



Arizona Department of Education

Arizona Education Learning and Accountability System (AELAS) Business Case

“Preparing Arizona Students for College and Career Success”

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1.0 Executive Summary

1.1 Introduction

Arizona's current education system is starving for information and resources. Parents, teachers and policy makers routinely ask questions the Arizona Department of Education (ADE) can't answer due to a lack of easily accessible, readily available data. Arizona's schools also face a shortage of resources in the slowly recovering economy. Despite these challenges, there is one very decisive action the state can take to make millions of additional dollars available to Local Education Agencies (LEAs) without raising taxes or increasing formula costs. By undertaking the design and implementation of a comprehensive education data system, Arizona can redirect millions of dollars currently spent on redundant and inefficient systems into the classroom, making the process of running our school system more efficient. Additionally, it is being designed to collect student-level data for our state's prekindergarten to post-secondary educational programs to better serve all Arizona educational stakeholders. This new statewide education data system, mandated by A.R.S. § 15-249, is known as the Arizona Education Learning and Accountability System (AELAS).

AELAS is at a critical point. All Arizona students deserve an education system that will help prepare them for future careers and leadership roles, and a number of recently enacted reforms require reliable data to succeed. The AELAS project is in alignment with ADE's vision of providing unparalleled support to Arizona educators and its LEAs, achieving transparency, and providing evidence-based strategies for improvement. It also aligns with the four pillars of Arizona's education reform plan—*data usage, standards and assessments, great teachers and leaders, and support of struggling schools*—with a data-centric approach. Finally, it provides the data needed to fully implement recently enacted legislative reforms such as comprehensive teacher and principal evaluations. None of these can be achieved unless AELAS becomes a reality.

This Business Case proposes a strategic plan and road map for the ADE—in consultation with the Arizona Data Governance Commission—to design, build and deploy a Learning and Accountability system. The Case outlines the research approach, findings, recommendations and financial justification to enable Arizona to fulfill AELAS' mission.

1.2 Research Approach

To understand where Arizona needs to go, we first must determine where we are. Researchers investigated the movement toward education data systems from a national, state, local and legislative perspective. Immediately, it was discovered that Arizona is not alone in this mission. Most State Education Agencies (SEAs) are pursuing a version of a Learning and Accountability system; however, no single SEA has all the answers, nor has any SEA deployed a comprehensive statewide Learning and Accountability system to date.

The researchers began by defining the components of a system: one that supports responsibility based on evidence; facilitates professional learning opportunities; and provides actionable feedback to the educator. First, the system must define the context of accountability. Second, the system must be built upon aligned components—objectives, assessments, instruction, resources and rewards or sanctions. Third, the technical aspects of the system must meet high independent standards. Fourth, the system must provide the catalyst for positive change.

Next, the researchers conducted a statewide study of the culture, processes and technology at LEAs and the ADE. Research objectives covered school software application type, usage, cost, and data, as well as the LEAs achievements and shortcomings that prevent them from meeting their primary mission—preparing students for college and career success.

LEAs actively contributed to the study through participatory action research, providing specific feedback on the requirements of a Learning and Accountability system through a variety of research methodologies such as a survey, site visits, phone interviews, and focus group sessions. Researchers were co-learners in this process, gathering qualitative and quantitative data about the software applications in the education market. These applications, also known as commercial off-the-shelf (COTS) solutions, were divided into three categories to understand the data collected and reported in each system type:

1. Teaching and Learning (e.g., Assessment and Content Management Systems)
2. Administrative (e.g., Student Information System)
3. Back Office (e.g., Finance and Human Resource Systems)

A purposive and convenience sampling of 187 LEAs was conducted, which is representative of approximately 30 percent of them. The LEAs surveyed provide education services to 56 percent of all students statewide. A wide range of LEA size, geographic location, and type (e.g., accommodation districts and joint technical education districts) were represented in the study.

Without exception, researchers heard the ADE has lost credibility and confidence based on past performance (pre-2011), but respondents noted and appreciated recent improvements. This prompted an internal audit of ADE's culture, processes and technology. Research objectives covered legislation, product portfolio, infrastructure, process workflows, and budget allocations.

All ADE program areas (School Finance, Exceptional Student Services, etc.) were included in the study. Researchers conducted root cause, performance and data error analyses, plus mapped all program workflow processes, to understand dependencies and impacts to other program areas and LEAs. The researchers sought evidence of best business practices through documentation, and assessed program area resource and budget allocations.

Lastly, a half dozen of Arizona statutes and federal grant programs were identified as potential drivers for AELAS. Researchers aligned statutes to objectives, benefits, business change, and Information Technology (IT) enablers, using the Benefits Dependency Network model to interpret drivers for organizational change. All the data collected was processed and analyzed to expose systemic issues across the state at cultural, process and technological levels.

1.3 Current State of Education

Despite the overwhelming apparent desire, Arizona’s current environment is not conducive to data sharing. The state has a system of local control over the delivery of education policies adopted by the legislature and the Arizona State Board of Education to ensure the education provided meets the needs of local communities. While this flexibility works well in many respects, from a data perspective, it has led to thousands of software applications statewide that stand independent, disparate and disconnected. The problem also exists at the ADE, which has approximately 150 applications/utilities, in large part on non-supported technologies dating to the early 1990s. One of the most valuable assets, data, is recognized to drive transformative change in education; however, oftentimes data is inaccurate and mismanaged. There are no real value-added incentives for LEAs (in conjunction with the ADE) to cooperate, coordinate, and work together on common initiatives across Arizona in regards to data sharing and data quality.

1.3.1 Local Education Agency Findings

The study found LEAs spend more than \$281 million annually on software licenses and implementation at the onset of a software rollout if all of them deployed the maximum number of software systems. When the figures are divided by LEA size, as outlined in Chart 1, very small to medium-sized LEAs account for 46 percent of the total spend but only serve 18 percent of the student population. On average, very small to small LEAs procure three to four software systems; whereas, large to very large LEAs procure nine to 10 software systems—mostly separate, independent applications, resulting in isolated data.

Chart 1 – Local Education Agency Breakdown and Average Software System Count and Cost

Local Education Agency Sizes	Size Ranges	Local Education Agency Counts	Student Counts	Average Number of Software Systems	Average License Cost Per User for One System
Very Small	≤ 199	245	24,115	3–4	\$57.28
Small	200–599	197	72,378	3–4	\$18.07
Medium	600–1,999	88	93,304	5–6	\$12.87
Medium-Large	2,000–7,999	58	243,388	5–6	\$8.17
Large	8,000–19,999	20	246,833	9–10	\$9.51
Very Large	≥ 20,000	11	397,045	9–10	\$5.33
Totals	–	619	1,077,063	–	–

As illustrated in Chart 1, very small LEAs pay 10 times more than very large LEAs for software licenses per user. Closer examination of the most prolific COTS application, the Student Information System, revealed implementing a statewide solution with pricing similar to a very large LEA would enable LEAs to recover \$11.6 million, thereby freeing up money that could be used to hire more teachers, purchase additional software or curriculum materials, or provide better technology in classrooms. This figure only highlights the financial reinvestment for a single application that tracks student data (e.g., attendance, demographic and grades).

In addition to software, infrastructure costs such as servers and network switches are estimated at \$47 million at the time of hardware purchase, amortized over time. There are also costs for desktop computers, laptops and tablets not accounted for in this study. Larger LEAs replace servers on a three- to five-year cycle, while smaller LEAs must extend the normal life an additional three to four years, oftentimes leaving them with unsupported hardware and limited capability. This Business Case does not

address infrastructure cost savings because the greatest and most immediate impact is recognized with software licenses; however, future consideration should be given to infrastructure costs.

1.3.2 Arizona Department of Education Findings

An internal audit shows systemic and cyclical data issues, due to inadequate budgets and resources, have led to immature business practices in regards to data management, resulting in no 'single source of truth' for data quality and accuracy. The collection of approximately 150 applications/utilities is maintained as minimal stopgaps for legislative compliance and lead to excessive reliance on manual labor, resulting in the ADE expending 568,000 man-hours annually. Opportunity costs, as a lost benefit, are the foregone services provided to support LEAs. The downstream impact of these issues permeates throughout the ADE and furthermore impacts LEA data management, costing an estimated \$12.5 million annually for full-time-equivalent positions to determine data accuracy.

ADE program areas such as School Finance and Exceptional Student Services are at their operational limit because this pattern of data-induced inefficiency repeats across the organization, forcing them to remain in a persistent reactive mode. For example, in the academic year 2011–2012 school grading was delayed, initially reported inaccurately, then recalculated and resubmitted. This impacts the credibility of the ADE, the reputation of LEAs, and the perception of Arizona education. Most disappointingly, as this example illustrates, the expertise, dedication, and quality work of the ADE is overshadowed by the shortcomings and failures of data management.

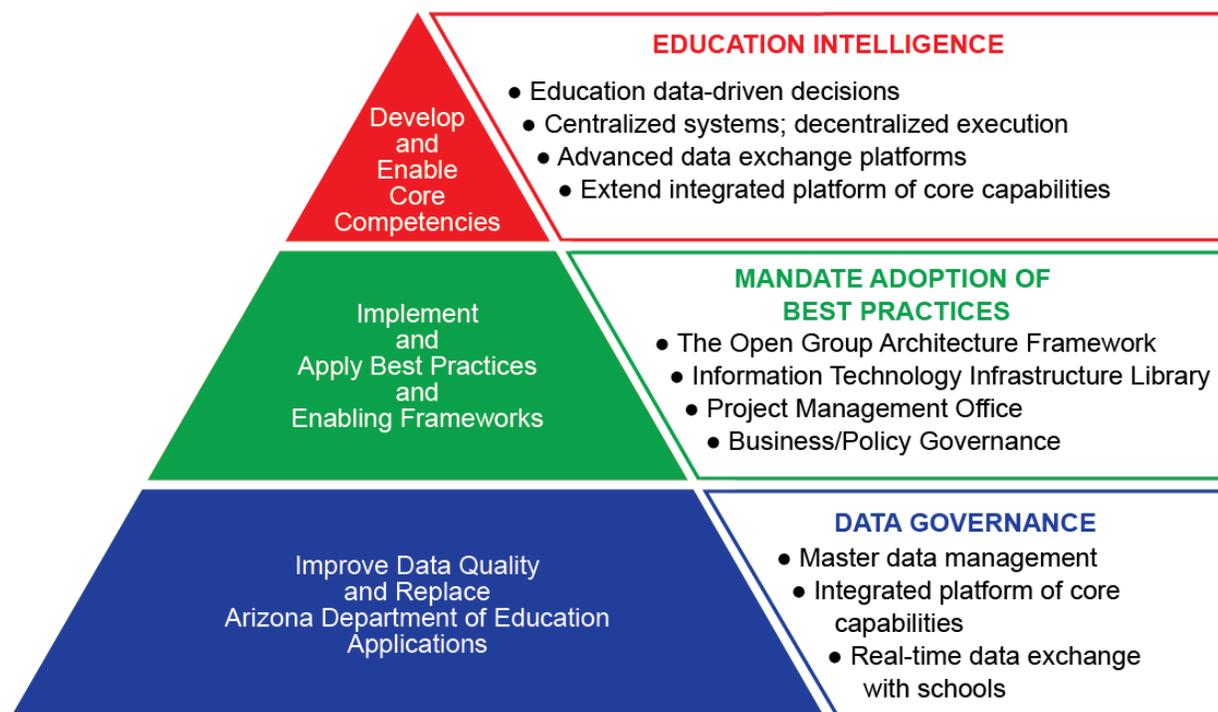
Even though the ADE has exhibited successful stabilization and optimization efforts in recent years, a complete overhaul of data management, business practices, and application replacement is mandatory to avoid the highly probable failure that would result in issues with redistributing the \$5.7 billion in school funding to LEAs each year.

1.4 Recommendation Hierarchy

The study yielded 13 recommendations from which a three-level hierarchy was formed to show an order of prioritization as a way to achieve transformative change. The range of issues identified earlier is addressed by implementing the recommendations as illustrated below:

1. Improve data quality and replace ADE applications
2. Implement and apply industry best practices and enabling frameworks
3. Develop and enable core competencies

Figure 1 – Arizona Education Learning and Accountability System’s Recommendation Hierarchy



This Business Case reflects and details the new business model for how to conduct a state-led, cooperative education program. The above recommendations align with tangible benefits that will result in cultural, process and technological changes across the ADE and LEAs. All recommendations lay the foundation and lead to Education Intelligence—integrated data and analytics transformed into actionable information—which is delivered in ‘real time’ to education stakeholders—that can contribute to improved student success.

A key aspect that often occurs in the IT domain is the tendency to overemphasize technology and tools rather than the importance of culture and processes in making sustainable change. It is crucial to address and focus on how culture and processes will change the current ‘as is’ to the ‘to be’ state and, more importantly, to have a strategy for these rather than a reactionary observation of what happened. This is precisely how the value proposition will produce substantial reinvestment opportunity to the state of Arizona.

1.4.1 Culture

A change in culture begins with first, the recommendation of mandating an internal ADE data governance structure under a state data officer. Second, the implementation of a Master Data Management policy using the Common Education Data Standards, as established by the National Center for Education Statistics, to unify data across the state. Third, the ADE will utilize industry best practices and enabling frameworks, which will lead to enhanced ADE performance, changing the perception of the ADE that internal and external stakeholders currently have. Last, the deployment of centralized systems at reduced statewide pricing can change the isolated behavior across the Arizona landscape by enticing LEAs to work collaboratively by sharing resources, ideas, and innovations for data-driven education decisions.

1.4.2 Processes

Adopting and applying formalized enabling frameworks such as ITIL, The Open Group Architecture Framework, and Project Management Organization will enable the ADE to reap the benefits of best practices from mature industries that have dealt with data-related issues and their associated processes. New and advanced file interchange platforms will make it easier for the ADE and LEAs to exchange immediate, actionable data to influence and inform decisions at the state, district, LEA, class and student levels.

Moreover, the improved processes can be integrated and reflective of reporting needs from ADE program areas within and across the organization, and with LEAs as integrated and interoperable systems. This integration will help Arizona to further realize the benefits of the new Learning and Accountability system.

1.4.3 Technology

Technology serves both those who use technology to conduct their work as well as the recipients of those work products. This Business Case recommends replacing the entire infrastructure and implementing more up-to-date architecture and platforms. This complete rebuild will introduce an integrated platform to support efficient agency operations. This goal does not rely on leading-edge technology, but rather on the application of rigorous discipline and integration of the culture and processes described above. The proposed new platform will lead to configurable program area services and the architecture to support new uniform data exchange requirements.

1.5 Financial Investment

A state investment in AELAS at this time is critical to maintaining momentum in education reform. Opportunity for systemic change, albeit ambitious, is attainable and sustainable. The financial investment requested is based on the execution of the recommendations outlined in this Business Case and illustrated in the Recommendation Hierarchy (Figure 1).

1.5.1 Local Education Agencies

At the center of AELAS are the educators and students that will benefit from the overhaul of education. It is important to note that very small and small LEAs currently pay more for less. They are estimated to spend \$25 million for software licenses and implementation on the three or four software systems that they can typically afford to implement. By adopting AELAS instead, they could implement an additional five software systems to better support teaching and learning, and reinvest nearly half their current expenditures directly into the classroom.

LEAs will have the ability to configure and use systems in ways that work best for their local needs. No longer will LEAs be required to manage vendor relationships; the ADE will be poised to manage the service-level agreements with a range of education vendors, based on industry best practices and state-adopted data management standards.

Based on ADE-hosted focus groups, a full range of LEA representation identified the systems most needed, which would be supported as a centralized, opt-in model. The cost of implementing these centralized systems was calculated at economies of scale pricing over a five-year period and equals \$87.8 million. See Chart 2 for the roll-out plan for the proposed nine systems starting in fiscal year 2014, and the breakdown between software license and implementation costs. The approach proposed is that LEAs will eventually discontinue their vendor contracts and convert to ADE’s opt-in model, reallocating the cost for software and implementation through the ADE, paying the state pricing point, which is lower than their current pricing.

Chart 2 – Centralized, Opt-In Model Software Systems License and Implementation Costs (\$ in millions)

Fiscal Year	2014	2015	2016	2017	2018	TOTAL
Number of Software Systems	5	7	7	9	9	9
Number of Local Education Agencies	20	110	314	555	619	619
Software License Costs	\$1.1	\$4.0	\$7.8	\$13.7	\$20.7	\$47.3
Implementation Costs	\$3.8	\$7.1	\$9.3	\$9.6	\$10.7	\$40.5
Total Local Education Agency Investment Costs	\$4.9	\$11.1	\$17.1	\$23.3	\$31.4	\$87.8

Overall, LEAs of all sizes will realize the benefits of cost reinvestment, improved services and support, and integrated, centralized systems that will support data-driven decision-making all the way down to the individual student level. LEAs can choose to reinvest monies saved on software licenses and implementation in ways that best support their local needs. The total annual LEA cost reinvestment is estimated to be between \$30 and \$60 million annually, depending on the number of them that opt in.

The success of the centralized systems approach is based on several factors including increased investment in local needs, superior services and support from the ADE, and offerings of advanced integration and analytics across multiple systems and data sources. A jointly owned cooperative formation of LEAs is recommended to provide the ADE with requirements, feedback, and guidance. The ADE will work with this group to ensure continuous improvement in services.

1.5.2 Arizona Department of Education

The basis of the Recommendation Hierarchy (Figure 1) begins with the ADE improving data quality and replacing applications with an integrated platform to serve ADE program areas, and subsequently, the LEAs. Concurrently, the ADE will employ industry best practices and enabling frameworks. The ADE has the potential to realize a cost recovery of 568,000 man-hours expended annually on data management and corrections, which would be freed up to provide services to LEAs. LEAs will also experience a cost recovery or reinvestment of 500,000 hours expended on data management and corrections or an estimated \$12.5 million annually due to better data quality from the ADE.

A financial investment is required to accomplish these recommendations. See Chart 3 for the rollout of the recommendations over a five-year period. The recommendation to improve data quality and replace ADE applications with an integrated platform equals \$65.3 million and is divided between software licenses and implementation. The recommendation to implement industry best practices and enabling frameworks equals \$4.4 million. The fiscal year 2014 financial investment request totals \$23.1 million.

Chart 3 – Arizona Department of Education Financial Investment Request (\$ in millions)

Fiscal Year	2014	2015	2016	2017	2018	TOTAL
Recommendation #1: Implement and Apply Industry Best Practices and Enabling Frameworks						
Implementation Costs	\$3.2	\$0.3	\$0.3	\$0.3	\$0.3	\$4.4
Recommendation #2: Improve Data Quality and Replace Arizona Department of Education Applications						
Software License Costs	\$3.2	\$0.3	\$0.3	\$0.3	\$0.3	\$4.4
Implementation Costs	\$16.7	\$10.8	\$18.1	\$6.3	\$9.0	\$60.9
Total Arizona Department Of Education Investment Costs	\$23.1	\$11.4	\$18.7	\$6.9	\$9.6	\$69.7

This financial investment analysis demonstrates that within a short, three-year time frame of AELAS implementation, the investment requested under this proposal is recovered in accumulated benefits to the state and LEAs, and that the cumulative benefits outpace the ongoing investment needed to support and maintain all of AELAS. The cumulative benefit calculation includes two components: (a) the reinvestment costs from the ADE, and (b) the reinvestment costs for LEAs from the implementation of AELAS. In other words, after three years, the investment has fully paid for itself and continues to deliver benefits to both the ADE and the LEAs. See Chart 4 for the cumulative financial investment and benefit of AELAS as implemented per the recommendations in this Business Case. It is important to note that LEA investment is a reallocation of current funds, which is less than their current expenditures on data systems. This approach minimizes risk, improves the ability of the organization to adapt to change, and provides the ongoing measurement of success and confidence in ADE’s execution and LEA adoption.

Chart 4 – Arizona Education Learning and Accountability System Cumulative Financial Investment and Benefit (\$ in millions)

Fiscal Year	2014	2015	2016	2017	2018	TOTAL
Cumulative Local Education Agency Investment	4.9	16.0	33.1	56.4	87.8	\$87.8
Cumulative Arizona Department of Education Investment	23.1	34.5	53.1	60.1	69.7	\$69.7
Total Cumulative Investment	28.0	50.5	86.2	116.5	157.5	\$157.5
Total Cumulative Benefit	–	\$45.0	\$133.9	\$222.8	\$334.0	\$334.0
Net Benefit	\$(28.0)	\$(5.5)	\$47.7	\$106.3	\$176.5	\$176.5

Effective measures are critical to ensure the benefits being sought are achieved and will report against the value proposition that justifies the investment. In the past year, the ADE has begun to employ the discipline of industry best practices and enabling frameworks required to improve data quality. The ADE will continue to identify the necessary metrics to measure and monitor benefits in anticipation of further justifying and providing auditability of success for the financial investment.

1.6 Conclusion

The time is now to unite Arizonans on the common mission of AELAS. The stakes are too high to allow business as usual to continue. It is insufficient to acknowledge the issues and allow them to go unchecked. AELAS—an integrated Learning and Accountability data system—is the opportunity for transformative change from cultural, process and technological perspectives across all Arizona LEAs.

Since 2011, the ADE has been building the early foundations for transformative change by initiating cultural, process and technological improvements through past and current projects such as the Student Accountability Information System stabilization; Student-Teacher-Course Connection; and Instructional Improvement System, to name a few.

Chart 5 – Arizona Education Learning and Accountability System Project Improvements and Benefits

Arizona Department of Education Project	Description
Student Accountability Information System Stabilization	Replaced obsolete hardware without interruptions and enabled system availability 99.75%, increasing process efficiencies for local education agencies and the credibility of the Arizona Department of Education
Student-Teacher-Course Connection	Ensures accurate linkage of student performance data to specific classrooms, teachers, schools and districts
Instructional Improvement System	Integrated software systems that will provide portals for students, teachers, parents and local education agency administrators to access data and resources to inform decision-making related to instruction, assessment, and career and college goals. Will also provide instructional support for the implementation of Arizona’s Common Core Standards, teacher and principal evaluation, and preparation for the Partnership for Assessment of Readiness for College and Careers.

With this investment, the ADE will finish laying the foundation for AELAS by completely rebuilding its entire application portfolio and infrastructure; all LEAs will receive a complete family of advanced software systems that will integrate data across the state, provide new classroom education delivery capabilities and, finally, lead the state toward data-driven decision-making that relies on accurate and timely information. More importantly, these recommendations and their investment will position the state of Arizona to truly prepare students for future careers and leadership roles.

2.0 Problem Statement

2.1 Dilemma

Some of the fundamental problems facing Arizona and its current state of education involve data—one of the most valuable assets recognized as a change agent. Arizona’s education data is of poor quality, misused, and inaccessible. Software systems, which serve as containers to the data, exacerbate the problem because the systems are costly to Local Education Agencies (LEAs), and are disparate and non-interoperable. Another problem is that the culture has come to reflect isolated and reactive behaviors. Intertwined with this dilemma are issues from cultural, process and technological perspectives across the ecosystem of Arizona education.

2.1.1 Arizona Department of Education

The Arizona Department of Education (ADE) has a history of reacting to immediate needs without planning for future needs and long-term success. For various reasons—from the lack of stakeholder involvement to immature business practices to insufficient funding and tight time constraints—ADE program areas have developed or acquired a sizeable portfolio of disparate systems over the past decade. These disparate systems are in need of upgrades and, in many cases, are currently unable to efficiently provide the necessary capabilities to LEAs. The Information Technology (IT) program is responsible for maintaining these stand-alone program applications.

ADE’s immature business practices, in regards to data management and governance, have led to no ‘single source of truth’ for data quality and accuracy. The collection of systems and applications/utilities, now reaching more than 150, is outdated and exists on non-supported technologies resembling the early 1990’s IT environment. The collection is maintained as minimal stopgaps for legislation compliance. These un-integrated systems cause the excessive reliance on manual labor, costing the ADE 568,000 man-hours annually. Opportunity costs, as a lost benefit, are the foregone services provided to support LEAs.

To further emphasize the lack of quality, many of these systems were identified by the Arizona Auditor General in 2006 as being a significant security risk in terms of vulnerability. A 2011 study of ADE’s IT indicated the School Finance system, known as the Student Accountability Information System (SAIS), was not capable of handling either the amount of data or the complexity of the business rules required by state and federal legislation.

The ADE is perceived by LEAs primarily as a fiduciary agent rather than an agency that provides core competencies through vision, leadership and services to Arizona’s education community. Unless the ADE becomes a cooperative partner with LEAs in the joint responsibility of improving the quality of education in Arizona, the biggest losers will continue to be the students and the economy of the state of Arizona.

2.1.2 Local Education Agencies

Over the years, the problems described at the state level have had downstream implications on LEAs, resulting in dependence on their local expertise and the vendor community rather than turning to the ADE for guidance and service. Specifically, data errors at the ADE leave LEAs managing and reconciling data instead of focusing on educational responsibilities. This comes at a cost to the LEAs estimated at \$12.5 million annually. Moreover, the smaller LEAs have limited staff and lack essential capabilities to effectively manage and support the business of education, leaving personnel to focus on manually mapping bus routes, using Microsoft Excel spreadsheets to analyze test scores, and utilizing paper and pencil to track the professional development of teachers and principals. Having limited staff, this manual work drains those limited resources even further.

Another issue LEAs encounter is with the delay of receiving important data such as student performance and achievement results when transferring within LEAs and the ADE. It is estimated the delay of transferring the student data accounts for three to five weeks of lost, valuable instruction time. LEAs are left with retesting students and manually manipulating the data to obtain meaningful results. LEAs must have their results accessible in a timely and immediate fashion if they are to use them to improve outcomes.

LEAs turn to a vast and fragmented market of education vendors to provide services and systems targeted for teaching and learning, administrative and back office capabilities. These systems are essential to manage back office and administrative responsibilities, as well as enable teachers to effectively instruct and prepare students with 21st-century skills in order to be competitive in today's global economy. However, the independent implementations of these systems make them costly, disparate and non-interoperable. Vendors typically change these systems every few years to newer technologies, causing a high risk of LEAs losing valuable data, assets, and intellectual property. LEAs haven't had the opportunity or options to procure software systems with robust compliance to industry standards of interoperability and integration.

LEAs struggle to procure data management systems with comprehensive data integration and interoperability that enable education stakeholders to make decisions that lead to improved teacher and student performance. For example, one of the biggest issues facing LEAs is student mobility and the immediacy of accessing student records to provide the necessary services from the day the student arrives.

The challenge that confronts the ADE is how it corrects the multitude of data issues it has while simultaneously improving its education systems and programs that is costing the organization and taxpayers millions of dollars, in the face of budget cuts and economic uncertainty.

In summation, the breadth and depth of the problems facing the ADE is extensive and critical because they encompass not only the systems on which LEAs are reliant—the applications used internally by personnel at the ADE—but the interaction and exchange of data and information between LEAs and the ADE. The problem even extends to the way the ADE conducts its business including, but not limited to, providing guidance and support for statewide education programs.

2.1.3 Background

This situation is further complicated and exacerbated by the following challenges:

- Unfavorable business and economic conditions across the state and nationwide
- Increased global competition for educated resources
- Recent reductions in state aid to education
- Implementation of new, rigorous Common Core State Standards and assessments further overloading teachers, administrators and LEA staff
- Ever-changing legislative landscape imposing additional mandates
- Complex landscape of LEAs in a 'local control' state of various sizes totaling 619
- The superintendent of public instruction is an elected position with a four-year term, so it is possible that the ADE may undergo changes in its strategic direction whenever a new official is selected
- Very mobile student/parent population moving from LEA to LEA (estimated at more than 10 percent of students annually)
- Diversity of student population and families across the state
- LEA reluctance and distrust to share data with the ADE due to perceived consequences

2.1.4 Consequences

The most notable consequences of these issues manifest in national and state research studies and investigations, and lead to sensationalized headline stories further drawing negative attention to the current state of education in Arizona:

- “Ghost students’ cost Arizona taxpayers \$125 million each school year”
- “Arizona drops in overall education rankings...”
- “Former Intel CEO blasts education in Arizona”

Inefficiencies in the state’s Student Information System (i.e. SAIS) and outdated school finance policies led the Goldwater Institute to conduct an investigation that found in the 2009–2010 school year, Arizona overpaid LEAs \$125 million on approximately 13,500 students in districts with declining enrollments. Jonathan Butcher, education director for the Goldwater Institute, recommends when migrating from the current statewide Student Information System to the future system, the ADE should adopt current-year student funding. Overall, it has been posed to the Arizona legislature to adjust school funding structure from last-year enrollment to current-year enrollment.

Quality Counts is *Education Week’s* annual report on the state-level efforts to improve public education, and is published each January. The 2012 report, *The Global Challenge*, looks at America’s international standing in education, and lessons to be learned from high-performing countries.

The research study measured assessments and standards to school finance and a student’s chance of success. News outlets picked up the research and headlines read, “Arizona drops in overall education rankings, but ‘achievement’ on rise.” That research ranked Arizona in the bottom 20 percent of all states including Washington, D.C., and gave Arizona an overall grade of ‘C-.’ A key finding is the increased use of international comparisons by states for assessment and accountability systems.

In 2011, Craig Barrett, former Intel CEO and board chairman, made remarks to the Arizona Commerce Authority claiming Arizona’s education system is hindering economic-development efforts. ‘Barrett’s comments were echoed by several Authority board members, all of whom are executives of leading Arizona businesses. Judy Wood, president of Contact One Call Center Inc., further commented, “Arizona students are lacking the basic skills needed for entry-level positions.”

2.2 Management Question

The management question confronting the ADE is how to efficiently and effectively design, build and deploy the Arizona Education Learning and Accountability System, otherwise known as 'AELAS' and as mandated by A.R.S. § 15-249. Central to the research study is seeking answers to resolve the issues described wherein and changing perceptions of Arizona education.

This Business Case proposes a strategic plan and roadmap to direct the ADE to design, build and deploy a Learning and Accountability system to maintain accountability and longitudinal information, and student-level data including student demographic, grade level, assessment, teacher assignment, and other data required to meet state and federal reporting requirements through commonly used Internet browsers. The importance of the project is underscored by the creation of the Data Governance Commission for the express purpose of providing system oversight and guidance. The Case outlines the research approach, findings, recommendations and financial justification to enable Arizonans to envision and fulfill AELAS' mission. If deployed thoughtfully and with the current dilemmas in mind, AELAS can be the connection between the ADE and LEAs that leads to the whole being greater than the sum of its parts, making the students and the state of Arizona the big winners.

3.0 Landscape Review

3.1 A Culture of Evidence

The next generation of Learning and Accountability systems is being ushered in, altering the landscape of education reform by federal, state and local initiatives and legislation. Local Education Agencies (LEAs), educational vendors, and organizations are encouraged to share, collaborate and innovate on comprehensive solutions to deliver new instruction and accountability measures, such as the initiatives of the Race to the Top program, Common Core State Standards, Smarter Balanced Assessment Consortium, and Partnership for Assessment of Readiness for College and Careers.

The challenge of creating a Learning and Accountability system is not new. What is new are the ever-constant, ever-changing regulatory and industry standards, and emerging educational trends and technologies—all while attempting to transition from the existing to the future environment. The purpose of this research study was to gain a very clear and complete picture of the existing environment and supporting the need for a new Learning and Accountability system from a federal, state and local perspective, including the education industry.

The research team consisted of former educators, industry experts, and Information Technology (IT) professionals such as enterprise architects and business analysts. They gave special consideration to the type, breadth and quantity of information required for a Learning and Accountability system, covering Arizona's nearly 1.2 million students, 60,000 educators, 2,000 LEAs distributed over at least 5,000 disparate systems, as well as thousands of spreadsheets of data going back as far as 10 years and 'simply' attempted to create a clear and complete picture. Although the researchers investigated national and industry-wide initiatives and legislation, the two main subjects of the research study were Arizona's LEA stakeholders including teachers, administrators, students and parents, and Arizona Department of Education (ADE) program areas, which provide direction, guidance and services to the LEAs.

Researchers investigated Arizona Education Learning and Accountability System's (AELAS) mission (i.e., to build the Learning and Accountability system) from the following perspectives:

- U.S. Department of Education (federal) initiatives and legislation
 - Education-industry vendor products and services
 - State Education Agency initiatives and legislation Arizona Department of Education
 - Arizona Department of Administration
 - Other state education agencies
- Local Education Agency initiatives and legislation

3.2 Research Objectives

The research was kicked off with a series of initial investigative questions outlined in Chart 6. As the investigation continued, it drilled down into the answers, and ultimately more questions. The result of this body of research will be reported in the School Data Analysis Detail Report (Appendix C) and Recommendations section.

Chart 6 – Research Objectives by Agency Type or Entity

Agency Type/Entity	Investigative Question
U.S. Department of Education – Federal Level (F)	(F1) How does the federal government, industry, or other entities define a Learning and Accountability system? (F2) What federal initiatives, legislation, or innovations contribute to building a Learning and Accountability system? (F3) Are there nationally recognized standards that should be considered when building a Learning and Accountability system?
Education-Industry Vendors (E)	(E1) Are the current vendor software systems compatible with the recognized standards and specifications? (E2) Does the education industry offer a comprehensive, integrated system the Arizona Department of Education can procure for the Learning and Accountability system? (E3) Is the data residing locally in the vendor software systems critical for inclusion in the Learning and Accountability system?
Other State Education Agencies (S)	(S1) Which states have implemented a Learning and Accountability system and how did the states accomplish this initiative? (S2) How much have other states been awarded from federal programs and initiatives? (S3) What can the Arizona Department of Education learn from other state initiatives and programs?
Arizona Department of Education (A)	(A1) Which Arizona legislative mandates or programs are driving the mission to build and implement the statewide Learning and Accountability system, and what are the objectives and benefits of these legislative mandates and programs? (A2) Which Arizona Department of Education data is required to support the Learning and Accountability system? (A3) How does the Arizona Department of Education currently treat data and what are the current processes and procedures for data management? (A4) Does the Arizona Department of Education have the Information Technology infrastructure to support the new Learning and Accountability system?
Local Education Agencies (L)	(L1) What is the cost of the vendor software systems at the local level? (L2) Which are the top vendor software systems procured by LEAs? (L3) What are the priority capabilities and critical data of those vendor software systems at the local level?

3.3 Research Design

There were a number of approaches used in conducting the actual research. See Charts 7 through 10 for the research design methods per each type of agency or entity. Generally speaking, a significant amount of data and information was collected by conducting interviews and researching available documentation. But a number of other newer, innovative research methods and frameworks were leveraged for this Business Case as well. The Benefits Dependency Network model, which is one part of the Benefits Management approach, was used to interpret the drivers of organizational change at the ADE. There were two frameworks used to properly gather, structure and analyze the data, which are the Information Technology Infrastructure Library and The Open Group Architecture Framework. Methodologies within these frameworks were only employed where they were most appropriate and useful. A third methodology used was a non-probability sampling utilizing purposive and convenience techniques to collect information from LEAs.

