State of North Dakota
Longitudinal Data System Strategic Roadmap

Longitudinal Data System Committee
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1.0 Executive Summary

Each biennium, North Dakota and its citizens invest billions of dollars across many state agencies to maintain and improve the quality of life for residents of the state. Each program operated by these agencies collects some type of performance data to measure short-term and medium-term outcomes. However, data collected within a program does not always provide a fuller picture of longer-term, or "longitudinal" outcomes, for how the program and its participants fared over time.

This report, the State of North Dakota Longitudinal Data System Strategic Roadmap, lays out the planning, development, and budget efforts that are required to realize a data repository that unifies key data from public PK-12, higher education, and workforce development initiatives and provides the analytical insight to better administer state services and foster economic development. The LDS Strategic Roadmap presented here is a product commissioned by the state's Longitudinal Data System (LDS) Committee, which was formed in 2007 after interest in data warehousing was expressed by several state agencies.

1.1 Understanding Data Warehousing

The creation and adoption of a strategic roadmap for a state longitudinal data system (LDS) first requires an understanding of a LDS and its basic building blocks: data, data warehousing, and business intelligence tools.

Data warehousing is the logical and strategic ordering and storage of data into a central repository thereby allowing easy and intuitive analysis and reporting. Several steps are required for an entity, such as a state agency, to achieve a data warehouse. First, the agency must gather and integrate data from its multiple sources. Additionally, it must establish *data governance* including rules for reporting and processing data to enforce data quality over a period of time. Next, the agency can utilize the warehouse to effectively use data for planning, decision making, and program improvement. Data warehouses can store data over short or long periods of time and are scalable from an agency-based to a statewide system.

Business intelligence tools are software tools used in conjunction with databases to facilitate access to and analysis of data for informing a business or entity's decision making. Typically, business intelligence tools are purchased in a bundle to provide a robust reporting environment with its own portal and administrative capabilities that may be used to manage data reporting.

A *state longitudinal data system* consists of a statewide data warehouse that allows program evaluation over single or multiple years. It integrates data from several state agencies for cross-agency analysis. Generally, an agency data warehouse includes all data relevant to the mission, programs and operations of an agency. However, a LDS that maximizes efficiency and performance only extracts and includes the portion of an agency's stored data that is required for cross-agency analysis. A LDS applies a business intelligence tool on top of the data warehouse to provide authorized users direct access to analytical tools and data in one interface.

1.2 Evaluating Program Outcomes Using Cross-Agency Data

The state LDS – a powerful combination of an easy-to-use business intelligence tool and a state data warehouse populated with select data from multiple agencies—empowers and enlightens state leaders by providing answers to questions that are essential for meeting North Dakota's education and workforce goals. A few of these questions include

- How many students who graduated from a North Dakota school district needed to take remedial courses in reading, math or writing when they enrolled in North Dakota community colleges or North Dakota colleges and universities?
- Are students enrolled in college courses that lead to high demand occupations that are experiencing workforce shortages?
- How does student performance in college correlate with student performance on high school achievement tests, and/or earlier achievement tests?
- How well do workers in the university system Workforce Training Programs do in terms of employment and future earnings gains?
- How does student achievement in college programs correlate with workforce participation and workforce earnings?

1.3 LDS Roadmap Methodology

To construct the Longitudinal Data System (LDS) Strategic Roadmap, Claraview applied its Education Analytics Maturity Model (EAMM) as a framework to examine North Dakota's current practices in data governance, data collection and sharing, and data analysis. Claraview developed the EAMM to aid states in planning and attaining an optimized longitudinal data system capable of leveraging data from multiple sources to benefit the state as a whole. It starts with a foundation of education data and grows to include data from other related agencies such as departments of labor, health, corrections, and human services.

First, the consultant team reviewed current reports and associated documentation provided by state agencies related to education and workforce. Next, the team interviewed state agency representatives to learn their current data practices and how they would ideally like to use data in the future. During these individual interviews with each agency, state staff indicated what data and infrastructure would be needed to achieve increased functionality and effectiveness as the state moves toward a shared LDS. The consultant team compared information from the current or 'As Is' description and the ideal future or 'To Be' picture to create a gap analysis identifying what changes are required to achieve a robust multi-agency state LDS that will assist state agencies in meeting North Dakota's goals. The team then developed several solution options describing how to resolve the gap in data functionality and attain a state enterprise-wide education and workforce data system. Finally, the consultants provided cost estimates for each solution option based on Claraview's experience delivering similar data warehousing solutions and by gathering quotes from product vendors.

1.4 Current Environment

North Dakota's current data environment for its education and workforce efforts is driven by a need to collect and report specified data used to measure state agency program performance. Just as each agency has its own set of programs to administer, each program has its own set of state

or federally required performance measures. The dynamics of multiple education and workforce programs administered across six agencies—Department of Public Instruction (DPI), North Dakota University System (NDUS), Department of Career and Technical Education (CTE), Job Service North Dakota (JSND), Department of Commerce, and Department of Human Services (DHS)—results in a high degree of variation in the hardware and software tools, and methodology used to handle data demands. Several agencies already have well-established databases that are primed for transitioning into agency-based data warehouses.

Agencies have a well-established history of gathering and reporting data. Some agencies have nearly 20 years of historical program data. Each agency has a regular schedule for data collection and reporting generally based on state and federal reporting requirements. That said, data collection is not as streamlined as it could be. The absence of data governance councils at the state and agency levels creates a data system void of the data definitions, rules, and processes needed to ensure data consistency, quality and reliability. Data is collected via paper, electronic files and face to face interviews, yet agencies are not collecting all the data they believe are needed to inform and improve program operations.

Current data reporting practices, which sometimes involve combining data across agencies, meet immediate needs to provide an agency accounting of program performance as set forth in state and federal legislation. The state is working on adopting a tool for matching an individual's files from one agency to another. The inability to match data files coupled with data quality concerns are the greatest reporting challenges. While some in-house analysis takes place, a large share of the reporting effort is provided by FINDET, a state supported follow-up data reporting service. FINDET also provides data matching for any reports requiring related data from more than one agency. The current data environment has served the state well, but does not yet meet its full potential.

1.5 Future Environment

The future data environment for North Dakota should include a state longitudinal data system that supports the sharing of quality data across agencies. It first establishes a data governance council to ensure data are complete, valid, and reliable, and to make decisions regarding what and how data should be shared. Building on a foundation of quality data, a state data warehouse is established, integrating select education and workforce data across agencies. Master Client Index software is used to confidently match data records enabling longitudinal analyses of education and workforce programs and participant cohorts across agencies.

In addition to data system integration improvements, the future environment supports highly expanded analytic capabilities. It provides user friendly business intelligence tools that present data in multiple formats to easily reveal trends. It uses maps and charts to provide regional information. Most importantly, it allows agencies to independently access the full array of data needed to not only meet government reporting requirements, but also perform additional intra-agency and interagency analyses to examine and improve program performance.

1.6 Themes and Policy Challenges

Several consistent themes were identified during the LDS Roadmap interviews and analysis including:

1) There is strong support across state agencies to share key information and leverage the benefits of longitudinal data analysis that a state LDS can provide
2) There are data quality challenges surrounding the implementation of a state LDS that must be solved to achieve a successful project
3) Opportunities exist for each agency to enhance its data warehousing and data analytics capabilities.

Similarly, a few policy challenges were revealed that should be considered in designing and selecting an approach to a state LDS:

1) A process for maintaining the state ID in a student's postsecondary records for a former North Dakota K-12 student transitioning to higher education.
2) NDUS needs to adopt a process for enrolling or registering workforce students in ConnectND upon their participation in NDUS workforce training programs.
3) The state LDS, and in which agency it is placed, needs to be compliant with federal privacy laws, and should meet the Data Quality Campaign's (DQC) ten essential elements and fundamentals for P-12 longitudinal data systems.

1.7 Recommendations

Data Warehousing Capabilities

- **Implement a State Longitudinal Data Warehouse**. A state-level LDS that integrates data from multiple government agencies will provide a stable, scalable, and sharable data repository for cross-agency longitudinal data analysis.
- **Implement a K-12 Data Warehouse.** DPI should acquire or build a state-level K-12 data warehouse that includes a business intelligence reporting capability.
- **Implement Agency-Specific Data Warehouses [optional].** As an optional recommendation, each agency (NDUS, JSND, DHS, and Commerce/Workforce) should consider implementing agency-specific data warehouses to centralize and integrate data from multiple operational systems within each agency.
- **Allow Continued Viewpoint™ Rollout Among School Districts.** Today, local school districts have the ability to license Viewpoint, a K-12 data warehousing system. Viewpoint provides local districts the ability to load data into a data warehouse and build sophisticated analytical reports.
- **Define a Data Integration Strategy.** An important byproduct of implementing any data warehouse is the integration, consolidation, and governance of an organization's data. North Dakota will realize these benefits during and after implementing the state LDS.

Reporting

- **Relocate and Reconfigure FINDET.** In the short-term (1-2 years) FINDET should remain as the preferred tool for cross-agency data matching and reporting. In the long-term (beyond 2 years), the state LDS will provide all FINDET reporting capabilities and the FINDET application can be retired.
- **Select a Business Intelligence (BI) Reporting Tool.** The state should consider investing in an enterprise license with a BI reporting tool. The initial investment in an enterprise license is typically a lower cost decision compared to funding three or four separate agency-wide license agreements.

Business Process Re-engineering

- **Implement an Education and Workforce Council.** It is important to establish a statewide governing body made up of key leaders from each agency to make decisions related to statewide concerns. An Education and Workforce Council (covering pre-K education through higher education and workforce training) should be created to serve in this role and govern the state LDS program.
- **Implement Formal Data Quality Processes.** North Dakota should evaluate its existing data quality processes to determine whether they can support the state LDS program.

Operational Support

- **Rollout PowerSchool™ Statewide.** A majority (92) use PowerSchool™(a student information system) and more are planning to migrate to PowerSchool™ in the coming year. The state should continue to support the Governor's Education Commission's plan to fund the rollout of PowerSchool™ to all K-12 districts.
- **Educate Users to Develop Data Analysts.** Typical training programs focus on increasing people's skills in using specific tools or applications. North Dakota should look beyond this minimum level of training and strive to improve its staff's ability to analyze data, discover programmatic implications in the interpretation of the data, and also understand the limitations or dangers of improper application of data analysis.

Data Governance

- **Align Student Identifiers.** Identifying and matching student records across state agency data records is a fundamental issue in North Dakota. The success of the state LDS will depend on the state's ability to accurately identify individuals as they move through the educational system, into the workforce, and through other state support systems.
- **Implement Agency-based Data Governance Councils.** To oversee, monitor, and govern all data quality initiatives, North Dakota should implement data governance councils in each participating agency and an Interagency Data Governance Council (IDGC).

- **Establish and Enforce LDS-wide Data Standards.** The IDGC will oversee and govern the data standards and each agency will use the standards when applicable to establish proper use of existing data assets.
- **Mitigate Interagency Data Sharing Issues.** North Dakota must decide what data can be loaded and shared in the state LDS.
- **Implement a Master Client Index Solution.** The state LDS will be required to match student records, client records, and employment records across agency data sources. The state should investigate expanding its use of the Master Client Index solution to use with the state LDS.

Roadmap Implementation

- **Develop Action Memorandum**. Within six weeks of the issuance of the LDS Roadmap report, the LDS Committee should prepare and submit to the Governor an action memorandum explaining how the Committee and its participating agencies will act upon the recommendations contained in the report.

Project Milestones

- **2009-2011 Biennium**
  - Implement a Data Governance Program
  - Create a state LDS Infrastructure (established in Phase 1) to replace current FINDET functionality
  - Implement a K-12 Data Warehouse

- **2011-2013 Biennium**
  - Complete state LDS, Phases 2 and 3
  - Establish education program to build analytical capability among users

- **2013-2015 Biennium**
  - Operations, maintenance, and ongoing enhancements to the state LDS

Budget Item	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Tier I Totals:	$669,200	$821,800	$529,200	$50,400	$50,400	**$2,121,000**
Tier 2 Totals:	$2,905,100	$1,888,430	$1,884,630	$1,884,630	$1,086,630	**$9,649,420**
Tier 3 Totals:	$1,701,025	$2,349,530	$553,080	$553,080	$553,080	**$5,709,795**
LDS PROJECT TOTALS	**$5,275,325**	**$5,059,760**	**$2,966,910**	**$2,488,110**	**$1,690,110**	**$17,480,215**

2.0 Introduction

2.1 Background

North Dakotans' road to health and prosperity is paved by the many state agencies and programs expressly created to advance the common good. Each biennium, the state and its citizens invest billions of dollars across many agencies to maintain and improve the quality of life for North Dakotans. Responsible use of tax dollars calls for employing tools that provide citizens and leaders with an understanding of the effectiveness of state agencies and programs, and facilitate agencies working together to improve outcomes.

Each program collects some type of performance data to measure short-term and medium-term outcomes. However, data collected within a program does not always provide a fuller picture of longer-term, or "longitudinal" outcomes, for how the program and its participants fared over time. Individual program data collection and analysis also does not allow program managers and policymakers to look at the inter-relationships between programs, how citizens may be served by multiple programs simultaneously or sequentially, and how those programs might impact long-term outcomes for the participants. These are some of the questions that a longitudinal data system can address.

2.2 Purpose

The LDS Strategic Roadmap lays out the planning, development, and budget efforts required to realize a data repository that unifies key data from public PK-12, higher education, and workforce development initiatives and provides the analytical insight to better administer state services and foster economic development.

The LDS Strategic Roadmap presented here is a product commissioned by the state's LDS Committee. In 2007, the state of North Dakota formed the LDS Committee under the leadership of the Information Technology Department with the mission of proposing, developing and governing "a system for sharing longitudinal data that will maximize the usefulness of management information for stakeholders and partners of North Dakota education, training, employment and service systems…" In addition to sharing data among state agencies, the LDS Committee goals include creating standardized sources of longitudinal data, and providing accountability by making data publicly accessible while maintaining the privacy and security of personal information. In that light, the LDS Committee released RFP #112-LDS-2008-001 and through a competitive process procured the services of Claraview, a division of Teradata Corporation to provide this LDS Strategic Roadmap.

The LDS Strategic Roadmap paves the way to improved state services through application and sharing of data. It provides the state with a thorough analysis of current data practices across its education and workforce agencies, and a clear plan for developing a longitudinal data system that creates synergy among agencies by making education and workforce data more meaningful and accessible. Specifically, the LDS Committee asked that the roadmap address the following needs in order of priority:

1. Enhancing K-12 data collection and outcome reporting
2. Identifying shared data services and determining the role of FINDET (Follow-up Information on North Dakota Education and Training)
3. Enhancing higher education data collection and outcome reporting
4. Enhancing data collection, forecasting and outcome reporting for workforce programs

In addition to identifying the current approach to data, the LDS Strategic Roadmap provides a gap analysis that compares current data application capabilities against the desired data capabilities for the future. Using this gap analysis, the roadmap makes recommendations and budget projections for achieving the increased data functionality so policy makers can determine how best to meet and fund the state's data needs.

2.3 Participants

The LDS Strategic Roadmap brings together the perspectives and desires of key stakeholders from state and federal government programs related to education and labor. Information in the form of stakeholder interviews and state agency documentation of current policies and practices create the foundation for the analysis and recommendations set forth in this report. The state agencies and related entities contributing information used to develop the roadmap are listed below. For a full listing of individual participants by agency or entity, please see Appendix A.

