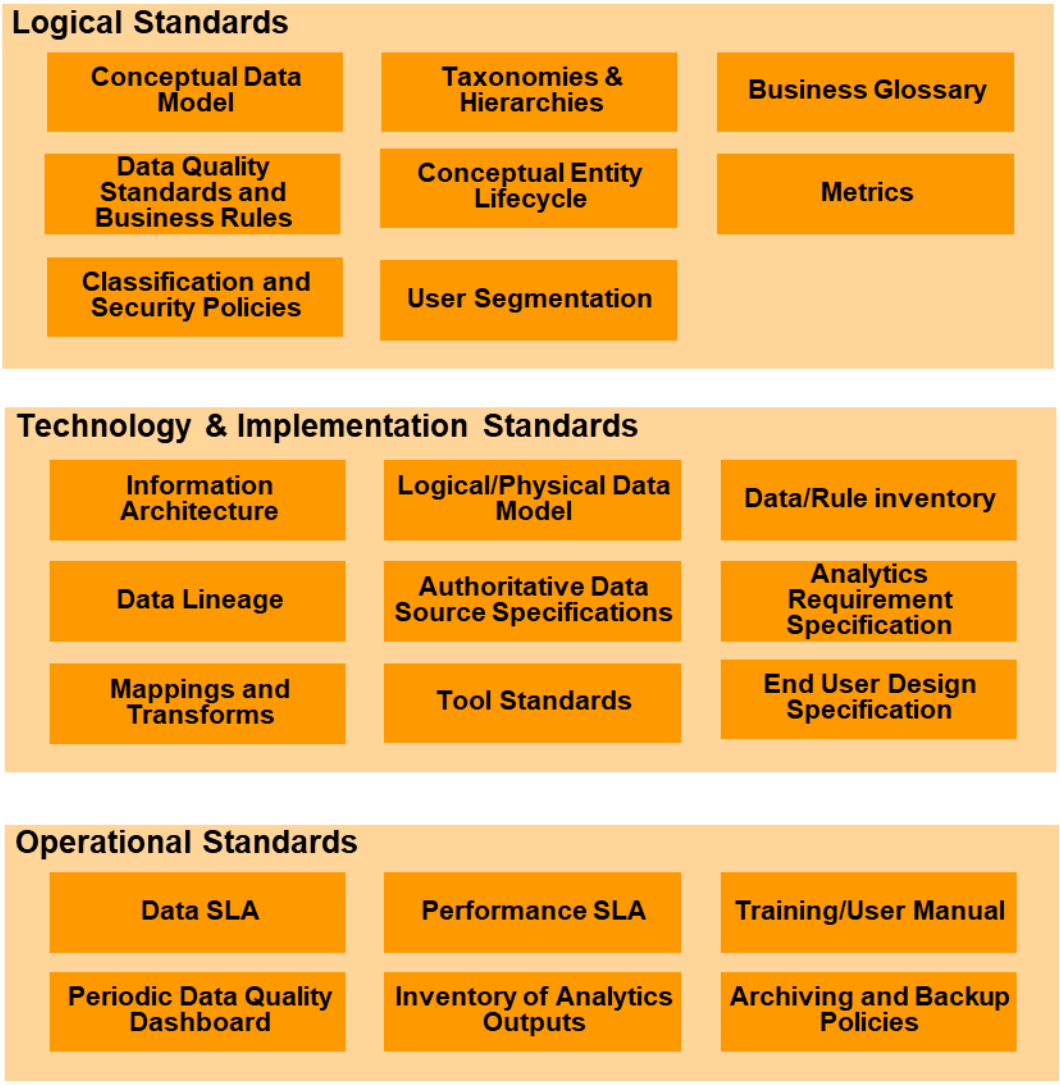
- *Timeliness*: There are various uses of information, spanning operations, applications, analytics and compliance. As such, there are a wide range of requirements related to how accessible information is. One of the most critical elements of accessibility (although not the only one) is timeliness.

There are three categories of standards:

- **Logical Standards** — These standards provide the semantic bridge between the business areas and technology in defining and implementing analytics service offerings.
- **Technology and Implementation Standards** — These standards increases the ability for the UNC System to maintain analytics products and infrastructure. They also enable consistent and quality outputs based on better understanding of various user groups.
- **Operational Standards** — These standards increases stability of the data and analytics service to users by establishing clear accountability and guidelines.

The standards included in each category that UNC will develop for finance data as part of the Data Modernization initiative are outlined in Figure 11 below. In many cases, it should be possible to re-use or adapt standards already in place for student and human resources data.

Figure 11. Overview of Standards



"SLA" = Service Level Agreement

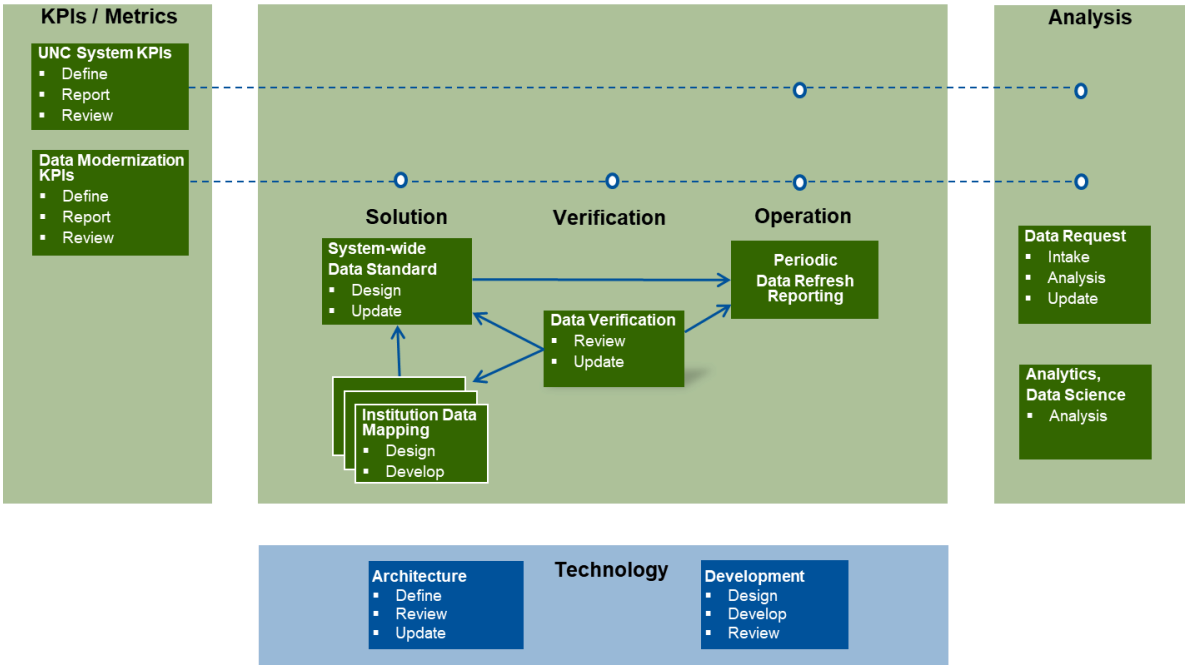
Appendix B contains more details on each of these standards.

5.4.2 Processes

Each of the institutions will be able to continue to use current processes to perform internal activities related to data collection, management, reporting and analysis. In order to maintain consistency of the data being used for cross-institutional reporting and analysis, processes related to this data need to be consistent.

Figure 12 below outlines a high-level model outlines consistent processes for managing key performance indicators (KPIs), managing data, transmitting it to the System Office, and responding to requests.

Figure 12. Process Model

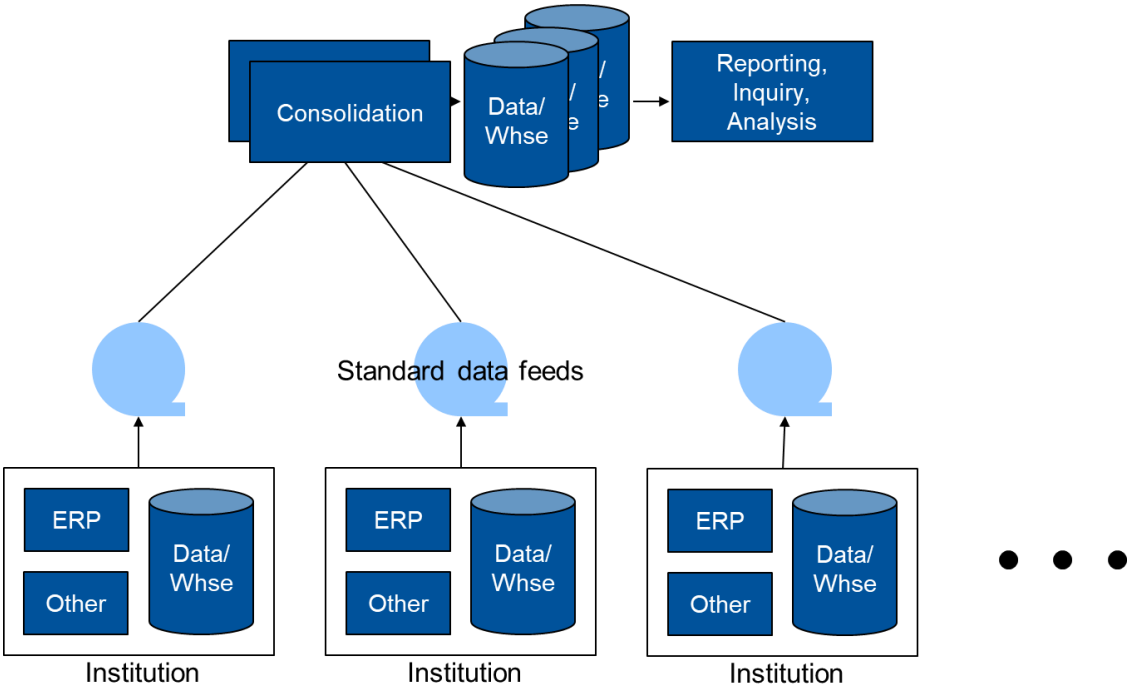


More information on each process is contained in Appendix C.