Chart 7 – Research Design Methods: U.S. Department of Education (Federal Level) and Education-Industry Vendors

Research Design Methods	Approach and Execution
Documentation Reviews	The business analyst team thoroughly reviewed documentation regarding federal initiatives and legislation on the www.ed.gov website and through other sources.
Request for Information and Request for Proposals	The business analyst team released one Request for Information and two Request for Proposals and analyzed proposals from the education-industry vendors.
Documentation Reviews	The business analyst team thoroughly reviewed documentation regarding vendor products and services on respective websites and through other sources such as Gartner, Inc.
Product Demonstrations	The business analyst team invited education-industry vendors to conduct product demonstrations.

Chart 8 – Research Design Methods: State Education Agencies

Research Design Methods	Approach and Execution
Documentation Reviews	The business analyst team thoroughly reviewed documentation on respective websites and through other sources. Several Request for Proposal documents were analyzed from other state education agencies.
Site Visits	The Arizona Department of Education Information Technology executive team visited another state education agency to understand progress on their longitudinal data system.
Interviews	The enterprise architecture team interviewed other state education agency personnel.

Chart 9 – Research Design Methods: Arizona Department of Education

Research Design Methods	Approach and Execution
Benefits Dependency Analysis	The business analyst team analyzed Arizona legislation and programs to define quantifiable benefits and values.
Data Error Analysis	The enterprise architecture team conducted a study on the quantity of errors that occurred over a period of time and within the Student Accountability Information System workflow. This error analysis identified the frequency of errors for incoming student records that result in their rejection and the error causes profile.
Performance Analysis	The enterprise architecture team conducted a study on the effectiveness of system functional modules, which are small applications; usually Microsoft Excel spreadsheets or Microsoft Access database forms that are used to automate some manual activities.
Workflow Process Mapping	The enterprise architecture team produced workflow process maps of numerous program areas in order to completely understand exactly how application needs are articulated, designed, built, deployed and supported. See the Information Technology Infrastructure Library description in section 3.4.
Reverse Engineering of Application Code	The enterprise architecture team reviewed every individual programming code block, documented each and every module, spreadsheet, Access database utilized, and processes.
Enterprise Architectural Review	The enterprise architecture team investigated the business, solutions, knowledge and information, and infrastructure architecture across Arizona Department of Education program areas. See The Open Group Architecture Framework description in section 3.4.
Data Infrastructure Review	The enterprise architecture team conducted a detailed analysis of the data assets within the Arizona Department of Education, examining volume, size and types of transactions, high-level data flows, database structures, access to databases, and storage policies.
Interviews	The enterprise architecture team interviewed Arizona Department of Education personnel on numerous projects, program areas, issues, and ongoing business as usual activities.
Documentation Reviews	The business analyst and enterprise architecture teams thoroughly reviewed documentation written to date by Arizona Department of Education program areas.
Root Cause Analysis (Ishikawa)	The enterprise architecture team conducted root cause analysis using an Ishikawa diagram process. See Appendix P.
Physical Inspection	The enterprise architecture team conducted a physical inspection of the Arizona Department of Education computer technology systems' architectural infrastructure housed within the Arizona Department of Administration data center to assess its current environmental setting and capacity, and to identify any potential risks as well as gauge its potential for expansion to handle future growth.

Chart 10 – Research Design Methods: Local Education Agencies

Research Design Methods	Approach and Execution
Online Survey	The business analyst team developed and conducted an online survey to understand the vendor product usage, cost, and implementation practices.
Business Requirements Documentation	The business analyst team conducted face-to-face and phone interviews to elicit, collect, prioritize and document high-level business requirements for software systems.
Site Visits	The business analyst and enterprise architecture teams conducted face-to-face site visits.
Focus Groups	The business analyst team conducted virtual online focus groups using survey and questionnaire methods to gather information.
Phone Surveys	The business analyst team conducted phone surveys to collect hardware and manual-labor costs.
Product Demonstrations	The business analyst team sought product demonstrations from LEAs to understand unique local implementation approaches.

3.4 Detailed Research Methods

Further explanation and description is provided below on the Information Technology Infrastructure Library (ITIL), The Open Group Architecture Framework (TOGAF), and the Benefits Dependency Network (BDN) methods since some of the research designs and methods are fairly new to the application of the education industry; however, these industry standards and frameworks are not new to software development.

3.4.1 Information Technology Infrastructure Library

The approach taken for ADE research was a ‘Service Portfolio Management’ approach for all services, both core and advanced. This was done in order to:

- effectively manage information delivery
- provide a stable core services infrastructure
- provide the capability to expand to advanced services
- be able to make strategic cost-effective decisions of what advanced services are needed and what core services changes are needed to support these needs

The overall roadmap for this maturation is the application of Carnegie Mellon’s Capability Maturity Model Integration (CMMI), applying the IT Service Management framework of ITIL. See Appendix A for more details and illustrations. ITIL relates to the degree of formality and optimization of processes from ad hoc practices to formally defined steps, to managed result metrics, to active ongoing optimization of the efficiency and effectiveness of the processes.

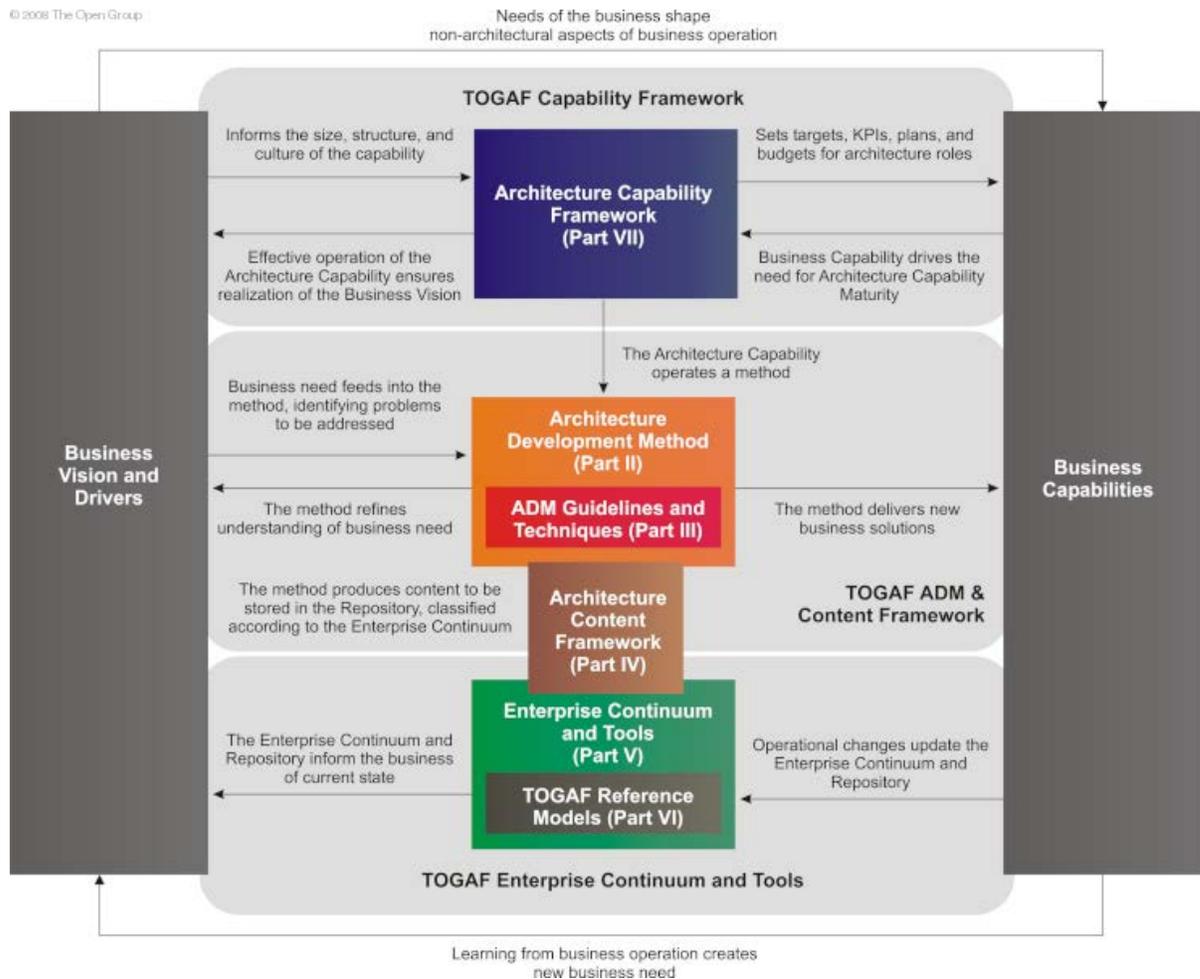
The remedial method taken to define and address the legislative mandates or customer demands is founded on the diligent and methodical application of two key processes within the service strategy segment of ITIL. It is essential to ensure and demonstrate sound investigation and research to identify and meet the needs being addressed and support the recommendations made within this Business Case. The two ITIL processes are those of Demand Management and Service Portfolio Management. See the Demand Management section and Service Portfolio Management section for a full description of these concepts.

Demand Management is an IT governance process that enables IT and the business to optimize the investment in IT through fact-based decisions. Producing deliverable solutions to meet the needed capabilities identified by Demand Management requires the execution of the second most critical ITIL process, Service Portfolio Management.

3.4.2 The Open Group Architecture Framework

TOGAF reflects the structure and content of an architecture capability within an enterprise as well as the process of applying it to the ADE. The documentation associated with the framework guides enterprise practitioners toward creating and implementing a pathway to achieve the business vision and goals. See Figure 2, which illustrates the pathway.

Figure 2 – The Open Group Architecture Framework Capability Framework



The application of this structured framework reflects and supports ADE’s commitment to improve its overall maturity of capabilities with clear and precise supporting frameworks. Under AELAS’ Business Case research, an enterprise architecture team was formed that conducted the analysis presented in the research method in order to produce the recommendations based on sound architectural principles.

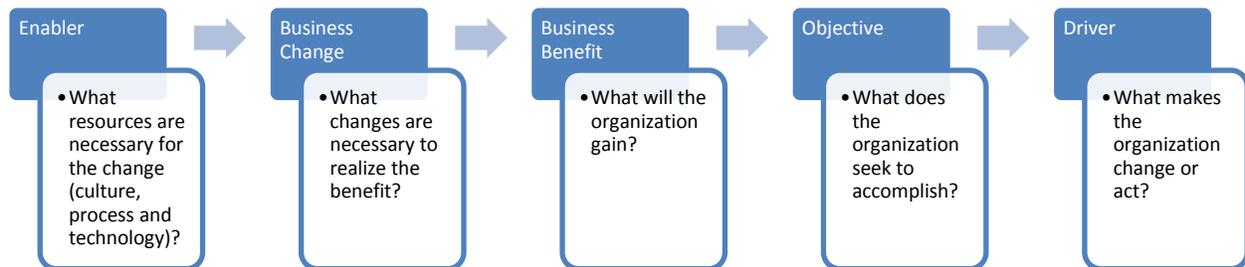
3.4.3 Benefits Dependency Network

Simply stated, the BDN is a model, usually created on a single page that links IT projects to the business activities that are being changed and the reasons behind those changes. The BDN aligns the key drivers for organizational change to objectives, benefits and changes required to realize the benefits. The linked elements are logically related and form a thread that tells the story of how IT enablers will drive or require changes by the business in order to realize associated, measurable business benefits and achieve objectives as defined by the driver.

Therefore, it was only logical to conduct a study of legislation, grant applications, and other key documents in order to determine those actually relevant to AELAS, which were then recorded in the BDN model. The model, while very complex, was constructed from right to left, as the BDN methodology requires. See Figure 3 for the flow from a driver to an enabler. Studying the legislation in detail revealed the objectives and the business benefits that are expected to be achieved. The two columns to the left of

the ‘business benefits’ column completed the model by identifying the IT enablers, and business and changes. Each ‘box’ was only linked to other boxes to which they were directly related.

Figure 3 – Flow of Organization Change to Information Technology Enabler



3.4.4 Purposive Sampling

The variety of approaches, from an online survey to site visits, provided adequate coverage and fair representation of the following aspects for the exercise in collecting LEA product usage and IT implementation and support cost data. The purposive sampling method was employed in a deliberate effort to collect accurate and complete product information and cost data from LEAs with a fair and reasonable level of coverage and, thus, reduce the likelihood that LEAs unable to participate in the study would still have representation by the fact that others with similar characteristics were included:

- LEAs for each geographic area coverage (i.e., urban/city, suburban, town, rural) represented
- LEAs for each size category (i.e., six size categories from very small to very large), with between 15 and 20 percent represented
- LEAs with proportional student demographic representation
- LEAs from each of the 15 counties represented
- All types of education institutions were represented including public school districts and charter associations and schools, joint technical and education districts, career and technical education schools, accommodation districts, corrections, regional education centers, as well as the county offices of education.

Other coverage considerations included:

- Education professionals at the LEAs should include, at a minimum, superintendents, district personnel, principals, and chief information officers
- All five regional education centers should be represented

3.4.5 Coverage of Arizona Local Education Agencies

In all, 187 LEAs participated in ADE outreach campaigns, which represented approximately 30 percent of all of them and 56 percent of all students statewide. While the majority of participants came from the small and very small categories, which make up the largest portion of the 619 LEAs, larger Leas actively participated—with the average larger LEA participating in two or more of the outreach campaigns.

Site visits by research team members were viewed very positively by most of the LEAs that participated. Attendees expressed their appreciation that the ADE came out to listen to their input. Small LEAs said

that their input often wasn't considered in the past, but that decisions made at the ADE affected them greatly. The most common problem regarding current systems had to do with Student Accountability Information System data redundancy, low accuracy, and the level of effort required to cleanse the data. High-level system capabilities previously collected and documented were reviewed at this time to ensure their completeness and priority levels for LEAs not previously involved in the requirements-gathering activity. The capabilities validated were for Teaching and Learning systems, as well as Administrative systems. Back Office systems were not reviewed due to the fact that most LEAs rely on one dominant vendor product. See Appendix C for a full report on the LEA research and data analysis.

Chart 11 provides a detailed breakdown of LEA coverage in the outreach program per size category and geographic area type.

Chart 11 – Local Education Agencies Outreach Coverage

LEA and Student Populations	Geographic Area Coverage				Total Number of Districts
	Urban/City	Suburban	Town	Rural	
Very Large (≥ 20,000)	4 Public School Districts	1 Public School District		1 Public School District	6 of 11
Large (8,000–9,999)	4 Public School Districts	2 Public School Districts		3 Public School Districts	9 of 20
Medium-Large (2,000–7,999)	9 LEAS (4 Districts & 5 Charters)	5 LEAS (4 Districts & 1 Charter)	14 Public School Districts	18 Public School Districts	46 of 58
Medium (600–1,999)	2 Public School Districts		5 Public School Districts	6 Public School Districts	13 of 88
Small (200-599)	21 LEAs	5 Charter School Districts	1 Public School District	21 LEAs (16 Districts & 5 Charters)	48 of 197
Very Small (≤ 199)	14 LEAs (5 Districts & 9 Charters)	6 Charter School Districts	6 LEAs (4 Districts & 2 Charters)	22 LEAs (15 District & 7 Charters)	48 of 245

LEGEND: No school participation in this geographic area. No school representation in this geographic area.

4.0 Data Findings

The preceding section described the key investigative questions that needed to be answered during this research project. It also described the geographic area types where the research was conducted and what methodologies were employed. This section presents pertinent and vital findings organized by the following subsections as also outlined in the Landscape Review section:

- U.S. Department of Education (federal) initiatives and legislation
 - Education-industry products and services
 - State Education Agency initiatives and legislation Arizona Department of Education
 - Arizona Department of Administration
 - Other state education agencies
- Local Education Agencies initiatives and legislation

4.1 U.S. Department of Education (Federal Level) Findings

The researchers sought to answer investigative questions by defining the Learning and Accountability system based on federal initiatives, legislation, and nationally recognized technology and data standards and specifications. The questions are listed below.

(F1) How does the federal government, industry, or other entities define a Learning and Accountability system?

(F2) What federal initiatives, legislation, or innovations contribute to building a Learning and Accountability system?

(F3) Are there nationally recognized standards that should be considered when building a Learning and Accountability system?

The researchers began by defining the components of a system: one that supports responsibility based on evidence, facilitates professional learning opportunities, and provides actionable feedback to the educator. First, the system must define the context of accountability. Second, the system must be built upon aligned components—objectives, assessments, instruction, resources and rewards or sanctions. Third, the technical aspects of the system must meet high independent standards. Fourth, the system must provide the catalyst for positive change.

Chart 12 aligns federal initiatives to nationally recognized technology standards and specifications that are applicable to building a Learning and Accountability system. The description notes the benefit to the end user such as teachers, administrators, and other education stakeholders.

Chart 12 – U.S. Department of Education (Federal Level) Initiatives and National Standards

Initiative	Technology Standards	Description and Benefit
Race to the Top – Instruction Improvement System	Learning Registry Learning Tools Interoperability	Learning Registry is a new approach to capturing, sharing and analyzing learning resource data to broaden the usefulness of digital content, which benefits educators and learners. Learning Tools Interoperability is a standard for integrating robust learning applications with platforms like Learning Management systems, portals or other educational tools.
Common Core State Standards	Common Education Data Standards	Common Education Data Standards is a specified set of the most commonly used education data elements for federal reporting and to support the effective exchange of data within and across states, as students transition between educational sectors and levels.
Partnership for Assessment of Readiness for College and Careers Smarter Balanced Assessment Consortium	School Interoperability Framework Accessible Portable Item Protocol	School Interoperability Framework is a data-sharing source code for academic institutions K–12. Accessible Portable Item Protocol standard provides assessment programs and question item developers with a data model for standardizing the interchange file format for digital test items.
Statewide Longitudinal Data System	Education Data Fidelity	The Education Data Fidelity solution is an XML-based set of tools, which creates a comprehensive longitudinal superset of student data access and dashboards across LEAs and states.

Other technology standards and specifications were evaluated and should be considered for state adoption for the purpose of providing a seamless, integrated experience to the end user of the Learning and Accountability system. See Chart 13, which illustrates that essential data resides in many separate, disparate systems, requiring standardized data exchange formats.

Chart 13 – National Technology Standards and Specifications

Technology Standards and Specifications	Description and Benefit
Application Programming Interface	A specification intended to be used as an interface by software components to communicate with each other
Extract, Transfer, Load	A process for database usage: extract data from outside source; transform data to meet operational needs; and load data to the operational database or other end user
Enterprise Service Bus	A software architecture model used for designing and implementing the interaction and communication between mutually interacting software applications in service-oriented architecture
Single Sign-On	A process where a user would only need to log in one time but would have access to all the systems to which they have been granted permission
Sharable Content Object Reference Model	A collection of specifications and standards defining how content can be packaged and transferred from a customer site to host site

4.2 Education-Industry Vendor Product Findings

As a result of identifying the technology standards and specifications necessary for the Learning and Accountability system, vendor software systems were evaluated for compliance or inclusion of these standards when applicable. The researchers released one Request for Information and two Requests for Proposals for evaluation and procurement purposes. Chart 14 summarizes the results for the most applicable standards and specifications (i.e., Common Education Data Standards and Single Sign-On). It is noted that education vendors have a lot of work to do to acknowledge and comply with these national standards and specifications.

(E1) Are the current vendor software systems compatible with the recognized standards and specifications?

Chart 14 – National Technology Standards and Specifications

Request for Information or Request for Proposal	Number of Respondents	Number of Respondents that Met Requirement	Percentage of Respondents that Met Requirement
Assessment System Request for Information	5	–	–
Common Education Data Standards	–	0	–
Single Sign-On	–	0	–
Educator Evaluation System Request for Proposal	8	–	–
Common Education Data Standards	–	4	50%
Common Education Data Standards	–	4	50%
Assessment System Request for Proposal	5	–	–
Common Education Data Standards	–	2	40%
Single Sign-On	–	2	40%

Overall, the research team evaluated the education industry and, specifically, those vendors that offer software systems to school districts across the nation. Since software systems provide certain capabilities to the end user, the researchers divided the software systems into the three categories defined below:

Teaching and Learning Systems are those targeted to directly support and improve instruction, student learning and assessment of learning, and teacher effectiveness. The types of capabilities include content creation, management, delivery and reporting. Content can be instructional resources, lesson plans, questions and tests. Software systems in this category include, but are not limited to, Assessment systems, Content Management systems, and Learning Management systems.

Administrative Systems support the management of information across the Local Education Agencies (LEAs). These systems manage data including student demographics, attendance, behavior and grades. Software systems in this category include, but are not limited to, Student Information Systems, Special Education systems, and Grade Book systems.

Back Office Systems manage the financial, human resource, grants, and procurement needs of LEAs. The types of capabilities include managing staff, payroll and budget. Software systems in this category include, but are not limited to, Finance Management systems, Human Resource Management systems, and Substitute Management systems.

(E2) Does the education industry offer a comprehensive, integrated system the Arizona Department of Education (ADE) can procure for the Learning and Accountability system?

(E3) Is the data residing locally in the vendor software systems critical for inclusion in the Learning and Accountability system?

Figure 4 summarizes the research results of 63 education-software-system vendors on the market. It should be noted that not one single vendor provides all the necessary software systems, capabilities—and especially—data required for a comprehensive Learning and Accountability system. The essential data is spread across all three categories, dozens of systems, and hundreds of vendors. Of the 63

vendors assessed, nearly 17 vendors each offered an assessment system with basically the same capabilities and functionality. Not every education vendor was included in the research study given the vast and fragmented nature of the education industry and the limited time frame of the study.

Figure 4 – Vendor Product Offerings by Category



In 2012, Gartner, Inc. concluded a study entitled *Closing the Gap: Turning SIS/LMS Data into Action*. The Bill & Melinda Gates Foundation funded the effort with an underlying premise of the study that by capturing and analyzing the data housed in Student Information Systems and Learning Management systems, the education community can positively impact classroom practice, and ultimately student learning. The key findings of this study directly correlate to the research in this Business Case and have relevance to the mission of building a learning and accountability system.

- Data governance is a critical success factor.
- Data has become the currency through which LEAs secure public support, including funding.
- Educators should make decisions based on information rather than intuition and tradition; however, training for teachers to learn how to gather or use information available in these systems should not be overlooked.
- Capturing, analyzing and using data can positively impact classroom instructional practice, and ultimately student learning, when a Student Information System is implemented with a Learning Management system.
- Careful consideration should be given when making decisions about the configuration settings and should include appropriate stakeholders.

4.3 State Education Agency Findings

Research was extended to and conducted outside the state of Arizona. The objective was to answer the following investigative questions.

(S1) What states have implemented a Learning and Accountability system and how did the states accomplish this initiative?

(S2) How much have other states been awarded from federal programs and initiatives?

(S3) What can the Arizona Department of Education learn from other state initiatives and programs?

It should be noted that there was no additional information provided by the other states that covered systems and products in use by their respective school districts such as usage, data, cost and implementation. However, as noted earlier, an extensive study was conducted on these parameters for the LEAs of Arizona. See the Local Education Agency Findings section.

While, by and large, the external statewide initiatives research began with the National Center for Education Statistics (NCES), there were a few leads or basis for review of other State Education Agencies (SEAs), which included seven states total: Florida, Georgia, Kentucky, Massachusetts, North Carolina, Ohio and Tennessee. The process that was generally followed was to use the research tools available on the NCES website to identify states that had been awarded grants for statewide data systems; read and study the grant documentation in order to confirm which states had projects similar to Arizona Education Learning and Accountability System (AELAS); and then reach out to the respective project managers to see what could be gleaned from their experiences that they were willing to share, such as data models, lessons learned, and other pertinent information.

4.3.1 Comparison of Arizona to Other State Education Agencies

Immediately, it was discovered that Arizona is not alone in this mission to develop a statewide Learning and Accountability system, although other SEAs name the system respective to their state. Most SEAs are pursuing a version of a Learning and Accountability system; however, no single SEA has all the answers, nor has any SEA deployed a comprehensive statewide Learning and Accountability system to date. While developing Arizona's requirements for an instructional improvement system, the ADE has drawn upon the work previously done in Florida, Massachusetts, North Carolina and Ohio. These states are among a national consortium of states that make up the Race to the Top IIS Consortium (Delaware, District of Columbia, Georgia, Hawaii, Illinois, Kentucky, Maryland, Massachusetts, New York, North Carolina, Ohio, Pennsylvania, and Rhode Island).

To place Arizona in context with other SEAs, Chart 15 provides the awarded funding streams to date that may contribute to building a statewide Learning and Accountability system. It should be noted that the funding streams Arizona was awarded do not directly contribute to the statewide system known as the AELAS. The funding streams do, however, contribute to the rollout of the Arizona Common Core Standards and the establishment of regional centers to support LEAs. In addition, the Statewide Longitudinal Data System (SLDS) funding is for historical reporting purposes.

Chart 15 – State Education Agency Funding Analysis (\$ in millions)

State	Awarded Funding Streams (\$ in millions)	Deliverables
Arizona	<ul style="list-style-type: none"> Race to the Top Phase III – \$25.0 Statewide Longitudinal Data System: (2007) – \$6.0 (2012) – \$7.0 	<ul style="list-style-type: none"> Regional Centers to support Arizona Common Core Standard Implementation Statewide Longitudinal Data System pilot dashboards Business Case to define the recommendations for the Arizona Education Learning and Accountability System
Florida	<ul style="list-style-type: none"> Race to the Top Phase II – \$700 Statewide Longitudinal Data System: (2005) – \$1.5 (2009) – \$2.5 (2010) – \$10.0 	<ul style="list-style-type: none"> Published minimum standards for a Local Instructional Improvement system 1/31/11 (in partnership with the Ohio Department of Education, the Gates Foundation, and CELT) Established 6/30/14 deadline for all LEAs to implement the Local Instructional Improvement System Created local systems exchange online network for LEAs to share ideas on meeting Local Instructional Improvement System deadline
Georgia	<ul style="list-style-type: none"> Race to the Top Phase II – \$400 Statewide Longitudinal Data System: (2009) – \$9.0 	<ul style="list-style-type: none"> Statewide Longitudinal Data System solutions with integration to Student Information Systems and identity management Educator Evaluation System
Kentucky	<ul style="list-style-type: none"> Race to the Top Phase III – \$17.0 Statewide Longitudinal Data System: (2005) – \$5.8 (2009) – \$2.9 (2010) – \$3.6 	<ul style="list-style-type: none"> Instructional Improvement System Request for Proposal with LEA Interoperability Framework Student Information System-based interoperability solution
Massachusetts	<ul style="list-style-type: none"> Race to the Top Phase II – \$250 Statewide Longitudinal Data System: (2005) – \$5.7 (2009) – \$13.0 (2010) – \$19.0 	<ul style="list-style-type: none"> Instructional Improvement System Request for Proposal (i.e., Assessment, Professional Development, Data Management, and Educator Evaluation)
North Carolina	<ul style="list-style-type: none"> Race to the Top Phase II – \$400 Statewide Longitudinal Data System: (2007) – \$6.0 (2012) – \$3.6 	<ul style="list-style-type: none"> Instructional Improvement System Request for Proposal (i.e., Assessment, Professional Development, Data Management, and Educator Evaluation) currently in selection process Plan to implement for 2013–2014 school year

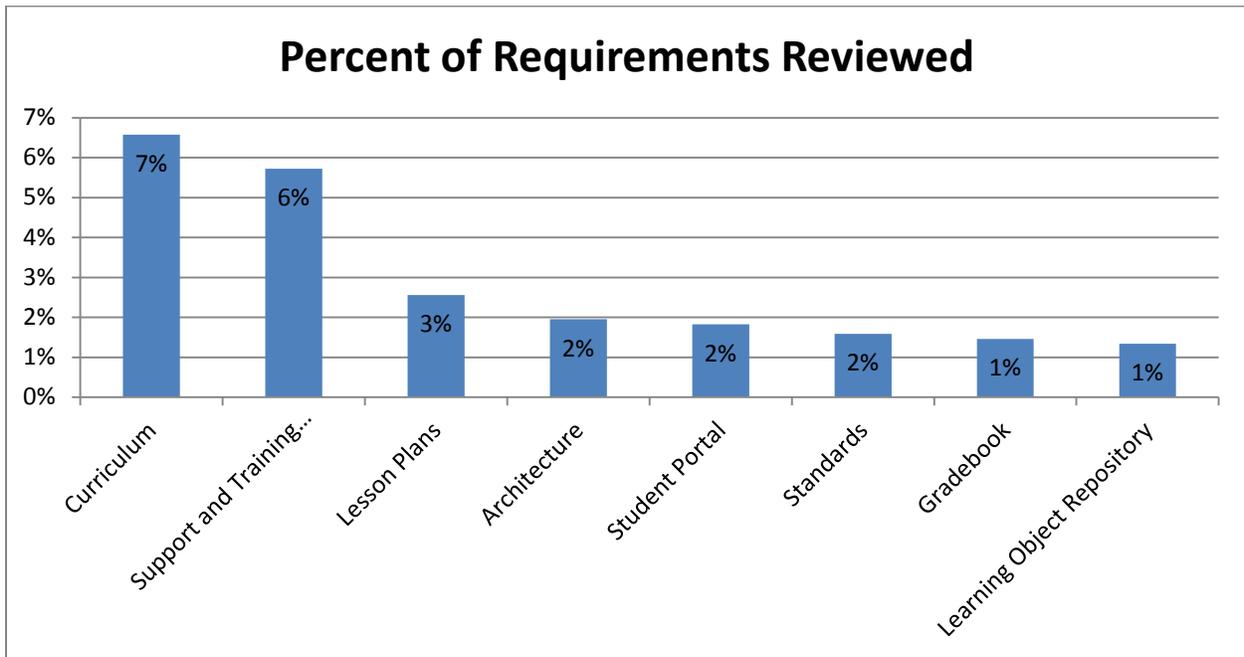
State	Awarded Funding Streams (\$ in millions)	Deliverables
Ohio	<ul style="list-style-type: none"> Race to the Top Phase II – \$400 Statewide Longitudinal Data System: (2005) – \$5.7 (2009) – \$3.0 (2010) – \$5.2 	<ul style="list-style-type: none"> Partnered with the Florida Department of Education, the Gates Foundation and CELT to establish minimum standards for a Local Instructional Improvement System 7/2010 Instructional Improvement System Request for Proposal (i.e., Assessment, Professional Development, Data Management, and Educator Evaluation)
Tennessee	<ul style="list-style-type: none"> Race to the Top Phase I – \$500 Statewide Longitudinal Data System: (2007) – \$3.3 	<ul style="list-style-type: none"> LEAs required to define local plans for an Instructional Improvement System as part of their Race to the Top scope of work submissions

4.3.2 Gap Analysis of State Education Agency Request for Proposal Requirements to Arizona

The business analyst team conducted a gap analysis of the other SEA requirements to the requirements gathered from Arizona LEAs. For the gap analysis, a total of 2,540 requirements were condensed into 821. Many requirements are mapped as ‘one to many,’ meaning that one high-level requirement from one source may include multiple detailed requirements from another.

Based on the gap analysis performed among Massachusetts, North Carolina and Ohio, and the new learning and accountability requirements, approximately 45 percent of our requirements aligned, like other states were, out of scope along with the other states, and approximately 55 percent were not aligned. The primary reason that 55 percent of the requirements were not aligned was that ADE-documented requirements stopped at the teacher level, while North Carolina went to the student level. The largest gaps were in the following areas. See Figure 5 for a percentage of the requirements reviewed.

Figure 5 – Percentage of Other State Education Agency Requirements Reviewed



4.3.3 State Education Agency Site Visit

A site visit to the Georgia Department of Education resulted in valuable lessons learned from a SLDS perspective. Personnel in Georgia’s Department of Education Information Technology (IT) department delivered the report definition layout, including stored procedures, to integrate with the visuals (i.e., report and dashboard graphs). ADE’s IT department has subsequently utilized the work artifacts from Georgia to successfully develop and implement the pilot SDLS to a handful of LEAs across Arizona.

4.4 Arizona Department of Education Findings

A major focus of this Business Case was conducted at the ADE for several reasons. Researchers were co-learners in the process when answering investigative questions, and listened when LEAs redirected researchers to conduct an internal audit at the ADE. Without exception, researchers heard the ADE has lost credibility and confidence based on past performance (pre-2011), but the respondents noted and appreciated recent improvements in SAIS. This prompted an extensive internal audit of the ADE covering legislation, application portfolio, process workflows, and infrastructure. These audits were performed as concurrent efforts. The research objectives are listed below.

(A1) Which Arizona legislative mandates or programs are driving the mission to build and implement the statewide Learning and Accountability system, and what are the objectives and benefits of these legislative mandates and programs?

(A2) Which Arizona Department of Education data is required to support the Learning and Accountability system?

(A3) How does the Arizona Department of Education currently treat data and what are the current processes and procedures for data management?

(A4) Does the Arizona Department of Education have the Information Technology infrastructure to support the new Learning and Accountability system?

It should also be noted that redirection to conduct the audit by no means indicated subpar service by the program areas; it was reflective of the data quality. The data results are intended to highlight areas for overall improvement in ADE processes, practices and services.

4.4.1 Arizona Legislation/Programs and Benefits

By and large, legislation is usually the driver of organizational change for the ADE since it is, in fact, a government agency and its structure, scope and mandates are summarized in A.R.S. § 15-249. In other cases, the ADE submits applications for grant monies and when awarded, is another example of an organizational change driver. The specific investigative question about Arizona legislature is:

(A1) Which Arizona legislative mandates or programs are driving the mission to build and implement the statewide Learning and Accountability system, and what are the objectives and benefits of these legislative mandates and programs?