Participating State Agencies
Department of Public Instruction
North Dakota University System
Department of Career and Technical Education
Department of Commerce
Job Service North Dakota
Information Technology Department
Department of Human Services
Education Standards and Practices Board

Related Participating Entities
Education Data Advisory Committee
Education Technology Council
EduTech
FINDET
Governor's Office
North Dakota Council of Educational Leaders
Regional Education Agencies
Nexus Innovations

3.0 Methodology

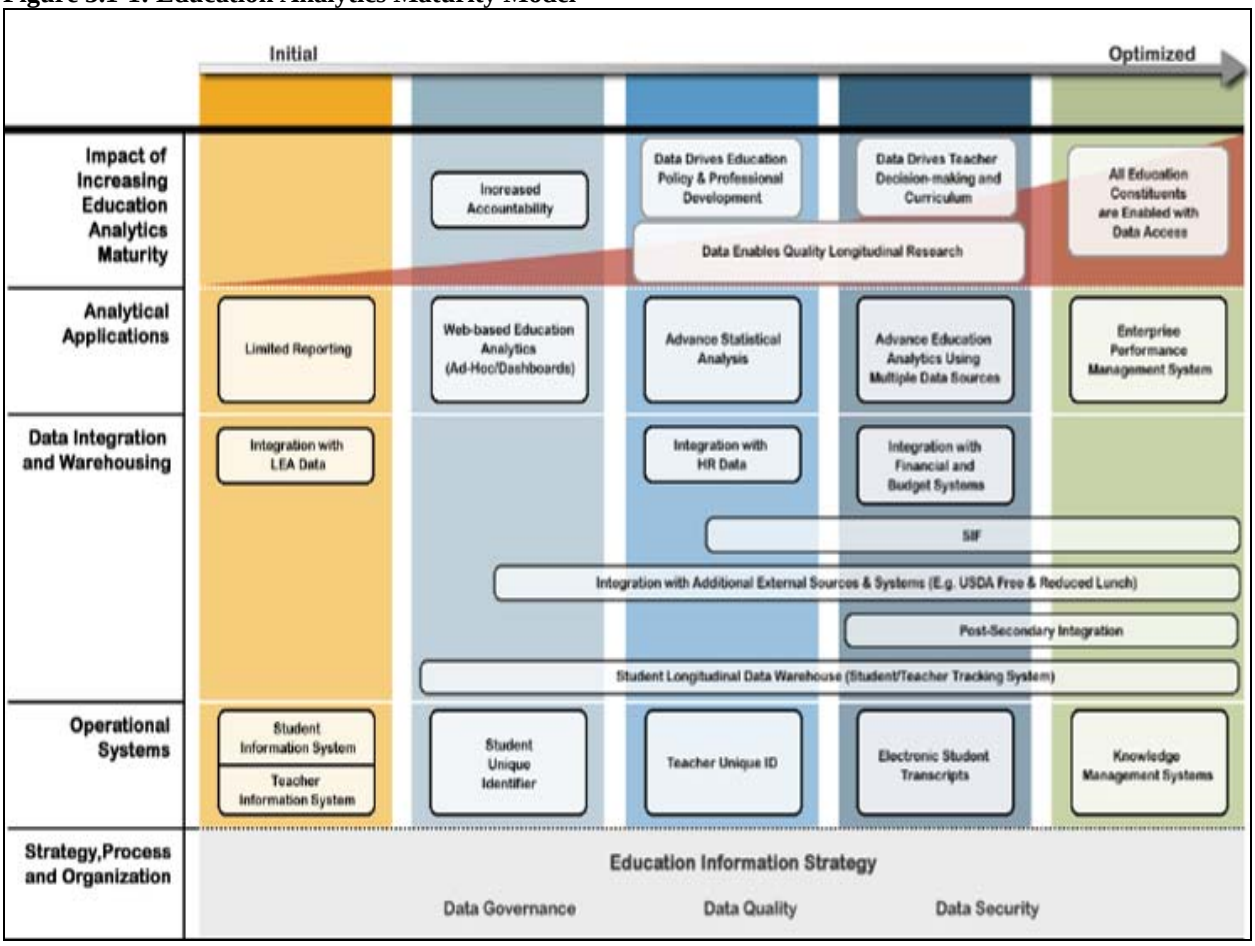
Defining a state longitudinal data system that simultaneously benefits several state agencies requires a well-structured methodology that considers each of the chief aspects of a state LDS and provides a logical, achievable path to a holistic solution. This section explains the model and approach used in creating North Dakota's LDS Strategic Roadmap, including the method of collecting and analyzing information to formulate recommended solutions.

The LDS Strategic Roadmap employs the industry best practice for information architecture by first defining the 'As Is' or current state of data use and functionality, then visualizing the ideal future or 'To Be' state of the data system. A comparison of these two states produces a gap analysis outlining *what* needs to be done to achieve the ideal future state. The North Dakota LDS Strategic Roadmap takes an additional step of again applying industry best practices to design recommendations for *how* to attain the 'To Be' state. These recommended options are then analyzed to determine the funding required for implementation.

3.1 Education Analytics Maturity Model (EAMM)

Claraview designed its Education Analytics Maturity Model (EAMM) to aid states in planning and attaining an optimized longitudinal data system capable of leveraging data from multiple sources to benefit the state as a whole. It starts with a foundation of education data and grows to include data from other related agencies such as departments of labor, health, corrections, and human services. The project team used this EAMM as a framework for analyzing North Dakota's current data system and developing this strategic roadmap.

Figure 3.1-1: Education Analytics Maturity Model



The EAMM recognizes five key strands of education analytics growth and maturity, which should be individually considered to collectively deliver a fully-developed, robust data system capable of integrating interagency data and answering changing state needs:

1. **Strategy, Process, and Organization** – A viable data system must account for how well its organization is meeting its success expectations, and should reflect the organization's priorities. Any system is only as good as the data it contains. Therefore, strong data governance that creates a secure, valid, and reliable data system guaranteeing accurate data is the key to credibility.
2. **Operational Systems** – Student and teacher information systems are the essential building blocks of education data systems, but they should not be the only elements of the system. Operational systems must evolve and mature to enforce business rules and data quality standards to ensure data from these systems can be integrated, i.e., unique id systems and electronic transcripts systems.
3. **Data Integration and Warehousing** – Perhaps the most intricate step in establishing a robust longitudinal data system is the integration and warehousing of disparate but related data. The EAMM identifies key data sources for integration and suggests a strategic and logical order for populating the longitudinal data record of each student in the data warehouse. It anticipates that over time these students graduate and may participate in other state services that are included in the longitudinal data system.

4. **Analytical Applications** – Reporting capabilities that seldom go beyond spreadsheets and database query tools are quickly replaced with more accessible Web-based analytics tailored to each user's needs. Eventually, a carefully planned data system matures to provide an enterprise-wide performance management system.
5. **Impact of Increasing Education Analytics Maturity** – As an education analytics system develops it provides increased accountability. Benefits expand with the evolution of the four strands noted above, eventually enabling data-based decision making, longitudinal research, and secure data access for all education and workforce constituents.

3.2 Data Collection

Developing an effective strategic roadmap requires a balanced understanding of the impacted and contributing state agencies, their current data use needs, and how those needs may develop over time. Such data provided by each agency through the coordination of the Information Technology Department make up the underpinning of the strategic roadmap.

The report information was collected over a four-week period via two modes—printed reports and documents, and interviews. In early April 2008, state agencies began providing the project team with background information, examples of current data reports, and policies impacting data reporting. These documents were reviewed in preparation for interview conferences with state agency representatives. The week of April 21st, the consultant team met with the LDS Committee and had separate meetings with the entities listed in Section 2.3 of this report (generally state agencies or programs associated with education and/or workforce efforts) to present its approach to the roadmap and to learn the entities' current data practices and how they would like their data abilities to evolve. Interviews lasted from a half hour to two hours and were conducted either face-to-face, via videoconference, or by telephone. To ensure the same kind of information was collected from each group, the consultant team created a list of questions specifically designed to capture the 'As Is' picture of data needs and use—how the groups individually handle data from day to day—and the 'To Be' picture of what their ideal data functionality would be if current conditions and limitations were removed. In most cases the information from these interviews was captured via notes and voice recorder.

3.3 Sample Questions

The Strategic Roadmap interview questions were composed and organized around the five key strands of the EAMM. 'As Is' and 'To Be' questions were included in each strand and became the main agent in gathering the information needed to shape the roadmap. A sample of the interview questions are included below. A comprehensive list of questions is included in Appendix B.

- What are the objectives of your organization?
- How do you know you are doing well? How often do you measure key success factors?
- Who are your key stakeholders?
- Describe your data quality efforts and any data governance structure that exists.

- Describe your current technology system, including information systems, hardware, software, security measures and any unique identifiers.
- Where are your data collected, stored, and how are they shared today?
- What routine analysis do you currently perform?
- How much historical data (one year, two years, five years, etc.) is required for your current reporting?
- Is there other information which is not available to you today that you believe would have significant impact on helping to meet your goals or enhance your data analysis?
- What analytic capabilities would you like to have? Do you have the data to support them?

3.4 Analysis and Roadmap Development

The chief purpose of creating a LDS Strategic Roadmap as noted in the mission of the LDS Committee is to identify the best approach to developing a statewide "…system for sharing longitudinal data that will maximize the usefulness of management information to stakeholders and partners of the North Dakota education, training, employment and service systems…" With this charge in mind, the first step in analyzing the information collected from agencies was identifying and summarizing each agency's purpose, success metrics, and key stakeholders. These key pieces of information drive the architecture of the state LDS. Next, an accounting was made of the current operational systems contributing to education and workforce data each agency is using. Then an enterprise-wide analysis of data use and analysis was performed across education and workforce agencies to create a statewide summary of how data is currently collected, shared and analyzed. These steps delineated the 'As Is' state of North Dakota's data system.

Similar steps were taken to define the 'To Be' vision that entails a state LDS that will meet the needs and expectations of data users. First, agency input regarding the elements of a state LDS that would be required to support state objectives was summarized to create the framework of the future state. Then specific details and examples of data use, sharing, governance, and analysis were provided to complete the 'To Be' picture.

The work that needs to be done to span the distance from the current to the future state was then highlighted by overlaying the 'As Is' picture with the 'To Be' vision. This overlay was done through a gap analysis that identified what must happen to arrive at the future state. Then the consultant team developed recommended approaches to realizing the roadmap by identifying which combination of industry solutions could best accomplish the 'To Be' vision. Once the recommended solutions were defined, the team developed budget estimates for each recommendation by considering the costs of similar data systems it has delivered and requesting quotes from product vendors.

4.0 Interview Results and Analysis

This section captures input from the LDS Strategic Roadmap participants listed in Section 2.3, and as provided via interview or written documentation. The results of the data collection and analysis are organized into two sections. The first provides an 'As Is' analysis across the five key strands of the EAMM. The second section provides a 'To Be' vision across the same areas.

4.1 'As Is' Analysis—the Current State

To arrive at a desired destination in a low-risk, and efficient manner, you must first have a firm knowledge of your beginning. The 'As Is' Analysis—the Current State section of the roadmap—defines North Dakota's 'beginning' as it embarks on the development and implementation of a state longitudinal data system for education and workforce related agencies. Using the five key strands of the EAMM, it describes what an entity is doing with its data today and the tools being used. Most importantly, it identifies the entity's purpose, priorities and the major influencers of its actions.

4.1.1 Strategy, Process, and Organization

The foundation of any longitudinal data system lies in the entities that both serve as the data sources and end users of the system. In North Dakota's case these entities are its state agencies for education and workforce. Recognizing their individual missions, priorities, performance measures, and stakeholders allows a holistic longitudinal data system to be built in a manner that meets the needs of the state and each agency. This section of the roadmap provides a brief synopsis of each agency.

Department of Public Instruction

The North Dakota Department of Public Instruction (DPI) administers the state's primary and secondary education system encompassing 187 operating public school districts and 377 public schools. The DPI provides a system of support to school districts. The nine Regional Education Associations (REAs), and 31 Special Education Units are affiliated with DPI and provide field support to their member school districts. Additionally, some technology needs of schools such as virus protection, email service, and PowerSchool are provided by EduTech, a separately funded service under the Information Technology Department and governed by the North Dakota Education Technology Council. The DPI also serves as the funding agent of schools, flowing federal and state funds to school districts.

The DPI mission and goals center on providing a uniform statewide system of effective learning that yields student academic success, and employs a system of accountability to foster continued improvement driven by data. The system of accountability relies on several key data elements derived from statewide student assessments, student demographics, program participation, and staff and teacher data, and is used in school accreditation. The state's five largest school districts have implemented the Viewpoint data warehouse and reporting capabilities from Central Minnesota Educational Research Development Council (cmERDC) to combine these and other data elements into insightful reports that can guide instructional practices and administrative decisions. The cmERDC package is available to other districts that are willing to purchase it.

The DPI accredits North Dakota schools and provides support in developing school improvement plans. It administers numerous federally funded education programs, each with its own set of

performance measures that must be reported to receive continued funding. The State Automated Reporting System (STARS) is a data collection tool to assist with providing performance information, and evaluating and accrediting schools (additional information on STARS, data collection, and reporting is provided in Sections 4.1.3 and 4.1.4). STARS also provides student data for the state's new special education data system, TIENET, to be implemented statewide during the 2008-09 school year. STARS data collections are shaped by a Data Advisory Committee hosted by DPI and made up of representatives from school districts, the Education Technology Council, CTE, and DPI. The list below is a sampling of DPI administered programs that feed information into STARS.

Key Programs Administered

- **Foundation Aid,** provides school districts with state funds for providing an equitable education
- **Title I, Elementary and Secondary Education Act (ESEA),** aimed at helping educationally disadvantaged students, this cluster of programs provides additional academic support to students at risk of not learning successfully
- **Improving Teacher Quality, Title II, ESEA,** funds teacher professional development
- **Safe and Drug Free Schools, Title IV, ESEA,** funds student and teacher education to reduce the presence of violence and drugs in schools
- **21st Century Community Learning Centers, Title IV, ESEA,** funds after school programs to keep students engaged in school and progressing academically
- **Special Education, Individuals with Disabilities Education Act (IDEA),** funds services necessary for educating students with disabilities.
- **National School Lunch Program,** provides free and reduced price meals to students from low-income families

Key Stakeholders

- Students
- Parents
- Business people
- Taxpayers
- Educators (classroom and administrative levels)
- Educator groups
- Career and Technical Education Advisory Boards
- School Boards
- Schools
- Districts
- University systems

Performance Measures

- Class size
- Teacher qualifications
- Aggregated and disaggregated student achievement (economically disadvantaged students, English Language Learners, Special Education and other required demographic groups under the Elementary and Secondary Education Act as amended by the No Child Left Behind Act of 2001)
- Attendance
- Pupil/student membership growth across state, from year to year

- Graduation rates
- Average daily membership
- Timeliness
- Complaint resolution
- Student Discipline

North Dakota University System

The North Dakota University System (NDUS) is comprised of eleven institutions of higher education. This System was organized in 1990 and is governed by the State Board of Higher Education. The NDUS is composed of two research universities, two universities that award bachelor's and master's degrees, two bachelor degree granting institutions, and five campuses that offer associate and trade/technical degrees. Each institution is unique in its mission to serve the people of North Dakota.
The NDUS has two distinct functions relevant to the state LDS: 1) general higher education - provision of courses for academic credits in earning a degree, and 2) workforce training - provision of workforce training, generally in collaboration with an employer, and not for credit. In both functions, the NDUS experiences several data challenges. For general higher education, NDUS campuses independently enter their data into ConnectND, the statewide Student Information Systems (SIS), resulting in disparate data even though they all use the same SIS software, PeopleSoft. While an NDUS data warehouse is in the early planning stages, the current lack of a data warehouse makes it virtually impossible to track a student longitudinally between NDUS programs.

The NDUS campuses operate short-term workforce training programs on a contract basis for companies. They use ACEware to track workforce transactions. Typically, the company enters into a contract with the NDUS campus to provide the short-term training. When the college conducts the training, it collects a minimal amount of information about the company employees, does not officially enroll or register them, and does not require the employee to provide his or her social security number. Information on contract training is maintained in simple spreadsheets, not the campus's regular student information database. Since workforce training participants are not entered into the student information database, it is impossible to track or compare the long-term employment outcomes for these workforce training programs.