5.5 Consolidation Model for Data Collection

As described in Section 4.0 above, the method for collecting data from across the UNC system will be for each institution to send data to the System Office following certain standards, so the information can be consolidated to support cross-institution reporting and analysis. Figure 13 below illustrates this approach.

Figure 13. Consolidation Model for Data Collection



Under this approach, the institutions will continue to use their existing systems for processing transactions, and for local reporting and analysis. The data that is sent to the System Office will be mapped by the institutions to a standard coding scheme. For example, the System Office will define a standard chart of accounts. The institutions will need to have a "crosswalk" capability to map their local chart of accounts codes to the System Office standard. In this manner, all information sent to the system office will use the same chart of accounts. Similar approaches will be followed for other codes (e.g.: cost type, restricted/unrestricted, etc.)

The current Human Resources data warehouse at the system office will require a complex redesign to include transactional data, in order to support HR-specific analyses and to make it possible to associate HR data with financial data for certain cost analyses.

Enterprisewide data is frequently used to perform various costing analyses. For example: calculating cost per credit hour, or cost per student (per year). In order for these calculations to be comparable across institutions, UNC needs a common framework for allocating costs to various objects (e.g.: credit hours, students, etc.). This framework will facilitate consistent allocation calculations where appropriate, while enabling institutions to continue performing such calculations as they deem appropriate for internal purposes. The Common Allocation Framework will consist of a set of common definitions for each of the following, so calculations can be quickly defined, described, and understood across UNC:

- **Cost Pool** — A collection of costs that will be treated as a lump sum to be assigned. For example: the cost of the Provost's office. Costs can be direct, indirect or step relative to the cost object under consideration.
- **Allocation Basis** — The measurement that will determine the share of the cost pool assigned to each object. For example: if Provost office costs are assigned to degree programs based on the number of students in each program, then number of students in each program is the allocation basis.

- **Allocation Method** — The mathematical approach for applying the allocation basis. In almost all cases, this is a pro-rata split.
- **Cost Object** — The output for which unit costs are being calculated. For example: degree program, credit hour, student year.

5.6 New Systems and Technical Architecture

In order to support the other recommendations in this report, UNC needs an appropriate technical infrastructure. There is no one software product that can address all of the needs. UNC needs an *architecture* that defines how various software components will work together to meeting the institution's needs. This architecture will be implemented at the System Office, with the expectation that the tools can also be used by individual institutions if desired.

This new architecture will follow certain guiding principles:

- **Enable Data Sharing via Standards-Based Approach**: UNC will benefit from consistent and accessible data sharing, for the System and Institutions, using appropriate Data standards for naming, messaging and data exchange
- **Metadata Management**: UNC will standardize Metadata at the enterprise level across the Sources, Ingest, Persistence, Access, Delivery and Consumption layers of the technology architecture employing suitable tooling
- **Continuously Improve Data Quality**: Data will be continuously reviewed and there will be a persistent focus on ensuring the highest quality of data content with specified data owners accountable for quality and establishing standards for data stewardship — Addressing data definition, transformation, integrity and quality issues
- **Data and Analytics Scope Agility**: Establish processes and tools to rapidly extend and adjust the boundaries of data available for analytics with a high degree of both flexibility and control of the persistent data scope
- **Data and Analytics Self Service**: Increase agility and responsiveness of analytics and decision support by providing tailored services directly to a broad cross-section of the UNC System and Institution user populations facilitating the analytics needs of a variety of analytics end-user roles
- **Avoid Redundancy and Maximize Reuse**: The target architecture should consist of a number of services that are compliant with industry standards to facilitate reuse, adaptability and interoperability
- **Increase Reusability of Analytics Objects**: Provide the platforms, design patterns, disciplines and management processes required to facilitate increased reuse of the analytics objects optimized for best value across the UNC system

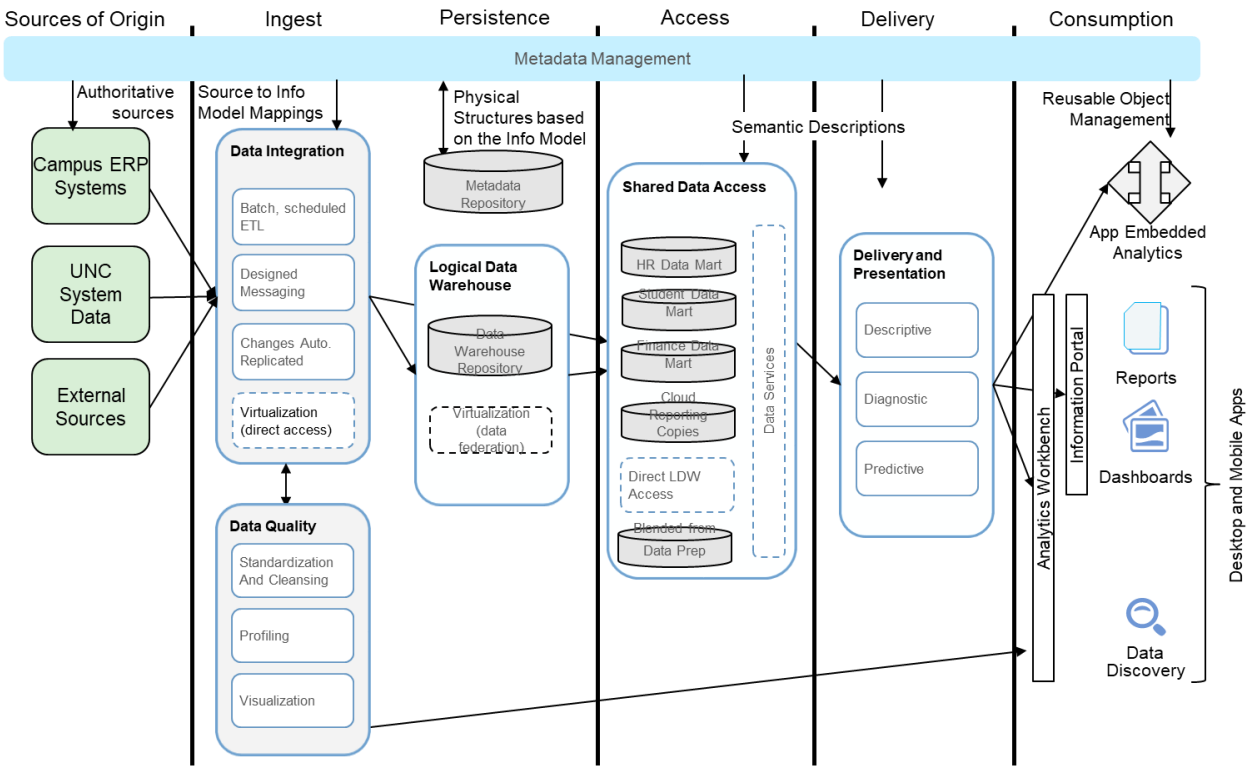
The architecture will contain the following major layers:

- **Sources of Origin —** The full variety of operational data sources that will enable the scope of the UNC System Office Data Modernization and Integration (DMI) Target Architecture

- **Ingest** — Extract or receipt of data from operational data sources and transformed into the structures used in the other layers. All data that are used in analytics have to pass through this layer regardless of their eventual destination.
- **Persistence** — Stores the historically persistent data, metadata, and models that provide the temporal analytical capabilities
- **Access** — Stores persistent and transient information, in the form of physical or virtual data marts, of prepared and accessible data that are ready for use by their respective use cases. This layer receives data from the Persistence or the Ingest layer directly, and prepares the data by enriching them and adapting them for consumption, based on specific end-user technical and business needs.
- **Delivery** — Enables the analysis of data and their delivery to their ultimate consumption users. This layer accesses the data made available in the Persistence and Access layers and provides the functionality to analyze the underlying data.
- **Consumption** — Provides an encapsulation of all tools and the single point of entry with two major styles for any interactions with the program both for Management, Occasional. Intensive and Scientist user roles.

Figure 14 below shows the various technical components within each layer, and how they relate to each other.

Figure 14. Technical Architecture



More information on each of these layers is contained in Appendix D.

Implementation Plan

6.0 Implementation Plan

6.1 Projects and Timeline

A series of eight projects have been identified to achieve the strategy and implement the recommendations outlined in Section 5.0 above. Figure 15 lists these projects, indicating which pillars each project addresses.

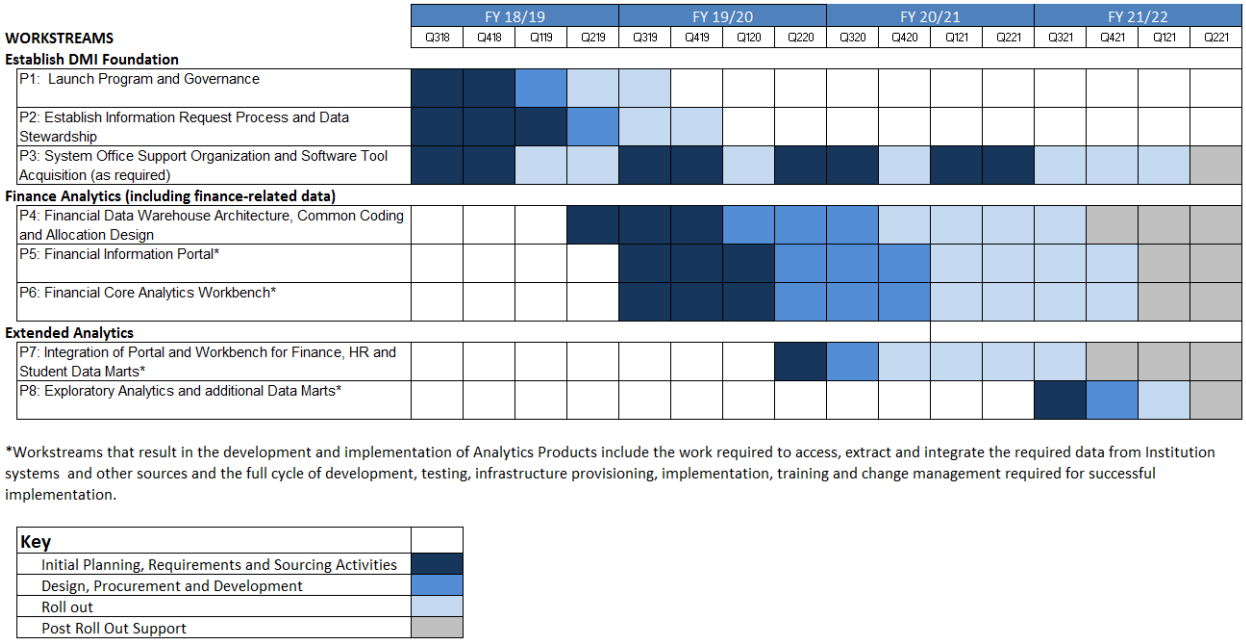
Figure 15. Data Modernization Projects Mapped to Pillars