4.4.1.1 Arizona Legislation

A number of Arizona legislation, federal grant programs, and plans were identified as potential drivers for AELAS. They were then studied in considerable detail in order to understand their true nature and relevance to the ADE. The document language, which was initially subject to interpretation by the business analyst team, was reviewed with and validated by subject matter experts from ADE's Policy Development and Government Relations department in order to confirm the relevancy of the documents and drivers, along with expected objectives and benefits to AELAS. Documents that were studied included those listed in Chart 16:

Chart 16 – Legislation, Grant Program, and Plan Research Summary

Document	Description	Document Date
A.R.S. § 15-249 & Senate Bill 1529	Arizona Education Learning and Accountability System authorization legislation	2010
Proposition 301	Performance pay for teachers	November 2010
Senate Bill 1040 & House Bill 2823	Educator observation and evaluation	May 2010
Statewide Longitudinal Data System Grant Programs	Statewide Longitudinal Data System	June 2007, June 2012
House Bill 2732	Move On When Reading	April 2010
House Bill 1286	A–F Letter Grade (A.R.S. § 15-241)	May 2010
Race To The Top Grant Program	A federal grant promoting improvements in state education	Phase III – December 2011
Arizona’s Education Reform Plan	Governor Janice K. Brewer’s plan including the four pillars as basic components	January 2011

Title 15 covers general provisions:

- State and local governance of schools; school elections, employees, attendance, district budgeting and financial assistance, district funds and related operations
- The Arizona State Schools for the Deaf and Blind
- Funding for the state educational system for committed youth
- Community colleges
- Universities and related institutions
- Provisions relating to community colleges, universities and private postsecondary institutions
- Interstate compacts
- School capital finance
- School accountability program
- The Arizona Empowerment Scholarship accounts

4.4.1.2 Objectives of the Arizona Education Learning and Accountability System

Objectives are the organizational targets to achieve by a project or program in relation to the drivers and the desired changes. In this Business Case, the key objectives are statements as to what is expected to be achieved by the LEAs and the ADE when AELAS has been fully implemented. They are listed, along with their descriptions, and linked to their respective drivers, as shown in Chart 17.

The achievement of these objectives will go a very long way toward addressing the challenges and overall situation that is facing the ADE today. For example, by promoting a Professional Development program, each educator will have the tools and capabilities to help them manage and track their own career so they can realize their aspirations, achieve growth, earn recognition, and potentially earn financial awards—all while becoming even better educators.

Chart 17 – Arizona Education Learning and Accountability System Program Objectives

Driver		Objective Description
A.R.S. § 15-249	Arizona Education Learning and Accountability System	<ul style="list-style-type: none"> • Maintain Statewide Longitudinal Data System • Collect student accountability data for P-20 longitudinal system institutions and workforce • Meet federal reporting requirements • Meet state reporting requirements • Establish data governance*
Statewide Longitudinal Data System Grant	Statewide Longitudinal Data System	<ul style="list-style-type: none"> • Provide timely access to information • Increased volume of actionable data to stakeholders • Support increasing P-20 and workforce data demands • Drive instructional, program and policy decisions, best practices, etc. • Improve student achievement and educator performance • Improve school, district and statewide performance
Proposition 301	Performance pay for teachers	<ul style="list-style-type: none"> • Improve educator performance • Provide additional monies for local education programs and strategies:* <ul style="list-style-type: none"> ○ Improve graduation rate ○ Reduce class size ○ Encourage professional development**
Senate Bill 1040	Educator observation and evaluation	<ul style="list-style-type: none"> • Adopt and maintain an educator model framework for evaluation* • Define educator performance classifications* • Provide highly trained evaluators • Encourage professional development**
Adverse Current Business Climate	–	<ul style="list-style-type: none"> • Reduce program data use costs • Reduce overall Information Technology total cost of ownership
Family Educational Rights and Privacy Act & State Confidentiality Compliance	–	<ul style="list-style-type: none"> • Provide privacy protection and secure access*
Arizona Department of Education Strategic Plans		<ul style="list-style-type: none"> • Offer services to improve and optimize education processes* • Positive Arizona Department of Education cultural change* • Improve Information Technology system integration between the Arizona Department of Education and all education institutions

*Work activity for an objective is already ‘in flight’

**Objective was linked to more than one driver, since it was cited as in each

For the full narrative on how an objective will improve an aspect of ADE business, or assist the ADE to meet its strategic objectives, see the Drivers – Objectives Linkage section.

4.4.1.3 Benefits of the Arizona Education Learning and Accountability System

Business benefits are defined as an advantage on behalf of a stakeholder or group of stakeholders; are preferably measurable (e.g., financial, quantifiable, or observable); and the type of business change would be categorized as either to do new things, do things better, or stop doing something. Chart 18 lists the expected business benefits of a full AELAS implementation that has been identified and associated indirectly with its specific driver.

Chart 18 – Arizona Education Learning and Accountability System Program Benefits

Driver		Benefit Description
A.R.S. § 15-249	Arizona Education Learning and Accountability System	<ul style="list-style-type: none"> • Increased visibility to relevant data • Broader user access to data • Data standards and improved data quality • Local data management oversight • Realized economic efficiencies and savings
Statewide Longitudinal Data System Grant	Statewide Longitudinal Data System	<ul style="list-style-type: none"> • Provide actionable education intelligence • Improved throughput and capacity • Real time access to data • Increased visibility to relevant data • Broader user access to data • Deploy best-in-class systems/products • Improve quality of education
Proposition 301	Performance pay for teachers	<ul style="list-style-type: none"> • Educators incentivized to achieve superior performance • Flexibility to use monies for strategies with best payback: <ul style="list-style-type: none"> ○ Reduced student drop-out rates ○ Improved student achievement ○ Promotes professional development ○ Attracts quality staff
Senate Bill 1040	Educator observation and evaluation	<ul style="list-style-type: none"> • Increased access to student academic progress data • Standardized educator evaluation tool • Increased availability of online evaluations • Identification of effective educators • Trained evaluators • Promotes professional development
Family Educational Rights and Privacy Act & State Confidentiality Compliance		<ul style="list-style-type: none"> • Secured access • Data visibility secured by role
Arizona Department of Education Strategic Plans		<ul style="list-style-type: none"> • Improved perception of the Arizona Department of Education

4.4.2 Arizona Department of Education Program Area Findings

The internal audit included a drill down on one of the major ‘pain points’ repeatedly mentioned by the LEAs as well as within the ADE, which are ‘data errors.’ The data error analysis subsequently rippled and expanded into several efforts. The data findings from the internal audit address the following investigative questions.

(A2) Which Arizona Department of Education data is required to support the Learning and Accountability system?

(A3) How does the Arizona Department of Education currently treat data and what are the current processes and procedures for data management?

4.4.2.1 Data Error Analysis

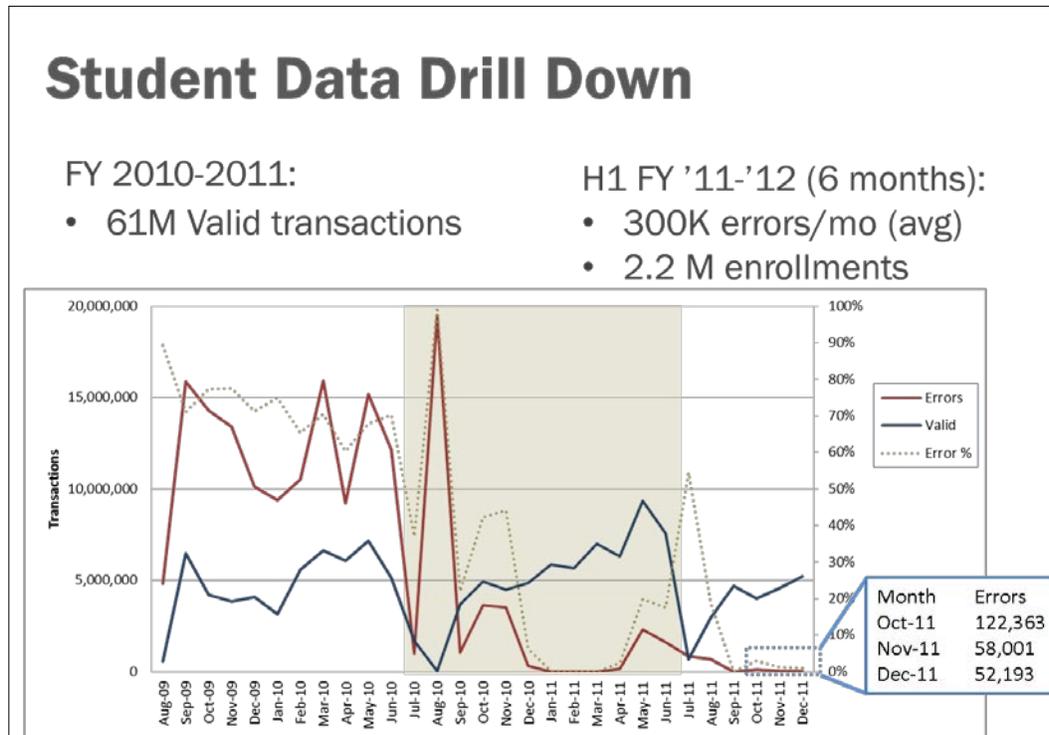
The data error performance improvement documented in the graph in Figure 6 shows one of the key areas that consume time and effort for the ADE and that is the ‘validating/correcting data’ component. This element is a common issue for the ADE and all the LEAs. There is a heavy reliance on tribal knowledge to know the data, which data, where the data is, how that piece of data is used, and which rules apply. Very much reflecting the applications development, data development proceeded nearly without any architectural guidance, policies, procedures or documentation. Given that the data the ADE collects is responsible for the approximately \$6 billion yearly paid out in education funding, it can be argued that ADE’s data is the department’s single largest asset base, far eclipsing its applications and infrastructure portfolio.

The ADE is primarily a data management enterprise whose key central function is to collect data across the state both to enable payment for educational services as well as infer performance to legislation using that data. Much like its application portfolio, ADE’s data portfolio has grown inorganically and now consists of some 120 database systems, 9,000 database tables, and 45,000 individual pieces of data within those databases.

To fully understand and clearly articulate the issues around timeliness and data quality, a root cause analysis was conducted with the major data consumers within the ADE. The specific targets were student-related data and enterprise data, as these are the two largest data stores that impact the state as a whole. These databases are directly tied to the payments issued to these institutions. The root cause analysis consisted of identifying the major data collection and processing modules referred to as the Student Accountability Information System (SAIS) and enterprise, and identifying each and every issue that persists and creates cascaded effects into the program area stakeholder. These effects consisted of errors, inaccuracies, lack of timeliness of data issues, historical loss of information, etc. The reason for the selection of these particular data collection processes is the fact that they are the major data collections and relate to the vast majority of the payments.

Findings show that in spite of recent significant efforts to stabilize and maintain SAIS-related operations, reducing the error rates from more than 80 percent down to less than 3 percent overall represents nearly 2 million errors per year that must be manually rectified by the ADE and/or LEAs. The total effort of these corrections translates into the cost to Arizona LEAs of an estimated \$12.5 million per year. This cost was borne out by the external analysis conducted at the LEA directly. Of greater concern are not the identifiable errors that are listed here, but of the more fundamental data errors that are introduced in the system that result directly in the previously stated impact to workflows. Typical profiles of these errors include: Exceptional Student Services (ESS) students count not being accurate, student information being incomplete or inaccurate, district of residence/education being inaccurately recorded, etc. It is these errors that cause the most significant impacts.

Figure 6 – Data Collection Error Rate



4.4.2.2 Performance Analysis

The outgrowth of program-specific functional modules has been a historical legacy at the ADE, where the rapid need for addressing legislative change did not allow for consideration of an enterprise data/system perspective. Moreover, system functions were simply added to existing functional modules without an architectural framework to guide their future growth, need or purpose. As a result, business rules, derived from legislative requirements, have been improperly applied, inconsistently implemented, embedded across numerous applications, and simply buried within undocumented workflows across the organization without any centralizing, organizing principle or oversight management.

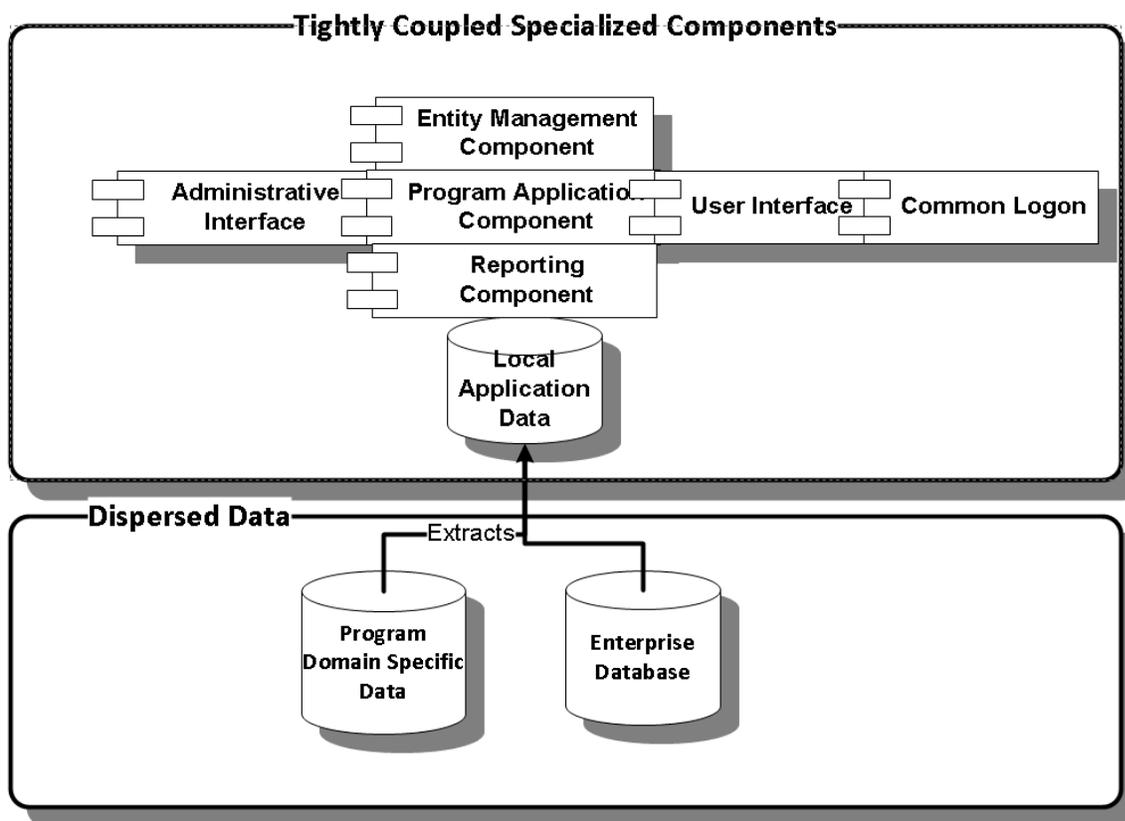
This has numerous effects to the ADE as a data/information operation:

- The unrecorded applications produce unregistered information that make it impossible to produce an audit trail of ‘who performed an operation on the data (i.e., add, change, delete) and when.’
- The unrecorded applications and the majority of recorded applications are poorly, if not completely, undocumented, thereby relying on the actual users to understand how they work and what they produce. And that’s assuming the user is still employed here.
- The recorded applications typically serve specific functions to handle data and isolate ADE data, along with its associated business rules, to the program area.
- The applications require multiple copies of ADE data across the organization without knowledge-sharing, resulting in customers having to submit the same information over and over again to different parts of the agency.
- The spaghetti-type of data connections across the ADE increases the efforts of data manipulation, verification, validation, cross-checking, etc. needed to produce such information as the ED*Facts* reports, ESS Indicators, Student Average Daily Membership, etc.

- Most at risk is the concept of ‘business continuity’ that goes beyond simply restoring databases to broader business functions, and with all the ‘hidden’ local information, in the event of a disaster, the ADE could in all likelihood not fully recover its business.

Figure 7 depicts the overall architecture of each of ADE applications. The key feature to note is that each of the 80 registered applications follows the same structure, but each completely self-enclosed module offers no interoperability and does not ‘return’ usable data to the enterprise. Each application, for example, consumes data from such sources as the enterprise or the student detail database, then imports the data into a ‘local copy,’ and enriches the data to produce whatever needed reports or program offering is requested. However, none of that enrichment is ‘returned’ to or stored in a central location. The behavior across the organization is to use, for example, enterprise as an occasional source to see if anything has been updated to carry on entities management locally.

Figure 7 – Current Arizona Department of Education Application Architecture



For example, most of the program areas, the key application executes in the following manner:

- LEA information is extracted from the enterprise system (the intended master holder of all entity information) and compared to what’s held in the local program area system (or spreadsheet) with identified changes incorporated into the system

- Program staff can then assign access rights to an individual at a LEA, once an authorizing signature has been received, then this individual is granted access to common log-in and has access to the tool
- Using the tool interface, the individual can further grant access to other staff, or submit data through the interface
- Staff can run reports on submitted data and enable LEAs to view reports, for example, on their SAIS counts and their submitted counts (once SAIS' process has been run)

Underscoring the organization-wide data silo issue is the fact that most of the enriched data (in the example above this would be the additions of contact or entity information that should be made to enterprise) is kept in a local database and only through 'knowledge' of who does what, can another program area reuse this data. Another significant gap is that all the contacts that are made with the LEAs are not recorded in enterprise; nor is the content or the subject matter of the contact. This condition can result in a significant number of program areas contacting LEAs with repeat information requests and/or submittals in an uncoordinated manner. As significant as that is, a paper trail is still needed to support many processes (e.g., teacher certification); however, the system is incapable of executing, much less supporting, any form of records management.

4.4.2.3 Process Mapping

As a part of the portfolio review effort, the enterprise architecture team was tasked to produce the workflow process maps of many program areas, and select a representative sample that were running the largest application pools, in order to completely understand exactly how application needs are articulated, designed, built, and consumed—and to identify shortfalls. Mapping workflow processes is a time-intensive and highly interactive facilitated activity that requires the participation of process subject matter experts, analysts, etc. in order to uncover and discover the specific details, such as:

- What's getting done?
- How is it getting done?
- What are the systems/data that help accomplish the process?
- What are the gaps and pain points?
- What functionality in the applications are being used most often?

All told, the enterprise architecture team produced detailed workflow maps for the following program areas:

- SAIS and School Finance (building on the previous work of the reverse engineering effort)
- Grants Management
- Exceptional Student Services' yearly census
- Exceptional Student Services alternate assessments
- Enterprise 'onboarding' of new entities
- Student enrollment

The key findings throughout the workflow exercise was that (1) there is substantial effort expended in all program areas that relates to the overly complex nature of the data architecture and the need for a high level of manual handling of data; (2) most, if not all, program areas have had to develop local management of the entities they interact with within the education environment; and (3) most applications are constructed to reflect these very specific weaknesses within the overall IT infrastructure and processes.

Figure 8 demonstrates the process mapping efforts that have been undertaken in several of the program areas (e.g., Grants Management, School Finance, Exceptional Student Services' yearly census, and

Health and Nutrition). Though illegible at this size, it does demonstrate the extensive nature of the effort. One of the key repeating features across all program areas is the excessive need for manual manipulation, transformation, conversion, transmittal, verification, and correction of data within and across program areas, application functions, etc. The level of effort has been estimated at 568,000 annual man-hours in lost productivity to the program areas just on verifying and correcting data alone. Entire workflows are designed only to verify, validate, and correct information. If ADE's data systems were truly integrated and met sound architectural best practices, then this should be a simple, effortless exercise instead of the painstaking process it is.

This last story line repeats across the ADE whether it's School Finance, ED*Facts* reporting, Grants Management, yearly school letter grade reporting, or any other program area. Each and every program area is at the limit of what it can produce and report because of system under-capacity, shortcomings, design flaws, coding errors, ongoing legislative changes, new programs, etc. Simply put, the labor intensity of the gaps between applications and data are severe to the point where the ADE has no capacity for additional tactical or strategic initiatives. Whenever a new program starts up, more personnel are required to execute the new mandate and systems are quickly altered to accommodate, resulting in increasing the overall technical debt and manual intensity.

Figure 8 – Workflow Process Diagram

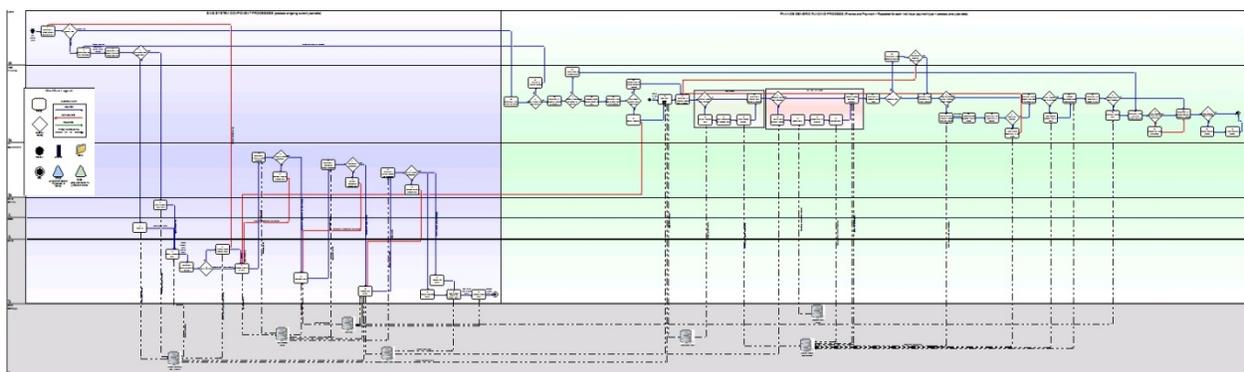
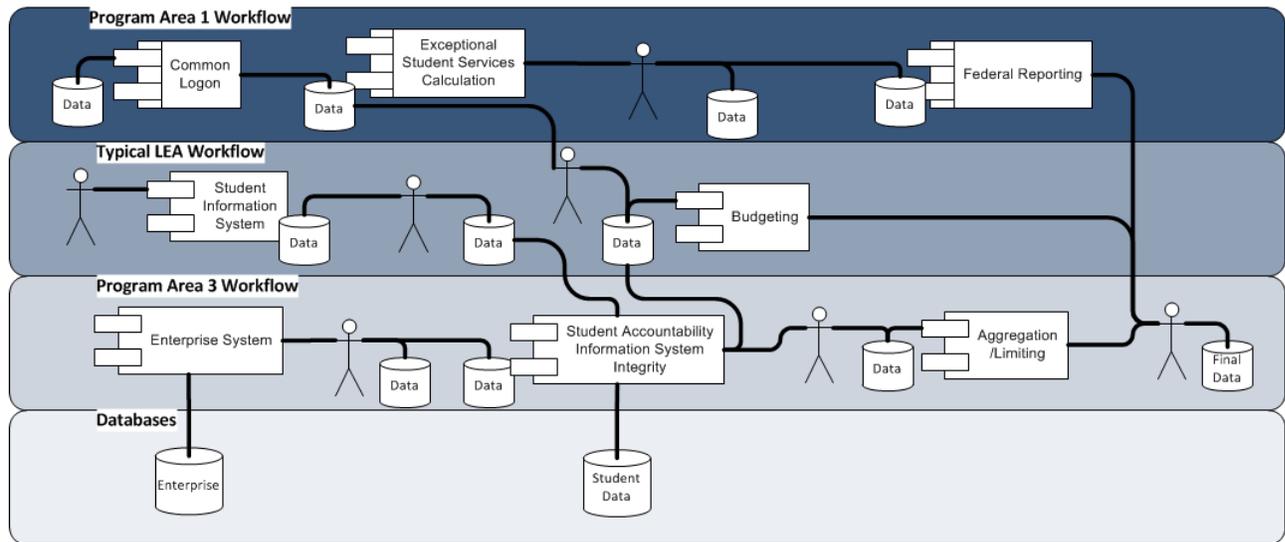


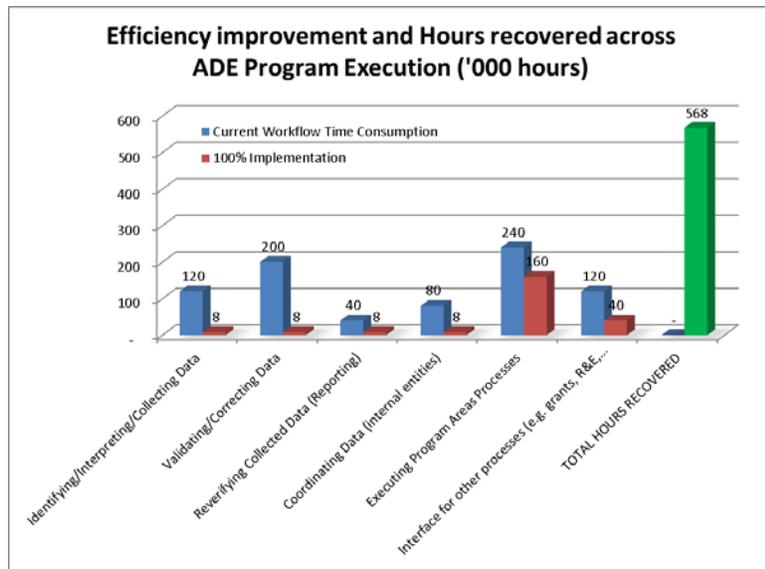
Figure 9, below, represents just one program area's work flow process map, illustrating the complexity of how program areas must move and obtain data in order to execute their mandates. The point of the illustration is that multiple sources of data are scattered throughout ADE program areas. It accurately reflects the actual day-to-day complexity the staff deals with to accomplish their role functions. It also explains why there are more than 120 applications to conduct simple program functions without end-to-end workflow management.

Figure 9 – Current Application Workflow Environment



Based on the workflow analysis and its implementation, Figure 10 depicts the work time recovery that is expected to occur. In total, the ADE could recover approximately 568,000 man-hours annually that are currently expended on non-value-added efforts.

Figure 10 – Arizona Department of Education Efficiency Improvement Impact



4.4.2.4 Reverse Engineering

During the LEA site visits, it was repeatedly identified that SAIS, literally the core data collection system for the ADE, is the major pain point affecting:

- LEAs’ ability to conduct their business
- ADE’s ability to make reliable, timely and accurate payments
- most of ADE’s program areas’ ability to execute their mandate in an efficient way
- IT’s ability to manage this system that has suffered significant and prolonged failures

About a year ago, sufficient time and resources were applied in order to stabilize this system enough to enable LEAs to upload their data, with availability times reaching 99.9 percent; data error rates went from 80 percent down to less than 3 percent. However, in spite of the stabilization, it was identified that the system was completely undocumented, the programming code out of date and highly fragile, and the data produced is unreliable (the less than 3 percent error rate is still too high).

The ADE hired an independent professional firm to conduct a comprehensive, in-depth reverse engineering of the entire SAIS and school finance payment process that is directly tied to and dependent on SAIS and relies on complex, convoluted and highly manual processes. Their finding, which reflects most of the organization's current application portfolio, is that:

- there exists numerous unregistered homegrown applications (i.e., applications that were built using Microsoft Excel or Access) that are responsible for large portions of mostly manual processes
- SAIS' code and the infrastructure it relies on cannot be upgraded or 'fixed,' owing to legacy operating systems; the rules structure is unreliable and unverifiable against its legislative basis

The firm recommended that all of the base SAIS functions (i.e., validation, integrity, aggregation, limiting modules, and data push) must be completely rewritten. The firm estimated that the level of effort and skills required financial estimates for this system, which also included the cleanup of manual processes and other applications for the payment system overall. These estimates are used as a part of the baseline against the entire services portfolio review produced in the Cost Benefit Analysis section.

4.4.2.5 Enterprise Architectural Review

The enterprise architectural review consisted of conducting a thorough investigation within and across the ADE in the domains of Business Architecture, Solutions Architecture, Knowledge/Information Architecture, and Infrastructure Architecture. From this enterprise architectural review effort, numerous key findings were identified that drive the recommendations made relevant to the implementation and execution of the IT service management framework of Information Technology Infrastructure Library (ITIL):

- the implementation and execution of data governance and master data management
- the prioritization of service upgrades, and the implementation of business governance such as policy management process
- knowledge management, etc.

In addition, numerous business processes were also singled out for implementation as well as the identification of the overall necessity for cultural change within the ADE toward its IT domain.

The following are some of the key findings that are of significant concern:

- No integrated knowledge management exists for the content of all ADE program area knowledge. The knowledge base is scattered across the 'I Drive,' multiple un-architected SharePoint sites, local drives, intranet and the Internet, etc.
- No standards in regards to the main www.azed.gov website, user interface look and feel, location of like information, navigation consistency, data presentation standards, etc.
- No standards in regards to data or information
- Extensive siloed systems, applications and business processes
- Segregation of like data
- Most of the program area's business processes have evolved over time and attempt to work around many of the data-related deficiencies. Also, these processes have been implemented strictly and solely to fulfill program-area mandates without any attempt at an organization-wide perspective

- Many times there are Multiple times inconsistent contact points between program areas and customers
- No enterprise-wide perspective of the four domains of architecture other than organizational charts

4.4.2.6 Data Infrastructure Review

A detailed analysis of the data assets within the ADE were examined, looking at key features of a typical organization of this size such as volume of transactions, size of transactions, types of transactions, high-level data flows, database structures, access to databases, storage policies, etc. There is no simpler, or more direct, way to describe the state of the data infrastructure than stating that if there were an encyclopedia of 'what not to do with enterprise data' the ADE's data infrastructure would have endless examples of each case. The following is a brief list of the most egregious issues that have to be addressed in the course of this strategic program:

- (1) Overloaded data fields (data fields that have multiple meanings depending on what's in the field)
- (2) Tables containing transactional data with reporting data
- (3) Similar data fields within tables with different meanings
- (4) Little or no naming standard for data fields or tables
- (5) Little or no documentation of elements, processes, etc., no data dictionary, no table relationship diagram
- (6) Inconsistently replicated tables, such as tables that should contain the same data, have differing row counts
- (7) A total count of more than 45,000 data elements, when the education Common Education Data Standards (CEDS)/Ed-Fi suggest the number should range between 1,000 and 3,000, depending on the implementation
- (8) No data normalization (i.e., data repeats, data rows not unique, little or no formal primary or foreign keys, indexes used as 'unique ID')
- (9) Data is unretired or no off-lining is executed
- (10) Duplicated 'unique' IDs (e.g., single-student multiple SAIS IDs, single SAIS IDs for multiple students)
- (11) Differing ID structures and IDs for the same data (e.g., certified teacher uses seven digits, while highly qualified teacher uses 16 digits)
- (12) Little or no documentation on the business rules associated with the data
- (13) No business definitions of the data elements that are required for production
- (14) No data flow diagrams encompassing the totality of data collections, incoming and outgoing data, etc.
- (15) Until recently, developers did not have full and direct access to production databases to make changes, etc.

Clearly, there is a serious and urgent necessity to address these issues in order for the ADE to be able to continue executing its current mandate, which grows with every new legislative change, as well as its need to execute AELAS. Correcting the data infrastructure issues is the single highest priority within the ADE at this point in time and the key reason for the adoption of the CEDS/Ed-Fi data standards.

4.4.2.7 Interviews of Arizona Department of Education Personnel

The enterprise architecture work effort consisted heavily of information gathering by interviewing ADE personnel on numerous projects, program areas, issues, and ongoing 'business as usual' activities. At each and every meeting, the opportunity was taken to query all individuals as to their area of interest, pain points, deficiencies, nice to haves, and ongoing needs. Copious notes were recorded and analyzed

for content, and patterns of issues and needs in order to formulate the overall picture of the enterprise. Every program area within the ADE was interviewed in this manner and every level of management and staff within the program areas provided opportunity for input into the ‘total picture.’ The single most overriding factor that is a significant impediment is the data infrastructure. The ADE is primarily a data management shop that uses this data to execute payment-related processes in the education system. The data issues discussed under the Data Infrastructure Review section have enormous and expensive consequences to the business and these were reiterated time and again across all of ADE areas. Additionally, the repeating theme was of the poorness of the application assets, the complexity of exchange of identical data, and the sparseness of documentation. Most program areas have resorted to recreating and maintaining their own data and application manuals.

4.4.2.8 Comprehensive Review of Arizona Department of Education Documentation

As was noted earlier, the knowledge infrastructure of the ADE is scattered across the organization, and primarily held in silos on private machines or as tribal knowledge within people. In attempting to understand much of the architectural issues within the ADE, the enterprise architecture team has scoured through the documentation base to identify required information, and determined that most of the documentation assets have accumulated without history or some form of documentation management. It is not unusual to find multiple updated versions of the same document with significant discrepancies and not be able to identify what is the source of truth within the documents.

The key finding of this review is the need to ‘clean house’ and retain only the documentation that is still relevant and accurate. Many of the program areas attempt to cull their documents when time permits or necessity dictates. The key recommendation is to develop documentation management policies, procedures and standards, and more importantly, a single, well-designed data store of enterprise information.

4.4.2.9 Root Cause Analysis: Ishikawa Diagram

One of the key issues across the ADE is the quality and timeliness of the data and the impact this causes on program area workflow execution, as well as to the perception of ADE competence in executing its mandate and supporting the state education environment. To fully understand and clearly articulate the issues around timeliness and data quality, a root cause analysis was conducted with the major data consumers within the ADE. The specific target was student-related data and the enterprise data, as these are the single largest data holdings that impact the state as a whole, and are directly tied to the payment of approximately \$6 billion that are streamed to entities annually.

The root cause analysis consisted of identifying the major data collection and processing modules, referred to as SAIS and enterprise, and identifying each and every issue that persists and creates a cascading effect. These effects consisted of errors, inaccuracies, lack of timeliness of data issues, historical loss of information, etc. A detailed diagram was created that lists all the known errors and identifies the downstream impacts that result. The result of this effort was used to drive the prioritization of the internal application rebuild. Refer to Appendix P for more details and the diagram itself.

All told, the diagram identified more than 100 persistent and severe problems and a cluster of 84 problems were focused within the three most critical modules that are responsible for applying the legislation-based and derived business rules that prepare the data for all the program area streams and maintaining the funding-based rules of the relationships between entities. This is, in essence, the root cause of the reason why so much effort is expended on verifying and correcting data within all the program areas. Further analysis to understand how this came about found that SAIS, as originally built and purposed, did its job well; however years of additions and changes brought about by legislative requirements and poor system planning resulted in a completely dysfunctional system.

4.4.3 Arizona Department of Administration Findings

Another concurrent work stream track was the study at the Arizona Department of Administration (ADOA) data center. The physical inspection of ADE’s computer technology systems’ architectural infrastructure housed within the ADOA data center was performed from a perspective of analysis to determine whether the existing resources are sufficient to support the anticipated and potential growth when AELAS is fully implemented. Chart 19 summarizes the data analysis and findings in each area of coverage, such as growth and risk assessment.