Key Stakeholders

- Individuals receiving training
- Employers who need a skilled workforce
- Governor
- Legislature
- Department of Commerce Workforce Commission
- U.S. Department of Labor
- Taxpayers
- Students and Parents
- Schools and School Districts (High School feedback)
- Regional Accrediting Agency
- Program Accrediting Agencies
- Education Standards and Practices Board (Teachers)

- U.S. Department of Education
- Research Agency Partners

Performance Measures
The NDUS publishes an annual outcomes report that uses a variety of data sources, both internally derived and externally derived. The performance measures that are derived, at least partially, from data in the campus student information systems are noted in bold italics.

Data for the outcomes report include:

Economic Development Connection
Entrepreneurship program enrollment and graduates
Employment related to education
Workforce training
Research expenditures as a percentage of total NDUS expenditures
Workforce training satisfaction

Education Excellence
Student graduation and retention rates
Performance on nationally recognized exams
Licensure first-time pass rates
Student-reported satisfaction
Alumni-reported satisfaction
Levels of satisfaction and reasons for non-completion
Levels and trends in the number of students achieving goals

Flexible and Responsive System
Responsiveness to clients
Biennial report on employee satisfaction

Accessible System
Non-traditional delivery methods
Tuition and fees compared to the regional averages
Tuition and fees compared to household income
Enrollment numbers and trends
Student participation levels and trends

Funding and Rewards
Net assets available for debt service compared to long-term debt
State general fund appropriations and total fund revenues
Cost per student and percentage distribution by major function
Per -capita general fund appropriations for higher education
State general fund appropriations compared to peer institutions
Operating and contributed income ratio
Primary reserve ratio
Net income margin
Status of NDUS long-term finance plan
Ratio of incentive funding to NDUS total state funding

Ratio of NDUS general fund appropriation to total state general fund appropriation

Department of Career and Technical Education

North Dakota career and technical education is directed by an independent education agency, the Department of Career and Technical Education (CTE). The programs it oversees are designed to work with individuals and provide them with the technical skills and knowledge necessary to compete successfully in today's global workforce. Specifically, North Dakota CTE provides instruction in the areas of career awareness, work readiness skills, occupational preparation, and retraining workers. The agency carries out the program requirements of the federal Carl D. Perkins Career and Technical Education Improvement Act (the Perkins Act) including the collection and reporting of program performance measures.

To eliminate duplicate effort and improve the secondary education data collection process as a whole, CTE incorporated its data collections into the STARS data system operated through DPI. Data related to the performance of high school students in career and technical programs are collected and reported from schools and aggregated through the Department of Public Instruction. Data on postsecondary career and technical students are collected at the campuses of the two-year CTE programs operated under NDUS, and reported to CTE. The agency has developed accountability reports, as well as other reports that that are produced by FINDET when working with students in the post secondary arena and workforce. CTE is a primary user of the FINDET system and was an important factor in helping establish FINDET.

One of the key performance measures for secondary students is placement into postsecondary education, and for postsecondary CTE students, retention or transfer within postsecondary education. To accurately report on this measure, North Dakota must link data between secondary and postsecondary, and between postsecondary institutions, however current data practices make this connection difficult. Students in K-12 education are assigned a state ID (a unique identification number for each enrolled student, which is not the student's social security number), but there does not appear to be a policy in place that mandates that state ID to be entered into the student's postsecondary record when he or she is enrolled at one of the NDUS campuses. Similarly, the NDUS student record data systems among campuses do not currently share data among each other, so it is difficult to report on student transfers from one institution to another within the State. NDUS uses FINDET to match records and report on student records across campuses.

Another approach used for finding students enrolled in postsecondary education and transfers between institutions is to try to match student information against the National Student Clearinghouse, a national consortium of colleges, universities, and student lenders that share postsecondary enrollment information. Currently, using this method, FINDET is able to match about 75% of students and to determine a post-education placement (workplace, further education, military) for about 68% of students.

Key Stakeholders

- Individuals receiving training
- Employers who need a skilled workforce
- Individual school districts providing CTE programs

- State CTE Board
- Governor
- Legislature
- Department of Commerce - Workforce Division
- Department of Public Instruction
- North Dakota University System
- U.S. Department of Education

Performance Measures (Secondary)

- Program enrollments, based on occupational clusters
- Academic achievement
- Acquisition of CTE skills (using valid, reliable assessments)
- Diploma equivalent degree credential
- Diploma with proficiency credential
- Total placement
- Nontraditional participation
- Nontraditional completion

Performance Measures (Postsecondary)

- Program enrollments, based on occupational clusters
- Academic achievement
- Vocational skills
- Diploma equivalent degree credential
- Total placement
- Retention
- Nontraditional participation
- Nontraditional completion

Department of Commerce

The North Dakota Department of Commerce Workforce Development Division (Workforce) has a leadership role in establishing policy for all workforce related activities. This role was clarified through HB 1018, passed by the Legislature in 2007. The legislation states "The division of workforce development shall develop and implement a system of performance and accountability measures for the state's system for workforce development, workforce training and talent attraction. Each partner of the state's system for workforce development, workforce training and talent attraction shall cooperate in providing the division with the data necessary to implant these measures." Workforce is currently using FINDET to prepare reports answering this accountability measures requirement.

Workforce provides support to a number of mandated boards and commissions and is responsible for the development of a public and private partnership for the recruitment of workers, as well as coordinating volunteerism activities in the state. These leadership responsibilities include: The Workforce Cabinet, a newly-formed Workforce Intelligence Council, the Talent Initiative, and the AmeriCorps Program.

In 2007, an internship and work experience program was expanded. Workforce is charged with tracking the program's success in retaining young people. The legislature also appropriated $2 million in workforce enhancement grants that state colleges can apply for to create new training programs or expand existing programs, based on industry needs.

Under HB 1018, the Department of Commerce is continuing to implement the "Common Accountability Measures" that were put in place by the Legislative Assembly in 2003 and 2005. These measures are listed below. The Department of Commerce is working to supplement official data with data gathered from surveys of employers, asking them to make projections of future hiring on a one-year, two-year, three-year and four-year basis.

Key Stakeholders

- Employers who need a skilled workforce
- Governor
- Legislature

Performance Measures

- Number of individuals trained or served
- Number who became employed as a result of each department's workforce development & training programs
- State's investment
- Areas of occupational training provided
- Average annual salary of those employed
- Average increase in earnings twelve months after completion of training

Job Service North Dakota

Job Service North Dakota (JSND) administers a number of programs, some of them federally supported, that aim to train and retrain adult workers for competitive employment and to meet the economic development needs of North Dakota. Specifically, these efforts are aligned to enhance the skills of the current workforce, attract workers into the state, and retain the current workforce (youth and adult) in the state. The services available to qualifying individuals include in- and out-of-area job search assistance, work experience, on-the-job training, vocational skills, and upgrading existing job skills.

The JSND aims to maximize workforce participation, with a focus on under-represented participants, such as Native Americans, military veterans, and individuals with disabilities. The JSND system also matches individual records against the Unemployment Insurance (UI) compensation system, to determine how long claimants receive benefits, and to find out the future employment status of previously unemployed individuals. By matching UI claims against other education and training records, analytics could determine the impact of education and training against unemployment trends.

Key Programs Administered

- **Workforce Investment Act (WIA) programs for adult and dislocated workers,** a federal program for adults who are over the age of eighteen and in need of assistance to meet their employment goals

- **Trade Adjustment Assistance (TAA),** a federal program that provides aid to workers who become unemployed as the result of foreign imports coming into America or jobs going out of America
- **Workforce Investment Act (WIA) Youth Employment and Training Program,** designed to assist youth – ages 14 to 21 – with a wide selection of year-round teaching and training services
- **Workforce 20/20**, a state-run initiative designed to assist business and industries in North Dakota in training and upgrading the skills of their workers to meet the demands of working in the 21st century
- **New Jobs Training,** provides opportunities through relocating and expanding businesses in North Dakota. With assistance from New Jobs, primary sector businesses are provided with no-cost funding to help offset the cost of retraining or training new employees
- **Unemployment Insurance (UI) Compensation** program, collects UI taxes from employers, and oversees payment to qualified citizens who have lost employment through layoffs and staff reductions
- **Labor Market Information** services, acting on behalf of the U.S. Bureau of Labor Statistics, gathers and reports current and projected employment information for North Dakota

Key Stakeholders

For all programs administered by the JSND, key stakeholders include:

- Governor
- Legislature
- Individuals receiving training
- Employers who need a skilled workforce
- Department of Commerce Workforce Division
- U.S. Department of Labor
- Job Seekers
- UI Employer Taxpayers
- UI Claimants

Performance Measures

- Entered employment rate
- Employment retention rate
- Six-month earnings change
- Employment and credential rate
- Participant satisfaction
- Employer satisfaction
- Placement in employment or education (for youths, ages 14 to 18)
- Attainment of a degree or certificate (for youths, ages 14 to 18)
- Literacy and numeracy gains (for youths, ages 14 to 18)
- UI Duration
- Trust Fund reserve adequacy
- U.S. Department of Labor Quality and Timeliness Standards for Unemployment Insurance
- Workforce 20/20 indicators include:
  - Obligated funds
  - Expended funds

- Unexpended balance
- Return on Investment

FINDET

FINDET is in its 15th year of operation and is currently organized under the North Dakota University System (NDUS), and is supported by two full time employees. Unlike the other entities described in this section, FINDET is not a state agency or an explicit function of the NDUS mission, but a service provided to multiple state agencies to assess their success based on the current activities of individuals who previously participated in programs operated under the jurisdiction of the particular agency. FINDET relates, analyzes, and reports data from individual tables, as well as all data that can be mined through data relationships regarding NDUS graduates, enrolled NDUS students, employers of NDUS students and graduates, including full-time and part-time earnings by industry, employer, or by classification of instructional program (CIP). FINDET matches education data with actual employment occupations when the standard occupational code (SOC) data are available. FINDET reports are provided to organizations involved in education, workforce training, job placement as well as policy making. FINDET is currently in the process of designing and developing a set of reports that include longitudinal data analysis.

The FINDET staff works with participating agencies to develop and publish accountability reports, recurring outcome reports, and ad hoc reports that require data related across state agencies. The FINDET partner agencies are:

- Department of Career and Technical Education
- Department of Commerce
- Department of Human Services
- Department of Public Instruction
- Job Service North Dakota
- North Dakota University System

FINDET's services are valuable to its partnering agencies because of its ability to match records across agencies. That said, FINDET staff expressed frustration in getting agencies to perceive a higher value of the FINDET services that would translate into sustained levels of fiscal support. While FINDET's functionality has increased considerably over the past two years, there remain several challenges to its growth: 1) additional staff would be required to scale up FINDET's current activities to a broader reporting platform that could be directly accessed in real-time by multiple users, 2) its funding structure is dependent on users but is not institutionalized in the user agencies' appropriations requests to the legislature, and 3) identifying the most appropriate agency to house the FINDET operation.

Key Stakeholders

- Job Services North Dakota
- Department of Career and Technical Education
- Governor
- Legislature
- Department of Commerce
- Department of Public Instruction

- North Dakota University System
- Department of Human Services
- U.S. Department of Education

Performance Measures

- Regularly scheduled reports that are generated
- Reports generated for each individual agency
- Provision of outcome measures, comparisons, and discussions of issues across many programs and operations.

Department of Human Services

The Department of Human Services (DHS) works to provide quality services to improve the lives of the vulnerable populations of North Dakota. The agency administers an array of human services programs spanning the needs of people of all ages and walks of life. For purposes of developing the LDS Strategic Roadmap, only programs that have a connection to education or employment were included in the Current State assessment, as listed below:

Key Programs Administered

- **Senior Community Service Employment Program (SCSEP)**, a federal initiative that serves unemployed low income persons age 55 or older by fostering and promoting useful part-time opportunities within the community
- **Temporary Assistance for Needy Families (TANF)**, a federal initiative created by the 1996 Welfare Reform Law provides financial assistance and work opportunities to low-income families through training and job-placement services
- **Job Opportunities and Basic Skills program (JOBS),** a federally sponsored initiative designed to make TANF recipients self-sufficient, reducing the amount of time they are dependent on public assistance. This companion program to TANF requires all TANF recipients to participate in either approved work activities or a job
- **Rehabilitation and Consulting Services (RCS),** state and federally funded program providing free training and employment services to individuals with mental or physical disabilities, often those transitioning from secondary education
- **Early Intervention Program for Infants and Toddlers with Disabilities (IDEA , Part C),** federally funded program providing early intervention to infants and toddlers (ages 0-3) with disabilities to improve infant development, likelihood of independent living, and to decrease the need for special education services in later years

It is possible that a single person could receive services from several DHS programs in his or her lifetime. For example, a male infant identified as having a disability may participate in IDEA, Part C. At age 3, he may transition into services under IDEA, Part B administered by DPI. The student may continue to receive special education services through DPI until age 21. At that time, he may use the services of RCS to receive additional training and become employed. The need to track individuals' participation across multiple programs could be met via a state longitudinal system only if the system includes data from the appropriate participating state agencies.

Key Stakeholders

- Legislators
- State and county social services
- 8 regional DHS offices

Performance Measures

- Entry into unsubsidized employment
- Earnings
- Eligible individuals served
- Satisfaction – both employers and participants
- Job entry
- Success in workforce
- Retention / Length of employment
- Earnings gain
- Annual increase in number of employed

Education Standards and Practices Board

The Education Standards and Practices Board (ESPB) is an independent board of 10 Governor-appointed members collectively representing educators, administrators, school board members and teacher educators. Its chief objective is to license all teachers in the state and is fully funded by educator licensure fees. Additionally, the Board approves teacher education programs and tracks each teacher's professional development units required for re-licensure. ESPB maintains the educator professional standards of the state, conducting background checks and recording disciplinary actions taken against a teacher.

Key Stakeholders

- Institutions of Higher Education
- Teachers
- Administrators

Performance Measures

- None provided

4.1.1.1 Data Governance

The use of accurate and reliable data from multiple sources requires a system of data governance that sets forth the policies and procedures for handling data to ensure their consistency, quality, security, and availability. Within an agency, data are collected from multiple programs, each having both data elements unique to the program and some data that are common to other agency programs. There is not always agreement between the data definitions of a data element common to two or more programs. Establishing a large-scale database or data warehouse makes data stewards more aware of discrepancies that exist between common data elements that are not defined in precisely the same way. Representatives from DPI's Data Advisory Committee noted that establishing STARS pressed school districts to be more responsible for their data quality and

accuracy. Collecting and reporting data as prescribed by STARS made data stewards more aware of data inaccuracies, moving them to correct or "clean up" the data.

Each agency prescribes a method of data collection and validation that staff members are expected to follow at the local schools, school district, one-stop job center offices, or other local sites where original client data are generated and added to a data collection system. These methods are meant to ensure accurate reporting, yet, in some cases, state agency interviewees questioned the quality of their data, citing errors they had found, even in so-called 'cleaned' data. While agencies have data validation checks in place, often they do not have a reliable method of correcting data errors at the source, and reducing data discrepancies over time. For example, DPI only loads clean data into STARS, but does not have a process in place to make sure the data cleaned at the state level also gets subsequently cleaned at the local level. In other instances, erroneous data are not cleaned, but simply discarded. A FINDET representative noted that correcting data errors at their source would simply monopolize too much time.

The lack of a data governance system within individual North Dakota state agencies poses an added challenge to the formation of a state LDS. Data governance programs can start with a few participating agencies and scale to meet the needs of an entire state over time, but no significant data governance presence exists within any of the participating agencies. Without clearly developed and implemented data governance policies, the outcome is data incompatibility within a state agency resulting in data having limited use. For example, every school district has its own set of course numbers, resulting in an inability to commonly identify similar courses from district to district. In some cases, a district's course identification may change from year to year. Similarly, there are inconsistent data definitions across NDUS campuses. This lack of standardized data definitions are a serious impediment to data usability. These issues need to be resolved on an agency by agency basis before tackling the more complex data governance issues that arise from linking data from multiple agencies.