			Pillar				
#	***Project***	***Description***	***1***	***2***	***3***	***4***	***5***
P1	Launch program and governance	Create charter, establish governance team, confirm roles & responsibilities	X				
P2	Establish information request process and data stewardship	Define process for handling information requests from BOG, Legislature, and Staff; assign/confirm data stewards at SO and in institutions		X	X		
P3	System office support organization and software tool acquisition	Align current SO data & analytics organization to support new roles; identify requirements for new tools and select/procure		X			X
P4	Financial data warehouse architecture, common coding and allocation design	Define the flow of Finance and HR data from institutions to SO, including process, format and coding, and ingest technology; design and implement persistence technology.			X	X	X
P5	Financial Information Portal	Define business intelligence use cases, build access and delivery technology to support dashboards and basic inquiry				X	
P6	Financial Core Analytics Workbench	Train users and configure delivery technology to support complex inquiry and analysis					X
P7	Integration of Portal and Workbench for Finance HR and Student Data Marts	Extend portal and workbench to include data from HR (including transactional data) and Student marts					X
P8	Exploratory Analytics and Additional Data Marts	Select and implement advanced tools such as predictive analytics and data mining; expand tools to include access to learning data and external data sources					X

The details for each project are included in Appendix E in the form of ‘mini charters’. Mini charters include the specifics about each project that enable UNC to plan for budget, schedule, and participation by UNC staff and stakeholders. A description of the project scope, KPIs/metrics, key activities, risks and outcomes are provided to further elaborate the purpose of each project. This list does not include any project or projects required to make any enhancements to the Human Resources Data Mart.

These eight projects are placed on a timeline based on priorities, and the logical sequence that reflects dependencies between projects. Figure 16 shows the schedule for the program.

Figure 16. Data Modernization Project Schedule



*Workstreams that result in the development and implementation of Analytics Products include the work required to access, extract and integrate the required data from Institution systems and other sources and the full cycle of development, testing, infrastructure provisioning, implementation, training and change management required for successful implementation.

After the fourth year, ongoing operational support will continue, requiring funding and staffing.

6.2 Estimated Costs

At this stage of planning and strategy development, any cost estimate is at best a high-level projection. Too many factors are still unknown to estimate costs with any accuracy.

In order to provide guidance on project costs for planning purposes, the project team developed high-level estimates by projecting the duration of each project, the total labor required, and additional costs such as software. These were developed using a “case based” approach based on prior experience and similar experiences elsewhere. The cost of labor was created based on an aggregated average rate that is intended to cover both internal UNC staff and external staff.

These estimates are presented in Table 4 below. **The accuracy of these estimates should be understood to be plus or minus 50%. Thus the total cost currently estimated at $21 million could be as high as $30 million.** This is dependent largely on decisions UNC will make during project execution, such as the mix of internal and outside staff on the project teams and the amount of incremental hiring required. It is also highly dependent on UNC’s ability to gain cooperation from all of the stakeholders at the System Office and the institutions, and management’s ability to promote rapid, effective decision-making. (This estimate does not include the costs associated with enhancements to the HR Data Mart.)

Table 4. Estimated Costs (millions)

	FY 18/19	FY 19/20	FY 20/21	FY 21/22	Total
Labor	$ 4.3	$ 6.0	$ 4.7	$ 2.0	$17.0
Other	2.0	1.0	1.0	-	4.0
Total	$ 6.3	$ 7.0	$ 5.7	$ 2.0	$21.0

6.3 Success Factors

The following items are identified and critical success factors toward achieving UNC's objectives:

- A clear, system-wide vision for the Data Modernization initiative needs to be developed in collaboration between stakeholders in the UNC System Office, the 17 UNC institutions and the Board of Governors.
- Direct tangible and perceived benefits and directives need to be identified and communicated to the System institutions providing the data.
- The success of the Data Modernization project largely depends on the participation of the appropriate staff at each institution and the UNC System Office. There must be adequate staff and resources, and management structure to support this initiative.
- A comprehensive Organizational Change Management program is needed which focuses on the UNC institutions, the University of North Carolina System Office and System leaders including the Board of Governors, will increase participation and support of new data processes and structures, updated governance.
- The Organizational Change Management program should also focus developing and increasing the understanding of the definitions and business context of the data from the UNC System to the University of North Carolina System Office and the Board of Governors.
- The University of North Carolina System Office leverages "Lessons Learned" from previous initiatives such as the Student and Human Resources Data Marts.

6.4 Risks

The following risk items need to be considered as part of implementation, and active risk mitigation reviews should be conducted as part of the project execution:

- The UNC System develops a strategy that focuses too much on answering individual questions from the Legislature and the Board of Governors and not enough on providing information to guide the UNC System in making long term strategic decisions and measuring progress-to-goal.
- The UNC System campuses will be hesitant to participate if they believe the data they provide will be used to cut their budgets, or to micro-manage their institutions.
- Gartner is concerned that, by itself, improving the ability to respond to external information requests may be an insufficient motivator for the campuses to undertake the expected levels of effort and disruption.
- Comparison of cost-per-unit data among campuses requires insights into the unique characteristics and context of the data, and may be misleading if not interpreted properly.
- In some cases, fundamental differences in the base data maintained by each institution may not allow for the collection, comparison or aggregation of all desired data. In other words: some questions of leaders will not be answerable regardless of how well this project is implemented. This creates the risk that the project could be perceived as a failure despite succeeding in meeting all stated objectives.

- Resources provided by UNC to any Data Modernization initiative could take resources from strategic initiatives at the UNC Institutions and the System Office. In particular, this project could divert resources currently supporting the existing data marts.

Appendices

Appendices

Appendix A – Current State Assessment Detailed Observations

Observation	Description	Implications
Vision		
Inconsistently recognized need for Finance data transparency.	Within the University of North Carolina System Office offices and the System administration there is agreement that more transparency and integration of Finance and HR data is needed in order to respond to request from the Board of Governors and the Legislature, and manage the business. Institutions do not see the benefits of greater data transparency and access. They feel that while making data more transparent eases the reporting burden for the University of North Carolina System Office, there is a risk that with greater financial transparency the Board of Governors and the UNC System Office will micro-manage their business.	As a result of these two views there is little agreement between the University of North Carolina System Office and the UNC institutions regarding data transparency and accessibility. In order to use data to guide UNC, a clear vision supported by both the University of North Carolina System Office and the UNC institutions for cross-enterprise data management is needed that defines the purpose, approach and process. UNC institutions will need to understand the benefits that data transparency and integration will have for them.
Lack of a unified vision for Financial Data Management at the system or Board of Governors.	The UNC system as a whole lacks a unified vision for how it will use its financial data. There is not a shared vision between the General Administration and the UNC institutions on how financial data is to be used and maintained across the individual institutions. Each institution within the UNC system has its own vision for how data should be managed.	Without a clear shared vision between the University of North Carolina System Office and the institutions in the System, UNC will not be able to define and use the data needed to guide the institutions and the System in reporting to the Board of Governors and the State Legislature. A strong Organizational Change Management effort will be required to communicate and refine the vision in a collaborative fashion among the UNC stakeholders to help facilitate buy-in and adoption of the vision.

Observation	Description	Implications
Strategy		
The University of North Carolina System Office has a reactive approach to Data Management.	The University of North Carolina System Office lacks a clear financial data management strategy. Its current approach to financial data management is driven primarily by the requests of their Board of Governors and the Legislature. The scope of questions and the data needed to answer them can be broad. There is no clear definition of where HR data elements can be found. In some cases data is housed in a Data Mart in the University of North Carolina System Office, with transaction data stored at the institutions. There are no data definitions to support mapping institutional financial and HR transactional data to a centralized reporting environment.	The scope of analysis and questions to be answered through integrated enterprise information management need to be determined to set the strategy for a modernized financial data solution. There is a risk that the University of North Carolina System Office's financial data strategy will focus on meeting reporting requests of the Board of Governors and the Legislature, and not be broad enough to support System's strategic goals. This could leave the UNC System Office with only enough data to be in a "reactive" position with the Board of Governors and Legislatures, rather than being able to set a "proactive" strategic course for the entire System.
Inconsistent approach to Finance and HR Data Management.	Each UNC System institution has its own finance and HR data strategies. These strategies are at various levels of detail and maturity. In addition each institution has its own definitions for key data, including how it is gathered and stored. As a result there are 17 different institutional data strategies and approaches.	The large number of different strategies in the institutions and the differences in financial and HR data definitions makes it difficult to use data for meaningful comparison and analysis across the UNC System. Each institution can define key data elements differently. Good examples are the multiple ways course costs are calculated across the System or how HR vacancies are defined.

Observation	Description	Implications
Difficulty linking HR, Student and Financial information.	There is no strategy or consistent process for data integration between HR, Student and Finance. Linking data from these areas for reporting, analysis and responding to information requests is a manual and time consuming process.	Creating reports or responding to inquiries requires significant validation time from both the University of North Carolina System Office staff and the staff at the individual institutions. The time these resources spend in creating and validating responses could be spent supporting the System's strategic mission of serving the students. The length of time it can take to answer even basic inquires erodes the trust of the Board of Governors and Legislature that the UNC System understands and can manage their business, and meet financial and strategic objectives.
Inconsistent level of detail in HR, Student and Finance Data.	There is a difference in the level of detail in the HR, Student and Financial data used in reporting. No financial Data Mart exists today. No transactional data is transmitted to the HR Data Mart. Needed HR transaction data is transmitted via Excel spreadsheet. Student Data has more detailed transactions and is easier to report on trends.	The lack of HR transaction data leaves the UNC System unable to do trend reporting from the HR Data Mart. Due to the difference in data detail, and accessibility, when answering a question requiring data from two or more areas, the University of North Carolina System Office has to create and load custom databases specifically designed to house the data needed to answer the inquiry. Answering some inquires could take months. For example it has taken four months to answer a question on diversity costs across the System.