Chart 19 – Arizona Department of Administration Data Analysis and Findings

Coverage	Data Analysis and Findings
Growth Assessment	<ul style="list-style-type: none"> • Site Capacity and Space Utilization <ul style="list-style-type: none"> ○ <u>Current Status</u>: The current technical strategy of 42U racks and blade servers affords a dense configuration of equipment with a minimal footprint. ○ <u>Findings</u>: Based on this configuration, there is sufficient space within the existing data center for growth. • Power Equipment and Supply <ul style="list-style-type: none"> ○ <u>Current Status</u>: Growth suggests additional equipment, and therefore additional power demands both for the additional equipment as well as the air conditioning requirements to keep the equipment cool. ○ <u>Findings</u>: The inspection, as well as a follow-up interview of an Arizona Department of Administration manager, revealed sufficient electricity to support growth.
Risk Assessment	<ul style="list-style-type: none"> • Floor Weight-Bearing Capacity <ul style="list-style-type: none"> ○ <u>Current Status</u>: Physical construction of the Arizona Department of Administration building housing the Arizona Department of Education data center is sufficient for current equipment. ○ <u>Findings</u>: Because of the weight of new-technology equipment that could potentially be installed and exceed the floor weight-bearing capacity in the data center, housing the additional equipment is a risk. • Bandwidth <ul style="list-style-type: none"> ○ <u>Current Status</u>: Existing available bandwidth is sufficient to support current systems and applications. ○ <u>Findings</u>: With the potential addition of multimedia applications, specifically video, and hundreds of thousands of simultaneous users, this connection rate would negatively impact the user experience and put the success of the Arizona Education Learning and Accountability System at risk. • Support Personnel <ul style="list-style-type: none"> ○ <u>Current Status</u>: There is enough staff to support current systems and applications. ○ <u>Findings</u>: If a software system is not capable of supporting multi-tenancy then there is a risk that even with virtualization in place, the existing support team will not be sufficient for creating and managing potentially thousands of virtual server environments. • Fire Suppression <ul style="list-style-type: none"> ○ <u>Current Status</u>: The data center is designed with an adequate WetFire suppression system. ○ <u>Findings</u>: A WetFire suppression system is not recommended for computer technology and is a significant risk. Floor penetrations above and below should be assessed as additional risks to prevent external issues impacting the data center. • Disaster Recovery <ul style="list-style-type: none"> ○ <u>Current Status</u>: A remote data center does exist in Tucson. ○ <u>Findings</u>: There is no disaster recovery/business continuity strategy currently in place for a complete failover to the remote data center in the event of a local catastrophe.
Costs	<ul style="list-style-type: none"> • The Arizona Department of Education pays only ‘rent’ for the Arizona Department of Administration data center usage; only using the space needed and keep overhead costs low.

4.5 Local Education Agency Findings

The researchers conducted a first-ever statewide study of the culture, processes, and technology at the LEAs. Research objectives covered LEA software application type, usage, cost, and data, as well as the achievements and shortcomings that impede LEAs from meeting their primary mission—preparing students for college and careers.

Participatory action research enabled LEAs to actively contribute to the study, providing specific feedback on the requirements of a Learning and Accountability system through a variety of research methodologies such as a survey, site visits, phone interviews, and focus group sessions. See the Purposive Sampling section for LEA participation rates and overall statewide coverage. Researchers were co-learners in this process, gathering qualitative and quantitative data about the software applications in the education market. These applications, also known as commercial off-the-shelf (COTS) solutions, were divided into three categories to understand the data collected and reported in each system type:

1. Teaching and Learning (e.g., Assessment and Content Management systems)
2. Administrative (e.g., Student Information System)
3. Back Office (e.g., Finance and Human Resource systems)

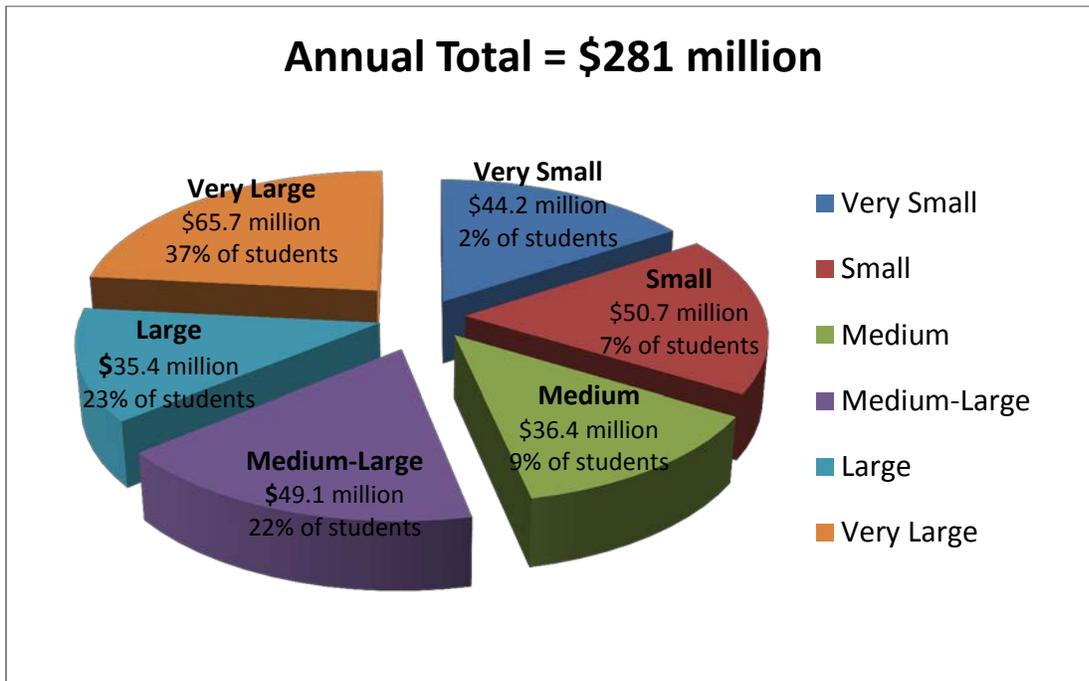
Thus, the resultant analysis of the LEA research data and information collected was broken into the following subsections:

- Software system license and implementation spend
 - Average implementation of software systems
- Top-vendor software systems usage
- Core software system capabilities

4.5.1 Software Systems License and Implementation Spend

The study found LEAs spend more than \$281 million annually on software licenses and implementation at the onset of a software rollout if all LEAs deployed the maximum number of software systems. See Figure 11 for the spend breakdown by LEA size.

Figure 11 – Software Systems License and Implementation Spend by Local Education Agency Size



When the figures are divided by LEA size as outlined in Chart 20, very small- to medium-sized LEAs account for 46 percent of the total spend but only serve 18 percent of the student population. On average, very small to small LEAs procure three to four software systems; whereas, large to very large LEAs procure nine to 10 software systems—mostly separate, independent applications, resulting in isolated data repositories. This figure considered costs associated with manual labor when those LEAs did not have automated processes of a software system to complete the capability.

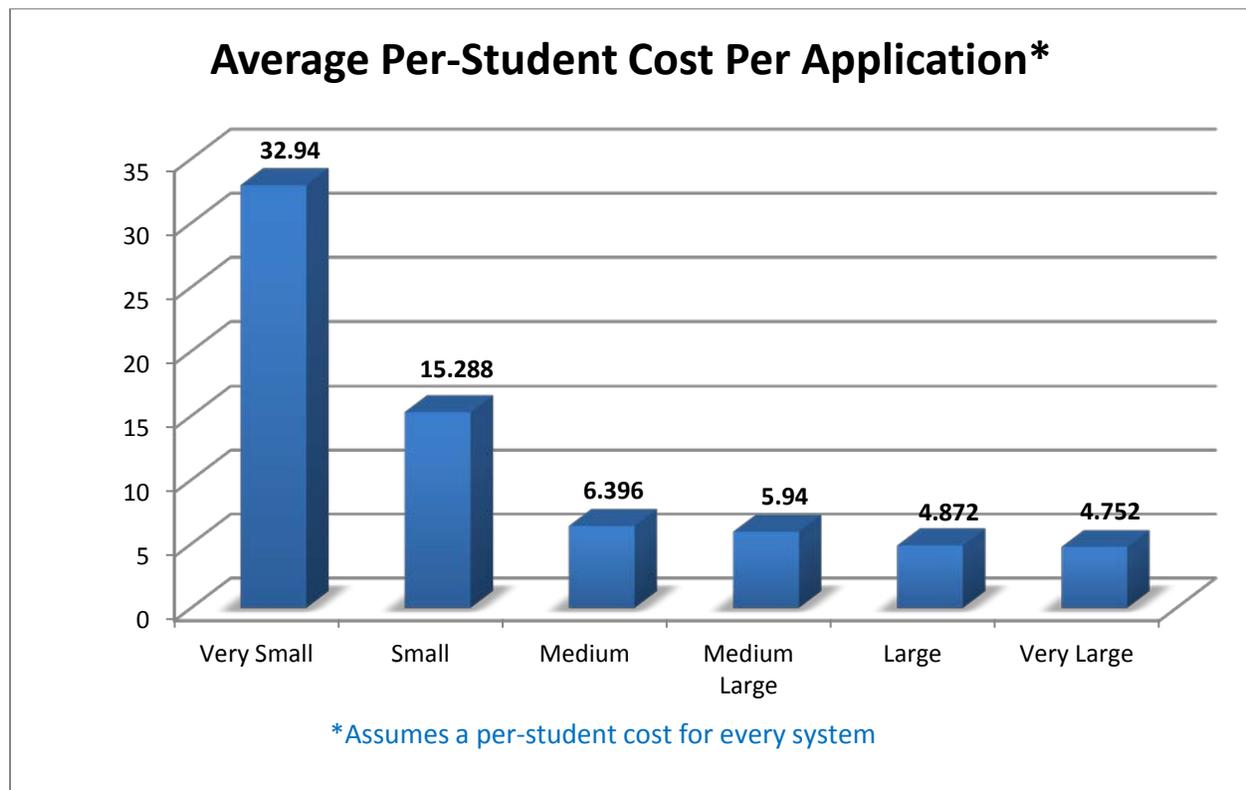
Chart 20 – Local Education Agency Size Categories, Student Counts, and Average Software Systems and Costs/User

Local Education Agency Sizes	Size Ranges	Local Education Agency Counts	Student Counts	Average Number of Software Systems	Average License Cost Per User for One System
Very Small	≤ 199	245	24,115	3–4	\$57.28
Small	200–599	197	72,378	3–4	\$18.07
Medium	600–1,999	88	93,304	5–6	\$12.87
Medium-Large	2,000–7,999	58	243,388	5–6	\$8.17
Large	8,000–19,999	20	246,833	9–10	\$9.51
Very Large	≥ 20,000	11	397,045	9–10	\$5.33
Totals	–	619	1,077,063	–	–

Closer examination of the most prolific COTS, the Student Information System, revealed very small LEAs pay more than 10 times what very large LEAs pay for software licenses per user. This is for a software system that performs the most basic needs of capturing and tracking student data (e.g., attendance, demographic, and grades). LEAs that do not have an average of nine to 10 systems are performing the work manually, further burdening a staff that is already shorthanded.

When a per-cost is averaged across all software systems and LEAs in a size category, very small LEAs pay seven times more than very large LEAs. See Figure 12 for the average cost per user, per application. This figure highlights the need for change in terms of financial reinvestment for LEAs and leads to one of the recommendations for a centralized, opt-in model. LEA respondents were surveyed to gauge interest in a centralized, opt-in model and the results are in Recommendation section.

Figure 12 – Local Education Agency Size Categories, Average Software Systems Costs Per User



To provide a holistic picture of IT spend across state, infrastructure costs such as servers, network, switches, and cabling is estimated at \$47 million at the time of hardware purchase, which is amortized over time. Chart 21 does not cover costs for desktop computers, laptops and tablets. Larger LEAs replace servers on a three- to five-year cycle, while smaller LEAs must extend the normal life cycle an additional three to four years, oftentimes leaving them with unsupported hardware and limited capability. This Business Case does not address infrastructure cost savings because the greatest and most immediate impact is recognized with the software licenses; however, future consideration should be given to infrastructure costs to complete the broad view of AELAS.

Chart 21 – Local Education Agency Information Technology Budget and Hardware Summary

Information Technology BUDGET AND HARDWARE SUMMARY				
Local Education Agency Size (Student Populations)	Average Information Technology Budget	Information Technology Budget as a Percentage of the Total Budget	Average Number of Servers	Average Local Education Agency Network Costs (excluding staff and software)
Very Large (≥ 20,000)	\$5,900,000	3.0%	350	\$800,000–\$1,483,000
Large (8,000–19,999)	\$1,384,000	2.5%	46	\$207,500–\$345,800
Medium-Large (2,000–7,999)	\$500,000	4.0%	17	\$75,000–\$125,000
Medium (600–1,999)	\$179,000	3.1%	15	\$26,900–\$44,750
Small (200–599)	\$175,000	4.2%	5	\$26,200–\$43,750
Very Small (≤ 199)	\$59,000*	3.1%	2	\$8,850–\$14,750

*Very small LEAs reported that they do not have a hardware budget, and they rely on donated servers as much as possible. This number represents what some very small LEAs reported as actual expenditures that were not budgeted.

4.5.2 Top Vendor Software System Usage

In order to gain a clearer picture about vendor market share across Arizona, respondents replied with the current product in use per each software system category. The findings are reported in Chart 22 of the top-vendor products being used from Teaching and Learning, Administrative, and Back Office systems. Since the respondent coverage of the study was not statewide, the intent of these findings was not to address complete market share of vendor system usage in the state.

Chart 22 – Local Education Agency Top System and Product Usage

TEACHING AND LEARNING SYSTEMS	
Assessment System	Galileo
Content Management System	Beyond Textbooks,
Educator Evaluation System	TrueNorthLogic, My Learning Plan, Teachscape
Learning Management System	Moodle, A+nywhere Learning System, e2020, PLATO
ADMINISTRATIVE SYSTEMS	
Nutrition Management System	NutriKids
Special Education Management System	e-IEP Pro
Student Information System	Schoolmaster, Synergy, PowerSchool
Transportation Management System	Versatrans, Transfinder
BACK OFFICE SYSTEMS	
Finance Management System	Infinite Visions
Human Resource Management System	Infinite Visions
Substitute Management System	Aesop

It was clear that LEAs rarely, if ever, design, develop, and implement software systems to support their local education needs. However, there are a few exceptions where very large LEAs have decided to build rather than buy software systems. In most cases, maintenance, support, and technical expertise decline while technical advancements increase over time, leading most LEAs to procure systems for replacement. Other instances force smaller LEAs to heavily rely on Microsoft Access databases and Excel spreadsheets—or alternatively on pencil and paper.

The chart further confirms there is not one single vendor providing all the necessary software systems, capabilities, and especially, data required for the Learning and Accountability system, and LEAs are forced to cobble together a string of software systems from different vendors to support their needs. At best, only a handful of LEAs statewide have a data management system, bringing together all the necessary data for a comprehensive Learning and Accountability system.

Procurement of these systems is time-consuming and requires expertise in advanced technical standards and specifications to purchase a system from a vendor with sound technical development process and practices. This effort also includes end user input to ensure capabilities match the demand of the users. It is estimated that LEAs spend millions annually to just procure the software applications, as illustrated in Chart 23.

Chart 23 – Estimated Local Education Agencies Procurement Expenditures

ESTIMATED LOCAL EDUCATION AGENCIES PROCUREMENT EXPENDITURES	
(1) Local Education Agency Procurement Personnel and (1) Local Education Agency End User	\$25 hourly per resource
(12) Weeks Process to Procure (1) System	480 hours
Number of Local Education Agencies	619
Total Procurement Effort Cost	\$14.856 million

4.5.3 Core Software System Capabilities

In order to gain a complete picture of a Learning and Accountability system from the LEA perspective, the research team conducted discovery tasks as part of the Demand Management practices to document the capabilities and data currently in the core software systems. Additionally, the researchers worked with regional, county, and LEAs to understand the future needs of software systems to meet state and/or federal mandates and initiatives. The high-level capabilities and accompanying data in those systems are summarized below.

- **Assessment System:**
 - Must offer capabilities to manage formative to summative high-stakes; secure tests for guiding instruction to accountability of teachers in non-core subjects
 - Needs to provide role-based access to creating, administering, and reporting on assessments (giving administrators and teachers access only to their content)
 - Needs to produce statistical values for items and tests (for validating high-stakes tests with impact on educator incentive pay); needs to maintain data on test item usage and teacher rankings of content
- **Educator Evaluation System:**
 - Must offer capabilities that enable each LEA to define their own evaluation rubrics and workflow (to support evaluation processes)

- Needs to integrate with other systems such as Professional Development, Assessment, Student Information, and Human Resource systems for data transferability to calculate the overall evaluation score of an educator
- Needs a high degree of security and measures to gauge usage and accessibility
- **Content Management System:**
 - Must offer capabilities to create, edit, store, publish, and deliver all forms of content—including instructional resources, lesson plans, and video activities—to help educators address deficiencies identified in the observation (to support continuous improvement)
 - Needs to maintain data on content usage and teacher rankings of content, otherwise known as paradata
- **Learning Management or Professional Development System:**
 - Must offer capabilities to deliver and track learning activities and data per learner
 - Needs capabilities to organize facilities, instructors, and resources of professional development offerings and manage course registration and administration (so educators can complete activities to improve their effectiveness)
 - Needs to allow for settings and tracking of annual goals that include individual, team, and LEA goals (to support continuous improvement and remediation of deficiencies)
- **Data Management System:**
 - Must offer capabilities that provide reporting and analytics that draw data from all of the systems listed above, as well as the Student Information System and Human Resource Management system, so professional development and student instruction are best aligned with identified needs
 - Needs a means for teachers and administrators to verify the accuracy of the data and report errors for corrections

Vendors in the education industry market have typically responded to a need or funding stream by producing a software system with capabilities that address those needs and requirements. However, over time and as in most industries, needs evolve and vendors respond by developing new capabilities and features to extend the lifecycle of the software. What was once very clear delineations between product lines in the market have become blurred due to the need demand for data from multiple systems to work in concert, providing a holistic picture of the student, teacher, administrator, and LEA.

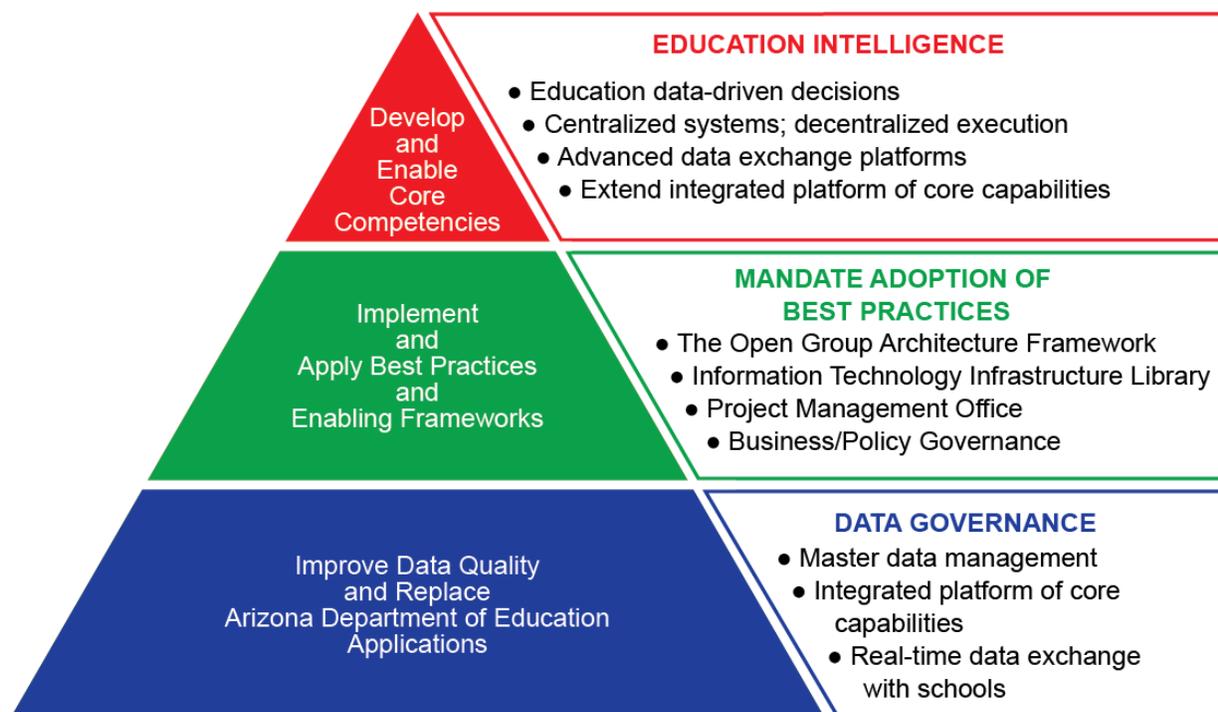
5.0 Recommendations

The study yielded 13 recommendations from which a three-level hierarchy was formed to show an order of prioritization and interdependencies to achieve transformative change. More specifically, the range of issues outlined in section 2.0 will be addressed and resolved by transforming Arizona’s educational culture, processes, and technology as proposed by implementing the recommendations. The hierarchy of recommendations is listed below and illustrated in Figure 13:

- (1) Improve data quality and replace Arizona Department of Education (ADE) applications
- (2) Implement and apply industry best practices and enabling frameworks
- (3) Develop and enable core competencies

5.1 Recommendation Hierarchy

Figure 13 – Arizona Education Learning and Accountability System Recommendation Hierarchy



This Business Case reflects and details the new business model for how to conduct a state-led, cooperative education program. The above recommendations align with tangible benefits that will result in cultural, process, and technological changes across the ADE and LEAs. All recommendations lay the foundation and lead to the tip of the hierarchy—Education Intelligence—integrated data and analytics transformed into actionable information—which is delivered in ‘real time’ to education stakeholders—that can contribute to improved student success.

A key aspect that often occurs in the Information Technology (IT) domain is the tendency to overemphasize technology and tools rather than the importance of culture and processes in making sustainable change. It is crucial to address and focus on how culture and processes will change the current ‘as is’ to the ‘to be’ state of education and, more importantly, to have a strategy for these rather

than a reactionary observation of what happened. This is precisely how the value proposition will produce substantial reinvestment opportunity to the state of Arizona.

5.1.1 Culture

A change in culture commences with the first recommendation of mandating an internal structure for ADE data governance structure under a single entity, namely a state data officer. By implementing a Master Data Management policy using the Common Education Data Standards (CEDS), as established by the National Center for Education Statistics (NCES), data will be unified across the state. Improvement in utilizing industry best practices and enabling frameworks will can lead to enhanced ADE performance through redefined core competencies focused on service orientation, and change the perception of the ADE held by internal and external stakeholders. Deploying centralized systems at a reduced statewide pricing can change the isolated behavior across the Arizona landscape by enticing LEAs to work collaboratively on similar initiatives by sharing resources, ideas, and innovations for data-driven education decisions.

5.1.2 Processes

Adopting and applying formalized enabling frameworks such as Information Technology Infrastructure Library (ITIL), The Open Group Architecture Framework (TOGAF), and Project Management Office (PMO) will enable the ADE to reap the benefits of tried and tested best practices from mature industries that have dealt with data-related issues and their associated processes. New and advanced file interchange platforms will make it easier for the ADE and LEAs to exchange immediate, actionable data to influence and inform decisions at the state and LEA class and student levels.

Moreover, the improved processes can be integrated and considerate of reporting needs from ADE program areas within and across the organization, and with LEAs as integrated and interoperable systems further realize the benefits of the new Learning and Accountability system.

5.1.3 Technology

Technology, being a means to an end, serves both those who use technology to conduct their work as well as the recipients of those work products. This Business Case recommends to replace the entire infrastructure and to implement more up-to-date architecture and platforms. This complete rebuild will enable the implementation of a comprehensive statewide Learning and Accountability system through the introduction of an integrated platform of core capabilities. This goal does not rely on leading-edge technology, but rather on the application of rigorous disciplined technology architecture principles and integration to the cultural and process frameworks described above. The sum of the proposed platform will lead to configurable program area services and the architecture to new support centralized systems and advanced data exchange platforms.

5.2 Recommendation #1 – Improve Data Quality and Replace Arizona Department of Education Applications

The data findings of two million data errors per year in Student Accountability Information System (SAIS) and 568,000 man-hours annually expended correcting and cleansing data, led the research team to declare the most fundamental change and recommendation for the state is to improve data quality. The ADE is already implementing a cultural change as it relates to the data assets by implementing Data Governance, Master Data Management and processes—and ensuring all data meets Common Education Data Standards (CEDS)/Ed-Fi compatibility. Improvements in our data assets will lead to replacing numerous applications with an integrated platform of core capabilities such as identity management, reporting, and a single business-rules engine to meet the legislative changes in an efficient manner. Improvements at the ADE will enable LEAs to reconsider their resource allocation to data management, cleanup, and reaction to the constant requests from the ADE for more data.

5.2.1 Master Data Management with Common Education Data Standards/Ed-Fi Adoption

In October 2012, the Data Governance Commission enforced the recommendation to implement a Master Data Management policy using the CEDS and Ed-Fi as the state-adopted standards moving forward for any new development and procurement.

CEDS is a specified set of the most commonly used K-12 education data elements. The standard supports the effective exchange of data within and across states, as students transition between educational sectors and levels, and for federal reporting. This common vocabulary will enable more consistent and comparable data to be used throughout all education levels and sectors necessary to support improved student achievement. The standards were developed by the NCES with the assistance of a CEDS stakeholder group that included representatives from states, districts, institutions of higher education, state higher-education agencies, early-childhood learning organizations, federal program offices, interoperability standards organizations, key education associations, and nonprofit organizations. CEDS is a voluntary effort and will increase data interoperability, portability and comparability across states, districts, and higher-education organizations.

The Ed-Fi solution is a universal educational data standard and tool suite that enables vital academic information on K-12 students to be consolidated from the different data systems of Local Education Agencies (LEAs), while leaving the management and governance of data within those LEAs and states. The standard and tool suite include a unifying data model, data exchange framework, application framework, and sample dashboard source code. The Ed-Fi solution is open, XML-based, and CEDS-aligned to integrate information from a broad range of existing sources so it can be sifted, analyzed and put to use every day. Ed-Fi components act as a universal translator of academic data, integrating and organizing information so that educators can start addressing the individual needs of each student from day one, and can measure progress and refine action plans throughout the school year.

5.2.2 Integrated Platform of Core Capabilities

It is clear that the ADE cannot progress effectively and efficiently to deliver new advanced services unless and until the current IT environment is replaced with a more up-to-date architecture and platform. This complete rebuild will enable the implementation of a comprehensive statewide Learning and Accountability system through the introduction of an integrated platform of core capabilities.

The proposed new architectural design is intended to revamp the disjointed applications within the ADE. The premise is that though there is functionality, nothing is recoverable from existing applications other than the knowledge they provide for requirements analysis as well as how workflows are organized within

the ADE. However, this is a contribution in and of itself. Program areas are well aware of what works and what does not work and the spectrum of shortcomings that the existing infrastructure holds.

5.2.2.1 High-Level Capabilities of the New Architecture

The following are the key criteria established to define the new architecture:

- Must provide for growth of new services seamlessly
- Must provide interoperability between the numerous program areas
- Must enable data sharing in such a way as to minimize replication and errors
- Must enable the management of business rules centrally in such a way as to provide governance, determine legislative impact, and adapt easily to legislative changes
- Must follow practices of Master Data Management and Data Governance to the organization
- Must provide a common look and feel of interfaces, where possible, and data exchange across the ADE
- Must reduce manual data transfer
- Must reduce/eliminate paper-based processes and items
- Must enable business continuity planning and implementation
- Must implement, as far as possible, data standards that are related to education data
- Must enable a staged migration of all ADE applications
- Must enable future changes and growth in technology and possibly migrate to cloud-based infrastructure

5.2.2.2 Proposed Architecture

To this end, a service-based architecture is proposed and is outlined in Figure 14, using a capabilities-based platform configuration. This architecture relies on industry best practices for the integration of functional services that are configured to deliver program-specific services. The key platforms are the following:

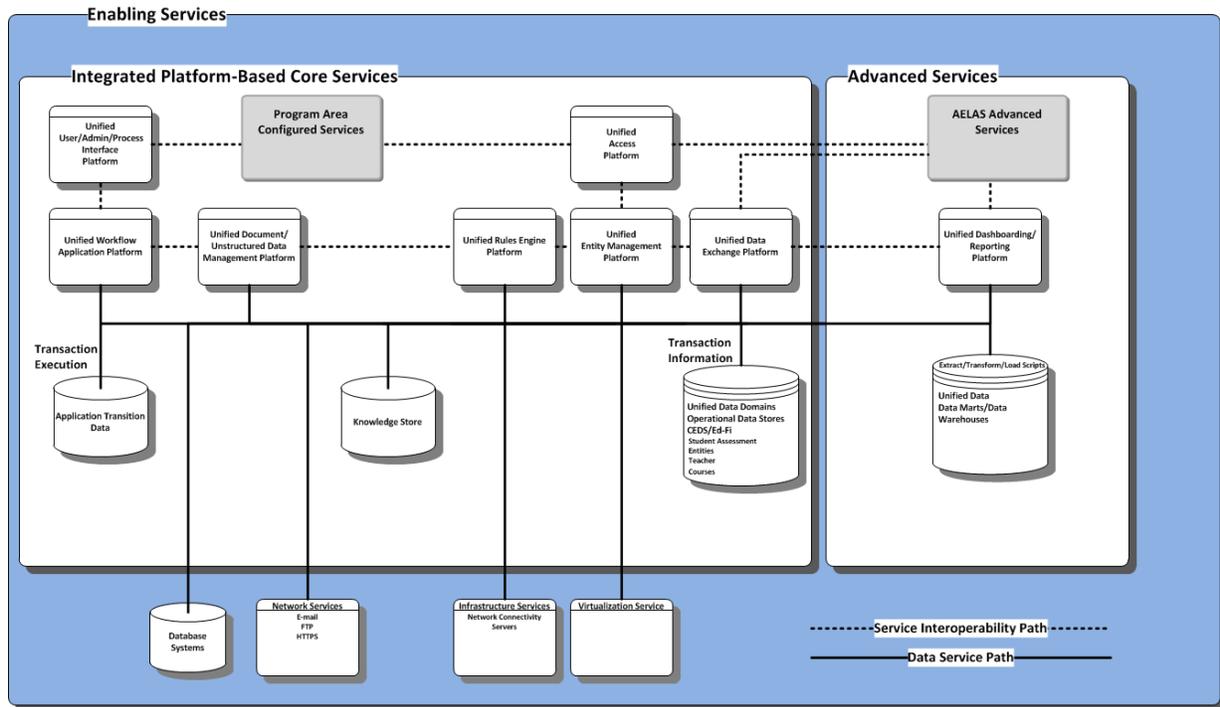
- A unified user interface platform that integrates look and feel across all interfaces and a common code repository for all interfaces
- A unified workflow-based application platform that, like above, provides for a common coding approach and common codes for all applications
- A unified data collection platform through and from which all data exchange is managed and moderated up to and including between program areas
- A unified dashboard/report platform from which all dashboards and reports will pull data from needed applications
- A unified rules engine platform that centralizes all business rules consumed by applications, reports and dashboards, as well as helps in the production of data marts, data warehouses and data requests
- A unified entity management platform that enables the creation and maintenance of the numerous entity types that program areas consume and manage, as well as manages the complex and rich relationship between these entities
- A unified document/unstructured data management platform that holds all forms, paperwork, and information such as glossaries, letters, reports, etc.
- A unified access platform (Identity Management system) that manages all user access to all system components and functionalities

The sum of these platforms will lead to the capability to configure program area services that consume these capabilities through sound and governed development processes. The architecture also provides for commercial off-the-shelf solutions to be used so long as the requirements of data exchange, based on

program-specific data and managed through governance, are applied and integrated in the Request for Proposal process.

The totality of the architecture rests on governance processes and discipline being implemented across the ADE, development and/or acquisition best practices and policies, and data exchange policies with all stakeholders well defined and documented. For a conceptual design of the proposed architecture, see Appendix E.

Figure 14 – Proposed Solution Services Architecture



5.3 Recommendation #2 – Implement and Apply Industry Best Practices and Enabling Frameworks

The data findings conclude that the ADE is an organization with Level-1 maturity of five levels. Level 1 is the lowest level, where processes are described as ‘chaotic,’ ‘non-existent,’ or ‘initial.’ ADE program areas have no formal process of documentation management, and most program areas only have historical, in-house knowledge of documentation without formal process. This led the research team to recommend the formal implementation and execution of industry best practices and enabling frameworks. The ADE is already in the process of implementing and executing ITIL, TOGAF, and a mature PMO. The cultural and process changes will enable the agency and the state to establish new core competencies leading to Recommendation #3.

5.3.1 Information Technology Infrastructure Library

The ADE has recognized that it can no longer incidentally manage its IT environment and must mature its overall capability to a higher level of performance both to minimize its operational costs and enable it to support and sustain the advanced educational services that are needed to advance Arizona’s position as an education leader in the U.S. The formal and practice-based framework chosen to achieve the maturation and the strategic direction taken by the ADE are:

- To implement ITIL’s framework, which is a set of practices for IT Service Management (ITSM) that focuses on aligning IT services with the needs of businesses. Specifically, the framework consists of 26 formal and well-defined processes and four service functions, all contained within five service groups: service strategy, service design, service transition, service operation, and continual service improvement
- To implement a formal data governance and master data management capability to support data as a statewide service

More importantly, the approach taken to fulfill the Arizona Education Learning and Accountability System (AELAS) mandate requires that the ADE take a Service Portfolio Management approach to all services, both core and advanced. This must be done in order to:

- effectively manage information delivery
- provide a stable core services infrastructure
- provide the capability to expand to advanced services
- be able to make strategic cost-effective decisions of what advanced services are needed and what core services changes are needed to support these needs

The service strategy segment of ITIL will enable the ADE to demonstrate sound investigative and research methodology to identify and meet the needs being addressed and support the recommendations made within this Business Case. The two ITIL processes are those of Demand Management and Service Portfolio Management. Demand Management is an IT governance process that enables IT and the business to optimize the investment in IT through fact-based decisions. The end result of understanding the actual capabilities demand addressed by AELAS, and framing them into deliverable solutions, requires the execution of the second most critical ITIL process, Service Portfolio Management.