Another aspect of data governance is security—ensuring data that reveal personal information are only accessible to individuals with appropriate authorization. Several federal laws set forth policies to guard privacy. They are summarized below.

FERPA

The Family Educational Rights and Privacy Act (FERPA) (20 U.S.C. § 1232g; 34 CFR Part 99) is a Federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education. DPI receives federal education funds through the Elementary and Secondary Education Act, and the Individuals with Disabilities Education Act, among others; the NDUS campuses all participate to some extent in federal student aid programs, and CTE administers the federal Perkins Act CTE funds. Hence, all these agencies as well as local public schools, and public and private colleges that participate in federal student aid are covered by FERPA requirements.

Generally, schools must have written permission from the parent or eligible student in order to release any information from a student's education record. However, FERPA allows schools to disclose those records, without consent, to the following parties or under the following conditions (34 CFR § 99.31):

- School officials with legitimate educational interest;
- Other schools to which a student is transferring;
- Specified officials for audit or evaluation purposes;
- Appropriate parties in connection with financial aid to a student;
- Organizations conducting certain studies for or on behalf of the school;
- Accrediting organizations;
- To comply with a judicial order or lawfully issued subpoena;
- Appropriate officials in cases of health and safety emergencies; and
- State and local authorities, within a juvenile justice system, pursuant to specific State law.

In the late 1990s, questions arose about how to validate the employment related outcomes called for in the Perkins Act of 1998 and the Adult Education and Family Literacy Act of 1998 (title II of the Workforce Investment Act). Guidance issued by the U.S. Department of Education on January 30, 2003, specified a tight interpretation of the circumstances in which an "authorized representative" could conduct the audit or evaluation using student records. The guidance concluded that,

> "…therefore, that for the purposes of FERPA, an "authorized representative" of a State educational authority must be under the direct control of that authority, e.g., an employee or contractors of the authority. Thus, the State educational authority could not, for example, designate a State department of labor to perform an audit or evaluation because the department of labor is not under the educational agency's direct control."
>
> "Regarding the collection of data, a State educational authority that maintains the student records should conduct, oversee, or participate directly in the computer match to ensure that it is carried out consistent with FERPA requirement."

This guidance has direct implications for how a state LDS that matches information from educational records to individual employment records must be administered. To be in compliance with FERPA, it is advisable that an educational authority within the state government be designated with the direct responsibility for administering North Dakota's Longitudinal Data System. This way, educational records will always remain under the "direct control" of that authority.

As of March 24, 2008, the U.S. Department of Education has proposed new regulations for FERPA that would impact the processes for disclosing student information and using student records to conduct research. The draft guidance includes some statements that recognize the legitimate role of research and evaluation, and as such, the state LDS will need to clarify that the purpose of the state LDS is to strengthen research and evaluation for program improvement. Further, specific protocols for sharing information in the research and evaluation context will need to be created and followed. In creating the state LDS, the state will need to consult the new regulations once they are finalized for specific guidance. However, nothing in the proposed regulations appears to impact the previous guidance that education records must be maintained under the direct control of an educational authority.

Health Insurance Portability and Accountability Act (HIPAA)

The Health Insurance Portability and Accountability Act (HIPAA) of 1996, Public Law 104-191, included provisions that required the federal Department of Health and Human Services (HHS) to adopt national standards for electronic health care transactions. At the same time, Congress recognized that advances in electronic technology could erode the privacy of health information. Consequently, Congress incorporated into HIPAA provisions that mandated the adoption of Federal privacy protections for individually identifiable health information. HHS published a final regulation in the form of the Privacy Rule in December 2000, which became effective on April 14, 2001. This rule set national standards for the protection of health information, as applied to the three types of covered entities: health plans, health care clearinghouses, and health care providers who conduct certain health care transactions electronically.

During the work sessions with state agencies, there was no explicit discussion of health privacy issues, but in designing a state LDS, there must be attention paid to ensure that the privacy of any health-related information related to an individual record is carefully protected. Such data would not be fed into the state LDS, except if it were aggregated or included in a non-identifiable form, such as evaluating the overall performance of individuals with certain disabilities in gaining and retaining employment.

4.1.2 Operational Systems

An important starting-point to conceptualizing a state LDS is to examine existing technology operational systems among the various state agencies. The current agency-specific operational systems for the state of North Dakota are very diverse, utilizing several different hardware, software, and databases. Each agency has its own specifications for the flexibility and usability of these tools. This section outlines each agency's operational system to determine scalability and usage, and to determine the feasibility of integration with other systems.

Department of Public Instruction

DPI recently reconfigured its data collection system and implemented STARS to collect data from district student information systems. STARS is the only statewide data repository for K-12 education data. STARS is built using ASP.Net with a SQL Server database. Districts are responsible for uploading data to STARS using a batch (an automated process that happens on a pre-determined schedule) interface or manually through the user interface. Updates typically occur three to four times per year. Some small schools are using STARS as a student information system. STARS provides reporting capabilities with the use of Crystal Reports, Microsoft Access database, and Microsoft Excel. In addition, DPI will be using the Master Person Index Software more commonly known as the Master Client Index (MCI) to perform probabilistic record matching across agency data. These tools are used for analytical purposes and also to develop EDEN reports which are sent to the federal government.

TIENET is the statewide special education data reporting system that provides an electronic tool for maintaining individualized education plans (IEPs) and monitoring special education services. TIENET will also be used to submit the annual performance report for the special education program as required by IDEA. TIENET utilizes STARS as the data source for common student level data.

North Dakota University System

The NDUS uses the Oracle Campus Solutions student information system. This was known as the PeopleSoft student system before Oracle's acquisition of PeopleSoft. ConnectND is the NDUS project name and currently the NDUS is running version 8 of the student system using Intel-based servers and the SQLServer database. In June 2008, an upgrade to version 9.0 is planned with a transition to the Oracle database. Many of the ancillary systems such as housing, parking, facilities, and payment gateway have already been upgraded or will be upgraded throughout the Summer and Fall.

ConnectND is the data system used to manage the daily operations of the NDUS as well as state government. ConnectND is well-secured, allowing only authorized personnel special access. There are also numerous network and firewall securities in place as well as routine random checks that look for suspicious activity. NDUS provides workforce, graduate and enrollment data to FINDET who then matches records with UI wage records to determine the percent of graduates who were employed in occupations related to their education or training.

Career & Technical Education

CTE is in a unique situation as it encompasses both secondary and post secondary education. The data collection process and the ability to provide accountability reports on students as they pass from secondary to postsecondary education systems is particularly challenging for CTE as the K-12 student ID is not retained in the post secondary systems. In 2007-2008, the CTE transitioned its secondary data into STARS. For postsecondary data, CTE utilizes FINDET. CTE uses FINDET to provide the student matching and retain the student continuity data. Through a FINDET application, CTE derives data on students who "concentrated" in CTE studies and matches those records against UI wage records to determine employment status and earnings. FINDET also matches CTE concentrator records against the National Student Clearinghouse system to determine which CTE concentrators have enrolled in non-NDUS institutions or have transferred within non-NDUS educational systems.

Department of Commerce

The Department of Commerce uses off the shelf applications such as Microsoft Excel and Microsoft Access to collect data from the programs that it administers. Commerce uses the FINDET service to produce informational reports about the status of the workforce and economic development in North Dakota. These reports use data collected through JSND, and some more qualitative information is collected directly by the Department of Commerce through employer surveys and focus groups.

Job Services North Dakota

JSND, like other larger agencies, has many different data collection systems ranging from mainframes, SQL server databases to local applications such as Microsoft Excel and Microsoft Access. JSND does not have a warehouse in place today to consolidate its data collections and allow for longitudinal analytics or data analysis through an enterprise business intelligence tool. JSND provides employment data collected through the Unemployment Insurance (UI) system based on the quarterly reports that employers file for their employees. The individual wage records, which are identified based on a social security number (SSN), are matched through FINDET against education and training records, to determine employment related outcomes for those program participants. Since the data is provided by employers, the UI system only

provides data for individuals working in a formal employer/employee relationship, and does not cover self-employed individuals. While the enterprise longitudinal data within JSND is outside the scope of this endeavor, the unemployment insurance data contained within its system are the critical data needed by other agencies as well as JSND for workforce program performance and analytics. The UI data should be considered as a prime candidate for a longitudinal data mart for the state LDS system.

FINDET

FINDET provides cross-agency data matching, analysis, and reporting services using a relational database management system (RDMS) in a FileMaker Pro Advanced Developer platform. In order to ensure the protection of personally identifiable information, the FINDET RDMS is not a server-based application that can be accessed outside authorized FINDET personnel. The source files for FINDET are sent via paper, e-mail, CDs, or are pulled from servers and FTP sites. The extraction, transformation, and loading (ETL) process is automated except in cases where FINDET's formal data validation process identifies the need for manual data correction and revalidation. FINDET matches data across multiple data sources using customized routines designed by the FINDET director. FINDET can scale up to incorporate additional data sources in order to accommodate new or changing reporting requirements. The FINDET RDMS is backed up regularly — three back ups are saved on a weekly basis, and the oldest back up is replaced when a new back up is generated. The system security measures include multiple levels of encryption and password protection using multiple passwords that require 20 to 25 alphanumeric character sets. Fields containing personally identifiable information are separately password protected. The RDMS was adapted from a pre-existing proprietary RDMS developed by the FINDET director, and was not made available for review and analysis by the Claraview team, therefore its full-range of capabilities and scalability could not be confirmed.

Department of Human Services

Currently, DHS uses many different mainframe-based applications and tools to enter and extract information from databases. It uses Initiate Systems Enterprise Master Person Index Software more commonly known as the Master Client Index (MCI) application for record matching across agency programs. It is important to note that other agencies are also considering the use of MCI to expand their data capabilities through record matching. Additionally, DHS is planning to implement an agency-specific data warehouse to support its Medicaid Management Information System (MMIS) upgrade.

4.1.3 Data Integration and Warehousing

Data warehousing is a widely implemented concept throughout many industries and government agencies. It is the concept of gathering data from multiple sources within a business or government enterprise, stabilizing the data over a period of time and managing them to gain a consistent picture of an entity's business. Further, it is the means by which organizations can capitalize on digital information by effectively using it for business planning and decision making.

The distinction between an agency's data warehouse and the state LDS, as conceptualized in this report, is one of scale and purpose. Since each agency collects and reviews multiple sources of data, it is advisable for an agency to consider implementing an agency specific data warehouse system to make better use of its own data and make logical decisions based on its data. The state LDS, in essence, is an interagency (or cross-agency) data warehouse that would draw from the data housed in each agency's data warehouse or other data sources.

It is important to consider how best to implement a data warehouse concept for agencies within North Dakota government, as a well-designed data warehouse minimizes data volatility and eases integration of data. This section provides a summary of methods of data collection, data use, and challenges to data integration.

Methods of Data Collection

Data collection and storage needs vary greatly from agency to agency based on the quantity and complexity of the programs they administer. While each participating agency has some type of repository for collecting data, it may not be sufficient for data storage and sharing needs. For example, ESPB's chief data function of tracking teacher licensure and participation in professional development for re-licensure is adequately met through a database program. On the other hand, DHS has transactional systems in place, but no central data warehouse today. DHS is planning to build a data warehouse to support the MMIS project. NDUS is making similar plans for a data warehouse.

Data collection methods range from electronic collections to face-to-face interviews. STARS collects data electronically through SIS uploads. Currently, schools and districts use over six different IEP software systems to collect special education data. TIENET will be collecting special education data, but currently, it is difficult to access special education data that originated in another school unit. ESPB and DPI's School Approval and Accreditation (SA&A) division collect data via paper and manually enter it into the system. The lack of an online data repository for SA&A licensure information slows the processing of applications, since applicants often send incomplete applications. The Department of Commerce collects data from employers, through surveys and focus group interviews, to predict the demand for jobs and forecast their projected hiring decisions. The adoption of a data warehouse and data processes is needed to improve and simplify data collection efforts.

For K-12 education, the state is transforming STARS into a state education database that houses data for DPI, CTE, and ESPB to improve data quality and facilitate data sharing. STARS also supplies TIENET, the special education data system with the data elements both systems have in common. Presently, 92 school districts use PowerSchool as their student information system with

more planning to implement in the coming year. Some school districts use STARS as their local student information system. The five largest school districts in the state—Bismarck, Fargo, West Fargo, Grand Forks, and Minot—have their own data warehouses.

Data Use

The collection and storage of data is largely guided by how data are used and why they are needed. Federal reporting such as federal education reporting for the Education Data Exchange Network (EDEN), and the Annual Performance Report for IDEA highly influence the data included in STARS and TIENET, respectively. JSND needs to track the array of agency services administered to an individual. It also has a profiling system to assess claimants and their risk of exhausting benefits.

Data use is also limited by the availability and depth of the data. Some North Dakota agency programs have one year of historical data while others have up to 15 years of data. Still, even historical data may not always be comparable from year to year. Policies such as changes to rules or laws may change the definition of data elements, as with the periodic re-writing (or "reauthorization") of federal programs.

Challenges to Data Integration

A few interviewees noted some challenges regarding data collection and integration. The Department of Commerce representatives noted the information they need is spread through many different agencies. In some cases, data are unavailable or incomplete. CTE noted a lack of data from Bureau of Indian Education (BIE) schools and tribal colleges and universities because it is not collected. JSND referenced many gaps in its system because there is not one place to capture all data on veterans who are re-entering the civilian workforce. They only have record of veterans who initiate interest in JSND services. STARS currently has no record of distance learning students. Instead, distance learning data are manually entered into each district's SIS by the district secretary. Further, the STARS validation process will only show a student enrolled in one district. This means a student enrolled in Powers Lake School District who chooses to take a distance learning course offered by Grand Forks school district will only show up in STARS as a Power Lakes School District student. Professional development data reported to the state do not contain course content that is measurable nor do the districts report the individual trained. STARS was designed as a means of districts reporting data to the state. It is not meant to be a mechanism for school districts to get data reports from the state.

Some treatments of data are very labor intensive, and do not fully leverage the industry tools available. The FINDET data storehouse includes disaggregated and raw state program data dating back to 1989. However, data files stored prior to implementation of the FINDET RDMS are subject to formal data validation before being related and analyzed. This stored data remains the property of owner agencies, including the protection of any and all personally identifiable information. FINDET is not an accessible library for use by agencies other than the data owner. Several state agency programs not participating in FINDET rely on paper data collections and manual entry of information into a database. High school dual credit participant information is manually entered. Schools submitting information to an REA for designing a school improvement plan typically submit data via boxes of hard copy files. Such archaic data sharing

practices make it difficult to navigate through data and create enhanced opportunity for data error when the data are transcribed from the hard copies to a data system.

4.1.4 Analytical Applications

The power of data lies not in their collection and storage in a data warehouse, but in their analysis. The analysis of data transforms numbers into knowledge that informs decision making, demonstrates implications for the practices of teachers and other professionals, and ultimately improves program performance. Agencies tend to use one or two tools for storing data while often using several business intelligence tools for reporting. Typically, agencies' reporting efforts fall into two categories 1) federal or state reports, and 2) ad hoc reports.

Government Required Reports

All agencies administering federal programs must submit reports to the federal government regarding program performance and use of federal funds. These reports tend to be prescribed by the federal government and are usually submitted once a year, except for monthly reports required for certain DHS programs. The programs under HB 1018 are also required to provide quarterly reports of the Common Accountability Measures, and largely rely on FINDET to run and report the analysis. These government required reports serve a specified purpose of measuring program effectiveness and do not have the flexibility of excluding or adding data elements.

FINDET was expressly created to report outcome information on education and workforce programs. FINDET partnering agencies send their data to FINDET for analysis and reporting. Its array of reports are sent to agency heads, board members, legislators, and shared with the public. Transmission of reports occurs through paper, but they can also be viewed online at agency websites, or downloaded to a PDF file. NDUS and CTE rely heavily on FINDET for reporting higher education outcomes as noted in section 4.1.1 above. As mentioned earlier, the Department of Commerce also relies exclusively on FINDET for fulfilling its reporting requirements.