Observation	Description	Implications
Metrics		
Lack of clear, objective metrics for success.	The University of North Carolina System Office has no clear metrics to determine the progress of the Data Modernization initiative, and its impact on operations and reporting.	Success metrics help define common initiative goals for both the University of North Carolina System Office and the institutions. Without objectives or metrics, it will be very difficult to guide stakeholders toward common goals, and to assess if those goals have been reached and the Data Modernization initiative has achieved its purpose.
Lack of consistently-defined University of North Carolina System Office metrics.	Interviews with the University of North Carolina System Office and institution stakeholders did not indicate a consistent process for identifying and reporting on metrics needed to measure progress of any financial data management and reporting initiatives. There are few metrics to measure the financial contributions of purely operational departments or entities at and across the UNC System.	Lack of consistent financial metrics enables continued variance of institution processes and activities across the UNC System. Metrics are a form of communication. Poor metrics leads to poor communication, which erodes trust.
Governance		
Lack of System-wide financial data governance.	There is no System-wide governance process that tracks or maintains the definitions and quality of the financial and HR data in use at the institutions. Different institutions have different definitions for the same data element. There is no comprehensive location for financial data. Needed financial data is extracted by the institutions and sent to the University of North Carolina System Office in an Excel file.	The ability to aggregate and analyze financial data across the UNC System is limited without a System-wide approach to data governance. Lack of consistent financial and HR data definitions will make it difficult to respond to on-going System-wide trend analysis, comparative benchmarks, or to respond to questions from the Board of Governors and the legislature.
Inconsistent data governance at the UNC System institutions.	Data governance structures vary from institution to institution. Roles are not consistently defined. Some institutions are in the process of redefining their data governance; while others have robust data governance processes.	Formal data governance processes and a clearly defined data steward role supports consistent use and definitions of data. It enables information to be consistently mapped to centralized reporting and analytics.

Observation	Description	Implications
Inconsistent governance of the several data marts.	The University of North Carolina System Office is not engaged at the institution level to ensure consistency of data. Other than making requests for financial data for reporting, the University of North Carolina System Office does not have a central role in financial data governance at the individual institutions. Data governance at the University of North Carolina System Office seems to be limited to maintaining the HR and Student Data Marts. There is stronger coordination of governance from the University of North Carolina System Office and the institutions on the data fed into the Student Data Mart. Less coordination is in place for the HR Data Mart. The goal of the Student Data Mart was to support broader trend analysis, whereas the goal of the HR Data Mart was more high level snapshot in time reporting.	The University of North Carolina System Office plays a limited role in managing and maintaining the data from the institutions which are fed to the data marts and used to build reports and answer queries. This contributes to the variations in data quality and definitions which are highlighted in other observations. There is no data mart for financial data. Different types of data and the levels of detail are being loaded into the Student Data Mart and the HR Data Mart. Confidence in current data analysis is low, due to the known difference in data definitions at each institution, and how the data is being combined and compared.
Organization and Roles		

Observation	Description	Implications
Significant need for Organizational Change Management.	The UNC System's culture and history have driven the current state of data, data management and data governance at both the System Office and institutional levels. The institutions do not see a need for System-wide modernization of financial enterprise information management, beyond making it easier to meet the University of North Carolina System Office's reporting requests. Governing bodies such as the Board of Governors and the Legislature do not have a clear understanding of the meaning of the financial data they receive and how it should be used. Institutions are afraid that by making their financial data accessible and transparent they will be at greater risk for budget cuts, program cuts and micro-management by the University of North Carolina System Office and the Board of Governors.	Changing people's attitude and beliefs about financial data and enterprise information management is critical to the success of any data management initiative. Without a shared understanding of the benefits, participation will be limited and the initiative is at risk of failure. Without a clear understanding of data definitions and business context, UNC System leadership and the Board of Governors can draw unfounded conclusions from comparative data and act accordingly.
Limited governance role for the UNC System Data and Analytics organization.	The Data Analytics organization acts primarily as a clearing house for information requests from outside the University. The System Office does not act as a governing body for enterprise information management. The purpose of the University of North Carolina System Office is to get the most out of the variety of information the System Office is receiving. However, without a role in data governance, this goal is difficult to meet.	As a result of a lack of data governance, there is little coordination of enterprise information management between the University of North Carolina System Office and the institutions. This results in differing data definitions, time consuming reporting and limited ability to use data to drive strategic decisions.

Observation	Description	Implications
Process		
Some of the 17 institutions have data stewards, but the existence and responsibility of the role is not consistent.	Many UNC System institutions have established the role of data stewards to oversee the usage and maintenance of data within their local financial systems. The roles and responsibilities of the data stewards in institutions are not consistently documented and defined. In some institutions the data steward is in IT; in other institutions business users perform this function.	Without a strong data steward role it is difficult to maintain the required level of data quality and clear data definitions needed to link and use data across the HR, Student and Finance pillars, and/or across institutions. Strong data stewards ensure that new financial values are properly defined and mapped to reporting and analysis tools, and current data is clean and meets current agreed upon definitions.
Limited predictive finance and HR analytics across the UNC System.	The current process for financial and HR predictive analysis is largely ad-hoc, labor intensive and time consuming. Most System-wide analysis is trend analytics, which is difficult to develop for HR and finance. The financial and HR data collection process is unique to each institution, and often requires an iterative “back and forth” period to clarify and correct inconsistencies in the data collected to answer inquiries. Some institutions, such as NC State University, are doing trend analysis and some predictive analysis work at their institutions.	Given the variance in process and financial data across the institutions, the resulting analysis is inconsistent and sometimes conflicts with other reports. Discrepancies call the data analysis into question in the eye of the Board of Governors.
Reactive Financial Reporting Process.	Financial data analysis is largely reactive to questions from legislators and to reconciling inconsistencies in the data as reported from different institutions and ERP systems. Each institution provides HR data to the UNC System Office and responds to requests for HR and finance information, but the value of the exercise is not always understood, and the manner that the data is used or decisions made are not always apparent.	The time required to receive an answer to a legislative or Board of Governors request can lessen confidence in the process if it takes too long. The time spent on creating responses to questions takes resources from supporting key strategic goals for the UNC System and from serving the students.

Observation	Description	Implications
Technology		
ERP Complexities.	There are 3 major ERP systems in use across the UNC System. The two largest institutions, UNC-Chapel Hill and NC State University, use PeopleSoft. The North Carolina School of Science and Mathematics uses NCAS. The rest of the institutions use Banner 8 and are in the process of upgrading to Banner 9. Each ERP system has very different data structures. They were also implemented with different goals in mind. The Banner System is transactional and memorializes older business processes, and it is harder to retrieve financial data for analytics. PeopleSoft is more robust and has a greater flexibility in retrieving and reporting information. NCAS is structured according to State agency needs. Each institution implemented its system to support its own needs, so there are inherent differences in what data is available and how it is defined.	Institutional differences in financial and HR data definitions, data structures and in what data is captured, makes harmonizing the data for System-wide reporting and guiding System-wide strategies a significant challenge. The inconsistencies and differences require significant time and effort to resolve in order to answer questions and provide information to stakeholders. Delays in delivering information needed to run the UNC System impacts trust in the information provided. It also impacts the quality and accuracy of any data reporting and analysis. Different levels of details are extracted from the ERP Systems and fed into the data marts.
Wide variety of data visualization and presentation tools are used.	Staff expressed the need for improved data presentation and visualization capabilities. The 17 institutions use a wide range of data visualization tools, with differing levels of capabilities and functionality. Existing data marts utilize relatively modern technologies, and pilots are planned to explore more advanced tools available in the market (i.e. Tableau).	Without strong data presentation tools, institutions may not have the capability they need to clearly present data analysis and models in a visual way that their data consumer can understand. Based on the vision and strategy of the Data Modernization project, a set of architectural and tools decisions will need to be made to best support the future analytics reporting solution.

Observation	Description	Implications
Viability of the technical architecture for Student, HR and Finance Data Marts.	The underlying architecture of the HR and Student Data Mart is strong and stable. The architecture is well suited for the current volume of HR and Student data being transmitted to each data mart. If the UNC System institutions provide HR transaction data, the structure and flows of the HR Data Mart may not be able to handle the increased volume of information.	The HR and Student Data technical architecture can be the foundation for a new Finance Data Mart. The architecture or data flows may need to be modified to support the greater volume of data expected from the Finance systems. The architecture and data flows for the HR Data Mart may need to be modified to accommodate an increase in data volume resulting from transmittal of HR transaction data.