Service Portfolio Management is a singular process executed to enable a comprehensive perspective of ADE’s existing IT service assets and combine them with the proposed services needed and identified by Demand Management. Next, a systematic and justifiable supporting rationalization for the proposed investment is performed based upon:

- the investment criteria of allocated/available funds

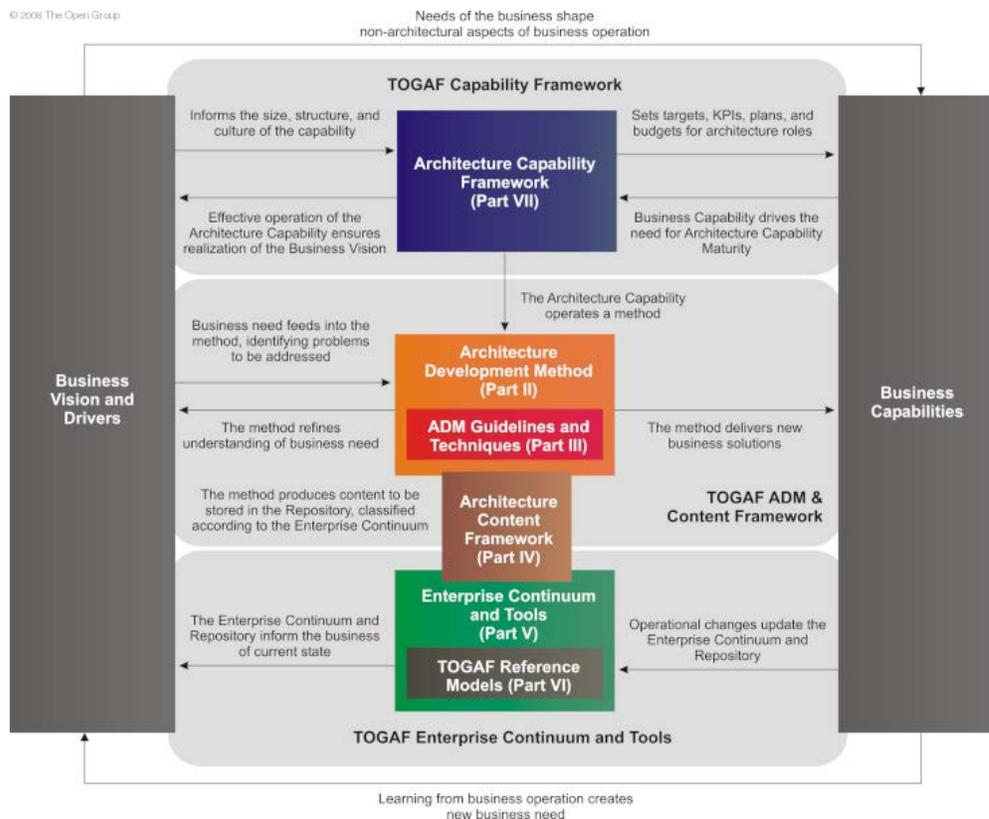
- criticality of services
- dependency of services
- mandated services
- ability to roll out the services
- legislative action

The road map for this maturation is the application of Carnegie Mellon’s Capability Maturity Model Integration, applying the ITSM framework of ITIL, which relates to the degree of formality and optimization of processes from ad hoc practices to formally defined steps, to managed result metrics, to active and ongoing optimization of the efficiency and effectiveness of the processes. See Appendix A for a complete assessment of ADE’s current capability maturity levels.

5.3.2 The Open Group Architecture Framework

TOGAF, an Open Group Standard, is a proven enterprise architecture methodology and framework that ensures consistent standards, methods and communication for enterprise architecture professionals within an organization. Figure 15 reflects the structure and content of an architecture capability within an enterprise as well as the process of applying it to the ADE. The documentation associated with the framework guides enterprise practitioners toward creating and implementing a pathway to achieve the business vision and goals.

Figure 15 – The Open Group Architecture Framework Capability Framework



The application of this structured framework reflects and supports ADE’s commitment to improve its overall capabilities maturity with clear and precise supporting frameworks. Under AELAS, an enterprise architecture team was formed that conducted the analysis presented in this Business Case in order to produce the recommendations based on sound architectural principles.

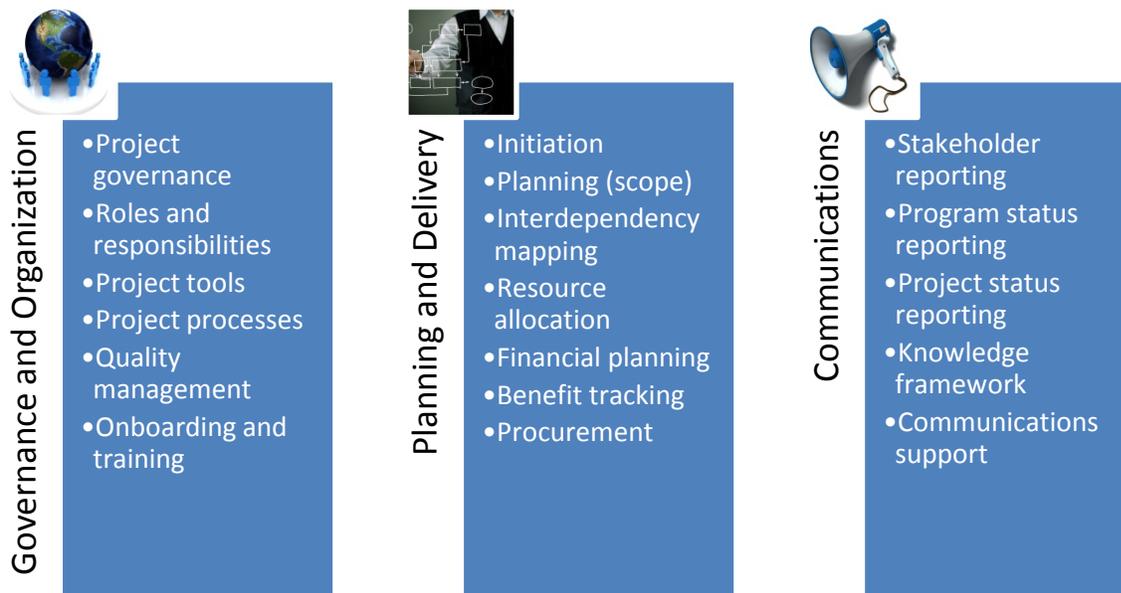
5.3.3 Project Management Office

The PMO is a department within the ADE that defines and maintains standards for project management. Thorough understanding and knowledge of the project life cycle is essential to this office. Initially, this office was formed in October 2012 with the understanding that all projects have interdependencies with other projects. For example, the completion of the Student-Teacher-Course Connection project is a precursor for the Statewide Longitudinal Data System project. These interdependencies must be owned and managed for successful completion, and this is where PMO plays a major role.

The primary goal of a PMO is to achieve benefits from standardizing and following project management policies, processes and methods. Over time, the PMO will become the source for guidance, documentation and metrics related to the practices involved in managing and implementing projects within the ADE. A project charter is essential to the success for it defines and identifies the key sponsorship and involvement to support the project. Communication is a key process for the office. The PMO will report on project activities, risks, issues, budget, and requirements to executive management as a strategic tool in keeping decision makers informed and moving toward consistent, business- or mission-focused goals and objectives.

The PMO structure has three components: Governance and Organization, Planning and Delivery, and Communications. Figure 16 delineates the components and outlines the objectives.

Figure 16 – Project Management Office Structure and Objectives



5.4 Recommendation #3 – Develop and Enable Core Competencies

Several of the study's data findings led the researchers to the recommendation of the ADE redefining core competencies with a more service-oriented focus. The findings included the scattered sources of data, lack of data and software system integration, and cost of disparate software systems incurred by the LEAs. LEAs annually spend more than \$281 million on software systems licenses and implementation at the onset of initial implementation. Very small LEAs pay seven times more than very large LEAs for software licenses per user. The researchers concluded that if the ADE were to offer the most demanded systems as a centralized, opt-in solution with reduced statewide pricing, LEAs of all sizes could realize benefits of cost reinvestment annually. Extending the integrated platform of core capabilities will support data-driven decision-making all the way down to the individual student level.

5.4.1 Centralized Systems; Decentralized Execution

ADE's centralized system model provides software systems procured at the state level with reduced pricing based on statewide user counts. The decentralized execution model enables LEAs to implement the software systems to meet local needs through configuration measures. The approach proposed is that LEAs will discontinue their contract with vendors, given the appropriate timing, and convert to ADE's centralized, opt-in model, reallocating the cost for software and implementation through the ADE, given the state pricing point is reduced from their current pricing point.

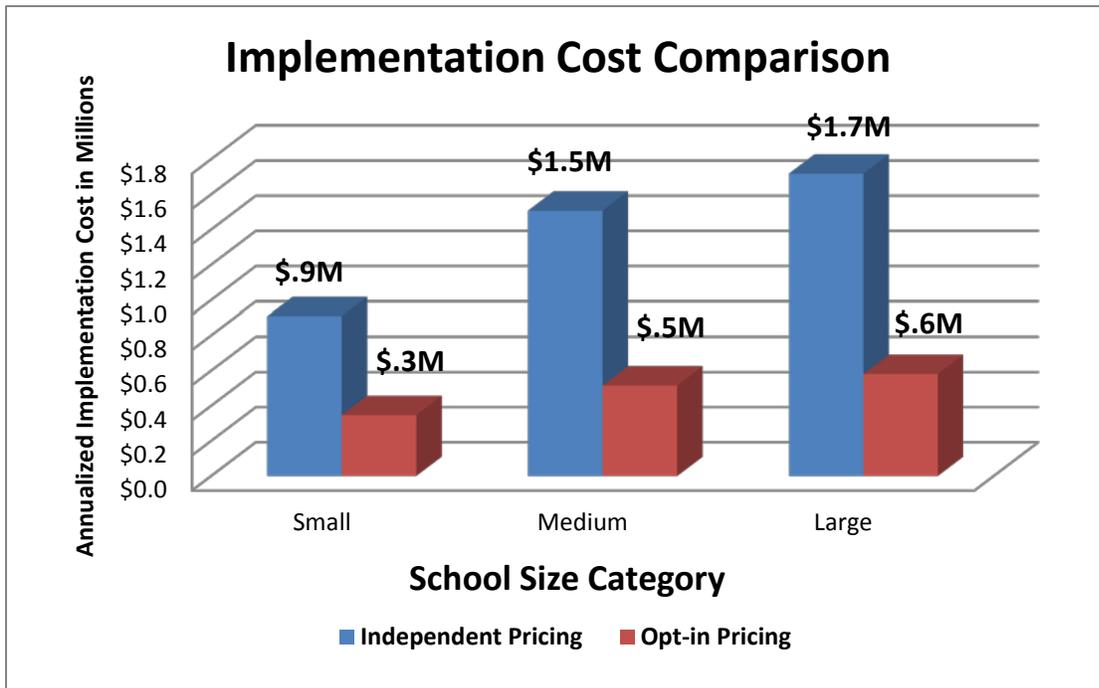
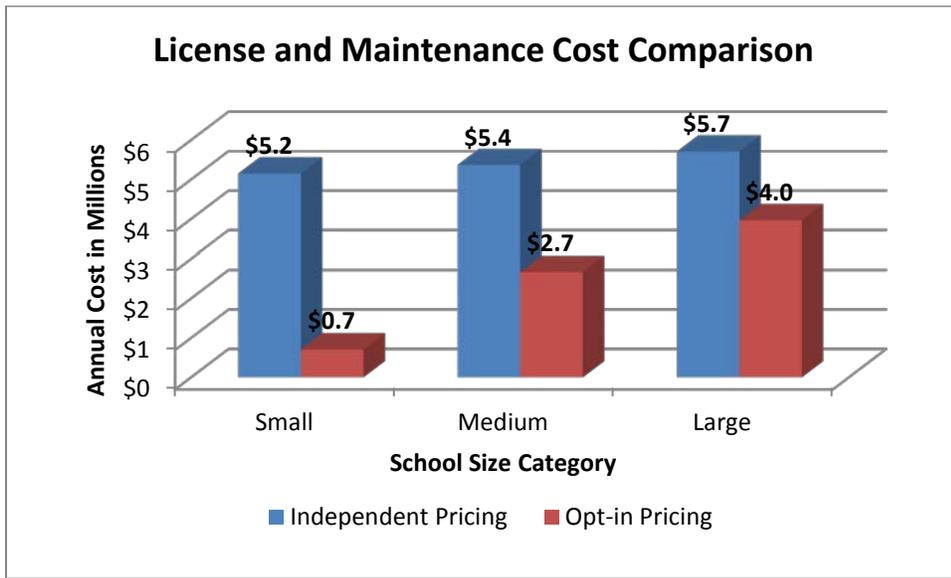
Through the extension of the Integrated Platform of Core Capabilities, systems will become interoperable, data will be integrated across multiple sources, and identity, audit, and security measures will be executed. Data-driven decision reporting and analytics will also be provided.

A cost analysis was completed to determine the potential reinvestment if the ADE were to offer centralized systems with reduced statewide pricing. Initial analysis of the cost data provided by LEAs for their systems revealed a wide range of prices paid by different LEAs for the very same product. Very small LEAs (fewer than 200 students) often have to pay a minimum cost for systems, which is substantially more than they would pay just based on the number of students they have. LEAs often settle for a less-than-optimal system for their needs simply because they cannot afford the system that does meet their needs. Large and very large LEAs often stick with a specific system when it doesn't meet their needs because it is too costly to go through the process of selecting, procuring, and implementing a new system. These are all examples of limitations on the ability of LEAs in all size categories to procure, implement, and use high-quality systems that support efficiency and effectiveness.

Figure 17 shows a very clear example of the level of savings associated with applying economies of scale to the purchase and maintain of one common LEA software system, the Student Information System. Of the 619 LEAs in Arizona, each has its own Student Information System. Each one of them negotiates pricing separately, and most of the 442 445 smallest LEAs have to pay a vendor minimum cost that is much higher than the per-student cost would be based on their enrollment. Centralizing the purchase of licenses, maintenance, and the implementation process statewide for the Student Information System would recover costs for LEAs in all size categories.

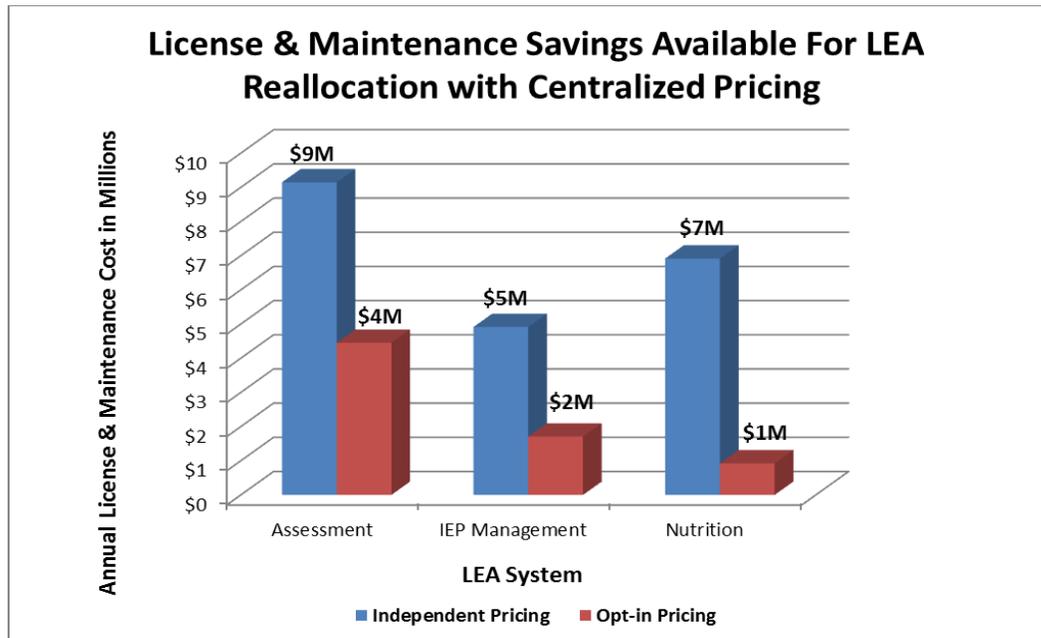
For example, small LEAs (less than 600 students) currently spend \$5.1 million collectively for maintenance costs for their Student Information System. With the centralized purchasing model, their collective annual cost would reduce to \$700,000, freeing up valuable dollars for reinvestment into other areas in those LEAs. Implementation managed centrally would save LEAs in all size categories two-thirds of what they are currently spending for implementation of a Student Information System.

Figure 17 – Student Information System Cost Comparisons



If we consider the systems that make up the majority of those used to operate their LEAs, we see significant savings for all of them when adopted as part of a centralized system, freeing up dollars that could be used to hire more teachers, provide more relevant professional development, or provide better technology in classrooms. Figure 18 shows current annual license and maintenance costs for three other common LEA systems as compared with the potential future annual license and maintenance costs for those systems in a centralized, opt-in purchasing model.

Figure 18 – Annual Centralized, Opt-In Pricing and Reinvestment



The potential savings at the LEA level for the centralized purchasing model are clear, but will LEAs choose to opt-in to the centralized model? To help determine the systems that were of the highest interest to LEAs for this model, focus groups were held with representation of LEAs from all size categories, types, and geographic areas. Figure 19 represents the preferences for top systems that could potentially motivate a LEA to be an early adopter of AELAS. The top three systems included: Assessment, High-Stakes Test Analysis and IEP Management, followed by Credit Recovery and Accrual and Professional Development. It is important to note that although we heard from LEAs that they had concerns about ADE’s ability to effectively implement this centralized system model, there is definite interest in accessing at least some of their systems in a centralized model.

Figure 19 – Top-System Adoption Ranking

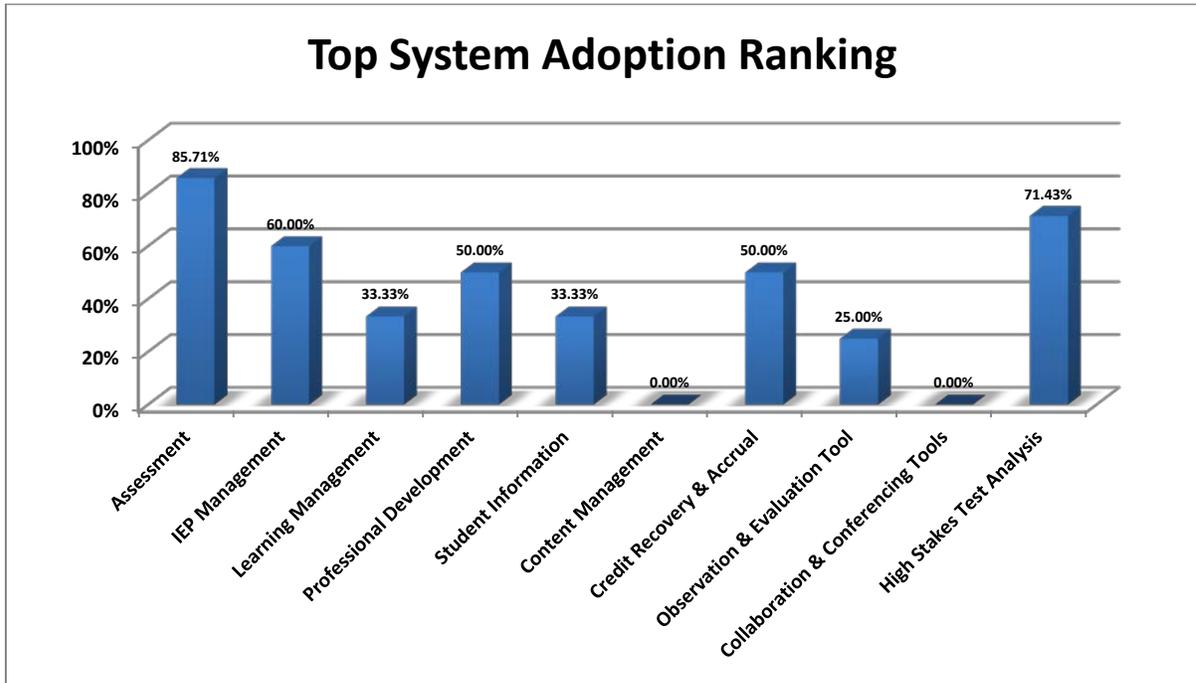
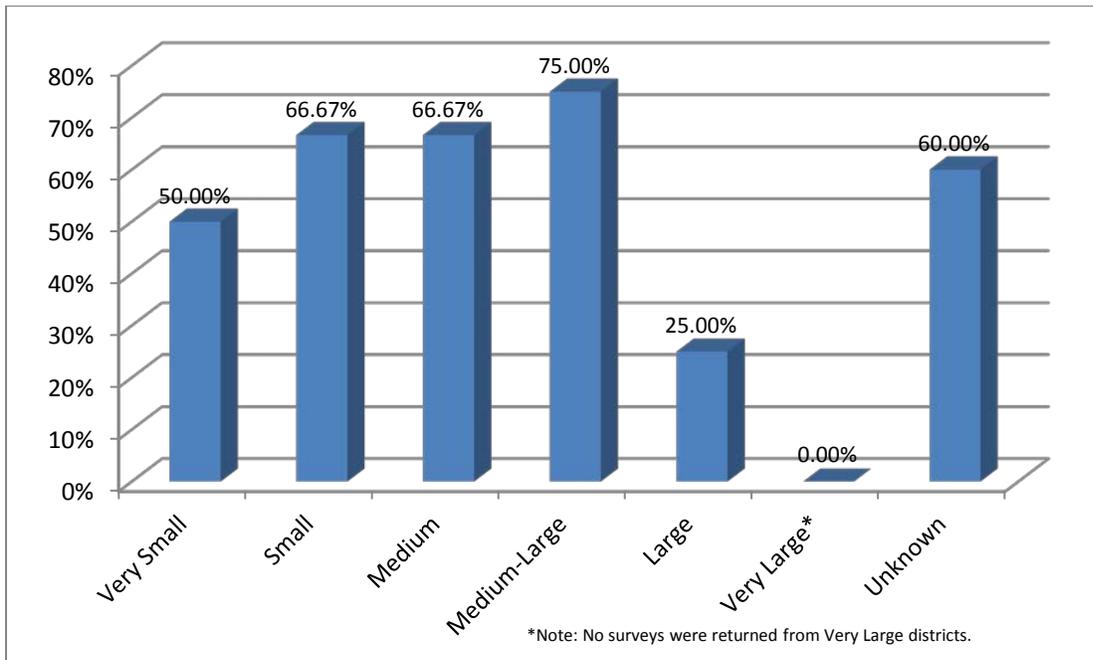


Figure 20 represents the size of the LEA segment that is likely to be an early adopter of AELAS. Medium-large (75%), medium and small (67%), followed by very small (50%) sized LEAs expressed the most interest at present.

Figure 20 – Arizona Education Learning and Accountability System Adoption Interest by LEA Size



Important motivational factors that could influence a LEA to opt-in to AELAS included:

- Significant decrease in cost over their current solution
- Significant improvements in operational efficiency
- Significant improvements in interfaces with state systems

But, according to the LEAs, a number of factors would be working against adoption of AELAS that would need to be addressed by the ADE:

- Lack of trust in the ADE, IT solutions, and state professional development support
- Sunk costs in existing systems and products
- Loyalty to existing systems and products
- Cost and effort to change products (conversion costs, training staff)
- Lack of funding
- Connectivity concerns
- Concerns over the ADE having access to all of their data
- Resistance to change in general

The combined results from the LEA outreach activities showed that there is interest in a centralized, opt-in model for LEAs but, (a) more work is needed at the ADE to build confidence with the LEAs, (b) the timing of a rollout would need to be factored in the implementation cycle that each LEA is on with their current systems, and (c) from a practical perspective, it would have to be identified which systems maximized LEA interest for adoption with the least amount of LEA concerns.

Note: See Appendix C and Appendix D for a set of charts that presents reports on these findings from this research in total.

5.4.2 Extend Integrated Platform of Core Capabilities

The ADE will adopt an integration strategy as a means to achieve interoperability between future systems, applications and the core Operational Data Store—the one source of truth. Export, upload, error report, and edit techniques of the past decade are creating intensive and expensive work efforts on the part of LEAs, consuming valuable resources that would better profit the education process for students versus performing administrative tasks, such as counting students.

Newly implemented data governance policies and procedures will address past behaviors that allowed poor data collaboration processes across program areas. Effective data governance will provide the framework to effectively utilize a different integration approach. The new integration strategy will highly value active integration via an integration engine. The heart of this technology will be XML-based contracts and Web services to receive the XML packages that will transfer data. Active integration allows error conditions to be detected sooner in the transfer process. Primarily, this would be the preferred mechanism utilized internally by the ADE when integrating both internally and externally hosted vendor systems to achieve automated data transfers. Industry standards will be utilized where possible to reduce development cost and simplify complexity in both internal and AELAS opt-in applications.

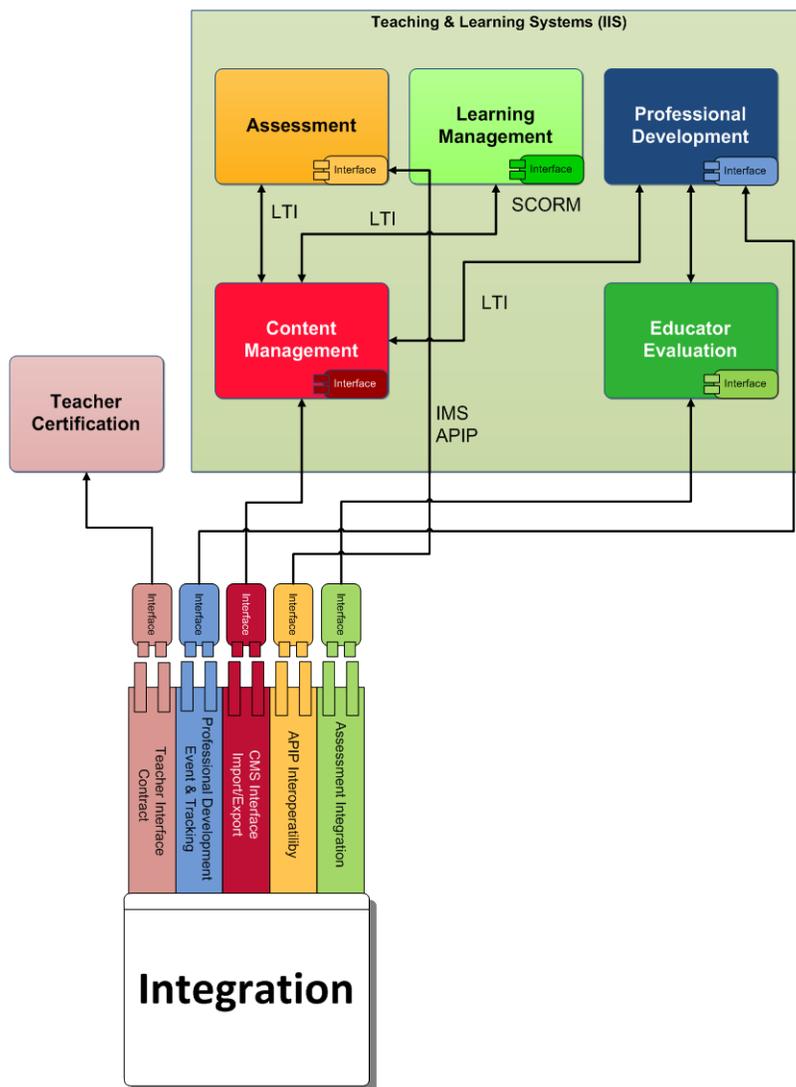
Understandably, it may not be possible to achieve all external data transfers through active mechanisms. When necessary, HTTP, Secure FTP, and batch file transfer can be used to move data to ADE staging areas where ETL (Extract, Transform, Load) will be used to stage and load the data. This will become the least preferable integration mechanism moving forward.

All of the approaches require an active participation of the Data Governance Board to simply achieve the best data quality at the lowest cost possible. Technical analysis of each project and system will determine the optimum transfer mechanism

The ADE has been licensed to use Ed-Fi as a core definition for the educational domain, as Ed-Fi is tracking to the CEDS. The ADE is targeting Ed-Fi 1.1 as the basis for the Operational Data Store. Data governance approval and processes will determine what relevant data will be mapped to the desired entities. A technical analysis will result in identifying the best integration approach to create, update, delete, and synchronize relevant data between the systems.

See Figure 21 for the integration conceptual architecture for Teaching and Learning systems that will be offered through the centralized, opt-in model. See Appendix E or a full conceptual architecture design of AELAS.

Figure 21 – Integration Conceptual Architecture



5.4.3 Education Data-Driven Decision System

Arizona's version of the Education Data-Driven Decision System (i.e., Az ED³S) is proposed as a real-time decision support system through the Learning and Accountability system.

Student data is entered at the LEA in software systems such as Teaching and Learning, Administrative, and Back Office. In the future though, a centralized, opt-in model with some of those systems will be offered as a service by the ADE.

The daily data captured in these systems is valuable and covers student formative assessment performance (Assessment system) and instructional performance (Learning Management system).

This information is combined with student demographics, attendance, and behavior records (Student Information System) and daily classroom or homework grades (Grade Book), aligned to teacher information (Human Resource system), and then collected and integrated with data from the ADE such as high-stakes assessment.

The data then moves to ADE's systems so program areas such as Research and Evaluation or Exceptional Student Services can use the data for state and federal reporting, reducing the constant requests from the ADE for local information. In the Operational Data Store, student data is housed as the 'single source of truth' and then placed in the data warehouse for longitudinal purposes.

Just like Business Intelligence promotes the ability of an organization to collect, maintain and organize knowledge to further new opportunities such as a competitive market advantage and long-term stability, Education Intelligence promotes the collection, integration, and display of education information into timely, actionable data in the support of educators. This data is further transformed into actionable reporting and analytics are then delivered in 'real time' to education stakeholders to increase learning opportunities for teachers and students.

Ultimately, the data is elevated to new usage, reporting and analytics models through Az ED³S. Personalized learning dashboards provide immediate feedback based on student performance from a variety of data sources. Assessment Comparison dashboards enable educators to view past and current student performance across high-stakes assessments to form district interim assessments. Student profile dashboards serve as an early warning system providing real-time and longitudinal views from a holistic perspective including attendance, behavior, homework, and overall readiness for college and career indicators.

The education stakeholders that benefit from these advanced analytics include the educators, families, and most importantly, students increasing not only their accountability of their education, but their entire support system.

6.0 Financial Investment

6.1 Cost Benefit Analysis

Research shows organizations are two to three times more likely to succeed in realizing the value of the financial investment when the business case is not only a way of obtaining funding but it also serves as a means of (1) demonstrating how the benefits depend on business changes as well as technology enablers, (2) gaining commitment to achieve the benefits, and (3) enabling the success of the investment to be judged objectively. It is necessary to understand that for all Arizona education stakeholders to realize the benefits of the Learning and Accountability system outlined in this Business Case, business and organizational changes are required. The conventional method of projecting the costs and financial returns follow in this section. Additionally, a more unconventional method of structuring the benefits to be measured and owned follows in the next section, Benefit Analysis.

6.2 Arizona Education Learning and Accountability System Appropriations to Date

Arizona Education Learning and Accountability System (AELAS) appropriations to date corrected problems that were not addressed in this Business Case, such as replacing obsolete hardware, increasing system availability, and addressing more than 800 unresolved customer service issues. These improvements are noted earlier in the Case as Student Accountability Information System (SAIS) optimization and stabilizations efforts, but go well beyond SAIS. See Appendix M for a complete list of the issues and resolutions corrected by Information Technology (IT) management since January 2011. In addition, the appropriations laid the foundations for ultimate systemic change and execution of the recommendations proposed in this Case. Some of these early projects include implementing the first stage of the Information Technology Infrastructure Library (ITIL) and an identity management solution, as well as establishing data governance practices and standards.

AELAS funding to date has been derived from legislative appropriations and a \$6-per-student transfer from universities and community colleges equaling \$6.2 million. Additional funding streams were received from federal grant programs such as Race To The Top and the Statewide Longitudinal Data System (SLDS). However, these funds are tied to specific project deliverables such as ultimately connecting student, teacher, and course data.

6.3 Arizona Education Learning and Accountability System Appropriation Request

Opportunity for systemic change, albeit ambitious, is attainable, sustainable and will transform education in Arizona. The financial investment requested is based on the execution of the recommendation outlined in this Business Case and illustrated in the Recommendation Hierarchy (5.1). The financial investment will be addressed starting with the LEAs and Recommendation #3, and will work backwards to the Arizona Department of Education (ADE) and Recommendations #2 and #1.

6.3.1 Local Education Agencies

At the center of AELAS are the Arizona administrators, teachers and students that will benefit from the overhaul of education. It is important to note that very small and small LEAs currently pay more for less. They are estimated to spend \$25 million for software licenses and implementation on the three to four systems that these LEAs can afford to implement. By adopting AELAS' centralized systems, they could implement an additional five software systems to better support teaching and learning, and reinvest nearly half the current expenditures directly into their classrooms.

LEAs will have the ability to configure the workflow and use systems in ways that work best for the individual needs of those teachers and students locally through the decentralized execution of the software systems. No longer will LEAs be required to manage the vendor relationships; the ADE will be poised to manage the service-level agreements with a range of education vendors, based on best industry practices and state-adopted data management standards.

Based on ADE-hosted focus groups, a full range of LEA representation identified the systems most needed, which would be supported as a centralized, opt-in model. The cost of implementing these centralized systems was calculated at economies of scale pricing over a five-year period and equals \$87.8 million. See Chart 24 for the rollout of the nine software systems across all LEAs, and breakdown between software license and implementation costs. The approach proposed is that LEAs will discontinue their contracts with vendors, given the appropriate timing, and convert to ADE's centralized, opt-in model, reallocating the cost for software and implementation through the ADE, given the state pricing point is reduced from their current pricing point.

Chart 24 – Centralized, Opt-In Model Software Systems License and Implementation Costs (\$ in millions)

Fiscal Year	2014	2015	2016	2017	2018	TOTAL
Recommendation #3: Develop and Enable Core Competencies						
Number of Software Systems	5	7	7	9	9	9
Number of LEAs	20	110	314	555	619	619
Software License Costs	1.1	4.0	7.8	13.7	20.7	\$47.3
Implementation Costs	3.8	7.1	9.3	9.6	10.7	\$40.5
Total LEA Investment Costs	\$4.9	\$11.1	\$17.1	\$23.3	\$31.4	\$87.8

Overall, LEAs of all sizes will realize benefits of cost reinvestment, improved services and support, and capabilities of integrated, centralized systems to support data-driven decision-making all the way down to the individual student level. LEAs can choose to reinvest monies saved on software licenses and implementation in ways that best support their local needs. The total annual LEA cost reinvestment is estimated to be between \$33 and \$69 million annually depending on the number of LEAs that opt-in. See Figures 22 and 23.