Ad Hoc Reports

Unlike government required reports, ad hoc reports do not follow a prescribed format. Generally, ad hoc reports are generated in response to legislators, researchers, and analysts making a special request for information. Such requests usually go to one or two analysts in an agency who must find time beyond their standard work duties to link to the database and develop a custom query. FINDET assists any partner agency, as well as non-partner agencies with ad hoc reporting upon request. Ad hoc reports are common, but time intensive since even a slight adjustment in the information request requires a new query to be developed.

Analysis Limitations

Interviewees raised a few concerns while discussing their current data analysis and reporting practices. One representative from DPI noted that the use of paper versus electronic files for school accreditation limits analyst's ability to conduct longitudinal analysis. Another commented that reports were not timely because of efforts to clean data. The lack of linking related data, even within an agency, is another obstacle to maximizing data utility. For example, teachers are

not linked to the students they teach unless the students are participating in a special program such as career and technical education or dual credit. STARS supports making this data connection, but schools choose not to exercise the capability. The lack of a teacher link to student performance inhibits a school's ability to target professional development to teachers who are having difficulty teaching a particular concept in a specific subject.

4.2 To-Be analysis—the Future State

The 'To Be' portion of roadmap development discovers what features and capabilities the state LDS should possess based on participants describing what they would like their data systems to become. In essence, participant input paints a vision of the future and ideal version of a state LDS. That picture includes both an overview of the state LDS as well as details about data sharing and analysis. By clearly defining what the state's data system needs to become, a multi-year strategy can be created that ensures the proper tools and tasks are implemented in a sequence yielding the ideal state LDS in the most time and cost effective manner.

4.2.1 Strategy, Process, and Organization

During interviews and reviews regarding the current state of gathering, governance, and reporting of program data, various stakeholders of the proposed state LDS expressed their concerns about current data issues and hopes about what benefits the state LDS could provide in the future.

The "business drivers," or purposes for each program, do not change in thinking about the future state of a state LDS. The purpose of the state LDS is not to change the drivers or purposes of individual programs, but to enhance those programs in fulfilling those purposes. A few themes emerged as participants described the characteristics of a successful state LDS.

Data Governance

Sharing of data between programs and systems will require careful attention to data governance issues and privacy concerns. Not all data are or should be linked into the state LDS – only relevant data that demonstrate the relationships between programs need to be linked into the system. Each agency contributing data to the state LDS should establish a data governance council to define and enforce consistent data definitions, data quality processes, and data quality standards. Similarly, the state will need to form an interagency data governance council made up of representatives from participating agencies. This IDGC ultimately will determine what data are included in the state LDS, and the policies and procedures surrounding their use and inclusion, such as reconciling conflicting data definitions.

Strong data governance policies and procedures will be needed to define the security approach to the state LDS. The IDGC will need to select and implement a security design that dictates who and under what circumstances individuals have access to certain state LDS data. Under a state LDS, security criteria can be established on a user by user basis, so that when an individual user logs on, he or she can only see data they have been pre-authorized to view. Similarly, the council will determine when data will be redacted to maintain confidentiality of personally identifiable information.

Focus on Program Excellence

Ultimately, North Dakota should build a state LDS for the right reasons. North Dakota should NOT develop an LDS simply because it is technologically feasible, but ONLY if it can make the business case that creating a state LDS will help improve the quality of services available to the citizens of North Dakota. Through these improved quality of services, North Dakotans will experience an improvement in educational and employment opportunities and the health and well-being of individuals, families, and communities.

Each facet of the state LDS must be focused on how the greater transparency facilitated by the sharing and linking of data systems will support better decision-making about programs, policies and services.

Accounting for the Unknown

Multiple programs rely on employment related outcomes, such as employment entry, employment retention, and employment earnings as a measure of their effectiveness. Currently, using FINDET, the individual records must be exported into a file, employment records must also be exported into a file, and then a match conducted between the two sets of files to determine how many records can generate employment outcomes. For each customization of this reporting, such as looking at a particular employment sector, or reviewing outcomes of students based on a certain secondary school district or campus, a new analysis process must be developed and run by the FINDET analyst.

Since JSND is working to maximize the workforce participation of under-represented participants such as Native Americans, military veterans, and individuals with disabilities, the state LDS should be designed to report on the employment status of such individuals. There is a challenge of identifying individuals living in the state who have had military service, unless they specifically apply for job service assistance and identify themselves as such. Similarly, it is difficult to identify Native Americans and individuals with disabilities prior to their applying for services.

One challenge with any of the employment outcomes is that each is only able to account for individuals who are "employed," where their employers are recording their employment and paying into the UI system. Thus, for individuals that become self-employed, there is no way to match and report their earnings. The lack of a match does not mean the individual is not employed or making a contribution to the North Dakota economy.

Linking Adult Education to Employment Outcomes and K-12 Records for Completion and Graduation

The Adult Education program needs to attach employment outcomes to each individual student record it maintains. Given that Adult Education already gathers each student's SSN, there would need to be a process whereby the adult education student record would be matched against a UI record, and the employment-outcome information would be imported into the Adult Education student record. Adult Education records, with SSNs, pre and post-test achievement data, and other program data, are available from about 1997. It might be possible to use the LDS to run some interesting long-term analyses on the impact of adult education on employment and

earnings over a multi-year period. Currently, FINDET offers deterministic matching services, but the use of MCI provides an opportunity to transition to probabilistic matching. Applying MCI's probabilistic matching will establish more accurate links between records with more complex typographical errors and error patterns than deterministic systems, since it uses statistical theory and data analysis to match.

Adult Education records are also currently not linked to the STARS system or any of the school district data warehouses. Now that the state has instituted a state ID, in future years there may be the capability to import the state ID into the adult education program record. Linking STARS to the adult education data system, will allow analysis of how many recent "dropouts" from K-12 education actually complete high school or attain a GED. This will provide a more complete understanding of high school completion and drop out patterns for North Dakota.

Scalability of FINDET

Even if FINDET systematizes its processes, program managers at the customer agencies cannot generate standard reports or customize these reports in any way without generating a new request. A statewide LDS including a data warehouse and business-intelligence capabilities would allow government leaders to independently conduct more real-time review and analysis of program outcomes and impact.

Use of New Career Technical Assessments

The 2006 Perkins Act requires each state to develop a system of assessment for student career and technical skills, using high quality assessment instruments and based on industry-recognized standards. As these assessments are developed and administered over a five year period, they will provide assessment scores that can be correlated against other outcomes, like employment, program completion, and earnings. The scores from these assessments, which must be valid and reliable, will provide a more meaningful data source for program evaluation than other measures like course completion and grade point average.

Measuring Attraction for New and Returning Workers from Out-of-State

Representatives of the Department of Commerce's Workforce Division indicated they need accountability measures relating to retention of the workforce, such as data to determine what number of students are finding jobs in the North Dakota job market. They also need indicators to determine if adults who were born in North Dakota, but left the state for postsecondary education, come back to the state to gain employment. Workforce is also tasked with being able to document the attraction of workers from outside the state, as well as worker participation in short-term training.

Projecting the Education-to-Workforce Pipeline

North Dakota leaders expressed strong interest in being able to align information about current and projected workforce needs against the "pipeline" of prospective employees. For example, the workforce intelligence function of the Department of Commerce would benefit from aligning current and projected demand in Information Technology (IT) jobs, comparing that to current enrollment in secondary and postsecondary IT-related courses and degree programs. Enrollment

data could be derived from the NDUS data warehouse, which could aggregate course enrollments, as well as DPI student data which indicates the number of students who have "concentrated" in two or three IT courses at the high school level. The analysis could look at high schools, two-year and four-year college IT programs within a certain region of the state. Reports could be generated that demonstrated how many IT "concentrators" at the secondary level enroll in IT programs at the postsecondary level, and how much of the current and projected workforce demand is likely to be addressed by the current educational pipeline. If the pipeline appears to be too small to meet demand, Workforce could suggest targeted awareness building activities for school and college administrators, faculty, students, and parents to make them more cognizant of the need. When program recruitment and awareness activities are launched on a regional or statewide basis, the business intelligence tools can be used to show where enrollments increase, giving some indication of the relative effectiveness of the efforts in various regions.

Preparation for Postsecondary Education and Training

Stakeholders from both the K-12 education sector and the higher education sector are concerned about improving student preparation for postsecondary learning. Based on national and state research, a large percentage of first-time college students need to take one or a combination of remedial courses in reading, mathematics, or writing, based on academic placement tests that are administered to students when they enroll in postsecondary programs. A longitudinal data system with analytic capabilities can have many positive applications in this regard. By matching data from the K-12 systems to data from the NDUS system, school districts could be notified about the number of recent high school graduates that needed to receive remedial courses upon entering postsecondary education. Under current laws and regulations, the school district would not be notified of the specific names of its previous students that needed remedial services, but could be given numbers of students as well as the type of remedial courses that were required. Proposed rule changes to FERPA are now being considered that may allow remedial course data to be loaded into a DPI data warehouse. If implemented, this rule change could allow school districts to analyze the content of secondary courses taken by students who must enroll in remedial courses in college, and potentially identify course, grade and assessment performance as indicators of the need for remedial postsecondary courses. The information could be provided on a campus by campus basis, as long as it did not compromise the student's confidentiality (for instance, where only one or two students from a particular high school attended a particular college.) More detailed analysis could also be conducted, comparing student scores on college entrance tests (ACT and SAT), their performance on the State's standardized reading and math assessments, attendance, grade point average, and demographics, on the amount and type of college remediation needed. Additionally, similar information on college success including degree attained could be shared. This linking of aggregate data would enable NDUS, DPI, and school districts to work together to decrease the number of high school and college students who exit school prior to earning a diploma and degree.

Regional Workforce Skill Inventories

Some participants expressed an interest in a workforce intelligence system that would allow regional economic developers to quantify the skills and knowledge possessed by individuals across the state or within a region. Ideally, the economic developer could demonstrate this skill/knowledge inventory to an employer that is considering expansion or moving into the state,

but is concerned about matching the skills of local workers. There is a very strong appeal to this type of sophisticated workforce intelligence. In its fullest sense, it would require the development of an individual electronic portfolio for every citizen, which could track their various educational and workforce experiences and quantify their formal and informal learning. This concept has been theorized by workforce advocates over the past 20 years, but no serious regional effort has been undertaken. At best, a state LDS could provide the historical data to review the current registered workforce, and through matching of records, could determine what courses individuals may have taken through CTE programs, or through short-term or for-credit programs offered by NDUS. This does not represent a skill inventory, per se, but a course taking inventory.

Nebraska is developing a career planning system, to make available to all its citizens, in which an individual's electronic portfolio will be accessible to the individual as they move from middle and high school to postsecondary and the workforce. Adults will also be able to establish their own portfolios that would help them conduct personal career interest assessments, and explore related career information and resources. If North Dakota develops a career and college planning tool similar to that under development by Nebraska, Kansas, and South Carolina, and chooses to link these systems to a student's unique ID or an adult's SSN, then a regional inventory of career interests and aptitudes could be analyzed in an economic development context.

Operational Data vs. Longitudinal Data

In some cases, agencies indicated a desire to share data more efficiently in a way that would affect operational decisions. For example, student participation in public assistance programs makes them automatically eligible for participation in school-based meal programs. Thus, if there were a mechanism to transfer public assistance participation data from the DHS to a statewide education data warehouse, then local school districts could pull down that data to pre-qualify students for school-meal programs. Exposing DHS data (as well as other state agency data) for use by other state agencies is an objective of the state LDS. Providing local school districts access to data related to student participation in public assistance programs provides districts with a third party source to validate their own data, thus promoting a higher degree of quality data in the districts.

4.2.2 Operational Systems

During the interview process agencies expressed their concerns and noted the limitations that are present within their current data systems. Agency representatives stressed that having the ability to do analytical reporting within an agency and across agencies would be a significant benefit. Such analytical measures require the use of a longitudinal system which can be utilized to link cross-agency data and pull student records at different levels. Several of the agencies that currently do not have a data warehouse expressed interest in building their own data warehouses. Representatives from DHS clearly expressed that they would like to upgrade from a legacy system to a standalone data warehousing concept. These data warehouses would help each individual agency to perform operational interagency analytics. Additionally, these data warehouses would serve as the source systems for the state LDS.

One of the difficulties with cross agency analytics is the ability to link data. In the 'To Be' vision discussion, an interviewee from CTE expressed that the agency would like to implement the Master Client Index (MCI) to better link data. While relatively new to North Dakota, agency representatives seemed confident that this matching algorithm is very effective, and should be used by agencies in addition to DHS.

JSND specified that some of its current operational systems should be replaced by more powerful and stable systems. The workforce data are currently placed in a Microsoft Access database. The linkage between jobs available, jobs occupied, and to potential employees is very manually intensive. Workforce would like to see this process automated and possibly transitioned from Microsoft Access database to either SQL Server or Oracle database.

4.2.3 Data Integration and Warehousing

Currently, in the state of North Dakota agencies have not implemented data warehouses. From the interview process it was expressed that many issues are visible due to the lack of a data warehouse. The recurring issues across agencies were an inability to integrate data, an inability to provide in-depth analytics, and an inability to easily manage data. In the 'To Be' vision discussion agencies specified that they would like to see their daily operational troubles be resolved and that manual processes be automated.

Data integration

Data integration is the process of easily combining or linking data across several different sources or databases. In the state of North Dakota, this seems to be a great challenge across agencies, largely because over time and across agencies different unique identifiers are used for the same person. DPI committee members voiced the importance of being able to integrate data across agencies to resolve their current issues regarding student achievement, obtaining remedial course information, identifying vocational education participation. DPI and NDUS would like to be able to follow student career paths from secondary to postsecondary education and onto the workforce. This would require being able to connect secondary and postsecondary education data on a single student. JSND indicated that an integrated system would resolve issues such as data inconsistency, data matching inaccuracy, and lack of cross agency data. DHS would like to have a central location for all data that will help improve daily operations and possibly replace the legacy system currently in place.

In-Depth Analytics

Analytics is the process of using data to discover and understand historical patterns to predict and improve an agency's performances in the future. Agencies across the state of North Dakota currently have such processes in place but with limitations. Agencies are unable to provide analytics on cross-agency data. They are unable to provide in depth analytical dimensions that can easily pinpoint business process flaws and effectiveness. They also are unable to provide critical measures due to the lack of integrated cross-agency data. Agencies expressed that an integrated system would help explore measures beyond their currently supported data metrics.

FINDET would like to provide detailed analytics concerning correctional facilities, Bureau of Indian Education systems, Tribal Colleges, Private Institutions, K-12 and also welfare programs. The Commerce Department would like to easily identify certified individuals based on geographical locations throughout the state of North Dakota and be able to pinpoint geographical locations that are experiencing upward career mobility.

Participants identified additional areas in which expanding data access could improve in-depth analytics capabilities. Other data sources currently used for matching include the Federal Employment Data Exchange System, which registers employer status in the federal government, the Postal Services, and the Uniformed Military Service. Data from the Uniformed Military Service could also be accessed to identify individuals who are being discharged from the military, to ensure they receive information about targeted employment and training services. Students who attend college out of state or that attend private colleges may be identified through matching student records against the National Student Clearinghouse. Since the UI wage record system only allows employment status for employees, other data could be accessed to determine the employment or earning of other individuals that participated in education and training programs. Linking results against data in the North Dakota Department of Taxation would verify the employment status of self-employed individuals such as entrepreneurs and farmers. Linking data against the North Dakota Correction and Incarceration database could identify individuals who are out of the labor pool because of incarceration.