Appendix B — Descriptions of Standards

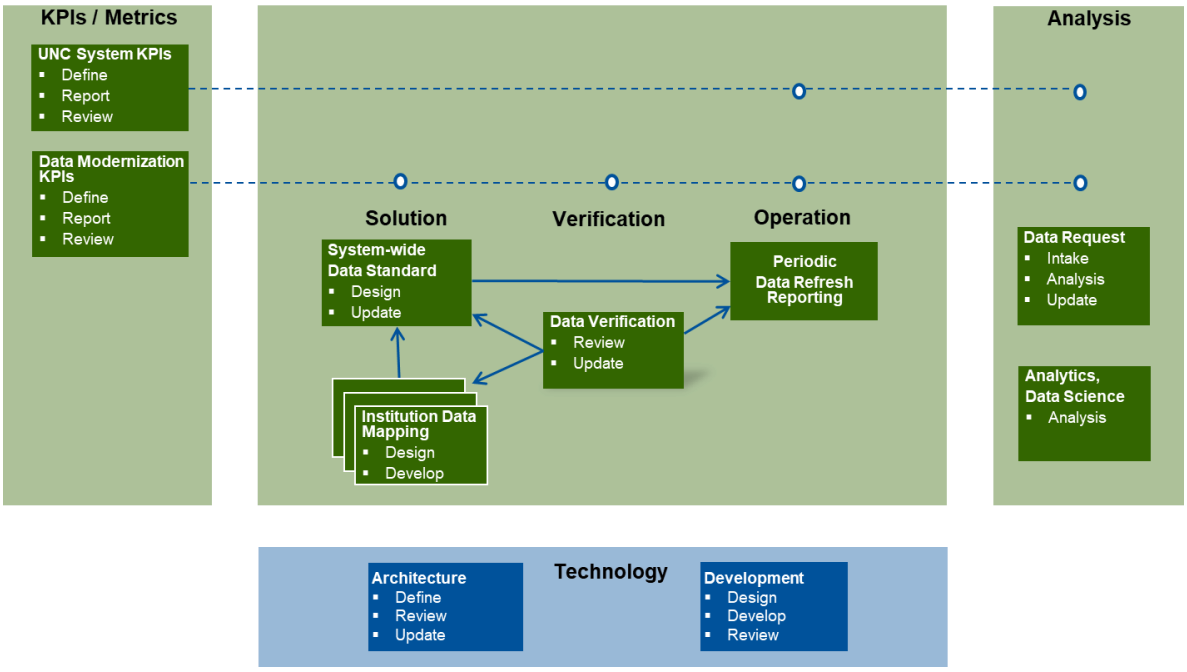
Artifact	Description	Rationale
Logical Standards		
Conceptual Data Model	A relationship model of the entire enterprise at a high level, depicting major data domains, information entities and relationships that are stable and most important to the business.	This artifact is a prerequisite to any other enterprise information architecture deliverables and facilitates: Understanding of the UNC System's business from a data perspective Provide common ground of communication between the System Office Institutions and technology Provide framework from which to evaluate data assets, assign stewardship, etc. Depict the data linkages across the system and disparate data concerns
Taxonomies & Hierarchies	Standardized business classification of the data based on affinity of each data and depicts their hierarchical relationship. (e.g., Asset part vs. Asset, Customer vs. Permitted Driver)	This provides consistency to refer to the data in standardized way and serves as a foundation to drill-down and roll-up analytics result.
Business Glossary	Definitive dictionary of business terms and relationships used across the UNC System. The definition must be designed to engender a common understanding of what is meant by a term for all employees and key business and leadership stakeholders regardless of their business function	Promotes consistent communication and decisions within the system by using agreed terms

Artifact	Description	Rationale
Conceptual Entity Life cycle	Depiction of core data value chain from creation/author to enrichment and final consumption	Provides visibility on the impact of the actions in each process on the information and it value stream (e.g., impact of incorrect data entry in the field on budget allocation) Foundation for data lineage
Metrics	Set of measures and indicators that MOCS Analytics program will use to determine how well it is achieving its goals and realizing the vision	Demonstrates the outcome of Analytics program to engage various stakeholders
DQ Standards and Business Rules	Expected condition of data for business use and associated rules	Provides criteria to monitor non conformant data and eventually improve quality of data to meet the business needs and expectations
Classification & Security Policies	Policy that defines various level of data security and guides how to classify current data	As electronic data is more accessible and consumed by various stakeholders, classification & security policy provide protection mechanism.
User Segmentation	Classified users based on various data needs and analytics consumption style and patterns	Helps to provide different analytics solution to appropriate user groups increasing user adoption and satisfaction. (one side does not fit all)
Technology and Implementation Standards		
Information Architecture	The target state architecture model that describes the enabling infrastructure components, and the relationships between them.	Helps to improve maintainability, extensibility, and scalability of overall solution
Logical/Physical Data Model	Data model that is used for implementing source systems and data sources in persistence layer	Helps to implement and maintain solution
Data & Rule inventory	Technical data level rules that may applied in source system, transformation process, or data quality monitoring.	Helps to implement and maintain solution
Data Lineage	Depiction of core data traceability from source of data origin to consumption by analytics by describing all technical components that data is travelled through	Helps to maintain solution and diagnose the source of issue in timely manner when data issue arises in analytics environment or during data quality monitoring process Additionally, this serves as a tool to conduct impact assessment when upstream source systems changes
Authoritative Data Source Specifications	Specification of authoritative data sources and its attributes based conceptual data model, taxonomy, business glossary, and the purpose of uses	Help the UNC System to tap into right sources per purpose and usage leading to consistent statistics and analytics outcomes

Artifact	Description	Rationale
Analytics Requirement Specification	Specification to capture analytics requirements to ensure deployed solution meets the real business needs	Gathering information requirements for analytic solutions is not straightforward and is often facilitated by IT. The question "What information do you want?" is a project pitfall; it does not engage with underlying issues or allow business users to explore hidden themes. and really doesn't seek to understand the business decision that the solution is intended to inform. Making connections between informational requirements and business outcomes is crucial, but often missed.
Mapping & Transformations	Mapping and transformation document that describes any changes/manipulation of data from one enabling infrastructure layer to another	Helps to implement and maintain the solution
Tool Standards	Documentation that inventories all the tools that UNC has and defines for what purpose the tool needs to be used	Maximize use of the tools while ensuring the right tool is used for specific problems. This standards also mitigates against redundancy and associated costs
End User Design Specification	POC/mock-up result to validate the understanding of end user requirements on how data is delivered to end users	Increases usability and user satisfaction
Operational Standards		
Periodic Data Quality Dashboard	Reported dashboard about the data quality based on the contracts of data rules and standards	Improves data quality and provides better analytics service based on better quality data
Data SLA	Contract of SLA on data quality and frequency between source to consumer	Improves data quality and increase accountability of data quality and service Provide better analytics service
Performance SLA	Contract of performance service level between parties (i.e., infrastructure service provider, analytics service provider, consumer)	Improve user satisfaction Increase accountability of performance issues
Training/User Manual	Any material/training aids to help understand new data standards and relationship or new analytics offerings or tools released.	Increase user adoption and conformance. Especially as MOCS is moving toward self-service analytics model, it is imperative to keep training/user manual up to date for easy consumption by MOCS analytics users
Inventory of Analytics Outputs	Inventory of analytics output such as reports, dashboards, visualization, datasets that can be mapped to new users	Increased accessibility of exiting outputs and reduces redundancy and associated costs

Artifact	Description	Rationale
Archiving and Backup Policies	Decision on archiving and back up of data and the way the data will be backed up	Ensures data are retained as required for legal compliance and business needs

Appendix C — Process Details



UNC System KPIs:

- Define
    - The Board of Governors sets the Key Performance Indicators (KPIs) used to manage the performance of the UNC System. The KPIs are determined upfront, and drive the data and reporting content for the Data Modernization Initiative.
- Report
    - UNC System KPI reports are provided to the Board Governors on a periodic basis (to be determined), providing timely and actionable data for UNC System governance.
- Review
    - The KPIs are periodically reviewed to ensure the appropriate metrics are produced for UNC System governance. KPIs may be added if repeated Data Requests are made for information deemed valuable by the Board of Governors and Legislature.

Data Modernization KPIs:

- Define
    - The Steering Committee and UNC System Office set the KPIs used to govern the activities of the Data Modernization Initiative. Data Modernization KPIs measure the processes and ability of the Data Modernization Initiative to meet its objectives.
- Report

        - Data Modernization KPI reports are provided to the Performance Management Steering Committee and UNC System Office Data Management on a periodic basis. Variance of actual versus planned KPI performance is used to improve the process and drive project activities.
- Review
    - Data Modernization KPIs will be reviewed and adjusted to ensure the metrics needed to govern the program are available.

System-wide Data Standards:

- Design
    - The UNC System Office Data Management team designs a standardized data definition aimed at supporting UNC System KPI reporting.
- Update
    - The standard data definition is periodically updated as UNC System KPIs change or Institution data mapping uncovers needed updates.

Institution Data Mapping

- Design
    - Institution Data Management and Analysts design how to best map Institution data to the standard data definition.
- Develop
    - Data transformation and extractions are developed based on data mapping.

Data Verification:

- Review
    - Central Data Steward and Institution Data Stewards continually monitor data quality and adherence to standards
- Update
    - Data clean up and data definition updates are coordinated by Central and Institution Data Stewards

Periodic Data Refresh and Reporting:

- Data is aggregated into a data mart that serves reporting, ad hoc queries and other data analytics activities.
- Processes to periodically refresh the data and generate standard reports are required.

Data Request:

- Intake
    - A clear Data Request intake process is needed to effectively track requests, assign resources, communicate status and coordinate with the parties involved to quickly process each request.
- Analysis

        - Experts familiar with System and Institution data will determine if the Data Request can be answered with existing data, or if additional analysis or data sources are required.
- Update
    - Resolution of the Data Request may require updates to the standard data definition, generated reports or other processes. The disposition of Data Requests should be used as a feedback loop to evolve the UNC solution.

Analytics, Data Science:

- Analysis
    - Processes for identifying patterns and trends, supporting predictive analytics and answering questions that have not yet been asked should be considered as an advanced Data Science approach.