Figure 22 – Local Education Agency Reinvestment with 42% Opt-In

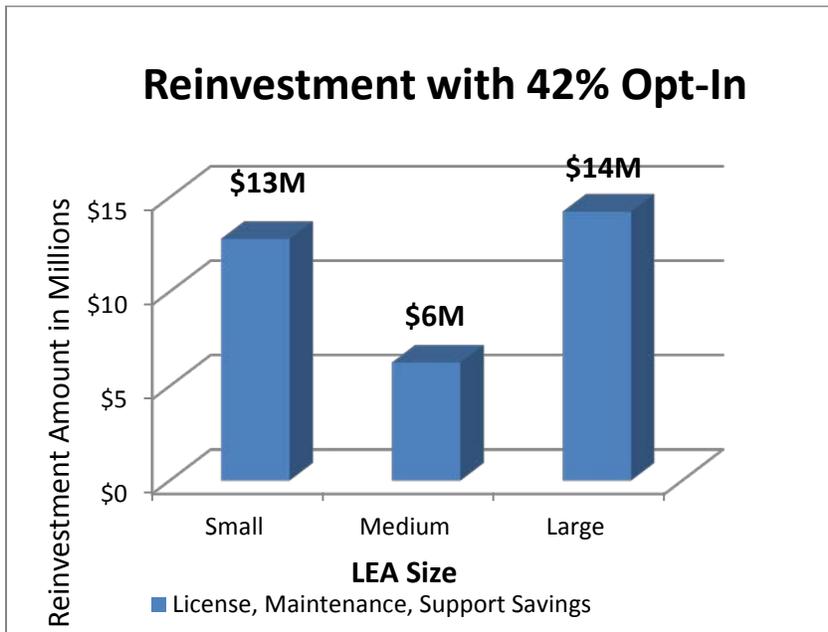
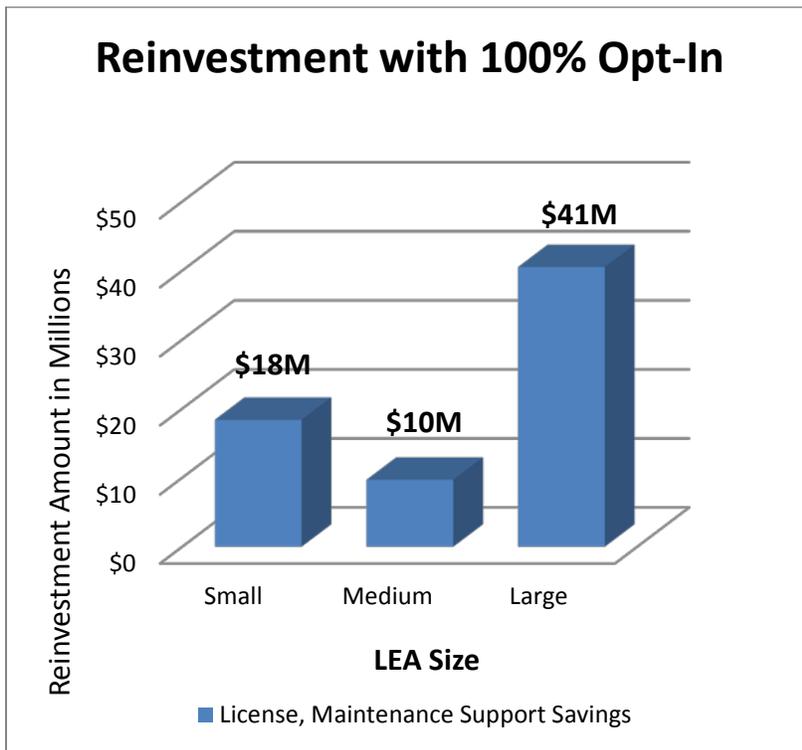


Figure 23 – Local Education Agency Reinvestment with 100% Opt-In



Success of the centralized systems approach is based on several factors including, but not limited to, LEAs realizing a cost reinvestment to other local needs, superior services and support from the ADE, and offerings of advanced integration and analytics across multiple systems and data sources. A jointly owned, cooperative formation of LEAs is recommended to provide the ADE with requirements, feedback,

and guidance so that the ADE can provide exceptional services through this approach. The ADE will continue to hone and enhance core competencies in this area, initiated within that last few years.

6.3.2 Arizona Department of Education

The basis of the Recommendation Hierarchy begins at the ADE, improving data quality and replacing applications with an integrated platform of core capabilities to service ADE’s program areas and subsequently the LEAs. Concurrently, the ADE will employ industry best practices and enabling frameworks. The ADE has the potential to realize a cost recovery of 568,000 man-hours expended on data management and corrections annually. Due to the downstream impact of improved data quality, LEAs will also experience a cost recovery or reinvestment of 500,000 man-hours expended on data management and error corrections or an estimated \$12.5 million annually.

A financial investment is required to accomplish these recommendations. See Chart 25 for the rollout of the recommendations over a five-year period. The recommendation to improve data quality and replace ADE applications with an integrated platform of core capabilities equals \$65.3 million and is divided between software licenses and implementation. The recommendation to implement industry best practices and enabling frameworks equals \$4.4 million. The fiscal year 2014 financial investment request totals \$23.1 million.

Chart 25 – Arizona Department of Education Financial Investment Request (\$ in millions)

Fiscal Year	2014	2015	2016	2017	2018	TOTAL
Recommendation #2: Implement and Apply Industry Best Practices and Enabling Frameworks						
Implementation Costs	3.2	0.3	0.3	0.3	0.3	\$4.4
Recommendation #1: Improve Data Quality and Replace Arizona Department of Education Applications						
Software Costs	3.2	0.3	0.3	0.3	0.3	\$4.4
Implementation Costs	16.7	10.8	18.1	6.3	9.0	\$60.9
Total Arizona Department of Education Investment Costs	\$23.1	\$11.4	\$18.7	\$6.9	\$9.6	\$69.7

The key findings of this financial investment analysis demonstrates that within a short, three-year time frame of AELAS’ implementation, the investment requested under this proposal triggers a return on investment that is equal to the accumulated benefits and, more importantly, that the cumulative benefits outpace the ongoing investment needed to support and maintain all of AELAS. The cumulative benefit calculation includes two components: (a) the reinvestment costs from the ADE and, (b) the reinvestment costs for the LEAs from the implementation of AELAS’ centralized systems. In other words, after three years, the investment has fully paid for itself and continues to deliver benefits to both the ADE and LEAs. See Chart 26 for the cumulative financial investment and benefit of AELAS as implemented per the recommendations in this Business Case. It is important to note that the LEA investment is a reallocation of current funds. This approach minimizes risk, improves the ability of the organization to adapt to change, and will provide the ongoing measurement of success and confidence in ADE’s execution and LEA adoption.

Chart 26 – Arizona Education Learning and Accountability System Cumulative Financial Investment and Benefit (\$ in millions)

Fiscal Year	2014	2015	2016	2017	2018	TOTAL
Cumulative LEA Investment	4.9	16.0	33.1	56.4	87.8	\$87.8
Cumulative Arizona Department of Education Investment	23.1	34.5	53.1	60.1	69.7	\$69.7
Total Cumulative Investment	28.0	50.5	86.2	116.5	157.5	\$157.5
Total Cumulative Benefit	--	\$45.0	\$133.9	\$222.8	\$334.0	\$334.0
Net Benefit	\$(28.0)	\$(5.5)	\$47.7	\$106.3	\$176.5	\$176.5

Effective measures are critical to ensure the benefits being sought are achieved and will report against the value proposition that justifies the investment. In the past year, the ADE has begun to initiate and employ the disciplines of industry best practices and enabling frameworks required to improve data quality and move toward applications with an integrated platform of core capabilities. The ADE will continue to identify the necessary metrics to measure and monitor benefits in anticipation of further justifying and providing auditability of success for the financial investment.

7.0 Benefit Analysis

The Benefits Dependency Network (BDN) model was utilized to identify the key drivers for organizational change, the objectives and the expected business benefits, the business changes, and Information Technology (IT) enablers. The linked elements are logically related and form a thread that tells the story of how IT enables the business to change in order to realize the associated, measureable business benefits that justify the financial investment.

Previously in this Business Case, the drivers, objectives, and benefits were outlined for the Arizona Education Learning and Accountability System (AELAS); however, through the BDN model, the researchers conducted a rigorous and systematic exploration of the benefits in the following ways and illustrated them in Chart 27:

- Benefit types are recognized outside of financial (quantitative, measurable and observable)
- Measures for all benefits are identified, including subjective and qualitative
- Evidence is sought for the magnitude of the benefit
- Ownership is selected for each benefit to ensure commitment and aid benefit delivery
- Risk assessment value is assigned to each benefit

Chart 27 – Arizona Education Learning and Accountability System Transformative Business Benefits

Explicitness Degree	Type	Business Benefits		
		Start Doing Things	Continue Doing Things	Stop Doing Things
High	Financial	Centralized, opt-in systems	Project Budgeting	Cleansing data
	Quantitative	Data governance	Gauging customer satisfaction	Maintaining current data elements and applications
	Measurable	Timely data access	Influencing national standards	Multiple data requests
Low	Observable	Advanced analytics	Local Education Agency participation in Arizona Department of Education surveys and initiatives	Reactive, firefighting mode

The following are samples of business benefits and the identification of measures, evidence, ownership and risks. The samples serve as a starting point, because the researchers of this Business Case should not work alone in this process. This process should be owned by the educational stakeholders and those who will gain value from the benefit.

Sample 1: ‘START’ Centralized, Opt-In systems (Financial Benefit)

A centralized, opt-in system model is a service and is activity proposed in this Business Case for the Arizona Department of Education (ADE) to start as a transformative business benefit. This benefit has a high degree of explicitness because it can be measured in financial terms. See the Financial Investment section of this Case for details. However, the risks associated with obtaining the financial benefit is directly associated to a number of factors including the statewide rate obtained for software system licenses and implementation, and the adoption rate of Local Education Agencies (LEAs). The risk assessment values assigned are low and medium, respectively. The owners of the benefit are assigned through a Project Management Office work artifact such as a Project Charter. In this case, the owner is

dependent on the type of centralized system being offered. For example, the owner of a Special Education Software system would be identified as executive sponsor in the Exceptional Student Services program area; whereas, the owners of an Instructional Improvement Software system would be identified across multiple program areas including Highly Effective Teachers and Leaders, High Academic Standards for Student, and Accountability and Assessment. A jointly owned, cooperative formation of LEAs is recommended to provide the ADE with requirements, feedback, and guidance to provide exceptional services through this business benefit. LEAs will be required to engage in an Intergovernmental Agreement with the ADE for the execution and implementation of the centralized systems.

Sample 2: 'CONTINUE' Gauging Customer Satisfaction (Quantitative Benefit)

Gauging customer satisfaction is currently an effective procedure conducted by ADE's program area of Strategic Planning. The value this practice brings to the ADE can be currently measured by each program area and typically becomes part of the annual strategic planning process when program areas define annual goals to achieve. For example, the IT program has written a goal to increase customer survey results by a certain point value. Since this benefit is already quantifiable, it has a slightly lesser degree of explicitness as compared to the financial type. Working with the Strategic Planning program area, a forecast should be made to determine how much value would result from achieving the benefit.

Sample 3: 'STOP' Multiple Data Requests (Measurable Benefit)

Requiring LEAs to comply with multiple and redundant data requests is a business practice proposed in this Business Case for the ADE to 'stop' as a transformative business benefit. The ADE cannot stop all data requests; however, the practice and process should be managed by a state data officer. This benefit has a lesser degree of explicitness because it is not measured in financial terms. The benefit can be measured through regularly scheduled customer satisfaction initiatives. The risks associated with reducing the overall number of data requests from LEAs is extremely low. The owners of the benefit includes the state data officer and Data Governance Commission, which serves as the governing body to assist the ADE and LEAs in complying with data policies.

8.0 Qualification of Researchers

8.1 LearningMate Solutions, Pvt. Ltd.

The Information Technology (IT) landscape of the 21st-century education world is changing rapidly. Student identity is increasingly digital, handheld devices are proliferating, applications and data storage are moving to the 'cloud' and our computing and network infrastructure is being taxed to its capacity. While students and teachers are consuming digital content at a rapid pace, teachers faced with larger class sizes and greater regulatory oversight have an urgent need for better teaching and learning analytics that can help them make a difference in every student's life. At the same time, administrators are demanding more insight into the business processes that keep our schools running.

LearningMate Works Here

LearningMate helps customers streamline their information, billing, grade management, teacher management, performance tracking and infrastructure management processes, then find ways to bring their spends down. Customers' portfolio of IT assets and applications are reviewed to make recommendations about what to keep, replace, retire, improve, build or buy.

LearningMate believes in making our customers independent and putting them back in the driver's seat on the information highway. The company has specialized in developing federated architectures that allow local independence in application deployment, while centralizing enterprise data and ensuring data integrity across statewide systems. Supporting open standards is essential in our work so our customers' technology and application portfolios stay relevant and current for a long time.

Building a unified data model is a pointless exercise if you don't have ways to leverage it. The LearningMate Business Intelligence and Learning Analytics team is tasked with developing meaningful views of teaching, learning, and administrative data from financial dashboards for the chief financial officer to real-time classroom dashboards for teachers; also, individual systems for students and parents ensure that everyone in the education system has the insight they need to succeed.

You don't get to be a world-class education-technology consulting firm without world-class processes. LearningMate has adopted the capability maturity model from Carnegie Mellon University's Software Engineering Institute. Today, LearningMate is one of a handful of education-technology companies that has been certified at Level 5—the highest level of performance measured by this model. By this commitment, our customers know LearningMate is constantly learning and improving in the quest for excellence in education.

LearningMate Solutions, Pvt. Ltd. is a U.S.-owned company with a global footprint. Headquartered in New York, the company employs more than 500 engineers, learning psychologists, designers and business analysts in four countries. In partnership with valued customers, LearningMate is committed to improving the lives of students, teachers and administrators across the world.

8.2 Researcher Biographies

8.2.1 Jolene Newton

Jolene Newton is an education executive and advocate with nearly 20 years of broad experience from classroom instruction and online educator to managing innovative educational products for state education agencies and K-12 districts. She earned her undergraduate degree in Education from Northern Arizona University and taught in the Washington Elementary School District in Phoenix, Arizona. While teaching, she earned a master's degree in education with a concentration in technology from Arizona State University, enabling her to implement and utilize technologies with the students she taught.

Prior to joining LearningMate and becoming a consultant for the Arizona Department of Education (ADE), Jolene worked at a few leading educational companies, where she displayed a strong record for managing and implementing educational products while ensuring customer satisfaction. Jolene also earned a master's degree in business administration from Arizona State University. Her expertise includes customer-focused and quality-minded product development and implementation; effective management of multiple projects simultaneously; extensive experience in public speaking and demonstrations; and instructional and assessment content development.

8.2.2 Ed Jung

Ed Jung is currently the chief technology officer for the ADE. He partners with ADE leadership to set technology product direction, guide the development of robust, scalable applications, and drive enterprise architecture.

Ed is a hands-on software product development executive, focusing on the education market during the last decade. He has deep knowledge of Learning Management systems, assessment solutions, and adaptive content and remediation. He has extensive experience building and growing technology organizations that span architecture, engineering, quality assurance, and infrastructure. He has built products using Java, C++, .NET, SQL, and JavaScript, running on Solaris, Linux, and Windows platforms.

While heading up K-12 curriculum development at Pearson, Ed started with an 80-person team consisting of employees, onshore and offshore consultants, then trimmed, reorganized, and recruited to build a series of focused, high-performance teams. He created Pearson SuccessNet, the K-12 interactive textbook and formative assessment system for Pearson, servicing more than six million students.

Ed's last assignment to kick-start mobile development at Pearson exemplifies his qualities: he taught himself iOS application development and used that knowledge to hire qualified contractors to work with him and build Pearson's first iPhone application. As interest grew in his work, he identified an offshore talent pool and built a remote development team one designer, developer, and tester at a time, hiring an offshore project manager when there was too many staff for him to directly manage.

Ed's principles at the core of his management style are: (1) know the tools and technology used by your staff as well as they do, (2) make a good decision quickly rather than make the optimal decision slowly, and (3) set clear expectations for all those you work with. At ease in organizations large and small, he effectively takes the entrepreneurial spirit required to innovate and invigorate, and blends it with proven veteran skills in software product development and technology personnel management.

8.2.3 Deborah Stirling, Ph.D.

Deborah Stirling has more than 15 years of proven leadership directing research and development projects, designing online learning environments, and conducting large-scale evaluations. She formerly served as senior director of research and development for Sebit, where she focused on developing the next generation of assessments and personalized learning environments for an international e-learning company, as well as investigating interactive technologies to improve global STEM education. Deborah previously worked for Pearson, where she directed the research portfolio for digital products and the development of learning models, the usability of products, and the design and development of adaptive technologies for the curriculum group. She has particular expertise in user-centered design activities, large-scale curriculum design and development efforts, and large-scale evaluation efforts related to digital learning programs.

Prior to Pearson, Deborah directed research and evaluation efforts at an Arizona State University research lab. She earned her doctorate degree at Arizona State University in curriculum and instruction with an emphasis in educational technology and has a master's degree in language, reading and culture.

8.2.4 Amit Soman

Amit Soman, LearningMate vice president of Enterprise Solutions, brings technical sophistication and business-savvy management to his work with the ADE. His 17-year consulting career has focused on software engineering in the education, publishing, transportation, e-learning and financial services sectors. He has architected, developed and managed critical educational services such as Learning Management systems, Assessment systems, Education Portals, Student Information Systems, Content Management systems, Reporting/Analytics systems and mobile apps.

Amit's superior record of delivering simultaneous, top-priority projects on time and under budget is driven by his expertise in managing knowledge transition, service transition from one location to another location, and reverse knowledge transition from vendors to internal employees. He has worked with various top-10 education and publishing companies like Pearson, McGraw-Hill, Harcourt, Scholastic and Elsevier in the U.S. and in Europe.

8.2.5 Marc Morin

With more than 20 years of experience in enterprise architecture, Marc Morin has spanned multiple industries in his career as a professional Information Technology/Information System consultant. He has spent more than 15 years as an IT executive with profit and loss financial responsibilities in industries ranging from high-tech to pharmaceutical to government.

Marc has a successful background working with executives and stakeholders to develop architecture framework that aligns strategy, processes, and IT assets with business goals. He has worked closely with C-level executives, project managers, developers and focus groups to avoid redundancy, minimize expenditures, and improve overall performance within their organizations. He is a business-savvy expert in establishing best practices and guidelines for modeling, selecting, developing and implementing information ecosystems spanning enterprise boundaries. He has acute hands-on knowledge of hardware, software, networking, applications, and systems engineering, and is an expert in the architectural applications of the Information Technology Infrastructure Library, The Open Group Architecture Framework, Institute of Electrical and Electronics Engineers, et al.

8.2.6 Loren Sucher

Loren Sucher is a former educator and a proven educational publishing professional with expertise overseeing marketing, product development, business development, and management of technology-based products. He has extensive knowledge of the education market and a proven track record of developing requirements, products, support materials, and marketing campaigns.

Loren has contributed his talents to a variety of education-centric companies nationwide, including executive positions where he oversaw research activities, guided technology development, and developed critical business relationships and strategic alliances. He has conducted field product research, focus group research, and surveys with teachers, principals, district staff and superintendents nationwide.

8.2.7 Don Hiatt

Donald Hiatt has more than 30 years of executive and technology management experience architecting and leading large, award-winning projects. He has implemented a wide range of solutions including business intelligence, documents and records management, and line-of-business applications development. Within Microsoft, he helped lead the Worldwide and U.S. Technical Communities Documents and Records Management special interest group; was active in the enterprise strategy technical community as an enterprise architect; and frequently spoke at technical conferences on IT strategy and enterprise content management subjects. He has significant experience in business process reengineering, document imaging and workflow projects valued at more than \$4 million, and projects lasting more than 18 months in duration.

8.2.8 Lisa McClure

Lisa McClure is an education leader with more than 25 years of experience in a wide variety of educational settings including online and blended learning, traditional K-12 education, and adult and alternative education. She has a track record of successful implementations of education programs for hard-to-serve populations nationwide.

As education director for the state of Wisconsin Department of Corrections, Lisa was responsible for the academic programming in all-adult correctional institutions across the state and led the development of the Employability Skills curriculum, which was later implemented across the state as part of Wisconsin's pre-release planning. As an operations director, she successfully led the launch and provided ongoing program oversight of 11 statewide virtual LEAs across nine states. Lisa is a highly skilled strategic manager with experience assessing program needs and developing efficient strategies to meet those needs.

8.2.9 Rich Schnettler

Rich Schnettler is a senior consultant with more than 30 years of IT implementation experience, including custom systems design and development, as well as vendor software package selection and implementations. He has worked in such environments as mainframe, mid-range and mini computers, customer servers, and the Web, while serving in the role of system, product and business analyst, computer operator, help desk support, trainer, developer, or project manager. Industries he has served include education (K-12), e-learning, e-publishing and consumer goods.

Rich earned his undergraduate degree in business administration specializing in operations management at the University of Missouri – St. Louis with a minor in quantitative computer science, and had previously earned certifications as a Siebel 2000 certified consultant and certified production inventory and manager sponsored by APICS (now the Association for Operations Management).

In recent years, and prior to joining LearningMate and the ADE, Rich has primarily served in the role of a business analyst and/or project manager, depending upon the need at Elsevier Health Science, in an effort to launch a series of strategic Web product initiatives including Mosby's Nursing Consult, Mosby's Nursing Skills, Procedures Consult, Mosby's Imaging Suite (the first integrated solution with a custom-developed Learning Management system), and Performance Management (also built on the Learning Management system's platform). This series of education and health content-laden products was launched in a period spanning only five years and with the exception of Procedures Consult, targeted nursing professionals, providing them with tools for continuing education and professional development.

With his hands-on career experience and ability to juggle both roles and projects, coupled with his extensive and deep understanding of systems design and implementation, Rich strives to provide the highest levels of quality and customer service possible for each and every customer project.

8.2.10 Joe Frost

Joe Frost has more than 20 years of IT experience in Arizona. He has earned a master of science degree in computer information systems from the University of Phoenix.

Prior to joining the ADE, he has had extensive experience and roles ranging from technology teacher to department chair to director of technology. His Fortune-500 company IT experience includes Intel, Honeywell, Apollo Group and Pearson.

8.2.11 John Bulwer

John Bulwer is an experienced IT professional with 10 years of customer-facing experience in a broad range of industries like parks and recreation, aviation and education. As a business analyst and IT liaison to the accounting, financial aid, and human resources functional areas, he worked directly with functional leaders and application developers to prioritize production support tasks in Agile/Scrum and Waterfall environments. His direct partnership with business stakeholders created business requirements, functional specifications, wireframes, flowcharts, test cases, and user-training documentation.

John, a college entrepreneur, designed and launched his company website, created marketing materials, and utilized social media as a means of promotion for the business. His successes include the design and implementation of a custom task management system and the implementation of the Sallie Mae Refund Disbursement program for more than 6,000 financial aid students at an online university.

John has earned bachelor of science degrees in aeronautics and in aviation business administration from Embry-Riddle Aeronautical University in Prescott, Arizona.

8.2.12 Tara Sprouse

Tara Sprouse is an experienced IT professional with more than 10 years of increasingly technical and managerial responsibilities. She has managed all aspects of It (including hardware, software, and technical support) for a national membership organization with more than 500,000 members. She also has project experience throughout the entire software development life cycle including requirements gathering, documentation, conversion, implementation, systems integration, and acceptance testing. She has an extensive background in both network and database administration, as well as in end-user support and vendor-relationship management.

Prior to joining LearningMate and becoming a consultant to the ADE, Tara served as her company's first enterprise services business systems analyst, in which she created business requirement documents for undocumented historical and current projects, resulting in an 800 percent increase in technical documentation within one year.

9.0 Appendix A – IT Service Management

The Arizona Department of Education (ADE) has recognized that it can no longer incidentally manage its Information Technology (IT) environment and must mature its overall capability to a higher level of performance both to minimize its operational costs and enable it to support and sustain the advanced educational services that are needed to advance Arizona's position as an education leader in the U.S. The formal and practice-based framework chosen to achieve the maturation and the strategic direction proposed by the ADE are:

- To implement the Information Technology Infrastructure Library (ITIL) framework, which is a set of practices for IT Service Management (ITSM) that focuses on aligning IT services with the needs of business. Specifically, the framework consists of 26 formal and well defined processes and four service functions, all contained within five service groups: service strategy, service design, service transition, service operation, and continual service improvement
- To implement a formal data governance and master data management capability to support data as a statewide service

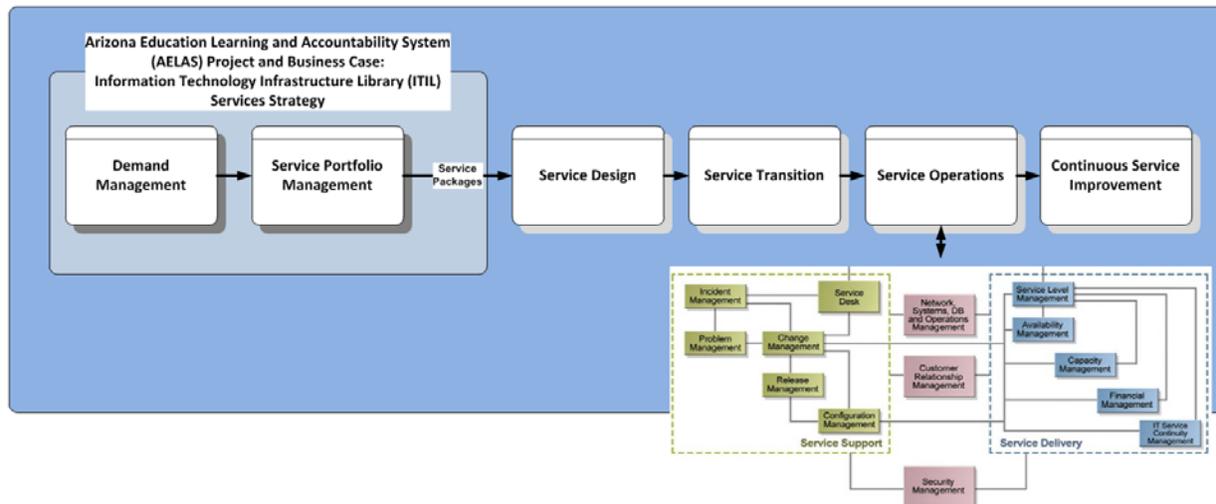
More importantly the approach taken to fulfill the Arizona Education Learning and Accountability System (AELAS) mandate requires that the ADE take a Service Portfolio Management approach to all services both core and advanced. This must be done in order to:

- effectively manage information delivery
- provide a stable core services infrastructure
- provide the capability to expand to advanced services
- be able to make strategic cost-effective decisions of what advanced services are needed and what core services changes are needed to the to support these needs.

9.1 Information Technology Infrastructure Library Framework

The road map for this maturation is the application of Carnegie Mellon’s Capability Maturity Model Integration, applying the ITSM framework of ITIL, which relates to the degree of formality and optimization of processes from ad hoc practices to formally defined steps, to managed result metrics, to active and ongoing optimization of the efficiency and effectiveness of the processes.

Figure 24 – Capabilities Maturity – Information Technology Infrastructure Library Framework



The ADE recognizes that the adoption of a comprehensive and formal framework, such as ITIL and Data Governance, in order to mature its capability will not occur overnight. Their implementation and effectiveness will ensue over time with ever-increasing implementation of, application of, exposure to and repetition of the detailed practices, policies, procedures and workflows associated with the framework.

The ADE is primarily a data management enterprise whose key central function is to collect data across the state both to enable payment for educational services, as well as infer performance to legislation using that data. Much like its application portfolio, ADE’s data portfolio has grown inorganically and now consists of some 120 database systems, 9,000 database tables, and 45,000 individual pieces of data within those databases. This does not include the uncounted Access databases and Excel spreadsheets that also store enterprise data. The complexity of the data can be compared to a large library where the index cards are in random order and the books are not tagged in accordance with the index card. There is a heavy reliance on tribal knowledge to know the data, which data, where the data is, how that piece of data is used, and which rules apply. Very much reflecting the applications development, data development proceeded nearly without any architectural guidance, policies, procedures or documentation. Given that the data the ADE collects is responsible for the approximately \$6 billion yearly paid out in education funding it can be argued that ADE’s data is the department’s single largest asset base, far eclipsing its applications and infrastructure portfolio.

Therefore, the purpose of this Business Case is to provide an assessment of the capabilities and expenses associated with fulfilling the educational technology requirements; produce a feasible road map for the implementation and maintenance of AELAS’ services; and overhaul ADE’s existing service portfolio to both modernize and meet its existing mandates, as well as provide the necessary services platform to implement the advanced capabilities contemplated by AELAS.

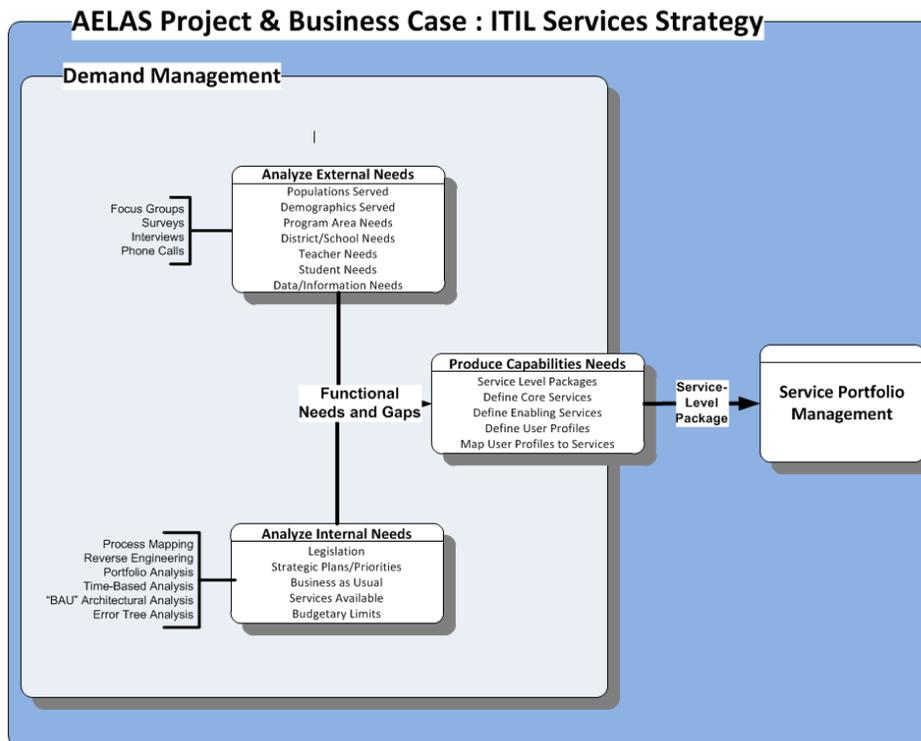
The approach taken to define and address the mandate of AELAS is founded on the diligent and methodical application of two key processes within the service strategy segment of ITIL to ensure and demonstrate sound investigation and research in order to identify and meet the needs being addressed and support the recommendations made within this Business Case. The two processes are those of Demand Management and Service Portfolio Management.

9.2 Demand Management

Demand Management is an IT governance process that enables IT and the business to optimize the investment in IT through fact-based decisions. This is the fundamental operating basis of this Business Case, which is concerned with researching and codifying the education environment in order to identify patterns of education activity and the resultant specific demands to IT. Patterns of education activity analysis is the formal codification of what people do, their roles, the processes they support and execute, and the requirements that need to be addressed through IT capabilities.

Demand Management considers and analyzes external and internal organizational needs in order to produce a business capabilities needs assessment that addresses functional needs and gaps as noted in Figure 25.

Figure 25 – Information Technology Infrastructure Library Services Strategy for Demand Management and Service Portfolio Management

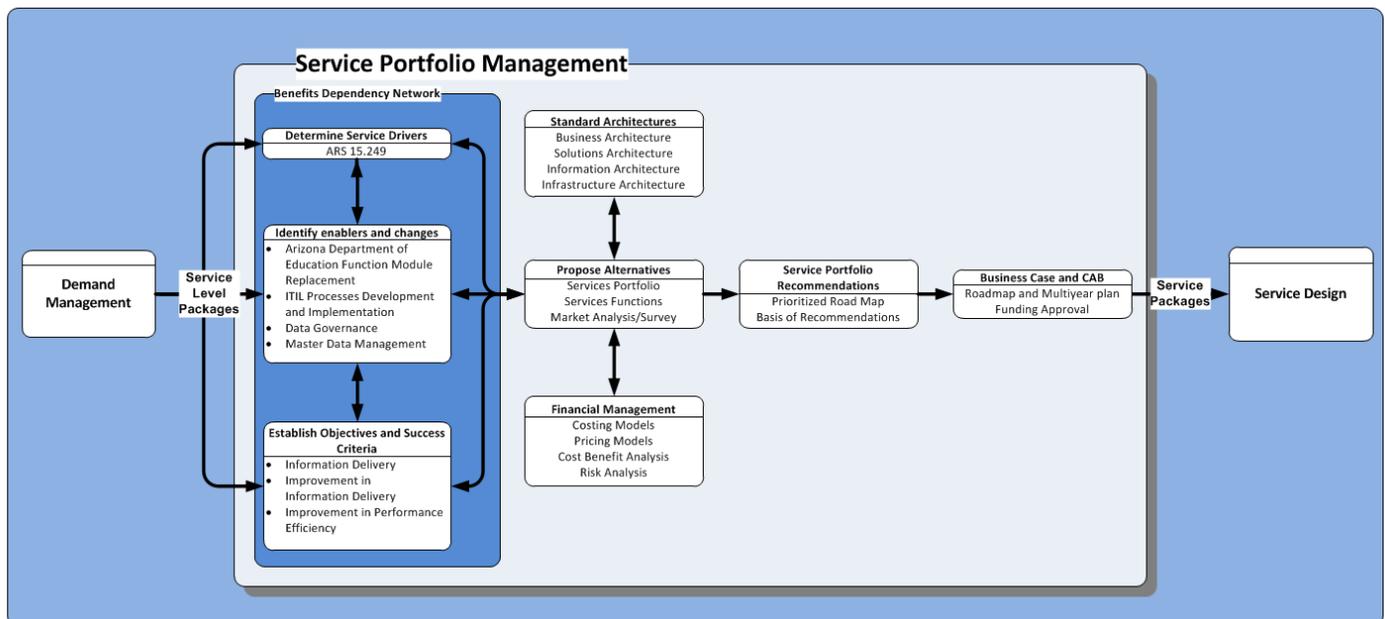


9.3 Service Portfolio Management

The end result of understanding the actual capabilities Demand Management addressed by AELAS and framing them into deliverable solutions requires the execution of the second most critical ITIL process—that of Service Portfolio Management. This is the singular process execution that enables this Business Case to take a comprehensive perspective of ADE’s existing IT service assets and combine them with the proposed services needed and identified by Demand Management. Next, a systematic and justifiable supporting rationalization is performed for the proposed investment into the service technology based upon:

- the investment criteria of allocated/available funds
- criticality of services
- dependency of services
- mandated services;
- ability to roll out the services
- legislated action

Figure 26 – Information Technology Infrastructure Library Services Strategy Model



9.4 Information Technology Infrastructure Library Deployment Status

The following is the current Capability Maturity Model Integration level of the efforts to implement ITIL processes across the ADE as of October of 2012:

Chart 29 – Arizona Department of Education Information Technology Infrastructure Library Deployment Status

Service Stage	Information Technology Infrastructure Library Process	Definition of Process	ADE Current Capability Maturity Model Level	Arizona Department of Education Status Explanation and Strategy
Service Strategy Processes	Demand Management	The supply chain management process balances the customers' requirements with the capacity of the infrastructure; it can match supply with demand proactively and execute the plan with minimal disruptions.	1	Is being applied as a part of the Arizona Education Learning and Accountability System project and is thus enabling the Arizona Department of Education to reach the first level of maturity by executing the process completely. The formal process documents will be produced as part of this exercise and will enable the Arizona Department of Education to grow to the second level of maturity.
	Service Portfolio Management	Ensures that the service provider has the right mix of services to meet required business outcomes at an appropriate level of investment	1	Is being applied as a part of the Arizona Education Learning and Accountability System project and is thus enabling the Arizona Department of Education to reach the first level of maturity by executing the process completely. The formal process documents will be produced as part of this exercise and will enable the Arizona Department of Education to grow to the second level of maturity.
	Financial Management for Information Technology Services	Provides cost-effective stewardship of the information technology assets and resources used in providing information technology services	0	This process is currently under review and analysis and has not been prioritized. The Arizona Department of Education is still using normal index funds and spreadsheet-based financial budgeting and management.
Service Design Processes	Capacity Management	Supports the optimum and cost-effective provision of Information Technology services by helping organizations match their Information Technology resources to business demands	1	In terms of infrastructure, this process is currently being done in anticipation of the Arizona Education Learning and Accountability System, and formal process documentation is scheduled to be developed.