Data Management

The 'To Be' vision for agencies includes a data warehouse that would easily manage data—providing data accuracy, data security, one central data location, data history, and data consistency. Agencies would like a state LDS that includes historical data that support longitudinal analysis across agencies. DPI and DHS would like to be able to see data accuracy and data consistency as they are currently using specially developed algorithms such as the MCI to perform data matching. DHS, Commerce Department, and JSND would like to have one central location where data can be easily managed, changes can be consistently applied throughout all data, and access can be provided based on user profiles. The NDUS would like to have a data warehouse that takes advantage of their eleven institutions running the same student software on a single database structure but with time slices relevant to higher education. Better data management would provide these agencies the ability to improve daily business operations and deviate from tedious manual, time intensive, sometimes ineffective data management processes currently in place. Finally, matching UI wage records to records from Workforce Safety and Insurance could allow more detailed occupational coding to determine how North Dakota jobs align with current and projected workforce needs.

4.2.4 Analytical Applications

Ultimately, the state should provide an accurate picture of what becomes of the trained and educated population of North Dakota. Moving toward the ideal state LDS, North Dakota education and workforce agencies identified several areas to enhance analytical applications. Three themes for analysis improvement emerged: data sharing, usability, and report content and functionality, including types of analyses and performance.

Data Sharing

In the ideal data system environment, participating agencies have direct access to each other's data to examine related data elements that may span multiple programs or agencies. When no longer dependent on FINDET, data users could go to a secure, online source and run reports populated with data from all agencies working in a particular sector. For example, DPI, CTE, NDUS, and JSND could each independently run a report showing the numbers of individuals employed through a JSND program who completed vocational training at the secondary or post-secondary level. While data is shared, each agency maintains control of its own data and develops confidence in the quality of data through its data governance council. Data sharing issues are addressed and resolved by the interagency LDS data governance council.

During the interviews, agencies identified their partner agencies with related data that, if shared, would expand their data analysis capacity. Each agency completed a survey indicating from which of its sister agencies it currently receives data, and the agencies from which it would like to receive data that it cannot access today. The response showed that data are being shared between agencies directly or via FINDET, but there are significant opportunities to improve data sharing and fulfill unmet needs for interagency data.

When read on a row by row basis, Table 4.2.4-1 Current Agency Data Sharing and Unmet Needs shows for each agency the partner agencies from which an agency receives data or would like to receive data as noted in the legend, below.

Table 4.2.4-1: Current Agency Data Sharing and Unmet Needs

	DPI	NDUS	CTE	Commerce	JSND	DHS	ESPB	School Districts
Dept of Public Instruction (DPI)	-	N	DA	N	FA	D	D	DA
North Dakota University System (NDUS)	N	-	A	N	F	N	N	N
Career & Technology Education (CTE)	D	D	-		F			
Dept of Commerce		FA	FA	-	AFD	FA		
Job Service North Dakota (JSND)	FA	DFA	FA	N	-	DA		
Dept of Human Services (DHS)	N	N			N	-		
Education Standards & Practice Board (ESPB)	D	DA	D				-	
School Districts	DA	DA	DA		N	N	D	-

Legend
D = Agency currently receives data Directly from listed agency
F = Agency currently receives data from other agency via FINDET
A = Agency currently receives data from other agency, but wants Additional data
N = Agency currently does not receive data, would like to receive New data

Boxes shaded in yellow indicate that while the two agencies currently share data, the agency listed at the top of the column has additional data that the agency listed in that row would like to receive. A box shaded in blue indicates the two related agencies are not currently sharing data,

but the agency listed at the top of the column has data the agency listed in the row would like to receive. An agency listed at the top of a column can see to which agencies it could provide data via a state LDS to fulfill unmet data sharing needs. Collectively, the shaded boxes show the unmet data sharing needs that may be addressed through the implementation of a state LDS. Each state agency column shows which and how many state agencies would want data from the agency listed in the column heading.

Usability

The interviewees, as potential end users of a state LDS, hope to see a state LDS solution with analytic capabilities that are intuitive and will be adopted easily by stakeholders. The data analysis and intelligence facet of the state LDS would need to meet the needs of a casual user as well as a program analyst running routine reports, and a research analyst building custom queries to answer a specific question. The reporting system would employ tables, graphs, and charts in a variety of formats to engage the user and easily reveal trends. One CTE representative suggested showing a state map color coded to indicate the number of CTE classes offered in each district. Additionally, the system would make it easy to drill down and up from a more aggregate view of data to a more granular examination.

Although the most widely used data analysis systems tend to be those that can be used intuitively, it is important to provide training so that the full power and function of a data reporting and analysis tool is tapped. A JSND interviewee insightfully noted that data need to be used analytically which requires training to help users develop their understanding of the tool, its functions, and how it can be leveraged to support data driven decision making. In essence, users who learn how to use the data analysis system concurrently learn how to properly use data to improve program performance.

Report Content and Functionality

A significant part of the 'To Be' vision for analytical applications is the inclusion of data and reports that currently are not electronically available, and analysis functions that are not possible under the current system. NDUS would like to easily get a list of students taking only on-line courses. While this sounds like a simple request, the current system makes the generation of such a list difficult because definitions of what constitutes an online course have not been established. DPI noted that it has some paper reports that still need to be incorporated into STARS. To maximize the utility of the state LDS, any data collections or reporting that are currently being done via paper would need to be put in an electronic format so they could be included in the state LDS. With this comes an expectation that reports will be generated in a timelier manner with less time required for cleaning data.

Participants also expressed an interest in having a tool that performs several types of analyses. Most basically, programs would like the ability to complete longitudinal analyses. Workforce stated that it would like to be able to track a program over five years and determine its level of success. JSND would like predictive analysis capabilities that allow analysts to examine projected demand in a particular field versus current enrollments. DHS wants to support impact studies with regression analyses that identify the influencing factors of an end result. DPI would like to use file matching capabilities. It wants to correlate student records in DPI with TANF records in DHS to see if a student's family received TANF, Food Stamps, or Medicaid benefits

since these students are automatically eligible for the Federal Lunch Program. This link would eliminate need for parents to fill out forms for the lunch program, and may lead to more children receiving the special assistance for which they are eligible. Currently, this analysis is done manually.

The following is a summarized wish list of reports, data, and functions that participants would want to be provided through a state LDS system:

Reports

- LDS reports that match students between K-12 and postsecondary programs, and with the other agencies to show what and how they do at each stage of education and workforce development
- Reports that show what combination of courses lead to a particular career
- Reports of trends in the type of pedagogy teachers are taking
- Reports that identify the four semester hours in the last five years a teacher has completed for re-licensure
- Reports that compare school performance with teacher professional development
- Reports that show where teachers graduate from high school and what their impact is on student performance
- Reports that show the success of graduates in higher education and the workforce
- Reports that show what jobs are available
- Reports showing academic success for first-year students
- Reports showing what careers are tied to degrees awarded
- Analysis of remedial education courses given at postsecondary institutions
- Reports of full faculty workload
- Reports of state and federal funding
- Analysis of longitudinal data for school evaluations
- Reports showing the percent of people who exhaust their JSND benefits before other resources are available
- Reports showing what individuals engaged in non traditional training and got hired
- Reports that identify upcoming talent pools based on graduations
- Reports that match students' ACT/SAT exam details with their career choices to see if the two correspond

Data

- Student grading should be included in STARS (part of DQC's ten essential elements)
- Community type information (e.g., criminal activity, [vandalism, juvenile crime, drug and alcohol related], health concerns,) that can be easily accessible for grant writing
- Parent's education level

Functions

- Be able to link students from secondary to post secondary or secondary to workforce using the Master Client Index (MCI)
- Be able to identify factors and trends that indicate a student is not doing well so one can proactively define students who may need help in the future.

4.3 Comprehensive Gap Analysis between 'As-is' and 'To-Be.'

A comparison of the 'As Is' and 'To Be' visions reveals what actions are necessary to move North Dakota from its current state of unlinked individual data systems to the desired future state of a single LDS that enables secure and automatic sharing of related data. This gap analysis goes through agency by agency to identify the key aspects of an agency's current data system and places them side-by-side with the main changes it wants to achieve in the future state. The final column lists the corresponding initiatives or actions required to close the gap between the current and future state.

Table 4.3-1: State LDS Gap Analysis

Agency	As Is	To Be	Close the Gap Strategy
Department of Public Instruction (DPI)	• STARS is ND's primary collection engine for district K-12 data • TIENET for special education and online IEPs • Small districts do not have same quality of education data tools as larger districts	• Wants Master Client Index (MCI) to match records across agencies • Districts receive data regarding their graduates' performance in NDUS • STARS expands to include additional reports; data system provides information back to districts	• Timely updates to STARS • Continue to expand STARS to collect more SIS data • Implement state-level, K-12 data warehouse to give information back to districts • Implement business intelligence (BI) reporting tool for data analysis • Implement MCI • Develop electronic student transcript
Information Technology Department (ITD) (EduTech)	• Viewpoint data warehouse in place at five largest districts; available to all districts • Variety of Student Information Systems (SIS) in place today	• All districts have longitudinal data analytics capability • Standardized SIS across all districts (PowerSchool)	• Provide funding to allow all districts to implement PowerSchool to improve K-12 data quality and data collection • Continue to allow all districts to implement Viewpoint; may use REAs to accommodate multiple small districts. • Implement MCI to improve interagency matching
Job Service North Dakota (JSND)	• Variety of operational systems serving multiple and diverse programs • Provides data to other agencies (via FINDET)	• Wants to efficiently collect data from other agencies, i.e., students enrolled in career and technical education classes in high school • Wants to help employers find skilled	• Consider implementing a data warehouse of JSND specific data • Implement business intelligence reporting tool for data analysis • Provide training programs to develop data

Agency	As Is	To Be	Close the Gap Strategy
	• Collects data from NDUS via telephone	labor • Wants ability to perform cross-system data analytics • Wants visibility into upcoming talent pools	analysts
Career and Technical Education (CTE)	• Relies on other agencies to provide data for outcome reporting • Uses FINDET to match data for outcome reporting • Uses STARS to collect data on CTE secondary students and NDUS for CTE postsecondary students	• Wants to be able to create own reports • Wants to link high school CTE program enrollment to college enrollment and workforce outcomes • Wants to identify non-duplicated CTE students • Wants public to have access to CTE data • Wants to identify at-risk students to provide intervention	• Align student identifier (SSN to State ID) across agencies • Implement MCI • Implement business intelligence reporting tool for data analysis • Provide training programs to develop data analysts
Workforce Development (Department of Commerce)	• Few business rules defined to govern data collection • Uses FINDET to match data for outcome reporting • Uses data from other agencies (via FINDET) • Collects common accountability measures as required by HB 1018	• Wants to measure how North Dakota is retaining talent, expanding skills, and attracting talent • Wants to track program success over 5 years • Wants geographic representation of skills across regions	• Align student identifier (SSN to State ID) across agencies • Integrate data from all sources such as NDUS, JSND, and external sources including Census, Bureau of Labor Statistics and businesses in the state • Implement business intelligence reporting tool for data analysis and geographic representation
FINDET (not an agency, but an interagency data reporting service)	• Provides outcome reporting for JSND, Workforce, NDUS, DHS, DPI, and CTE • Single user, Macintosh-based reporting solution on single machine providing cross-agency	• Foundation for the state LDS • Longitudinal data analysis • Integrate more data including K-12, Department of Corrections, Welfare, Bureau of Indian Education • Should be placed in an education	• Existing FINDET staff should become part of the LDS implementation team • Continue to fund the system until state LDS is fully operational • Retire system after state LDS is fully operational

Agency	As Is	To Be	Close the Gap Strategy
	data analysis • Provides cross-agency data matching capability • Limited accessibility	agency with responsibility that spans K-12 and postsecondary education	
North Dakota University System (NDUS)	• PeopleSoft/Oracle for student information services • Uses ACEware to capture workforce training participant data • Longitudinal data available starting SY 2006-07 • Lacking logical edits and standard set of definitions across 11 campuses (upgrades in progress) • Inconsistent collection of data on workforce training participants	• Wants integrated student linking across all campuses • Wants a common information system among workforce training delivery quadrants • Wants to measure student performance, student satisfaction, and employer satisfaction • Wants a 'Community of Science' database to identify faculty expertise • Future plans for a NDUS data warehouse • Sees state LDS not as a single warehouse, but a link to individual agency warehouses	• Link Student Information Systems to accurately report on students across NDUS campuses • Create NDUS specific data warehouse to provide robust reporting • Align student identifier (SSN to State ID) across agencies • Design process to consistently collect identifiable information (i.e., SSN, race) from workforce training participants • Provide training programs to develop data analysts
Department of Human Services (DHS)	• Data in legacy systems difficult to integrate • Planning to re-platform systems • Significant federal reporting requirements; reports run monthly	• Planning a data warehouse • Wants to do regression analysis to identify influencing factors (impact studies) • Wants access to wages, job types, and monthly salary data	• Implement DHS specific data warehouse • Implement Cognos reporting for data analysis • Implement Master Client Index (MCI) to match records (product selection complete)
Statewide	• Multiple agencies with disparate data warehousing and analysis capabilities • Need for data sharing • Agencies dependent on FINDET	• State LDS that allows each agency to utilize data from multiple agencies for increased success • Central hosting of applications in ITD	• Implement data governance programs at the state level to define, establish, and govern data quality across agencies • Establish individual agency data repositories that feed into one common state LDS w/ data

Agency	As Is	To Be	Close the Gap Strategy
	for shared data analysis • Agencies may not collect all needed data	• Common set of data standards and data definitions • Agencies collect and have access to all needed data	analytics capabilities • Educate users via programs that go beyond training on tools and data with the goal of developing data analysts • Identify any unmet data needs and the steps needed to collect and analyze such data

4.3.1 Policy Challenges

During our analysis and interviews, a few policy barriers emerged that would affect the full implementation of a state LDS, or currently appear to impede effective program implementation. These policy challenges may simply require attention during implementation, or may benefit from an actual change or clarification in policy at the appropriate level, either through programmatic guidance, or more formal policy adoption.

Transfer of State ID
There seems to be a lack of clarity about whether and how a student's state ID, generated in the public school system, should be transferred into a postsecondary record. A process for identifying the state ID upon enrollment in NDUS and attaching that to the postsecondary record is needed.

Workforce Training Registration
There is currently no process for enrolling or registering workforce training participants in the NDUS data system upon their participation. Paper records of enrollment are collected and there is not a Social Security Number (SSN) collected for that program enrollment. In some states such as Colorado, Montana and Georgia, all training participants, whether they are enrolled for credit classes or for short-term program participation, are enrolled in the college's student information system. If a record is created when individuals participate in short-term training, using the SSN or a unique student identification number, then a unique, non-duplicated enrollment record can be created. Each time an individual enrolls in non-credit or for-credit coursework, that student record could be accessed and updated.

Voluntary Collection of SSNs through the NDUS Campuses
One interview raised the concern that NDUS programs did not collect SSNs for program enrollments. The NDUS workforce program needs to consider whether voluntary provision of SSNs is the correct policy. Without that critical piece of data, it is very difficult to conduct accurate analysis of long-term employment outcomes, and thus difficult to judge program quality.

Essential Data Elements

The Data Quality Campaign provides guidance to state education agencies regarding the collection and use of education data to improve student academic learning and achievement. The Campaign has identified 10 essential elements to having a viable data system that maximizes benefit from data. In 2007, the Campaign surveyed states to learn how many of the 10 essential elements are part of a state's data system. North Dakota has not yet met four of the elements. The state LDS solution should support North Dakota in achieving the 10 essential elements. The solution presented in the Roadmap gives the capability to meet one additional element. The remaining three elements, however, require policy interventions such as including in the state LDS assessment data on college preparedness, unique IDs for teachers, and student level transcript information including grades and courses.

Governance of Education Records and Placement of the LDS
The student record privacy requirements of FERPA provide important protections to the confidentiality of student records. FERPA is not an impediment to the development of a

longitudinal data system, but it does provide constraints. Most important, educational records must remain under the supervision of an educational entity. FERPA guidance indicates that an agency that is "designated" as an educational entity, must in fact, carry out the substance of educational mission, and not simply be labeled as such, which could be a mechanism to bypass the constraints of FERPA. Further, FERPA asserts that individual education records can only be viewed by authorized personnel who have jurisdiction over a portion of a student's educational career. Thus, a high school principal would not be authorized to see the course enrollments and grades of former students on an individual basis. Information of that sort, however, could be provided in an aggregate report so that a principal could determine the general educational trajectory of former students.