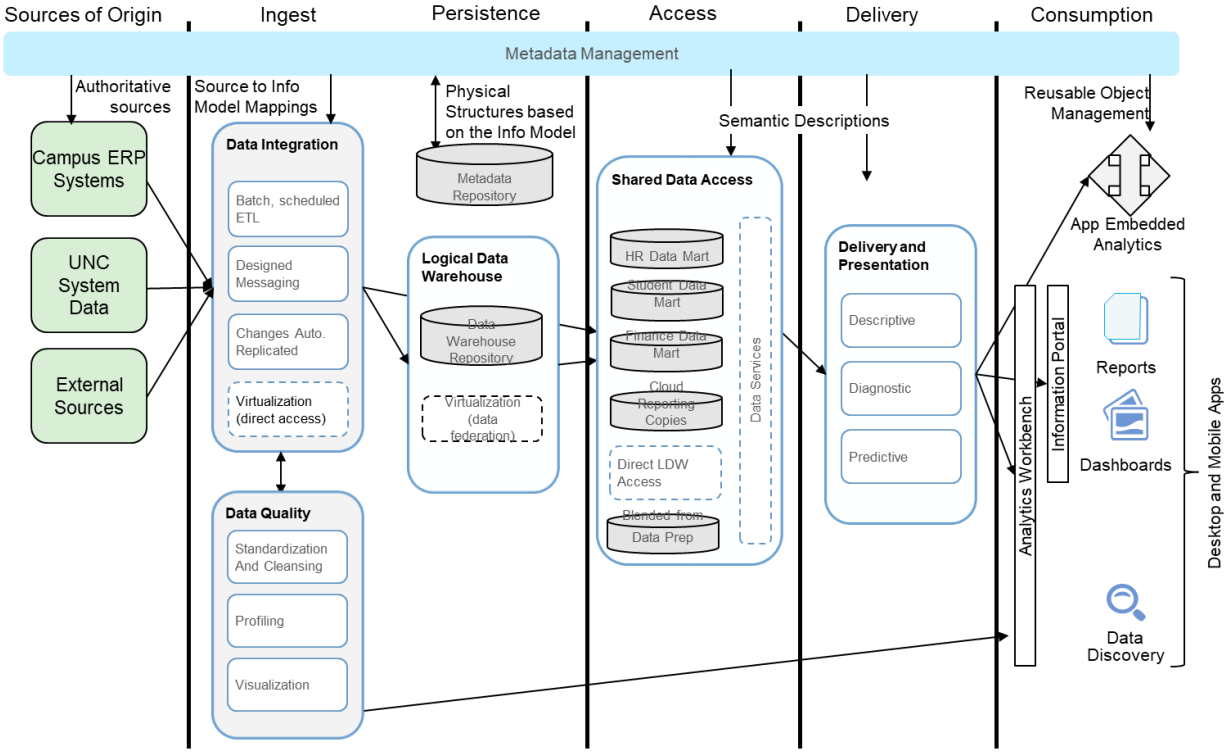
Architecture:

- Define
    - UNC System Office and Institution Technology teams follow a process to define the data platform needed to support Data Modernization. Architecture standards are defined and adhered to across the UNC System.
- Review
    - A process to evaluate the effectiveness of the data platform should be conducted from time to time. UNC Technology should evaluate the state of data tools and when they should be introduced into the data platform.
- Update
    - UNC Technology should plan and coordinate any updates to the data platform, taking care to understand the impact of data platform changes to UNC Institutions.

Development:

- Design
    - A life cycle process for designing custom data structures, programs, reports, analysis, etc. should be followed to enable a disciplined, controlled and stable data platform.
- Develop
    - UNC Technology and outside technology service providers follow a life cycle process for developing components of the data solution.
- Review
    - Components developed by UNC undergo a review process to ensure they meet business objectives and adhere to development and performance standards.

Appendix D — Technical Architecture



Metadata Management

- Overview:
  - Comprehensively managing metadata regarding all the data being used and shared for analytics
- Key Components include:
  - Map and track subject data in the information model to source systems, the “authoritative” sources and the accountable data stewardship
  - Provide mappings and transformation rules from source system structures to the persisting LDW, MDM and DM structures
  - Mappings and descriptions that support use and consumption of the data — the semantic descriptions provided in the Information Portal and Analytics Workbench
  - Management of how Analytics Products are organized as reusable objects and made available (by analytic role) in the Information Portal and Analytics Workbench
- Critical Success Factors:
  - Acquiring a consistent and integrated toolset across the full breadth of metadata types
  - Determining and adopting data standards

- Process discipline and compliance

Sources of Origin

- Overview:
  - Identifies as targets the full variety of data sources within the scope of the UNC System Office Data Modernization and Integration (DMI) Target Architecture
- Key Components include:
  - In addition to the rich variety of systems explored with current data marts the future will include more sources of data relevant to the Data Modernization and Analytics Strategy
  - This will include (but not be limited to) systems in 3 broad categories:
    - Campus ERP Systems (17 instances — PeopleSoft, BANNER and NCAS)
    - Other UNC System Office systems
    - Data from external sources
  - UNC should consider planning for greater varieties of data including "unstructured content," very low grain data in enormous volumes and data of fleeting relevance and validity
- Critical Success Factors:
  - Determining which apparently contradictory data is the most appropriate
  - Rationalizing sources used where possible
  - Obtaining permission to use the needed data
  - Connecting to and integrating with the varieties of technologies in use

Ingest Layer

- Overview:
  - This layer extracts or receives data from operational data sources and transforms into the structures used in the other layers. All data that are used in analytics have to pass through this layer regardless of their eventual destination.
- Key Components include:
  - Data Integration tools that support batch, continuous and virtualized ETL styles chosen to address:
    - Data Freshness: how much time has passed since the data was written into the database until we can include it in analytics results?
    - Query Response Time: how long does it take before the user receives a response?
  - Data Quality tools providing the following capabilities:
    - Profiling provides rules-based examination of data at source to determine issues
    - Visualization engages SMEs in enhancing profiles

  - Data can then be cleaned and enriched to address quality and protection issues

- Critical Success Factors:
  - Ability to maintain connections to all sources in a way that can efficiently process the sheer volumes and velocities involved
  - Fully aligning technology choices with the need for freshness and responsiveness
  - A comprehensive exception and remediation process
  - Service level definition and compliance
  - Managing sensitivities regarding confidential and personal data

Data integration can be achieved by either custom-developing connections between systems, or by using vendor software purpose-built as a tool to provide integration capabilities. There are strengths and challenges for each approach:

Custom-code

Strengths

- Developer knowledge and experience can mean fast results
- Allows for flexibility in design structure (no templates)
- Simple ETL can be produced very quickly with minimal planning

Challenges

- Tendency to create hard-coded transformation and quality resolutions that limit reuse
- Uncoordinated ETL can impact consistency
- Cost overhead in dealing with integration implementation complexity
- Key elements (such as “slow changing dimensions” and “consistent error handling”) can be missed
- Dependency on individual developers
- Maintenance cost overhead over time

Data Integration Toolsets

Strengths

- Generally improved ability to reuse even for “one offs”
- Provides coordination of ETL and metadata resulting in improved consistency
- Easier to share and benefit from a managed library of best practice approach modules
- Coordination and sharing of extracts for multiple purposes
- Shared automated processes for debugging, version control and impact analysis

Challenges

- Learning curve must be climbed — over time
- Consideration and discipline for sharing and reuse can slow development
- Not everything is automated — need for QA practices remains

While custom coding can have major tactical advantages but for the medium to long term a toolset will bring substantial advantages. For UNC, the strategy for integration includes:

- Utilize tool-driven development in organizations where developers are assigned to projects in an interchangeable manner and/or subsequently assigned to maintain and support systems that include broadly used data assets

- Permit custom code for data integration only when a primary or secondary functionality within your development tools is absent or cannot be augmented using another low-cost tool
- Utilize the same quality assurance requirements for custom-code and tool-driven development for data integration, but recognize that such assurances can be provided with highly different designs

Persistence

- Overview:
  - Stores the historically persistent data, metadata, and models that provide the temporal analytical capabilities
- Key Components include:
  - Metadata: A single data store for all relevant metadata
  - Logical Data Warehouse: Historical data in 2 main styles:
    - Data Warehouse Repository: Consolidates structured (and associated unstructured) data into a central repository. reduces impact to original systems, integrates data from diverse sources, synchronizes master data for key dimensions and optimizes performance for specific workloads — for most UNC needs
    - Virtualization: also known as data federation, retrieves and processes data on demand but source data must be reasonably well-ordered and low volume — UNC may use this to investigate and prep. new types of data
- Critical Success Factors:
  - Implementation of robust and resilient solutions that can reliably deliver the required levels of service
  - Manage “down” and minimize redundancy across the enterprise set of analytics data
  - Ensure the inherent complexity is considered in the design and fully documented

Access

- Overview:
  - Stores persistent and transient information, in the form of physical or virtual data marts, of prepared and accessible data that are ready for use by their respective use cases.
  - This layer receives data from the Persistence or the Ingest layer directly, and prepares the data by enriching them and adapting them for consumption, based on specific end-user technical and business needs.
- Key Components include:
  - HR, Student and Finance Data Marts: Physical data marts where data from the persistence or ingest layers is physically restructured in “materialized” tables and

organized to address a defined subset of analytics purposes. These data marts are accessed by the delivery layer via Data Services.

- Cloud reporting copies (organized to address a defined subset of analytics access via public cloud) are materialized views offloaded to cloud-based storage and accessed via cloud-based data services.
- Blended from Data Prep. Data (organized to address a defined subset of analytics purposes) that has been subject to end-user intervention via self-service data preparation is created as physical data marts. These data marts are accessed by the delivery layer via Data Services.
- Data Services are provided to streamline access to the data marts from the access layer.

- Critical Success Factors:
  - Manage “down” and minimize redundancy across the variety of data marts generated.

Delivery

- Overview:
  - Enables the analysis of data and their delivery to their ultimate consumption users.
  - This layer accesses the data made available in the Persistence and Access layers and provides the functionality to analyze the underling data.
- Key Components include:
  - Descriptive Analytics Functionality which is the examination of data or content, usually manually performed, to answer the question “What happened?” (or What is happening?) and is characterized by reporting, dashboards and visualizations such as pie charts, bar charts, line graphs, tables, or generated narratives.
  - Diagnostic Analytics Functionality is a form of advanced analytics which examines data or content to answer the question “Why did it happen?,” and is characterized by techniques such as drill-down, data discovery, data mining and correlations.
  - Predictive Analytics Functionality is a form of advanced analytics which examines data or content to answer the question “What is going to happen?” or more precisely, “What is likely to happen?,” and is characterized by techniques such as regression analysis, forecasting, multivariate statistics, pattern matching, predictive modeling, and forecasting.
- Critical Success Factors:
  - Ensuring the intended audiences and users of these capabilities trust, understand and are fully equipped to use them.