Service Stage	Information Technology Infrastructure Library Process	Definition of Process	ADE Current Capability Maturity Model Level	Arizona Department of Education Status Explanation and Strategy
	Availability Management	Targets allowing organizations to sustain the Information Technology service availability to support the business at a justifiable cost	0	Is still loosely defined and highly manual, apart from basic service-level agreements information and schedules being produced as it relates to individual services
	Information Security Management	The Information Technology Infrastructure Library process, Security Management describes the structured fitting of information security in the management organization.	1	This process is currently under review and development.
	Information Technology Service Continuity Management	Covers the processes by which plans are put in place and are managed to ensure that Information Technology services can recover and continue even after a serious incident occurs	0	Awareness of the need to manage from a continuity perspective has occurred, and information is being gathered sporadically and incorporated with minimal formal structure but with the full intent to achieve business continuity of the implementation life of the Arizona Education Learning and Accountability System project.
	Supplier Management	Ensures that all contracts with suppliers support the needs of the business, and that all suppliers meet their contractual commitments	0	This process is still currently in inception, as there is much control that is the result of the state and not the Arizona Department of Education. However, within the Arizona Department of Education, policies and procedures are being developed.
	Service-Level Management	Provides for continual identification, monitoring and review of the levels of Information Technology services specified in the service-level agreements.	0	It is still loosely defined and highly manual, apart from basic service-level agreements information and schedules being produced as it relates to individual services.
	Service Transition Processes	Knowledge Management	Aims to gather, analyze, store and share knowledge and information within an organization; its primary purpose is to improve efficiency by reducing the need to rediscover knowledge.	1
Change Management		Aims to ensure that standardized methods and	1	This process has been fully developed and

Service Stage	Information Technology Infrastructure Library Process	Definition of Process	ADE Current Capability Maturity Model Level	Arizona Department of Education Status Explanation and Strategy
		procedures are used for efficient handling of all changes		documented to suit the processes within The Arizona Department of Education. A formal Change Approval Board has been established, and weekly review of projects being released within the environment occur as well as changes to existing applications. The ChangeGear application is used, for the moment, to track change with a conversion to Microsoft Service Manager.
	Release and Deployment Management	Is used by the Software Migration team for platform-independent and automated distribution of software and hardware, including license controls across the entire Information Technology infrastructure	1	Is currently under review and development. At the moment, it is rolled into Change Management and is loosely addressed by the operations team
	Service Asset and Configuration Management	Primarily focused on maintaining information (i.e., configurations) about configuration items (i.e., assets) required to deliver an Information Technology service, including their relationships. Configuration Management is the management and traceability of every aspect of a configuration, from beginning to end.	1	Currently under review and development. ChangeGear is currently being used as an interim tool to begin the socialization of the Service Asset and Configuration Management process.
	Service Validation and Testing	Ensures that deployed releases and the resulting services meet customer expectations, and verifies that Information Technology operations are able to support the new service	0	This process is still fully ad hoc and relies on either project teams for new releases, the development team for existing applications, and/or the operations team prior to production release.
Service Operation Functions	Service Desk Function	One of four Information Technology Infrastructure Library functions, and is primarily associated with the Service Operation lifecycle stage	1	This process, while not yet fully and formally documented, is part of the Change Management process, and formal development is under way.
	Technical Management Function	Its management processes recommends best practices for requirements analysis, planning,	1	This process is currently under review and development as part of the enterprise architecture

Service Stage	Information Technology Infrastructure Library Process	Definition of Process	ADE Current Capability Maturity Model Level	Arizona Department of Education Status Explanation and Strategy
Information Technology Infrastructure Library		design, deployment and ongoing operations management, as well as technical support of an infrastructure.		analysis and review.
	Application Management Function	The Information Technology Infrastructure Library Application Management process encompasses a set of best practices proposed to improve the overall quality of Information Technology software development and support through the life cycle of software development projects, with particular attention paid to gathering and defining requirements that meet business objectives.	0	This process is currently under review and development as part of the enterprise architecture analysis and review.
	IT Operations Management Function	Provides the day-to-day technical supervision of the infrastructure	1	This process is currently under review and development as part of the enterprise architecture analysis and review.
	Request Fulfillment (a.k.a. Request Management)	Focuses on fulfilling Service Requests, which are often minor (standard) changes (e.g., requests to change a password or requests for information).	0	This process, while not yet fully and formally documented, is part of the Change Management process, and formal development is under way.
	Incident Management	Aims to restore normal service operation as quickly as possible and minimize the adverse effects on business operations, thus ensuring that the best possible levels of service quality and availability are maintained	1	This process, while not yet fully and formally documented, is part of the Change Management process, and formal development is under way.
	Problem Management	Aims to resolve the root causes of incidents and thus to minimize the adverse impact of incidents and problems on business that are caused by errors within the Information Technology infrastructure, and to prevent recurrence of incidents related to these errors	1	This process, while not yet fully and formally documented, is part of the Change Management process, and formal development is under way.

Service Stage	Information Technology Infrastructure Library Process	Definition of Process	ADE Current Capability Maturity Model Level	Arizona Department of Education Status Explanation and Strategy
	Access Management	Less commonly called Access and Identity Management (AIM), is a process focused on granting authorized users the right to use a service, while preventing access to non-authorized users.	1	This process is currently under review and development as part of the enterprise architecture analysis and review. This is part of the Identity Management System project.
	Event Management	The process that monitors all events that occur through the Information Technology infrastructure	0	This process is currently under review and development as part of the enterprise architecture analysis and review.
CSI Processes	Service Reporting		1	Not under consideration at this moment.
	Service Measurement		1	Not under consideration at this moment.
	7-Step Improvement Process		0	Not under consideration at this moment.

10.0 Appendix B – Data Governance

The Data Governance' mission is to achieve flawless data such that each program area, external entity, and the education community as a whole acknowledge that, in terms of data quality, the Arizona Department of Education (ADE) is the people, processes and technology's gold standard. To date, numerous steps have been accomplished within the ADE to roll out Data Governance and Master Data Management.

10.1 Current Status

The following is a list of the items completed to date:

- 1) Produced and submitted Data Governance Charter to senior leadership
- 2) Produced Data Governance Policy
- 3) Produced Master Data Management Policy
- 4) Produced Data Governance Procedures Manual outline
- 5) Produced Data Dictionary Standards
- 6) Produced Data Governance Process Workflow (Capability Maturity Model Level-5 Goal)
- 7) Produced Data Governance Cultural Ritual Strategy
- 8) Developed a Communication Plan
- 9) Implemented a Data Governance and Master Data Management SharePoint repository to begin centralizing all related information in accordance with policies and procedures
- 10) Began producing models of program area conceptual data, data flows, collections, and rules repository
- 11) Established Common Education Data Standards(CEDS)/Ed-Fi as target data model standards for data collections
- 12) Established coaching program areas through the process of mapping all data collections
- 13) Delivered several Data Governance and Master Data Management awareness presentations
- 14) Incorporated and reinforced in all process modeling efforts and all program interactions the concepts of organization-wide data, data modeling standards, ownership, custodianship, and stewardship—separating the 'what data?' from the 'how is data kept?'

10.2 Data Governance Ongoing Efforts

- 1) Meet and present with ADE's program leaders for support and guidance/feedback
- 2) Obtain formal sign-off of the Data Governance Charter
- 3) Produce and execute the Organizational Communication Plan
- 4) Create the Data Governance Board and begin the assignment of resources
- 5) Develop the detailed Procedures Manuals to support Data Governance and Master Data Management
- 6) Report on the results of the pilot projects and lessons learned

- 7) Continue to gather information and suggestions, and address questions

10.3 Data Governance Objectives and Goals

The following list is of the specific targets that Data Governance is charged with in driving strategic and operational objectives:

- 1) Implement a complete set of Common Education Data Standards/Ed-Fi-based Operational Data Store for all ADE data
- 2) Advance the CEDS/Ed-Fi data model standard by becoming the leader in its ongoing development
- 3) Measure and reduce the cost of ongoing and post-processing data corrections, isolated data collections, and reprocessing of data by adhering to data retention, data governance policies and Master Data Management policies
- 4) Centralize all shared data and provide capability
- 5) Implement formal and stringent Configuration Management process of all data entities, data elements, business rules, legislative rules, and their interrelationship, each of which is deemed as an ADE Configuration Item
- 6) Implement formal and stringent Change Management process to any and all changes that relate to all data Configuration Items
- 7) Achieve a data audit exception of zero
- 8) Integrate data governance oversight within each and every data handling application project/acquisition
- 9) Achieve 100 percent compliance with the data dictionary standard, where each and every data element within the ADE is formally defined and an owner designated
- 10) Achieve 100 percent compliance with the data modeling standards for each and every data subject area that relates to the program areas
- 11) Achieve 100 percent elimination of all production data being held 'offline' as local data stores that are subject to audit exceptions
- 12) Achieve 'push button' capability of the production of all legislated reporting requirements
- 13) Achieve complete oversight and management of incoming data requests
- 14) Enable the ability to capture, retain and utilize P-20 workforce data

The establishment of a Data Governance program within ADE program areas, the ADE as an enterprise, and data stakeholder groups and partnerships, targets these goals:

- 1) Better decision making anchored in the integration of available data assets into a single version of reality
- 2) Reduced operational friction between ADE's business units through an ADE-wide adoption of an enterprise view of all data assets

- 3) A commitment to the needs and a clarification of the responsibilities of all data stakeholders whether they are data providers, data consumers, or both
- 4) An ADE-wide culture that moves all levels of management and staff to seek out and adopt common approaches to data issues
- 5) Standardized, repeatable, and auditable data processes
- 6) Reduced costs and increased effectiveness in the data arena through the coordinated efforts of all business units and stakeholders
- 7) Transparency of all data-related business rules and the processes that execute them
- 8) Standardized data definitions across the complete data domain, with input from internal and external subject matter experts
- 9) Transition of business units from narrow-use data silo operations to broad-use enterprise data systems, and the evolution of their role as 'data owners' to stewards and suppliers of quality data
- 10) Establishment of direction and measurement of data quality initiatives, including the definition of responsibilities and accountabilities of business units and their data stewards
- 11) Creation of roles and their decision rights and accountabilities to (a) establish safeguards and controls for data privacy compliance, and (b) control Access Management to meet usage standards
- 12) Centralized technology architecture to mitigate data integration challenges between cross-functional business units in order to meet the data and information needs of all education stakeholders
- 13) Maintenance of the operational integrity of the Education Data Warehouse through the enforcement of Change Management standards and rules for all data processes that support this and other longitudinal data system components

11.0 Appendix C – Local Education Agency Data Analysis Detail Report

11.1 Survey

An electronic survey was developed to gather cost data and information from schools regarding systems and products that they were using that are classified as Teaching and Learning, Administrative or Back Office. The survey was disseminated to 44 Local Education Agencies (LEAs) that were identified by the Governor’s Office of Education Innovation as leaders in integrating new technologies into their educational practices.

11.2 Site Visits

As a follow-up to the survey, site visits were scheduled to gain clarification on the survey responses and to gain insight on the needs of the LEAs. The list of 44 LEAs supplied by the Governor’s Office of Education Innovation also provided a starting point for LEA site visits. Nearby LEAs that had not participated in the original survey were either invited to participate in the discussion or had a separate visit scheduled where they then completed the survey and gave feedback on their needs. The feedback obtained during the site visits enabled the researchers to develop a list of the 10 most used and needed systems to a LEA.

Figure 27 – Local Education Agency Outreach and Participation by Local Education Agency Size

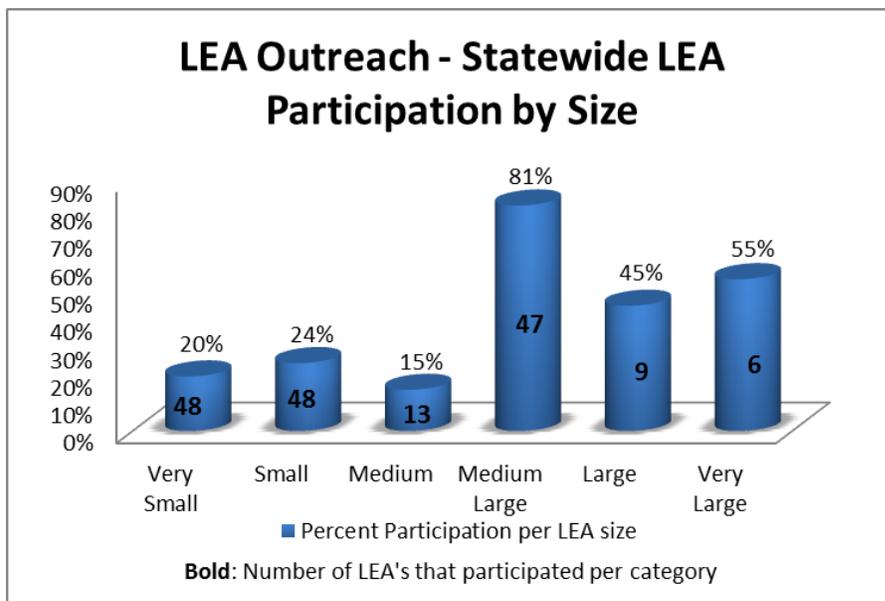
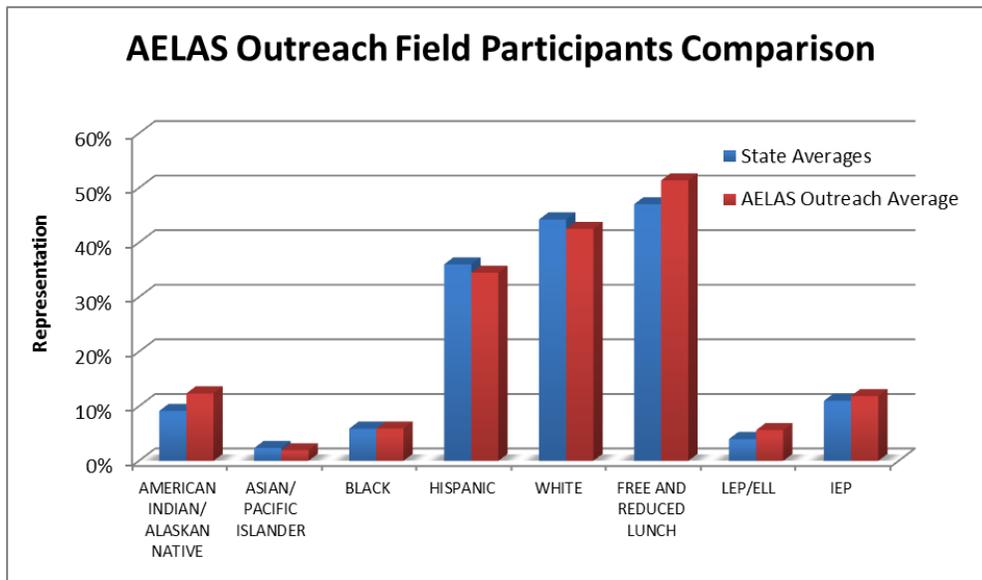


Figure 28 – State and Arizona Education Learning and Accountability System Outreach Response Averages by Demographic



11.3 Focus Groups

Five focus group sessions were conducted via online webinars. Each focus group session was centered on two of the top-10 systems identified in the site visits. The majority of participants were selected based on their subject matter expertise identified during site visits or as recommended by fellow team members. LEA representatives that were not able to participate in the first two outreach campaigns were also invited to attend the focus group sessions in which they felt they could contribute most. Participants were asked to validate a list of high-level system capabilities and rank each system in accordance to priority and likelihood of adoption as part of an Arizona Education Learning and Accountability System Phase I implementation.

11.4 Phone Interviews

Thirty phone interviews were conducted to gather hardware and infrastructure costs. As part of the interviews, school representatives were asked about the number of servers, service costs, overall Information Technology budget, and time investment involved in correcting Student Accountability Information System data.

11.5 Summary of Findings

The combination of these four methods allowed the researchers to collect data from urban/city, suburban, town, and rural LEAs of all size categories across the state. As evidenced by Chart 30, the geographic coverage of these LEAs allowed us to solicit information from a demographic population that closely matches the average of students across the state.

Chart 30 – Local Education Agency Outreach Coverage

LEA and Student Populations	Geographic Area Coverage				Total Number of Districts
	Urban/City	Suburban	Town	Rural	
Very Large ($\geq 20,000$)	4 Public School Districts	1 Public School District		1 Public School District	6 of 11
Large (8,000–9,999)	4 Public School Districts	2 Public School Districts		3 Public School Districts	9 of 20
Medium-Large (2,000–7,999)	9 LEAS (4 Districts & 5 Charters)	5 LEAS (4 Districts & 1 Charter)	14 Public School Districts	18 Public School Districts	46 of 58
Medium (600–1,999)	2 Public School Districts		5 Public School Districts	6 Public School Districts	13 of 88
Small (200-599)	21 LEAs	5 Charter School Districts	1 Public School District	21 LEAs (16 Districts & 5 Charters)	48 of 197
Very Small (≤ 199)	14 LEAs (5 Districts & 9 Charters)	6 Charter School Districts	6 LEAs (4 Districts & 2 Charters)	22 LEAs (15 District & 7 Charters)	48 of 245

LEGEND:

No school participation in this geographic area	No school representation in this geographic area.
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In all, 187 LEAs participated in our outreach campaigns, which represents approximately 30 percent of all LEAs and 56 percent of all students statewide. While the majority of participants came from the small and very small categories, larger LEAs actively participated—with the average larger LEA participating in two or more of the outreach campaigns.

12.0 Appendix D – Local Education Agency Outreach Reports

12.1 Site Visit Report

At the outset of the site visits, the Arizona Department of Education (ADE) research team presented the School Research Strategy and data collection plan that was reviewed and refined prior to its execution. The strategy included the research focus, framework/method, as well as the approach. The strategy and associated plan put forth goals regarding the coverage of visits in addition to the data and information to be collected. Goals for site visit coverage included the following:

1. Collect data from a representative sampling of educational groups in the state. The plan called for representation by:
 - a. **Local Education Agency Type** – Every type of education facility or institution, including public and charter school districts; joint technical education districts and career and technical education; accommodation districts; corrections; all five of the newly formed regional education centers; and county offices of education
 - b. **Local Education Agency Size** – Very small, small, medium, medium-large, large, and very large
 - c. **Geographic Area** – Urban/city, suburban, town and rural
 - d. **Demographics** – A general match to state demographics, with intentional representation of key subgroups such as high Native American or Hispanic populations
 - e. **Job Titles** – Superintendents, LEA leaders of instruction, finance/human resources, special populations, technology, principals, and teachers
2. Collect a broad set of data and information to support preparation of the Arizona Education Learning and Accountability System (AELAS) Business Case that would address the following:
 - a. Identify current software systems, vendor products, and/or manual processes
 - b. Identify initial and ongoing investments in software systems including implementation, maintenance, and support costs
 - c. Obtain feedback on ADE software applications and data systems
 - d. Assess connectivity capabilities
 - e. Gauge interest in adopting new, centralized, cloud-based systems from the ADE
 - f. Gauge interest in further ongoing AELAS research participation

To maximize the available time, ADE's research team offered individual visits to the Local Education Agencies (LEAs). Medium to small and small LEAs received invitations to regional site visits where the research team met with multiple organizations at the same time. The analysis of visits completed, relative to goals, follows.

12.1.1 Data Collection by Local Education Agency Type

Regional Service Centers

All five of the newly formed regional service centers received invitations for site visit meetings. Response varied greatly by region:

- Maricopa County Education Service Agency was represented extensively through meetings for the Rewarding Excellence in Instruction and Leadership (REIL) grant and through focused meetings with their finance team.

- Southern Arizona Regional Education Center, the region anchored by Pima County, hosted a meeting that was attended by representatives of their three counties.
- Northeast Arizona Regional Center, anchored by Navajo County, declined a joint meeting, but all three county superintendents attended regional focus groups with LEAs in their counties.
- East Central Regional Center, anchored by Pinal County accepted the invitation and scheduled a live meeting with a teleconference for their four counties. Only Pinal County attended the meeting; however, one of their counties, Graham County, was represented at a separate focus group by their deputy superintendent.
- West Central Regional Service Center, centered in Yavapai County, was unable to schedule a joint meeting of their four county superintendents' offices; however, their deputy superintendent met with AELAS' team and attended a focus group.

Local Education Agencies (Districts)

As of June 30, 2012, AELAS' team conducted a total of 15 visits focused on school districts, seven visits focused on charter schools, and one visit to the Arizona Department of Corrections. The visits have resulted in coverage of 21 percent of school districts, representing 33 percent of students:

Chart 31 – Local Education Agency (District) Site Visits

Total Local Education Agencies	Local Education Agency Visits	Percentage of Local Education Agencies Visited	Students Served by Size Statewide	Students Served by Visits	Percentage Students Represented
228	48	21%	960,012	315,528	33%

Local Education Agencies (Charters)

A total of nine meetings with charters collected information from eight charter organizations and nine independent charters. While charter representation as a percentage is lower than for school districts, AELAS' team believes that the feedback from charters is consistent, and additional meetings are unlikely to reveal new information. Visits to charter schools have resulted in coverage of 15 percent of charter schools, representing 8 percent of charter students.

Chart 32 – Local Education Agency (Charter) Site Visits

Total Local Education Agencies	Arizona Education Learning and Accountability System Local Education Agency Visits	Percentage of Local Education Agencies Visited	Students in Local Education Agencies Statewide	Students in Local Education Agencies by Site Visits	Percentage Students Represented
408	60	15%	113,369	8,954	8%

Other Educational Institutions

ADE's research team completed a visit to the Arizona Department of Corrections, with another visit planned for local correctional facilities that serve incarcerated students. A visit was also completed to the

East Valley Institute of Technology to gather information on software systems used in Career Technical Education programs. No visit has been made to the Arizona School for the Deaf and Blind, which may be another visit that should be scheduled, time permitting.

12.1.2 Data Collection by District Size

For purposes of this process, public school districts were divided into just three categories (small, medium and large), since this report was created before going to the six-size categories. Based on this, the representation for public school districts was as follows:

Chart 33 – Data Collection by District Size

District Size	Total Districts in Arizona	District Visits	Percentage of Districts Visited	Students Served by Size Statewide	Students Served by Visits	Percentage of Students Represented
Large (5,000+ students)	15	4	27%	474,791	186,174	39%
Medium (1,500–14,999 students)	79	25	32%	433,139	116,956	27%
Small (> 1,500 students)	134	19	14%	52,082	12398	24%

Visits to charter schools also covered a broad range of organizations based on size. As noted previously, visits to charters included visits to both charter organizations and individual charter schools. The largest organization, The Leona Group, served more than 6,000 students in 24 schools. The largest independent charter was Primavera, serving more than 3,000 students online. Among brick and mortar charters, Noah Webster Basic School served more than 1,000 students in K-6. The majority of charter schools are between 150 and 400 students in size.

12.1.3 Data Collection by Geographic Area

The categories assigned by the National Center for Education Statistics indicate that Arizona educational institutions are weighted toward city and rural locations. Percentages by category are somewhat over-weighted for ‘city’ because individual charters are counted equally with school districts (and charters are more common in larger cities). With that caveat, it still appears that the percentages of visits to date are within range of state representation, and in fact are a bit higher in rural areas, which are a location we especially wanted to represent.

Chart 34 – Data Collection by Geographic Classification

Geographic Classification	Arizona State Percentage	Visit Percentage
City	43%	30%
Suburbs	11%	6%
Town	14%	23%
Rural	31%	41%

Another way to view geographic location is by looking at the visits by county. To date, ADE researchers have visited 10 of the 15 counties in the state. The counties not visited were Gila, Greenlee, La Paz, Mohave, and Santa Cruz. Collectively, these five counties represent 4.8 percent of the state student population. Mohave represents half of that amount and should possibly be targeted during any additional visits.

Chart 35 – District Representation by County

County	Number of Students	Percentage of Total AZ Students	Number of Students Represented	Percentage of Students Represented	Number of Districts	Number of Districts Visited	Percentage of Districts Represented
Apache	13,087	1.4%	12,975	99.1%	12	10	83.3%
Cochise	18,560	1.9%	6,396	34.5%	25	4	16.0%
Coconino	18,219	1.9%	15,256	83.7%	16	4	25.0%
Gila	7,698	0.8%	0	0.0%	8	0	0.0%
Graham	6,160	0.6%	5,813	94.4%	9	4	44.4%
Greenlee	1,609	0.2%	0	0.0%	5	0	0.0%
La Paz	2,416	0.3%	0	0.0%	6	0	0.0%
Maricopa	603,691	62.9%	172,736	28.6%	66	8	12.1%
Mohave	22,803	2.4%	0	0.0%	13	0	0.0%
Navajo	18,751	2.0%	17,877	95.3%	13	9	69.2%
Pima	130,784	13.6%	65,572	50.1%	17	2	11.8%
Pinal	47,999	5.0%	7,950	16.6%	21	1	4.8%
Santa Cruz	10,160	1.1%	170	1.7%	8	0	0.0%
Yavapai	22,141	2.3%	16,734	75.6%	23	5	21.7%
Yuma	35,815	3.7%	10,216	28.5%	12	1	8.3%

12.1.4 Data Collection by Demographics

Visits to LEAs reflect fairly closely the demographics of students by ethnicity, and special statewide classifications for all LEAs as shown in Chart 36.

Chart 36 – Local Education Agency (Districts) Visits by Student Demographics

	State Average	Visit Average
American Indian/Alaskan Native Students	5%	10%
Asian/Pacific Islander Students	3%	3%
Black Students	6%	6%
Hispanic Students	41%	40%
White Students	44%	41%
Free And Reduced Lunch	47%	51%
Limited English Proficient/English Language Learner Students	8%	8%
Individualized Education Program	12%	12%

While the site visit numbers match up quite closely with state averages, it should be noted that emphasis was placed on collecting information from areas with high Native American and border-area Hispanic populations.

Demographics for charter schools who participated in site visits are likewise reflective of the state averages of demographics for charter schools.

Chart 37 – Local Education Agency (Charter) Visits Student Demographics

	State Average	Visit Average
American Indian/Alaskan Native Students	4%	2%
Asian/Pacific Islander Students	4%	7%
Black Students	8%	6%
Hispanic Students	35%	29%
White Students	50%	54%
Free and Reduced Lunch	43%	17%
Limited English Proficient/English Language Learner Students	4%	3%
Individualized Education Program	9%	4%

12.1.5 Data Collection by Job Title

To date, the visits have included 199 participants, including a number of superintendents and assistant superintendents; primarily LEA leaders of instruction, finance/human resources, special populations, and technology; and fewer than 20 principals (including charter operators). Although invitations have asked that teachers be included, only a few have been in attendance at site visits.

12.1.6 Recommendations

The completed site visit research represents a comprehensive baseline of Arizona LEAs. While additional visits might not yield new findings, scheduling visits should be considered to Mohave and Gila Counties to involve them in the process. Kingman and Payson Unified School Districts are likely targets as well. It is also recommended that a meeting be scheduled with Yavapai County superintendents if the opportunity arises.

Chart 38 – Site Visit Data Collection Overview

Category	Current Status	Next Steps
Current Local Education Agency software applications	There are some trends and common applications being used, which could translate into acceptance of those common applications in a private-cloud environment.	Schedule focus groups: <ul style="list-style-type: none"> • Validate high-level requirements for applications • Clarify status of additional potential 'early adopters'
Initial and ongoing investments in Local Education Agency applications	Financial/cost information received from: <ul style="list-style-type: none"> • Survey respondents • Some site visits • Vendor materials 	<ul style="list-style-type: none"> • Analyze coverage of cost information for a representative sampling of Local Education Agencies
Interest in adopting new, cloud-based applications	Interest in the overall benefit of the Arizona Education Learning and Accountability System's private-cloud solution was neutral. Without specific information to provide to Local Education Agencies regarding exact cost, a roll-out time line, and specific applications available, none were willing to commit to be early adopters. <ul style="list-style-type: none"> • Small Local Education Agencies were open to changing applications if efficiencies were possible. • Certain applications, such as Special Education Management software had broad appeal for the Arizona Education Learning and Accountability System because of the ability to share Individual Education Programs easily when students moved. • There are three or four common Student Information System applications utilized by the state 	<ul style="list-style-type: none"> • Maintain contact with Local Education Agencies following focus groups to better gauge interest in early adoption of the Arizona Education Learning and Accountability System. • Identify applications that could be 'easy wins' for building trust in the Arizona Department of Education. • Move ahead with interim solutions such as a Request for Proposal for Special Education Management software. • Use focus groups to better understand the drivers and barriers to adoption of the Arizona Education Learning and Accountability System.

Category	Current Status	Next Steps
Connectivity capabilities	Internet connectivity issues were not as widespread as we had anticipated. Even rural areas are improving their bandwidth and reliability through federal programs such as GovNET and E-Rate. Concerns were expressed, however, about Internet service loss because of power failures in remote areas, and infrastructure issues in older school buildings.	<ul style="list-style-type: none"> Continue to follow up on Local Education Agency concerns about the reliability of cloud-based solutions for systems that are essential to daily operation. Update information about connectivity as improvements are identified.
Interest in ongoing Arizona Education Learning and Accountability System research participation	Part of the site visit process included asking participants for their willingness to participate in future focus groups as well as other input and review opportunities. This information and personal knowledge of individuals that have an interest in the benefits of the Arizona Education Learning and Accountability System will be used to develop focus group participant lists.	<ul style="list-style-type: none"> Conduct focus groups Follow up with Local Education Agencies that expressed interest about the Arizona Education Learning and Accountability System participation to cultivate relationships and look for ways to bring them into the process.
Feedback on Arizona Department of Education data systems	<p>Participants were all given the opportunity to give feedback on their experiences with Arizona Department of Education data systems. Many viewed our presence in the site visit as the only time they have had the opportunity to be heard by the Arizona Department of Education. We collected all of their feedback and are in the process of organizing it in a way that will be shared to relevant teams in the Arizona Department of Education.</p> <p>Some of the most common feedback included:</p> <ul style="list-style-type: none"> The Student Accountability Information System is improving but still requires significant resources The Arizona Department of Education needs to streamline state system workflows to eliminate the need for redundant data All Local Education Agencies would like to have historical data follow students in real time All Local Education Agencies want dashboards and tools to assist in analyzing data All participants support implementation of Single Sign-On to state systems 	<ul style="list-style-type: none"> Feedback to be compiled and ready for distribution

Chart 39 – Categories of Systems Discussed

Teaching and Learning	Administrative	Back Office
<ul style="list-style-type: none"> • Assessment • Content Management system • Credit Recovery • Learning Management system • Lesson planning (included with Content Management system) • Progress monitoring/response to intervention • Social networking 	<ul style="list-style-type: none"> • Curriculum mapping • High-Stakes Test Analysis • Individualized Education Program Management • Library (not added until later in our visits) • Nutrition/food management • Program Management • Student Accountability Information System (included functions for Grade Book, scheduling, parent portal, English Language Learners, health/medical) • Transportation 	<ul style="list-style-type: none"> • Finance • Highly qualified teachers • Human resources management • Payroll • Professional development • Purchasing • Staff collaboration and conferencing • Substitute management • Teacher and principal evaluation • Warehouse/inventory

Chart 40 – Potential by Specific Application

Potential	Systems
Common applications identified	Student Information Systems, Individualized Education Program, progress monitoring/response to intervention, Professional development, Credit Recovery, Formative Assessment
Commonly addressed with manual solutions or not at all	High-Stakes Test Analysis, Learning Management system, Content Management system (including lesson planning and content mapping), Substitute management, staff collaboration/conferencing, teacher and principal evaluation and goals
Local Education Agencies were satisfied with their current solutions	Nutrition/food management, transportation, finance, purchasing, payroll, human resources, warehouse/inventory
Local Education Agencies are not looking for options	Social networking, highly qualified teachers

Chart 41 – Potential by Local Education Agency Size/Type

Local Education Agencies Size/Type	Greatest Potential Drivers to the Arizona Education Learning and Accountability System
Large Districts (> 15,000)	Having one source of truth for student data; providing Local Education Agencies with vendor solution analysis; scalability of solutions
Medium Districts (1,500–14,999)	Cost savings, electronic transfer of records, transition to using tools rather than manual solutions
Small Districts (> 1,500) and Charters	Cost savings, fewer local resources needed, electronic transfer of student records

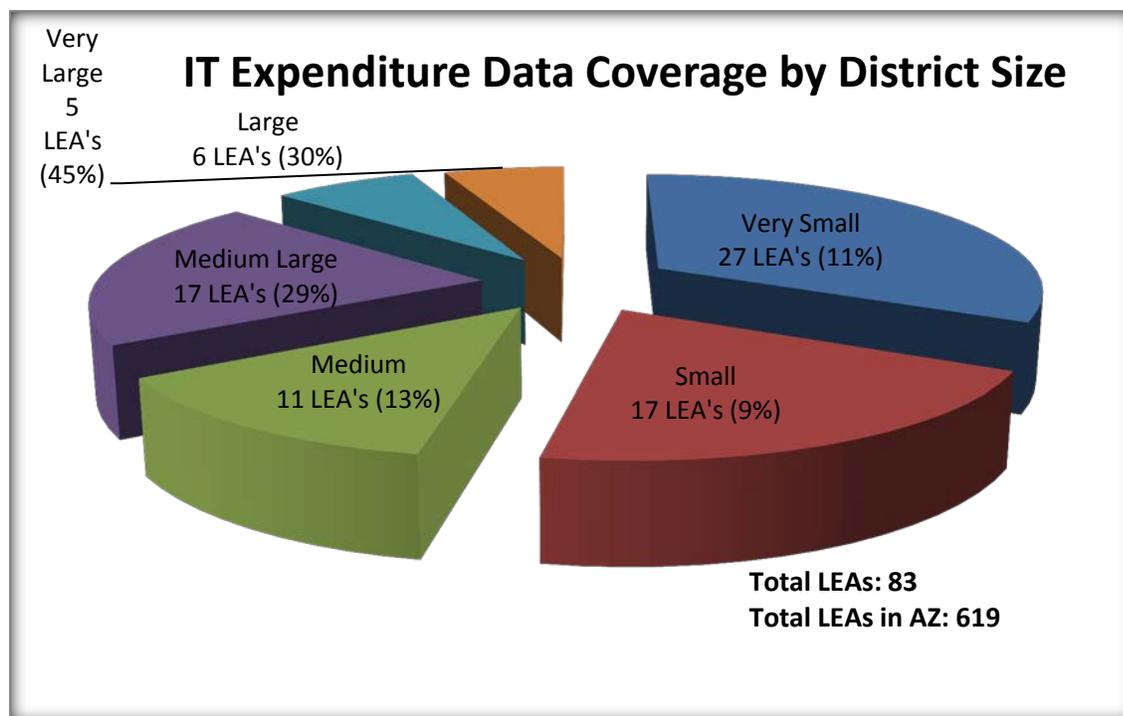
12.1.7 Data Collection

Chart 42 highlights the results of the LEA phone surveys.