FERPA does recognize the legitimate role of research and evaluation, and as such, the state LDS Committee (and any other establishing policies) will need to clarify that the purpose of the state LDS is to strengthen research and evaluation for program improvement. Agencies should not interpret FERPA to create a blanket prohibition of sharing personally identifiable student data among state agencies. The IDGC will need to clarify the research and evaluation context for the state LDS and that specific protocols and authorizations for sharing student records for research and evaluation will need to be created and followed. As North Dakota plans and implements its state LDS solution, the status of the proposed rules that impact FERPA should be closely monitored, since they may impact data sharing.

5.0 LDS Roadmap Recommendations

The following section outlines the recommendations derived from the close the gap strategies identified in the gap analysis presented earlier in section 4.0. Recommendations include those items that are relevant to achieving a successful state LDS. They are organized in a way that allows the state to make decisions related to schedule, dependencies, level of effort, cost, and fit with existing state standards.

The purpose of each recommendation is to establish a set of building blocks that will enable the state to implement a successful state LDS that satisfies the needs of the key stakeholders across multiple departments and state agencies. Ultimately, these building blocks when assembled over time will achieve the desired result.

5.1 Data Warehousing Capabilities

Across all state agencies interviewed, there is a lack of sufficient data warehousing capability to meet the reporting and analytical needs of each agency. The following recommendations focus on activities that will enhance the state's ability to collect, organize and report on data within each state agency and across state agencies.

5.1.1 Recommendation: Implement a State Longitudinal Data Warehouse

A state-level longitudinal data warehouse that integrates data from multiple government agencies will provide a stable, scalable, and sharable data repository for cross-agency longitudinal data analysis. Some of the features and benefits include:

1) Providing users easy access to cross-agency data
2) Leveraging industry-leading technology to provide robust reporting capabilities that each user can perform via a browser
3) Opportunities to automate record matching activities to ensure high quality data
4) Consolidation of business rules to ensure consistent results from data analysis

A new full-time program manager position should be created to provide management, coordination, support, and advocacy for the state LDS data warehouse project. The responsibilities of this position should include:

1) Overall product management for the state LDS
2) Coordination of all project plans including tasks, resources, deliverables, and schedules
3) Management of contractor resources
4) Coordinating the interagency data governance council

5.1.2 Recommendation: Implement a K-12 Data Warehouse

DPI should acquire or build a state-level K-12 data warehouse that includes a business intelligence reporting capability. As Viewpoint provides local districts with the ability to perform analytical reporting at the local level, a state-level K-12 data warehouse will provide similar reporting capability across all districts at the state level. To limit the data collection burden on districts, data for the DPI K-12 data warehouse should be extracted from STARS. As a result, it

will be necessary to increase the frequency of data loads into STARS in order to ensure the DPI data warehouse contains current and accurate data. Additionally, it will be necessary to continue to enhance STARS in order to expand the scope of data domains collected and passed through to the data warehouse. The K-12 data warehouse will provide detailed, student level data analysis across schools districts.

A new full-time program manager position should be created to provide management, coordination, support, and advocacy for the K-12 data warehouse project. The responsibilities of this position should include:

1) Overall product management for the K-12 data warehouse
2) Coordination of all project plans including tasks, resources, deliverables, and schedules
3) Management of contractor resources
4) Other related duties, as appropriate

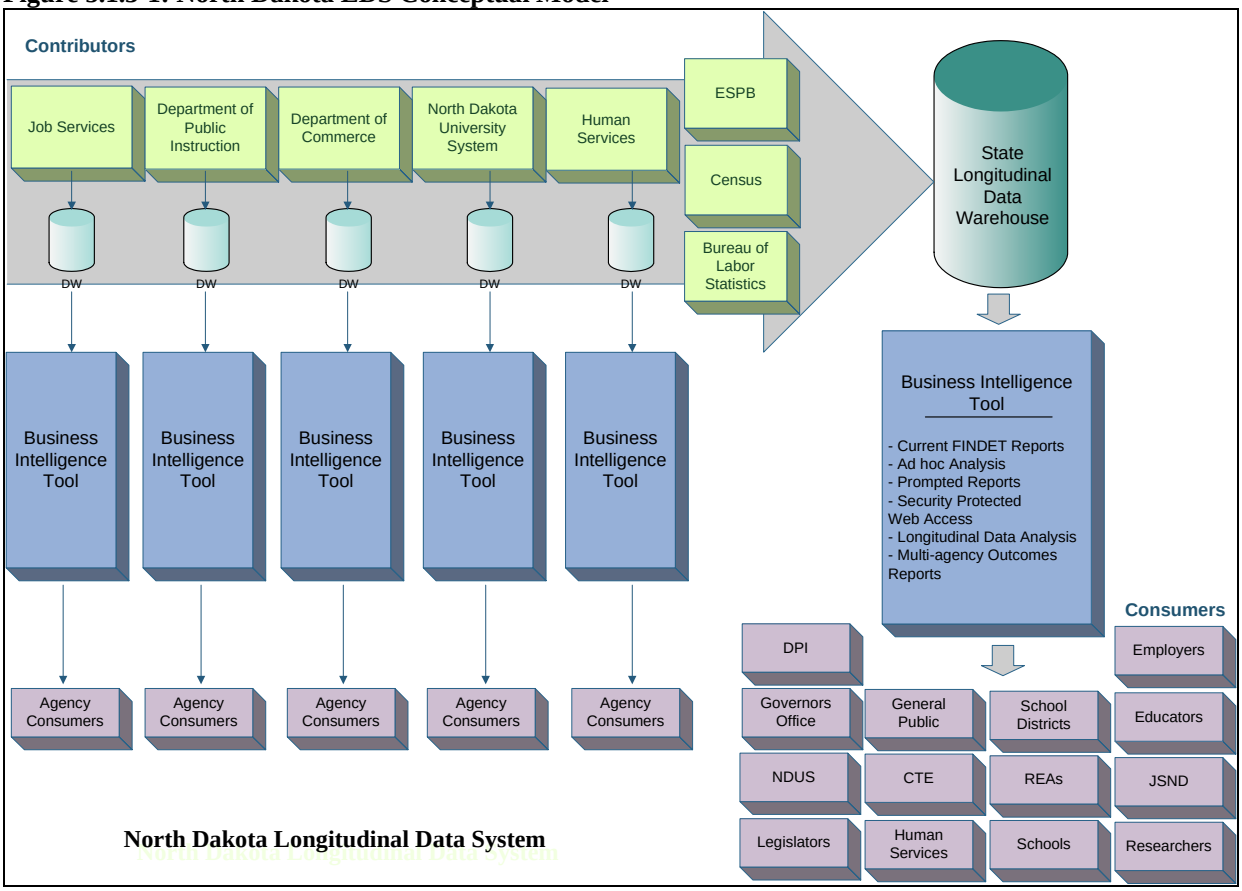
5.1.3 Recommendation: Implement Agency-Specific Data Warehouses [optional]

As an optional recommendation, each agency should consider implementing an agency-specific data warehouse to centralize and integrate data from multiple operational systems within the agency. A central data warehouse for each agency will have multiple benefits:

1) Centralize data within an agency to provide longitudinal analysis of important data captured in that agency
2) Improve data quality in the agency's operational systems. Implementing data quality checks within a data warehouse's routines for data extraction, transformation and loading will identify data quality issues that can be corrected at the source system
3) Organize data for operational and analytical reporting
4) Serve as a staging area for the state LDS

Figure 5.1.3-1 provides a conceptual view of the future data warehousing environment including the state LDS. Data are received into the state LDS from various contributors including internal and external sources. For agencies with data warehousing needs, the agency-specific data warehouses are used to organize and cleanse data before they are sent to the state LDS. The data are consolidated and organized into a state LDS and made available to a large number of data consumers via a business intelligence reporting tool. Consumers of agency-specific data are able to perform data analysis on their agency's data using similar business intelligence tools.

Figure 5.1.3-1: North Dakota LDS Conceptual Model



It is recommended that the following state agencies consider implementing a data warehouse:

JSND: Build an agency-wide data warehouse to centralize data from the agency's multiple transactional systems. Given the large number of existing operational data repositories within JSND, a data warehouse will improve the intra-agency reporting capability.

NDUS: The NDUS has already begun the planning and architecting activities to implement a data warehouse of NDUS general higher education data that are currently collected by ConnectND. Another opportunity to improve its data collection capabilities is to evaluate the ACEware application and the processes surrounding ACEware usage to determine whether NDUS can collect identifiable information (i.e., SSN and race) from participants in workforce training programs.

DHS: Like NDUS, DHS has already begun the planning and architecting activities to implement a data warehouse of agency program data. This initiative is still very early in the planning stages and a software platform has not been selected.

Workforce: The Department of Commerce should consider acquiring or building a data warehouse to enhance the data analysis surrounding its Workforce initiatives. This capability may be enabled via the state LDS. Therefore, further analysis should be performed to determine whether Commerce should invest in its own data warehousing initiative or instead plan to leverage the features of the state LDS.

5.1.4 Recommendation: Allow Continued Viewpoint Rollout by School Districts

Today, local school districts have the ability to license Viewpoint, a K-12 data warehousing system. Viewpoint provides local districts the ability to load data into a data warehouse and build sophisticated analytical reports. There are currently five school districts that have licensed and implemented Viewpoint.

While districts will gain longitudinal data access and analysis capabilities through the state K-12 data warehouse, they should retain the option of funding and adopting Viewpoint. This allows districts to establish a local data warehouse that can include data elements specific to local interests, such as a district program initiative that may not be addressed in the state K-12 data warehouse.

5.1.5 Recommendation: Define a Data Integration Strategy

An important byproduct of implementing any data warehouse is the integration, consolidation, and governance of an organization's data. North Dakota will realize these benefits during and after implementing the state LDS. Typically, the process of defining and designing the data models and extraction, transformation, and loading (ETL) processes for a data warehouse reveal legacy problems with an organization's data that were previously undetected and provide opportunities to correct those problems. A good example of this is the implementation of the STARS database. This project revealed disparities among course codes and course descriptions throughout the state. This prompted districts to focus on the issue and make positive progress toward cleaning up their data.

Investing up front in data analysis across state agencies will lead to the development of new business rules and business processes that will enable data integration. This starts with each agency investing time during the implementation of each agency-specific data warehouse. Defining data standards to govern data within an agency is a fundamental step in launching each data warehouse. But more importantly, it is critical to define a state-wide data integration strategy that each agency can reference and use as a guide to its own data integration efforts. Solving data integration issues early and across the entire agency's programs and data systems is a first step toward an effective state LDS implementation.

5.2 Reporting

5.2.1 Recommendation: Relocate and Reconfigure FINDET

In the short-term (1-2 years) FINDET should remain as the preferred tool for cross-agency data matching and reporting. FINDET is an established application for providing outcomes reports and, more recently, for longitudinal reports.

In the long-term (beyond 2 years), the state LDS will provide all FINDET reporting capabilities and the FINDET Filemaker Pro application can be retired. The existing FINDET staff should become part of the state LDS implementation team. The FINDET staff will bring valuable knowledge, lessons learned, and insight to the state LDS program.

In order to best leverage FINDET in the short term and allow the application to support the cross-agency reporting needs of all state agencies, it is recommended that CTE assume ongoing governance for FINDET. This change will position FINDET to best support the needs of all stakeholders.

CTE is an educational entity, so it meets the requirements of FERPA that an educational authority maintain direct control of education records while overseeing matching against other data sources. CTE is focused on strengthening the quality of the North Dakota workforce and aligning its offerings to emerging needs within the workforce; thus, its mission matches well against the workforce and employment goals that are the basis for the state LDS. Additionally, through the requirements of the Perkins Act, CTE already focuses on both secondary and postsecondary education programs and has a positive working relationship with both DPI and NDUS. As an agency that sits at the nexus of education and employment, CTE is well positioned to manage FINDET and the state LDS successor to FINDET, and ensure that the interests of all the partnering agencies are fairly represented and addressed.

5.2.2 Recommendation: Select a Business Intelligence Reporting Tool

North Dakota has defined Cognos as the recommended business intelligence (BI) reporting tool for state reporting needs. This selection was made after performing comparisons of comparable BI reporting tools. Cognos is a proven reporting tool especially in the education market providing robust reporting features and intuitive ad hoc reporting capabilities.

Despite having defined Cognos as the preferred reporting tool, the state does not have a state-wide (enterprise) license arrangement with any BI reporting tool. Individual departments and agencies must negotiate and fund separate license agreements on their own. An example of this is DHS which has licensed Cognos for use within that organization.

As each agency considers deploying its own data warehouse, each will need to include the costs of licensing a BI reporting tool. The state should consider investing in an enterprise license with a BI reporting tool. The initial investment in an enterprise license is typically a lower cost decision compared to funding three or four separate agency-wide license agreements.

5.3 Business Process Re-engineering

5.3.1 Recommendation: Implement an Education and Workforce Council

Undertaking a statewide LDS program is a vision that requires a long-term commitment and investment by North Dakota. The ultimate success of the program cannot be judged based on the initial investment. True success will be measured over time. This requires all participating state agencies to buy into, support, and commit to its success. Each agency, if left to operate in a stovepipe manner, may only see as far as its agency's individual interests are concerned. It is important to establish a statewide governing body made up of key leaders from each agency to make decisions related to statewide concerns. An Education and Workforce Council (covering pre-K education through higher education and workforce training) should be created to serve in this role and govern the state LDS program.

The Education and Workforce Council will take a long-term approach to program sustainability that includes staff participation, process re-engineering, and investment of funds. Legislators and

the governor's office should be involved to ensure that the state LDS program will survive beyond the first few years of investment.

A partial list of the responsibilities of the Education and Workforce Council includes:

1) Assuming overall ownership for success of the state LDS program
2) Mediating interagency issues related to data, data usage, and levels of authorized access to specific data sets
3) Considering proposals from the IDGC related to data quality solutions
4) Providing guidance and solutions related to the implementation and operation of the state LDS
5) Making decisions related to the scope of data to be included in the state LDS repository

5.3.2 Recommendation: Implement Formal Data Quality Processes

North Dakota should evaluate its existing data quality processes to determine whether they can support the state LDS program. Data discrepancies are certain to occur over time. When they do occur proper processes should be in place to manage and resolve the issues. Typically, data problems are resolved by the managers or "owners" of the source system. The state LDS will introduce a new level of data ownership that may involve multiple source systems. Updating current processes to account for state-wide instances of data quality issues will ensure that responsibility is understood and problems can be resolved in a timely manner.

5.4 Operational Support

5.4.1 Recommendation: Rollout PowerSchool Statewide

Currently, school districts use a variety of different student information systems. A majority (92) use PowerSchool and more are planning to migrate to PowerSchool in the coming year. The state should continue to support the Governor's Education Commission's plan to fund the rollout of PowerSchool to all K-12 districts. A single SIS platform throughout the state will improve the quality of K-12 data collected and loaded into the state LDS by leveraging standard training programs, processes and procedures, data extraction routines, and policies.

5.4.2 Recommendation: Educate Users to Develop Data Analysts

Typical training programs focus on increasing people's skills in using specific tools or applications. These programs are appropriate for situations in which users must understand the mechanics and processes to accomplish a well defined operational task. These types of training programs are usually not sufficient to educate people how to analyze data. The state LDS will provide the data and tools for multiple levels of data analysis. At a minimum, users should be trained to execute pre-defined reports and build their own reports using an ad hoc reporting tool. North Dakota should look beyond this minimum level of training and strive to improve its staff's ability to analyze data, discover programmatic implications in the interpretation of the data, and also understand the limitations or dangers of improper application of data analysis.

An advanced level of training will help state LDS users who already understand their data to begin asking new questions about their data, use the tools to produce results, and make decisions based on the results.