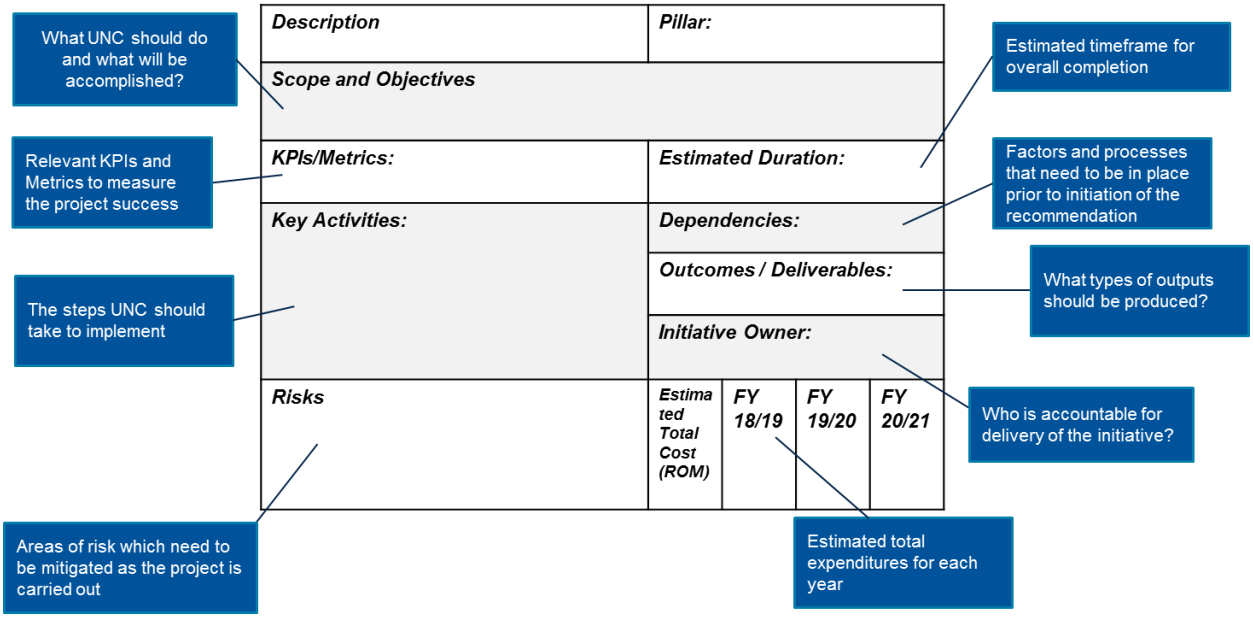
Consumption

- Overview:

        - Provides an encapsulation of all tools and the single point of entry with two major styles for any interactions with the program both for Management, Occasional. Intensive and Scientist user roles.
    - Key Components include:
        - Application Embedded Analytics: Providing organized and maintained analytics data made available to provide analytics capabilities embedded within business applications. These capabilities can be Descriptive, Diagnostic or Predictive.
        - Information Portal: Managed access to largely Descriptive and some Diagnostic analytics capabilities provided for Management and Occasional analyst user roles.
        - Analytics Workbench: Managed access with the maximum level of end-user freedom of action provided for Intensive and Scientist analyst user roles. This provides access to the full set of Descriptive, Diagnostic and Predictive capabilities for the relevant subject areas. Includes extensive data discovery and self-service data preparation capabilities.
    - Critical Success Factors:
        - Ensuring user segmentation is correct and up-to-date and that each individual has the best possible access to capabilities that will enable their analytic efforts.
        - Keeping training and user-group activities aligned with individual needs and profiles.

Appendix E — Detailed Project Mini Charters

Mini Charter Layout



Project 1: Launch Program And Governance

Description: Create charter, establish governance team, confirm roles & responsibilities	**Pillar: 1**
Scope and Objectives: Create a governance structure to manage financial reporting of supporting key strategic goals as defined by *Higher Expectations: The Strategic Plan for the University of North Carolina,* and key strategic financial metrics required by the Board of Governors and the Legislature. The governance structure should also oversee integration between HR, Finance and Student data, to support strong cross functional reporting requirements, such as retention and diversity goals.	
KPIs/Metrics: ▪ % requests satisfied by financial data mart ▪ # days for response (speed) ▪ % decisions proven to be correct ▪ Satisfaction rating ▪ Quality of financial data	**Estimated Duration:** Six months — Q3 FY 18 and Q4 FY 18
Key Activities: ▪ Using the model described in the Governance Vision, update the UNC	**Dependencies:** None

<table>
<tr><td rowspan="2">System Office data governance and reporting model. Design the structure to deliver the level of governance needed to meet the objectives.
▪ Define decision rights for each of the roles in the new governance model.
▪ Define how information is shared between the institutions, the Board of Governors and the legislature.
▪ Define and document the governance decision making process, including how topics are raised, and decisions are communicated and success measured
▪ Define Strategic KPI’s to be measured.</td><td>Outcomes / Deliverables:
▪ Governance structure organization chart for the System Office and how it will intersect with UNC Institutions.
▪ KPI to measure progress to goal
▪ Documented policies and RACI on how decisions will be made.</td></tr>
<tr><td>Initiative Owner:
UNC System Office CIO, CFO</td></tr>
<tr><td rowspan="2">Risks:
No process can be developed that will answer every possible question. A successful Data Modernization initiative should focus on key strategic goals. KPI’s should come from the Strategic plan, and a few others developed to measure progress to key goals set by the Board of Governors. Reporting that is snapshot based misses important trends. Useful reporting is focused not on point in time information, but on long range trends.</td><td>Staffing / Skillsets:
System Office CFO and CIO, Institutional CFO and CIO’s. Data Stewards for HR, Finance and Student.</td></tr>
<tr><td>
<table>
<tr><th>Estimated Total Cost (ROM)</th><th>FY 18/19</th><th>FY 19/20</th><th>FY 20/21</th></tr>
<tr><td></td><td></td><td></td><td></td></tr>
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Project 2: Establish Information Request Process And Data Stewardship

<table>
<tr><td>Description: Define process for handling information requests from Board of Governors, Legislature, and Staff; assign/confirm data stewards at the System Office and in institutions</td><td>Pillars: 2, 3</td></tr>
<tr><td colspan="2">Scope and Objectives:
Define a process for responding to request for Financial, HR and Student information from the Board of Governors, System Leadership and the Legislature. Define the roles and responsibilities for HR, Finance and HR Data Stewards in both the UNC System Office and the UNC Institutions.</td></tr>
<tr><td>KPIs/Metrics:
▪ # days to respond to request
▪ FTEs to respond (effort)
▪ % self-service requests</td><td>Estimated Duration:
Planning: Nine months — Q3 FY18, Q4 FY18, Q1 FY19
Rollout and Support: Ongoing starting Q2 FY19</td></tr>
<tr><td>Key Activities:
▪ Define and document a process to determine whether an request can be</td><td>Dependencies:
Project 1 Launch program and governance runs in parallel to the Planning Phase</td></tr>
</table>

<table>
<tr><td>answered only through the UNC System Office Data Marts or will require support from the UNC institutions
▪ Define and document the process to respond to requests that require information only from the UNC System Office.
▪ Define and document the process to respond to requests that require information from the UNC System Office and/or the UNC institutions.
▪ Define and document and communicate the role, rights and responsibility of the Data Steward in the UNC System Office and the UNC Institutions in defining and maintaining HR, Finance and Student data and responding to requests for information.
▪ Define and communicate SLA’s for responding to ad hoc inquiries</td><td>Outcomes / Deliverables:
▪ Documented process for prioritizing and responding to ad hoc data request from the Board of Governors, System Leadership, and the Legislature.
▪ Documented RACI for Data Stewards
▪ SLA for response to inquiries based on complexity

Initiative Owner:
Initiative Owner: UNC System Office CIO, CFO</td></tr>
<tr><td>Risks:
Without a process for managing and responding to ad hoc data inquiries, requests will move through the UNC Institutions and the UNC System Office in an unmanageable flow. Without a process for prioritizing and responding to requests important information may be missed, as less critical requests are responded to. Without SLA’s expectations cannot be managed, increasing frustration and decreasing trust.</td><td>Staffing / Skillsets:
Staffing / Skillsets: System Office CFO and CIO, Institutional CFO and CIO’s. Data Stewards for HR, Finance and Student.

Estimated Total Cost (ROM) | FY 18/19 | FY 19/20 | FY 20/21</td></tr>
</table>

Project 3: System Office Support Organization And Software Tool Acquisition

<table>
<tr><td>Description: Align current SO data & analytics organization to support new roles; identify requirements for new tools and select/procure</td><td>Pillar: 2, 5</td></tr>
<tr><td colspan="2">Scope and Objectives:
▪ Establish the organization that will most effectively support the System Office’s role in Data Management
▪ Enable UNC to build the required technical capabilities</td></tr>
<tr><td>KPIs/Metrics:
▪ % required positions filled, time to fill
▪ % required tools acquired, time to acquire</td><td>Estimated Duration:
▪ Initial 6 months
▪ Additional procurements 3 months each</td></tr>
</table>

<table>
<tr><td rowspan="3">Key Activities:
▪ Define the new roles required to support the information request process and manage/operate the data management technical environment
▪ Determine the optimal organization structure
▪ Perform necessary training and hiring
▪ Roll out the new organization, supported by appropriate organizational change management activities
▪ Identify the strategic requirements for the tools required to perform, ingest, persistence and access functions, and to perform the delivery and consumption functions required to support the financial portal and workbench
▪ Identify candidate tools, including any already licensed by UNC
▪ Develop solicitation (e.g.: RFP) for each tool to be acquired
▪ Receive proposals and demonstrations, select, and contract for each tool</td><td>Dependencies:
▪ Launch program and governance
▪ Establish information request process & data stewardship</td></tr>
<tr><td>Outcomes / Deliverables:
▪ Organization design
▪ Job/role descriptions
▪ Organizational change management plans
▪ Software solicitation documents
▪ Selected tools</td></tr>
<tr><td>Initiative Owner:
TBD</td></tr>
<tr><td rowspan="2">Risks:
▪ Staff resistance to organizational changes
▪ Difficulty acquiring new skills
▪ Reliability of available funding for staff training, new staff, software
▪ Complexity of acquiring tools that will work together effectively
▪ Ability to reach consensus on tool selection including System Office and institutions</td><td>Staffing / Skillsets:
▪ Organization design & change management
▪ Software procurement</td></tr>
<tr><td><table><tr><td>Estimated Total Cost (ROM)</td><td>FY 18/19</td><td>FY 19/20</td><td>FY 20/21</td></tr></table></td></tr>
</table>

Project 4: Financial Data Warehouse Architecture, Common Coding And Allocation Design

<table>
<tr><td>Description: Define the flow of data from institutions to SO, including process, format and coding, and ingest technology; design and implement persistence technology</td><td>Pillar: 3, 4, 5</td></tr>
<tr><td colspan="2">Scope and Objectives:
Put into operation the “consolidation” model for collecting finance and related data from across the system, including processes, policies and supporting tools/technologies</td></tr>
</table>