5.5 Data Governance

5.5.1 Recommendation: Align Student Identifiers

Identifying and matching student records across state agency data records in a fundamental issue in North Dakota. DPI uses a state ID while most other agency systems define unique individuals using the social security number. The success of the state LDS will depend on the state's ability to accurately identify individuals as they move through the educational system, into the workforce, and through other state support systems. NDUS is currently enhancing its systems to capture the state ID for all North Dakota high school students. NDUS's efforts will be the foundation to uniquely identifying individuals in the state LDS.

5.5.2 Recommendation: Implement Data Governance Councils

To oversee, monitor, and govern all data quality initiatives, North Dakota should implement data governance councils in each participating agency and an Interagency Data Governance Council (IDGC). The IDGC would focus on data issues related to the state LDS while each agency council would focus on data issues within each agency.

A partial list of the responsibilities of the IDGC includes:

1) Making recommendations on data usage, data quality, and data security to the Education and Workforce Council
2) Identifying data issues (such as multiple sources of data having differing data definitions for the same term) and proposing solutions
3) Developing recommended business rules to ensure data quality and consistency
4) Identifying the primary data source for data elements that could have multiple sources

5.5.3 Recommendation: Establish and Enforce LDS-wide Data Standards

The state should define interagency data standards to govern the data loaded into the state LDS. In conjunction with the data integration strategy, the data standards will define standard definitions, values, and usage of all state LDS data elements. The IDGC will oversee and govern the data standards and each agency will use the standards when applicable to establish proper use of existing data assets.

5.5.4 Recommendation: Mitigate Interagency Data Sharing Issues

As part of overall data governance, North Dakota must decide what data can be loaded and shared in the state LDS. For example, it may be necessary to avoid loading detail data that is considered personally identifiable information. The IDGC and the Education and Workforce Council will be the mitigating bodies to decide what data can be shared.

5.5.5 Recommendation: Implement a Master Client Index Solution

The LDS will be required to match student records, client records and employment records across agency data sources in order to generate aggregated (not personally identifiable) program performance reports. The state should investigate expanding its use of the Master Client Index

solution to use with the state LDS. Specifically, this should be considered for matching data between secondary, post-secondary, and workforce systems.

5.6 Roadmap Implementation

5.6.1 Recommendation: Action Memorandum

To ensure that the development of the Roadmap has timely impact, it is recommended that the state LDS Committee prepare and submit to the Governor an action memorandum explaining how the Committee and its participating agencies will act upon the recommendations contained in this report. The action memorandum should be delivered within six weeks of the date of the issuance of the Roadmap.

5.7 Recommendations Summary and Proposed Schedule

The following schedule organizes all recommendations into logical groups or "Tiers". There are four tiers defined to group recommendations by similar function, schedule dependencies, and relative importance to the state LDS.

Tier 1: Infrastructure and Data Governance – Includes activities related to improving the state's ability to share data by improving data quality through a Data Governance program.

Tier 2: State LDS – Includes all activities to plan, build, implement, and sustain a state LDS, including replatforming FINDET reporting..

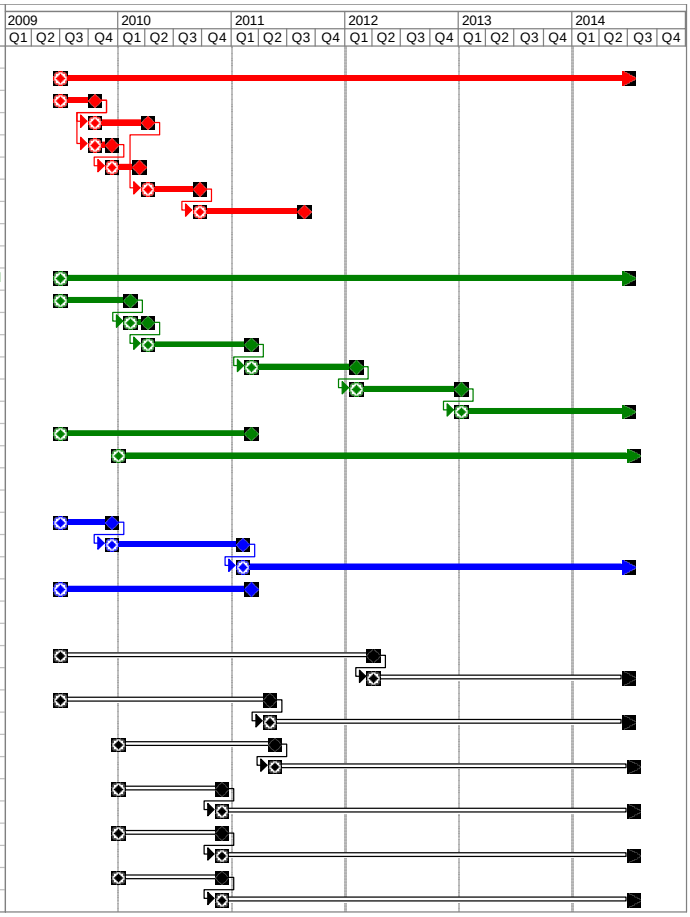
Tier 3: Data Collection and Reporting – Includes activities surrounding enhancing K-12 data collection capabilities.

Tier 4: Important, but Not Critical to State LDS – Includes recommendations that are related to, but not critical for, the state to implement a successful state LDS. These items do not appear below in the budget considerations. Preparing budget estimates for items not related to the state LDS program fall outside the scope of this document.

The schedule below represents a proposed order and sequencing of implementing the state LDS roadmap recommendations.

Figure 5.7-1: North Dakota LDS Recommendations Schedule

ID	Task Name
1	**Tier 1 - Infrastructure and Data Governance**
2	Implement a Data Governance Council
3	Establish and Enforce LDS-wide Data Standards
4	Define a Cross-Agency Data Integration Strategy
5	Implement a Master Client Index Solution
6	Align Student Identifiers
7	Mitigate Inter-Agency Data Sharing Issues
8	Implement Formal Data Quality Processes
9	
10	**Tier 2 - State LDS**
11	SLDS Establish and Sustain an Education and Workforce Council
12	SLDS Planning and Platform Implementation
13	SLDS Select a BI Reporting Tool
14	SLDS Support Outcomes Reporting (Re-platform FINDET)
15	SLDS Load Historical Data (Longitudinal)
16	SLDS Expand Scope of Data Sources
17	SLDS Ongoing Operations and Maintenance
18	FINDET (sustain, then retire)
19	SLDS Educate Users to Develop Data Analysts
20	
21	**Tier 3 - Data Collection and Reporting**
22	DPI K-12 DW - Planning
23	DPI K-12 DW - Implementation
24	DPI K-12 DW - O&M
25	STARS - Ongoing Enhancements
26	
27	**Tier 4 - Important, but Not Critical to State LDS**
28	Viewpoint - Complete Rollout
29	Viewpoint - O&M
30	PowerSchool - Implement State-wide
31	PowerSchool - O&M
32	JSND DW - Implement Data Warehouse
33	JSND DW - O&M
34	NDUS DW - Implement Data Warehouse
35	NDUS DW - O&M
36	DHS DW - Implement Data Warehouse
37	DHS DW - O&M
38	Workforce DW - Implement Data Warehouse
39	Workforce DW - O&M



6.0 Budget Considerations

Turning recommendations into reality requires additional funding from the state and/or federal grants. The following section outlines options that the state can use to decide what recommendations to fund and the timing of making those funds available.

6.1 Tier 1 - Infrastructure and Data Governance

Tier 1 includes the following:

- Implement the Interagency Data Governance Council
- Establish and Enforce LDS-wide Data Standards
- Define a Cross-Agency Data Integration Strategy
- Implement a Master Client Index Solution
- Align Student Identifiers
- Mitigate Interagency Data Sharing Issues
- Implement Formal Data Quality Processes

Table 6.1-1: Tier 1 Summary

Budget Item	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Implement Interagency Data Governance Council	0	0	0	0	0	**0**
Establish and Enforce LDS-wide Data Standards	0	$239,400	$239,400	0	0	**$478,800**
Define a Data Integration Strategy	$319,200	$159,600	0	0	0	**$478,800**
Implement a Master Client Index Solution	$308,000	$183,400	$50,400	$50,400	$50,400	**$642,600**
Align Student Identifiers	$42,000	0	0	0	0	**$42,000**
Mitigate Interagency Data Sharing Issues	0	0	0	0	0	**$ 0**
Implement Formal Data Quality Processes	0	$239,400	$239,400	0	0	**$478,800**
Total:	**$669,200**	**$821,800**	**$529,200**	**$50,400**	**$50,400**	**$2,121,000**

6.2 Tier 2 - State LDS

Tier 2 includes the following:

- State LDS Establish and Sustain a Education and Workforce Council
- State LDS Software
- State LDS Hardware
- State LDS Implementation
- State LDS Ongoing Operations and Maintenance
    - State LDS Program Management
    - Application Maintenance
    - Help Desk
    - Disk Space
    - IT Support
- FINDET (sustain, then retire)
- State LDS Educate Users to Develop Data Analysts

Table 6.2-1: Tier 2 Summary

Budget Item	Year 1	Year 2	Year 3	Year 4	Year 5	Total
State LDS Establish and Sustain a Education and Workforce Council	0	0	0	0	0	**0**
State LDS Software	$ 1,800,000	$ 300,000	$ 300,000	$ 300,000	$ 300,000	**$3,000,000**
State LDS Hardware	$ 100,000	0	0	0	0	**$100,000**
State LDS Implementation	$ 532,000	$798,000	$532,000	$532,000	0	**$2,394,000**
State LDS Ongoing Operations and Maintenance	$131,100	$ 182,430	$ 706,830	$ 706,830	$ 706,830	**$2,434,020**
FINDET (sustain, then retire)	$262,200	$262,200	0	0	0	**$524,400**
State LDS Educate Users to Develop Data Analysts	$ 79,800	$ 345,800	$ 345,800	$ 345,800	$ 79,800	**$1,197,000**
Total:	**$2,905,100**	**$1,888,430**	**$1,884,630**	**$1,884,630**	**$1,086,630**	**$9,649,420**

6.3 Tier 3 - Data Collection and Reporting

Tier 3 includes the following:

- DPI K-12 Data Warehouse - Software
- DPI K-12 Data Warehouse - Hardware
- DPI K-12 Data Warehouse - Implementation
- DPI K-12 Data Warehouse - Operations and Maintenance
- STARS - Ongoing Enhancements

Table 6.3-1: Tier 3 Summary

Budget Item	Year 1	Year 2	Year 3	Year 4	Year 5	Total
DPI K-12 DW – Software	$ 376,000	$ 174,000	$ 174,000	$ 174,000	$ 174,000	**$1,072,000**
DPI K-12 DW – Hardware	$ 100,000	0	0	0	0	**$100,000**
DPI K-12 DW – Implementation	$ 561,925	$ 1,461,100	0	0	0	**$2,023,025**
DPI K-12 DW - O&M	$ 131,100	$182,430	$ 379,080	$ 379,080	$ 379,080	**$1,450,770**
STARS – Ongoing Enhancements	$ 532,000	$ 532,000	0	0	0	**$1,064,000**
Total:	**$1,701,025**	**$2,349,530**	**$553,080**	**$553,080**	**$553,080**	**$5,709,795**

6.4 Budget Totals and Project Milestones

Budget Item	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Tier I Totals:	$669,200	$821,800	$529,200	$50,400	$50,400	**$2,121,000**
Tier 2 Totals:	$2,905,100	$1,888,430	$1,884,630	$1,884,630	$1,086,630	**$9,649,420**
Tier 3 Totals:	$1,701,025	$2,349,530	$553,080	$553,080	$553,080	**$5,709,795**
LDS PROJECT TOTALS	**$5,275,325**	**$5,059,760**	**$2,966,910**	**$2,488,110**	**$1,690,110**	**$17,480,215**

- **2009-2011 Biennium Milestones**
  - Implement a Data Governance Program
  - Complete State LDS Phase 1 to replace current FINDET functionality
  - Implement a K-12 Data Warehouse

- **2011-2013 Biennium Milestones**
  - Complete State LDS Phases 2 and 3
  - Establish education program to build analytical capability among users

- **2013-2015 Biennium Milestones**
  - Operations, maintenance, and ongoing enhancements to the state LDS

7.0 Appendices

7.1 Appendix A: Participant List

STATE AGENCIES

Department of Public Instruction
David Massey, Assistant Superintendent
Gary Gronberg, Assistant Superintendent
Anita Decker
Tom Decker
Dorice Miller
Greg Gallagher
Joleen Gross
Guy McDonald
Jean Newborg
John Porter
Girish Budhwar
Steve Snow
Doris Tonneson

North Dakota University System
Michel Hillman, Vice Chancellor for Academic & Student Affairs
Marsha Krotseng, Vice Chancellor for Strategic Planning & Executive Director/College Technical Education Council
Mick Pytlik
Julie Schepp
Randall Thursby

Department of Career and Technical Education
Wayne Kutzer, Executive. Director
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7.2 Appendix B: Interview Questions

A. STRATEGY, PROCESS, AND ORGANIZATION (BUSINESS DRIVERS)

- Describe your organization/agency and its relationship to the rest of the company/state.
- What are your primary responsibilities?
- Who are your key stakeholders? Who else makes up your audience for data?
- What are the objectives of your organization? What are you trying to accomplish? What are your top priority organizational/agency goals?
- What are your success metrics? How do you know you're doing well? How often do you measure key success factors?
- What are the major influencers of your entity's actions?
- Describe your data quality efforts and any data governance structure that exists.
- What type of routine analysis do you currently perform? What data is used? How do you currently get the data? What do you do with the information once you get it?
- What analysis would you like to perform? Are there potential improvements to your current method/process?
- What support is provided for small districts/rural areas?

B. OPERATIONAL SYSTEMS

- Describe your current technology system:
  - What are the applications in use?
  - What hardware and software are used?
  - What are your security measures?
  - What unique identifiers do you use?
  - What information systems are in use?

C. DATA INTEGRATION AND WAREHOUSING

- Where are your data stored today? What are the data sources?
- What are your business rules for ETL (extract, transform, and load)?
- What data are most important to your organization? Key stakeholders at the state level? Local level? How is this information collected and shared today?
- Is there other information which is not available to you today that you believe would have significant impact on helping to meet your goals?
- What opportunities exist to dramatically improve effectiveness of your organization based on improved access to information? What's the financial impact?
- Are there data collected at another agency that could enhance your data analysis?
- Are there specific bottlenecks to getting at or sharing information?
- Which source systems are used for frequently-requested information?
  How do production systems relate to each other? Which systems feed others?
  What is the granularity?
  How often is the data updated? Availability following update?
  How much history is available?
  What is an estimated size of this data (preliminary # of rows)?
- What are the known data issues in current source systems?

Which fields are not populated (e.g., not required and/or validated at input)?
Are there dual-purpose fields depending on context?
What is the availability of lookup tables? Are they buried in reporting programs?

- What master files do you have? Describe the maintenance of these master files.
  Do you currently have common source files?
  Who maintains the source files?
  How are keys maintained? Are keys reassigned?
  What is the cardinality (# distinct values)?

D. ANALYTICAL APPLICATIONS (DATA SHARING AND REPORTING)

- What is the current process used to disseminate information?
- What tools are used to access/analyze information today? Who uses them?
- Which reports do you currently use? What data on the report is important? How do you use the information? If the report were dynamic, what would the report do differently?
- How much historical data (one year, two years, five years, etc.) is required for your current reporting?
- What analytic capabilities would you like to have? Do you have the data to support them?
- Describe typical ad hoc requests. How long does it take to fulfill these requests?
- Who are the most frequent requesters of analysis and/or data?
- What is the technical and analytical sophistication of the users?

E. NEEDS SUMMARY

- What must this project accomplish for you to deem it successful? (Criteria must be measurable).
- What are the different categories of users who would need training in a Longitudinal Data System?
- What training tools currently exist?
- How urgent are your data needs? How soon would you need/expect additional data solutions to be offered?