KPIs/Metrics:

- Measures of project progress and completion for tools design and implementation
- On time % for data transmission from institutions
- Measures of completeness and quality of data transmitted

Estimated Duration:

6 Months

Key Activities:

- Determine the scope of data to be sent from institutions to the System Office
- Determine the technical method of transmission (e.g.: file exchange, messaging) and any associated formats/layouts
- Develop the initial version of the “chart of accounts” to be used to classify the data being transmitted
- Develop persistence layer logical and physical design (e.g.: single warehouse, federated, marts)
- Implement tools to support ingest and persistence
- Work at institutions to perform mapping to system office COA and transmission to system office

Dependencies:

System office support organization and software tool acquisition

Outcomes / Deliverables:

- Standards & procedures for transmitting finance and related data to system office
- System office chart of accounts
- Technology in production to support transmission and storage of finance data at System Office

Initiative Owner:

TBD

Risks:

- Difficulty gaining consensus on data to be sent to system office
- Initial SO chart of accounts design too detailed for institutions to easily support

Staffing / Skillsets:

- Chart of accounts design
- Logical/physical data design

Estimated Total Cost (ROM)	FY 18/19	FY 19/20	FY 20/21

Project 5: Financial Information Portal

<table>
<tr><td colspan="2">Description: Define business intelligence use cases, build access and delivery technology to support dashboards and basic inquiry</td><td colspan="4">Pillar: 5</td></tr>
<tr><td colspan="6">Scope and Objectives:
The creation of a predefined set of reports and dashboards based on the KPI’s most useful for overseeing and managing the financial metrics for the UNC System and based on the data made available by the Financial Data Warehouse Architecture. Objectives include:
▪ Provide ready access to a broad set of financial data that is: current, authoritative, consistent and focused on chosen KPIs
▪ Reports and Dashboards are created quickly based on validated needs and are adaptable to changing needs</td></tr>
<tr><td colspan="2">KPIs/Metrics:
▪ Level and frequency of usage of the reports and dashboards
▪ Elapsed time to make required enhancements</td><td colspan="4">Estimated Duration:
6 months</td></tr>
<tr><td colspan="2" rowspan="3">Key Activities:
▪ Identify current pain points of Financial systems reporting and select KPIs to become the basis of the Portal
▪ Identify representative users and gather user requirements
▪ Define service level (e.g., availability and response time of reports, data frequency)
▪ Design and implement access layer data mart structures
▪ Choose report and dashboard development tool(s)
▪ Design and develop portal structure, reports and dashboards
▪ Test & train users
▪ Deploy Financial Information Portal</td><td colspan="4">Dependencies:
Dependent on Project 4 (Financial Data Warehouse Architecture</td></tr>
<tr><td colspan="4">Outcomes / Deliverables:
▪ Requirements, Design and Testing Documentation
▪ Data Mart, Report, Dashboard Objects and updated Metadata
▪ Training Courses and Materials</td></tr>
<tr><td colspan="4">Initiative Owner:
TBD</td></tr>
<tr><td colspan="2" rowspan="2">Risks:
▪ Obtaining agreement on the choice and definition of KPIs
▪ Quality and consistency of the Financial Data Mart
▪ Correct identification and segmentation of users based on analytics roles
▪ Availability and engagement of users in requirement gathering
▪ Timing and thoroughness of communication & training</td><td colspan="4">Staffing / Skillsets:
▪ Data Design and DBA
▪ Business Analysis
▪ ETL and BI Tool Development</td></tr>
<tr><td>Estimated Total Cost (ROM)</td><td>FY 18/19</td><td>FY 19/20</td><td>FY 20/21</td></tr>
</table>

Project 6: Financial Core Analytics Workbench

<table>
<tr><td colspan="2">Description: Train users and configure delivery technology to support complex inquiry and analysis</td><td colspan="4">Pillar: 5</td></tr>
<tr><td colspan="6">Scope and Objectives:
Provide a usable set of data discovery tools for UNC System Office business analysts to develop specific ad hoc queries to provide responses to special requests by the Board of Governors or State Legislature using the Financial Data Mart. Objectives include:
▪ Provide comprehensive access to the Financial Data Mart for all authorized and certified (trained) users
▪ Exploration accomplished with queries, reports and dashboards created by Business Analyst Staff</td></tr>
<tr><td colspan="2">KPIs/Metrics:
▪ % of targeted users certified
▪ Level and frequency of usage self-service capabilities</td><td colspan="4">Estimated Duration:
4 Months</td></tr>
<tr><td colspan="2" rowspan="3">Key Activities:
▪ Identify intensive/power user groups and self-service needs
▪ Define service level (e.g., availability and response time of reports, data frequency)
▪ Extend/Modify Financial Data Mart structures as needed
▪ Select Data Discovery toolset(s)
▪ Define user certification process
▪ Train users
▪ Deploy self-data discovery capability
▪ Provide access to additional “sandbox” data via self-service tools</td><td colspan="4">Dependencies:
Dependent on Project 4 (Financial Data Warehouse Architecture</td></tr>
<tr><td colspan="4">Outcomes / Deliverables:
▪ User Classification and target groups
▪ End User Design Specification
▪ Implemented Views and Tool Configuration
▪ Training and certification process</td></tr>
<tr><td colspan="4">Initiative Owner:
TBD</td></tr>
<tr><td colspan="2" rowspan="2">Risks:
▪ Quality and consistency of the Financial Data Mart
▪ Correct identification and segmentation of users based on analytics roles
▪ Acceptance of user certification process
▪ Timing and thoroughness of communication & training</td><td colspan="4">Staffing / Skillsets:
▪ Data Design and DBA
▪ Business Analysis
▪ BI Tool Usage Skills</td></tr>
<tr><td>Estimated Total Cost (ROM)</td><td>FY 18/19</td><td>FY 19/20</td><td>FY 20/21</td></tr>
</table>

Project 7: Integration Of Portal And Workbench For Finance HR And Student Data Marts

<table>
<tr><td colspan="2">Description: Extend portal and workbench to include data from HR and Student marts</td><td colspan="4">Pillar: 5</td></tr>
<tr><td colspan="6">Scope and Objectives:
Extend the Financial Information Portal and Financial Core Analytics Workbench to provide streamlined access to both Student and HR data as well as the Financial data to authorized and certified users. Objectives include:
▪ Provide a single and consistent assess point and analytics self-services to the targeted user community based on approved access rights, analytics role and certification (training completed) for all available data</td></tr>
<tr><td colspan="2">KPIs/Metrics:
▪ % of targeted users certified
▪ Level and frequency of usage
▪ Elapsed time to make enhancements and changes</td><td colspan="4">Estimated Duration:
4 Months</td></tr>
<tr><td colspan="2" rowspan="3">Key Activities:
▪ Identify intensive/power user groups and self-service needs
▪ Define service level (e.g., availability and response time of reports, data frequency)
▪ Extend and integrate Data Mart structures as needed
▪ Extend the user certification process beyond Financial data users
▪ Train users
▪ Deploy reports, dashboards and self-data discovery capability in the integrated structure</td><td colspan="4">Dependencies:
Dependent on the Financial Data Mart projects (4, 5 and 6)</td></tr>
<tr><td colspan="4">Outcomes / Deliverables:
▪ User Classification and target groups
▪ End User Design Specification
▪ Comprehensive set of Reports and Dashboards
▪ Implemented Views and Tool Configuration
▪ Training and certification process</td></tr>
<tr><td colspan="4">Initiative Owner:
TBD</td></tr>
<tr><td colspan="2" rowspan="2">Risks:
▪ Conflicts related to unresolved data inconsistencies across Data Marts
▪ Correct identification and segmentation of users based on analytics roles
▪ Acceptance of user certification process
▪ Timing and thoroughness of communication & training</td><td colspan="4">Staffing / Skillsets:
▪ Data Design and DBA
▪ Business Analysis
▪ BI Tool Usage Skills</td></tr>
<tr><td>Estimated Total Cost (ROM)</td><td>FY 18/19</td><td>FY 19/20</td><td>FY 20/21</td></tr>
</table>

Project 8: Exploratory Analytics And Additional Data Marts

Description: Select and implement advanced tools such as predictive analytics and data mining; expand tools to include access to learning data and external data sources

Pillar: 5

Scope and Objectives:
Further build out the Analytics platform to address specific needs through predictive analytics and use a wider set of data sources. Objectives include:

- Provide a single and consistent assess point for basic and advanced analytics self-services to the targeted user community based on approved access rights, analytics role and certification (training completed) for HR, Student, Financial and Learning data
- Analytics services are created quickly based on validated needs and are adaptable to changing needs

KPIs/Metrics:

- % of targeted users certified
- Level and frequency of usage
- Elapsed time to make enhancements and changes

Estimated Duration:
Two phases of 6 months each

Key Activities:

- Identify opportunities and collect requirements for learning data and advanced analytics
- Define service level (e.g., availability and response time of reports, dashboards, models, data frequency)
- Extend and integrate Data Mart structures as needed
- Design and develop portal structure, reports, dashboards and models
- Extend the user certification process as needed
- Train users
- Deploy reports, dashboards, models and self-data discovery capability in the integrated structure

Dependencies:
Dependent on the Integrated Portal and Workbench project 7

Outcomes / Deliverables:

- User Classification and target groups
- End User Design Specification
- Learning Data Mart
- Comprehensive set of Reports and Dashboards and selective predictive models
- Implemented Views and Tool Configuration
- Training and certification process

Initiative Owner:
TBD

Risks:

- Availability of specialized skills and knowledge for predictive modeling and learning data
- Conflicts related to unresolved data inconsistencies across Data Marts
- Correct identification and segmentation of users based on analytics roles
- Acceptance of user certification process
- Availability and engagement of users in requirement gathering
- Timing and thoroughness of communication & training

Staffing / Skillsets:

- Data Design and DBA
- Business Analysis
- Statistics and Modeling
- ETL and BI Tool Development

Estimated Total Cost (ROM)	FY 18/19	FY 19/20	FY 20/21

Any questions regarding this Report should be addressed to:

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