Chart 42 – Local Education Agency Phone Survey Results

Criteria	Results
Total contacts made	120
Number providing information	31
New survey responses	24 (14 very small, 8 small, 2 medium)
Clarification of original survey data	7

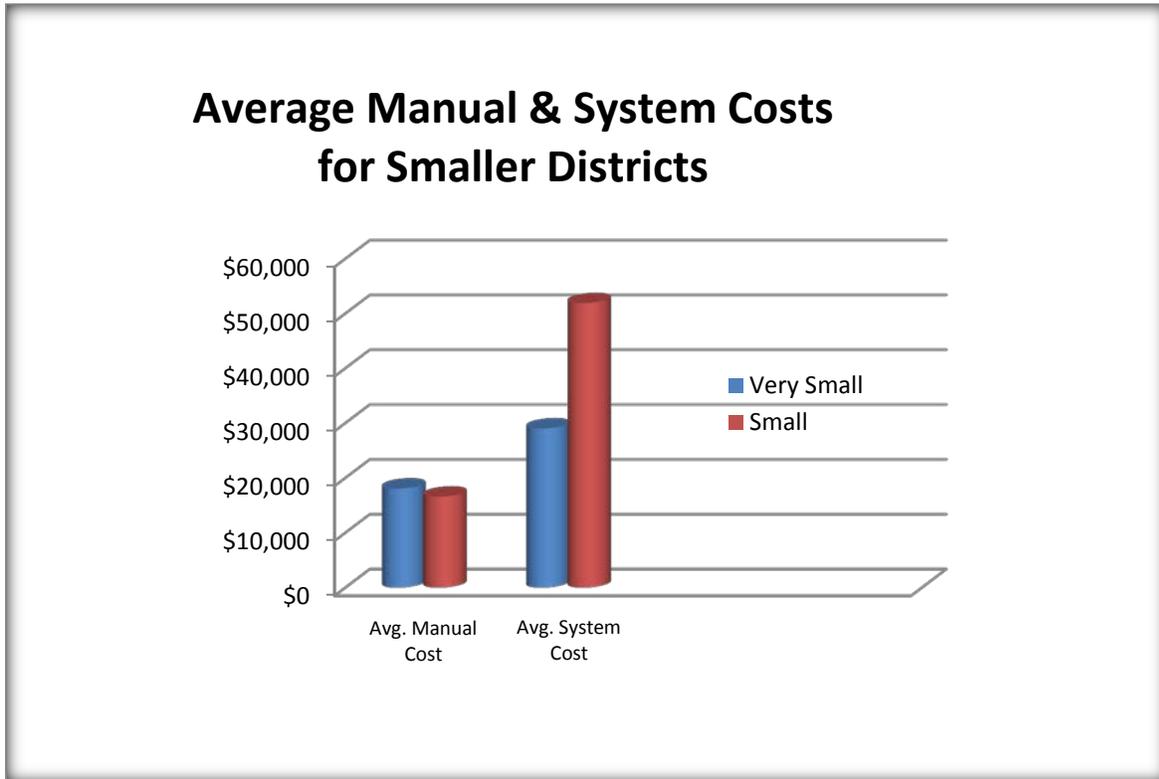
Figure 29 – Local Education Agency Information Technology Expenditure Data Coverage by Size



Although the goal was to get survey responses up to a minimum threshold between 15 and 20 percent of the LEAs in each of the smallest size categories, the goal was not quite reached. The phone survey lasted two weeks. And although the calling team had other responsibilities during that time, the majority of the two business analysts' time was dedicated to preparing, calling, re-calling, emailing, and documenting the responses.

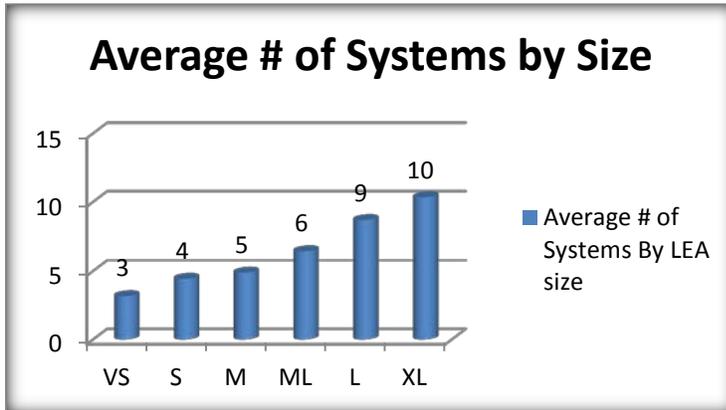
An important outcome of the follow-up phone calls is the documentation of the amount of manual work in areas where systems were not used. Figure 30 quantifies the tasks that are completed manually as opposed to purchasing a technology solution. Manual costs were not included in the original survey, but they were collected in the follow-up phone calls. Although there is not a budgetary line item for the manual costs, there is a cost of manpower that could be redeployed to other education-related tasks.

Figure 30 – Average Manual and System Costs for Smaller LEAs



Another way to look at the role of manual labor in smaller LEAs is shown in Figure 31. Very small LEAs have a few systems on which they rely. Typically, they have a Student Information System, some formative assessment tools, and some sort of finance tool. Other business needs are completed manually.

Figure 31 – Average Number of Systems by Size Category



12.1.8 Summary of Data Collection Findings

Although it was not possible to get responses from enough districts to reach the lower end of the range (15 percent) of representation for each of the LEA size categories, the number of responding districts did double the number of responses. It also resulted in the necessary information on hardware costs for all six LEA size categories, calculated costs for manual efforts in very small and small LEAs, and calculated information from districts in all size categories to quantify the ‘cost’ to LEAs for Student Accountability Information System submissions.

Through this exercise, a more critical look at the original survey results was taken in relation to the phone survey information obtained, and resulted in the ability to make more appropriate decisions as to the accuracy of some of the data submitted in the survey and how best to handle data that fell into the category of being an outlier. This has led to an increased level of confidence in the cost data that was collected for AELAS’ Business Case.

12.2 Focus Group Report

Following the site visits that were conducted May thru July of 2012, focus groups were facilitated to further refine the LEAs' needs and priorities of systems within AELAS. By the time the site visits were completed and the focus groups were scheduled, it was nearing the beginning of the new school year for many districts, and availability for participation in the focus groups would be limited. To mitigate this challenge, the sessions were held online using ADE's licensed GoToWebinar tool, and multiple methods were utilized in order to gather input. The goals of the focus groups were to:

- Validate high-level capabilities for systems that could be accessed through AELAS
- Prioritize systems needed in early phases of an AELAS implementation
- Identify LEAs interested in an early adoption of AELAS' statewide opt-in systems

Focus group participants represented LEAs in all six of the size categories that have been identified in this Business Case. Each of the five focus group sessions was hosted online, and covered two systems that were identified in site visits as having a higher potential for early adoption of AELAS. A total of 10 systems were covered in the five sessions. Participants provided input via discussion, online polling, and post meeting surveys.

12.2.1 Objectives and Strategy

The focus groups targeted the 10 systems that showed the greatest potential cost savings, and those that were identified during site visits as popular systems for adoption through AELAS. The systems were: Assessment, Content Management, Credit Recovery, Individualized Education Program Management, Learning Management, Professional development, collaboration and conferencing tools, student information, observation and evaluation tools for teachers and principals, and High-Stakes Test Analysis.

Only two systems were presented at a time for each focus group to minimize the number of participants that would be needed and ensure that the right participants attended the right focus groups. Questions relating to the Identity Management System (IMS) project were also collected on behalf of a separate initiative to consolidate what would have been a separate effort to collect some information. IMS was not originally in the focus group meeting scope, but that topic was added to three focus group sessions as follows:

- Professional Development and Teacher/Principal Observation and Evaluation
- Learning Management system and Credit Recovery/Credit Accrual (plus IMS)
- Assessment system and Test Analysis (plus IMS)
- Student Information System and Content Management system
- Individualized Education Program Management and Staff Collaboration and Conferencing (plus IMS)

Analysis of the site visits identified a number of Local education agencies that provided good input and/or identified a need for AELAS. These same institutions were targeted for focus group invitations. Within these organizations, potential participants for the focus groups were identified based upon their knowledge of the specific systems or tasks that the systems support. Invitations were sent to 80 potential participants. Each invitee was given the option to select a different focus group if they felt they could better contribute to other topics. In some cases, there were multiple staff in a room participating, but they did not each have their own computer to add to the poll results; however, they were able to contribute as a group.

Chart 43 – Local Education Agency Focus Group Participation by Size Category

Size Categories	Percentage of Local Education Agencies
Very Large (≥ 20,000)	3
Large (8,000–19,999)	4
Medium-Large (2,000–7,999)	9
Medium (600–1,999)	5
Small (200–599)	3
Very Small (≤ 199)	2
Other Local Education Agency	2

12.2.2 Agenda Template

The focus group meetings were hosted on GoToWebinar. Participants were able to contribute to the discussion and ask questions by use of this technology. The slide deck that was used to guide the sessions is included in the appendix. All sessions were approximately 90 minutes in length.

- I. Introductions, Purpose, Background (5 minutes)
- II. Topic 1 (30 minutes)
 - a. Discussion questions
 - b. Online poll questions
 - c. Rating of high-level requirements
- III. Topic 2 (30 minutes)
 - a. Discussion questions
 - b. Online poll questions
 - c. Rating of high-level requirements – This will be done in the same way as for Topic 1.
- IV. Q & A (30 minutes) follow-up from typed questions; new questions, wrap-up and closing
- V. Direct feedback via post-session survey questions

12.2.3 Focus Group Participation

Eighty-five individuals from 53 LEAs were invited to attend one of the five focus group sessions. Final attendance was 40 individuals from 26 LEAs, plus two attendees from other education agencies (i.e., county office of education and an education technology consortium)—a 50 percent attendance rate. A few individuals responded that they had to miss the sessions because of other higher priorities in their districts or charters, but still took the time to complete the rating sheets after the sessions were held. Most of the participating LEAs were also part of the site visits, with the exception of two districts. The focus group sessions were recorded online through the software.

Participation during the focus groups was very positive. Participants that had access to a microphone for the session were able to participate more fully, but even those without a microphone still entered

questions and provided valuable input. The questions and input were read aloud and incorporated into the meeting. Feedback during and after the session was very positive in that people felt that their voices were being heard, and felt it was positive that there were LEAs of all sizes included in the discussion.

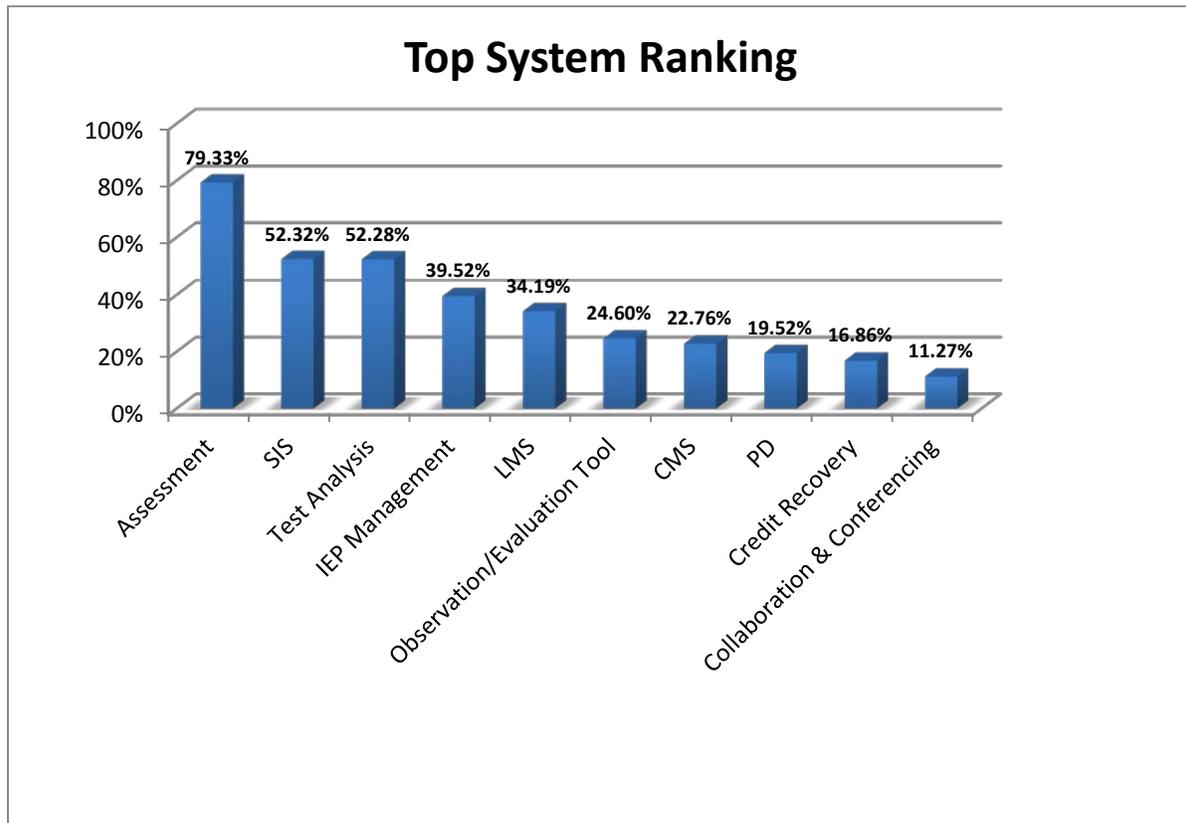
Chart 44 – Local Education Agency Focus Group Participation and Response Rate

Session	Systems	Number Invited	Participation Rate	Rating Sheets Response Rate	Survey Response Rate
1	Assessment system and Test Analysis, IMS	18	50.00%	100.00%	66.67%
2	Individualized Education Plan Management & Staff Collaboration and Conferencing, IMS	18	55.56%	60.00%	50.00%
3	Learning Management system & Credit Recovery, IMS	14	50.00%	28.57%	85.71%
4	Professional Development & Teacher/Principal Observation/Evaluation	20	45.00%	33.33%	44.44%
5	Student Information System & Content Management system	15	33.33%	60.00%	60.00%

To meet the goals of the focus groups, four information gathering techniques were employed: capability-rating work sheets, discussion, interactive polling, and a survey questionnaire—all were completed and submitted after the focus group session was completed.

The polls focused on the prioritization of software systems desired as a statewide, centralized solution. For the purpose of ranking applications, participants were presented with two lists of five applications, and asked to select their top two from each list. Note: The webinar tool did not allow more than seven items to be in a poll, so we chose to break the list into two groups of five applications. The results reflect how many times an application was identified as a top choice, and are summarized in Figure 32.

Figure 32 – Local Education Agency Top Systems Ranking

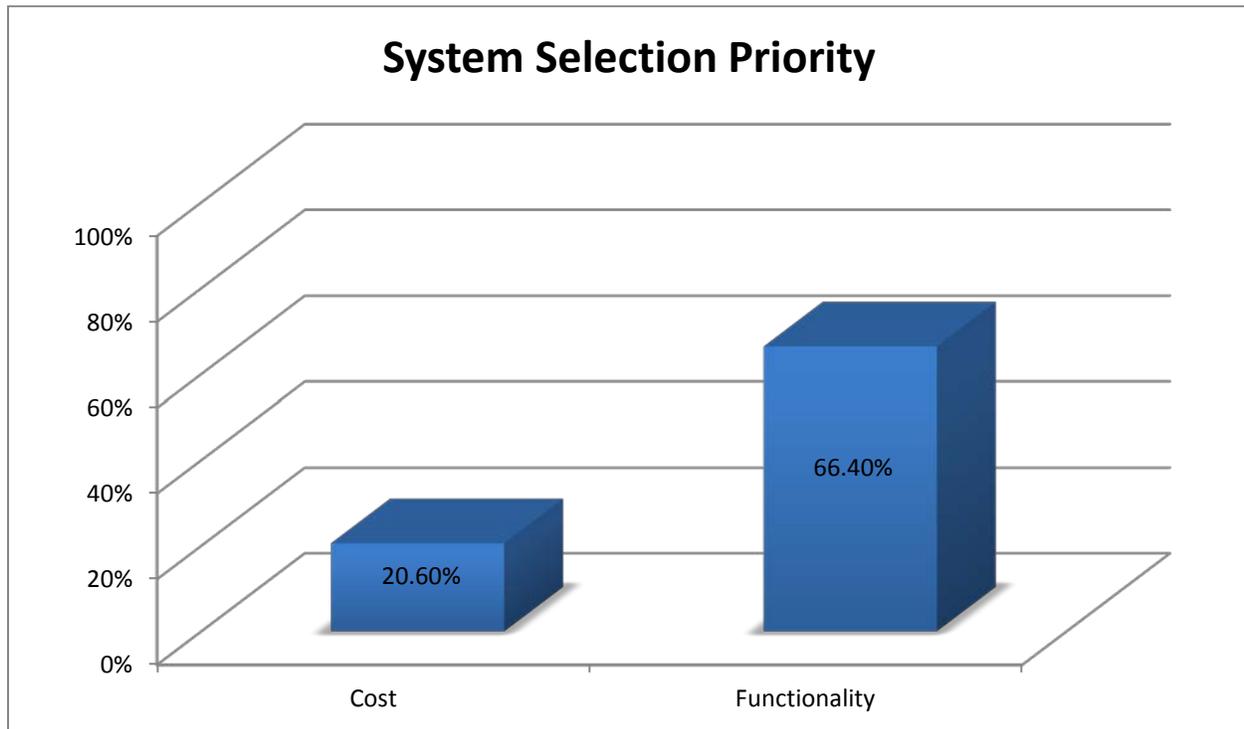


The fact that the Assessment system was ranked as a top choice by nearly 80 percent of the participants is significant considering the fact that only one focus group session had it as a topic. This means that the majority of the participants, regardless of which two topics their group discussed, view an Assessment system positively as a statewide opt-in solution. Some of the systems, such as Professional Development, that maybe should have received a higher ranking likely did not because there are greater needs and desire for systems that benefit student learning more directly. Even Collaboration and Conferencing, with its low ranking, could still be a powerful system for supporting student success, but was ranked as a lower priority because participants could only choose two systems from each list.

Another important outcome from the polling was that the most important reason that the participants chose a particular system was its functionality, followed by cost. The ADE does understand that cost savings would be important to all LEAs, but if the systems do not meet their functional needs, and are not easy to use, interest in early adoption will more than likely not be there.

Most participants indicated that they were happy with their current systems and did not plan to make a change within the next 12 months. But that does not necessarily mean they would not be interested in accessing that same system through AELAS if there were meaningful cost savings. If the functionality of the current system meets their needs, is commonly used by many LEAs, and the functionality requirement is satisfied, then the last criteria for consideration is the potential for cost savings.

Figure 33 – Local Education Agency System Selection Priority



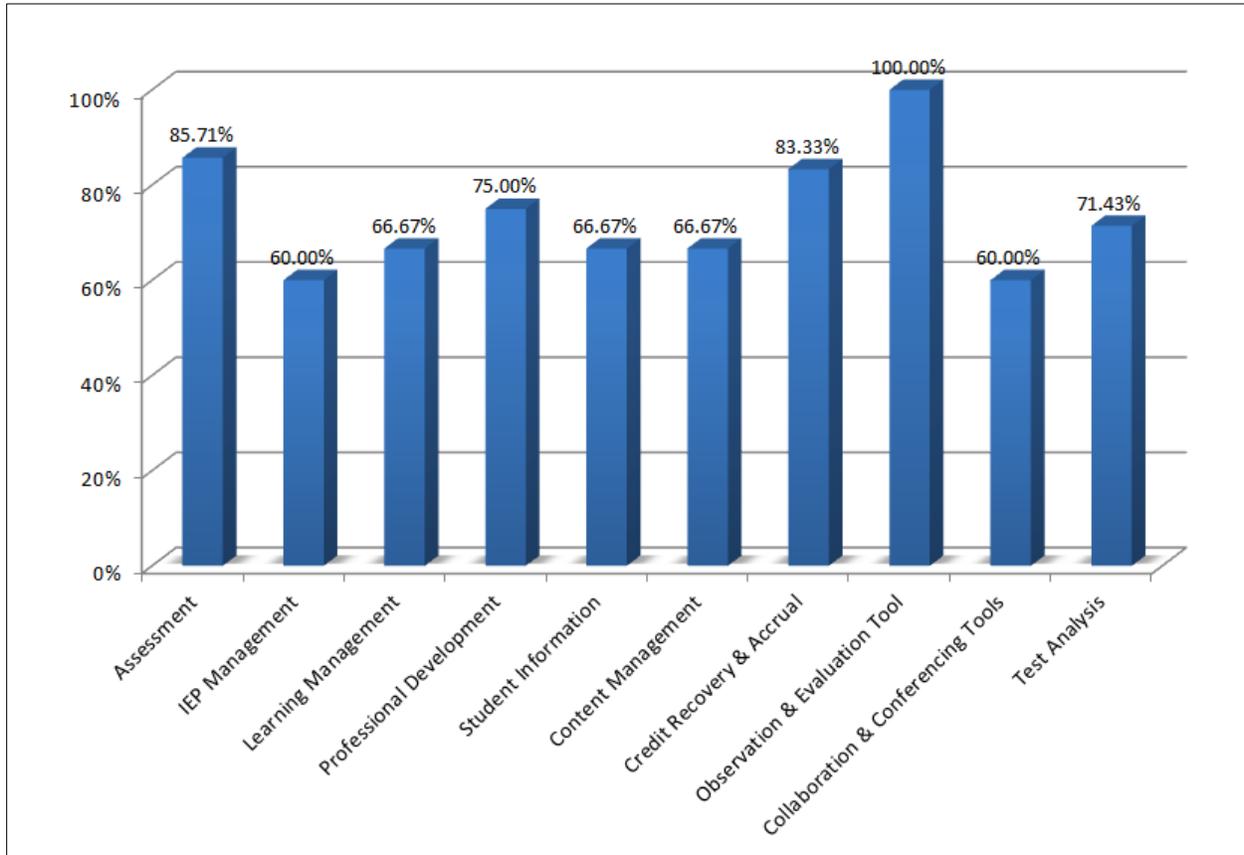
Additional information was gathered with a survey that was made available to participants after each focus group session. The webinar tool did not have a way to give a survey during the session, so participants were automatically sent an email after the session that contained a link to the survey. This limitation contributed to a lower-than-expected participation and reduced number of surveys received. Subsequently, several reminders were issued as well as another attached copy of the survey, but still only 24 surveys were received from participants.

The survey questions asked participants specifically about their likelihood of moving to a statewide opt-in solution for the two systems that were discussed during their focus group session. Additional survey questions were specific to the IMS and any responses were forwarded to the IMS project manager.

In the survey, participants were asked the following question: “On a scale of 1 to 5, with 5 being high, rate your district’s interest in using a statewide opt-in solution for _____.” They were asked this question for each of the two systems discussed in their focus group session.

Figure 34 shows the percentage of survey respondents that answered the question with a ‘4’ or ‘5’ ranking, indicating a moderate- to high-interest in using AELAS’ system.

Figure 34 – Local Education Agency Interest Level in System Adoption

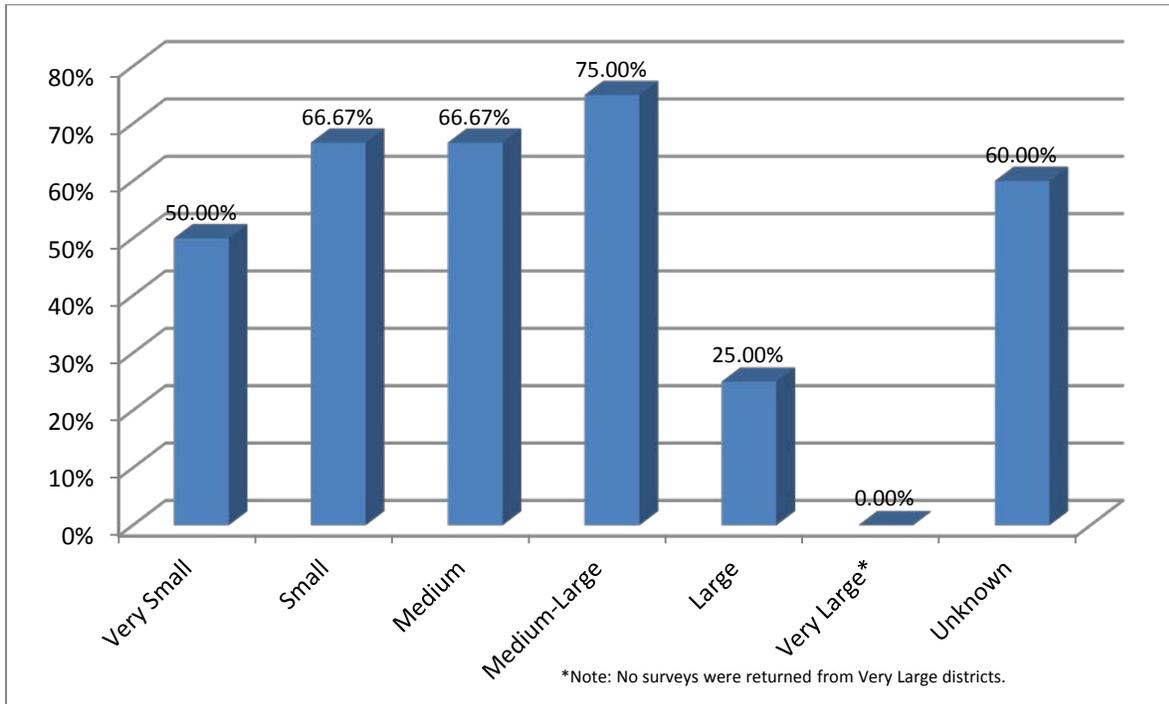


These results differ from the ranking that was done through the polling feature in that participants were only asked about the two systems they were discussing in their focus group session. In most cases, the participants were directors or assistant superintendents, and therefore in a position to understand the needs of their LEAs, making these results more meaningful. Comments provided in the survey, however, also indicated a reluctance to trust that these systems could be implemented on a statewide scale successfully, given ADE’s previous track record. These comments speak to the need to implement successful system pilots with willing participants before expecting larger numbers of LEAs to opt in.

Another observation is that two systems that were not ranked with a ‘4’ or ‘5’ for adoption are systems that very few LEAs currently have, namely the Content Management system and Staff Collaboration. Consequently, adopting these systems in AELAS would be a new expense that would be incurred. The systems are critical, however, in improving instruction and breaking down barriers of time and space that limit communication and sharing of resources and information. Implementation planning for these systems would need to include explaining the importance of these systems and possible financial support or incentives for initial implementation. Once use of these systems is part of the normal education workflow, the systems would likely become part of the standard IT opt-in program for all LEAs.

Figure 35 shows the percentage of LEAs that gave either of their systems a rating of ‘4’ or ‘5,’ broken down by their size category. For example, for small LEAs that submitted a survey, two out of three of them gave this ‘high’ rating for at least one of the systems they discussed in their session, indicating a moderate to high interest in AELAS adoption. Note: Some surveys were received but since it was not possible to determine from which LEA it was submitted, it was counted in the ‘Unknown’ column.

Figure 35 – Local Education Agency Interest in System Adoption by Size Category

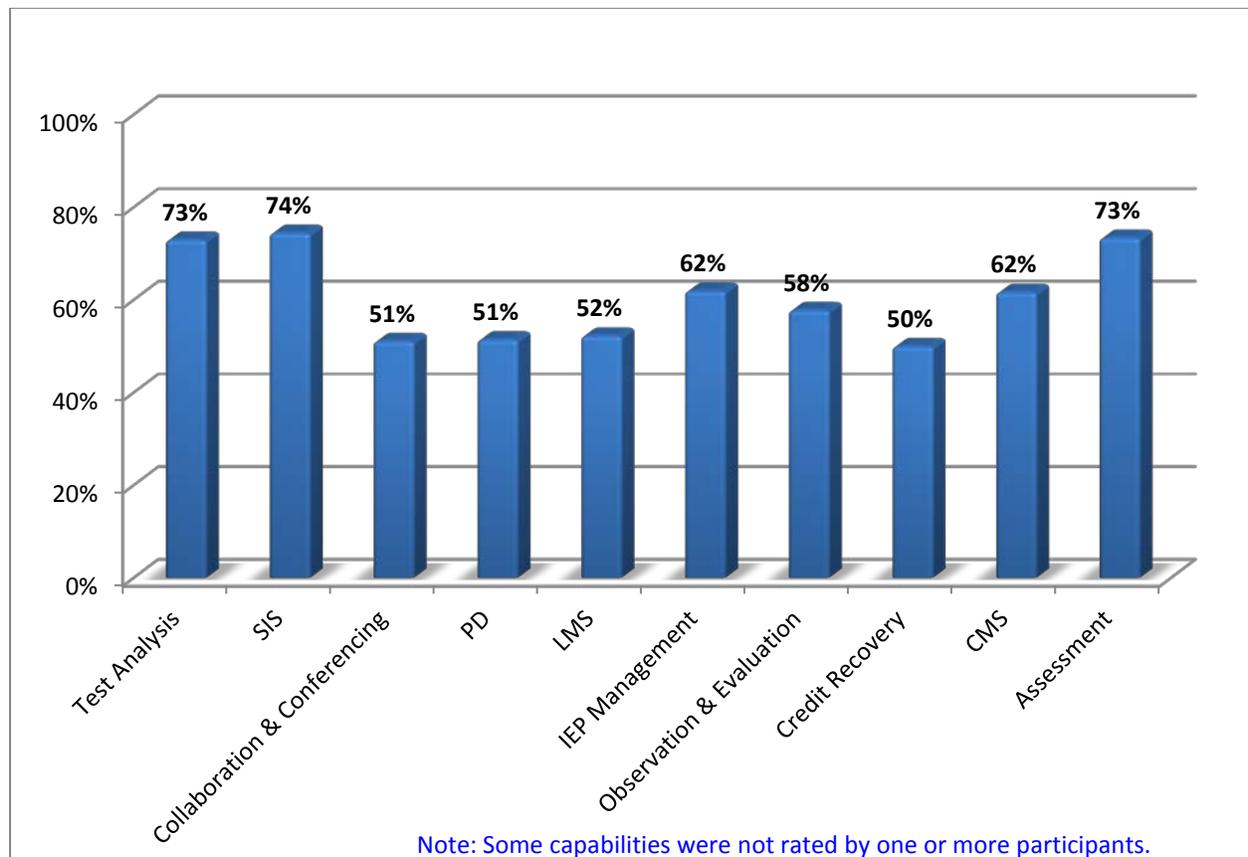


The data shows that depending on the system, there is opportunity for cultivating interest in AELAS in most of the size categories. If the large-size categories are a desired target for early phase implementation, for example, it would be important to include systems that they were interested in. However, the higher levels of interest in the very small to medium-large categories speak to not only a higher level of interest, but also potentially a broader list of systems. Prior to developing an implementation strategy, it would be important to confirm these results with a larger group of LEAs, but the potential for pilot implementations among very small to medium-large size categories appears to be favorable.

Survey participants rated a listing of high-level capabilities for the two systems discussed in their respective focus group sessions. The purpose of this exercise was to obtain broader confirmation about each capability and its associated priority for each of these systems. Each system being evaluated contained a list of high-level capabilities or features that are being sought by LEAs. The system capabilities documented during the Maricopa County Education Service Agency Rewarding Excellence in Instruction and Leadership grant effort was included in this exercise. Each participant was assigned a priority rating that correlated as follows: 4=critical, 3=high, 2=medium, or 1=low.

This information was collected, analyzed and summarized, with the results being incorporated into a master list of system requirements that is being documented for AELAS. Figure 36 illustrates the level of coverage that the capabilities provide for each respective system. Thus, the capabilities for Student Information System, Test Analysis, and Assessment systems graded the highest in terms of level of coverage, while four systems graded the lowest.

Figure 36 – Local Education Agency Capabilities Validation by System



12.2.4 Comments and Feedback

Participants were given the opportunity and were encouraged to include questions or comments along with their survey responses. Though many did not comment, those comments received are listed below and provide important insight into the future of AELAS adoption.

- “I would like to see how all of the systems will interact.”
- “The concept of bringing all those systems together in one place that does almost everything a school is required to do by the state is ideal. The rollout and management is a big concern from several people that I've discussed this with. ADE's data systems management and support have not instilled much confidence in many staff. The fact that you are gathering this information and getting people involved is a good sign that the future may hold a different level of quality of service.”
- “With the challenges found in implementing Az SAFE, the district is a bit leery in a new state system since the current Student Information System is working.”
- “My primary concern is the quality of the technical infrastructure necessary to support the systems. I would love to have options for our district but have concerns about systems that grow ever larger.”
- “My biggest concern is that the systems have some default so that you can work offline if the Internet is down, and then easily upload the files when possible.”
- “A statewide system that is reliable and has the functionality of our current system would be very desirable.”
- “I think this is going to be a huge project for the state to take on and I'm concerned about the manpower. Currently, systems that have a more narrow focus on the data they provide have a fair amount of support and data analysis that has been pretty well thought through.”
- “It would be nice to have systems that talk to each other and do all the things we end up doing manually.”

12.2.5 Summary of Focus Group Report Findings

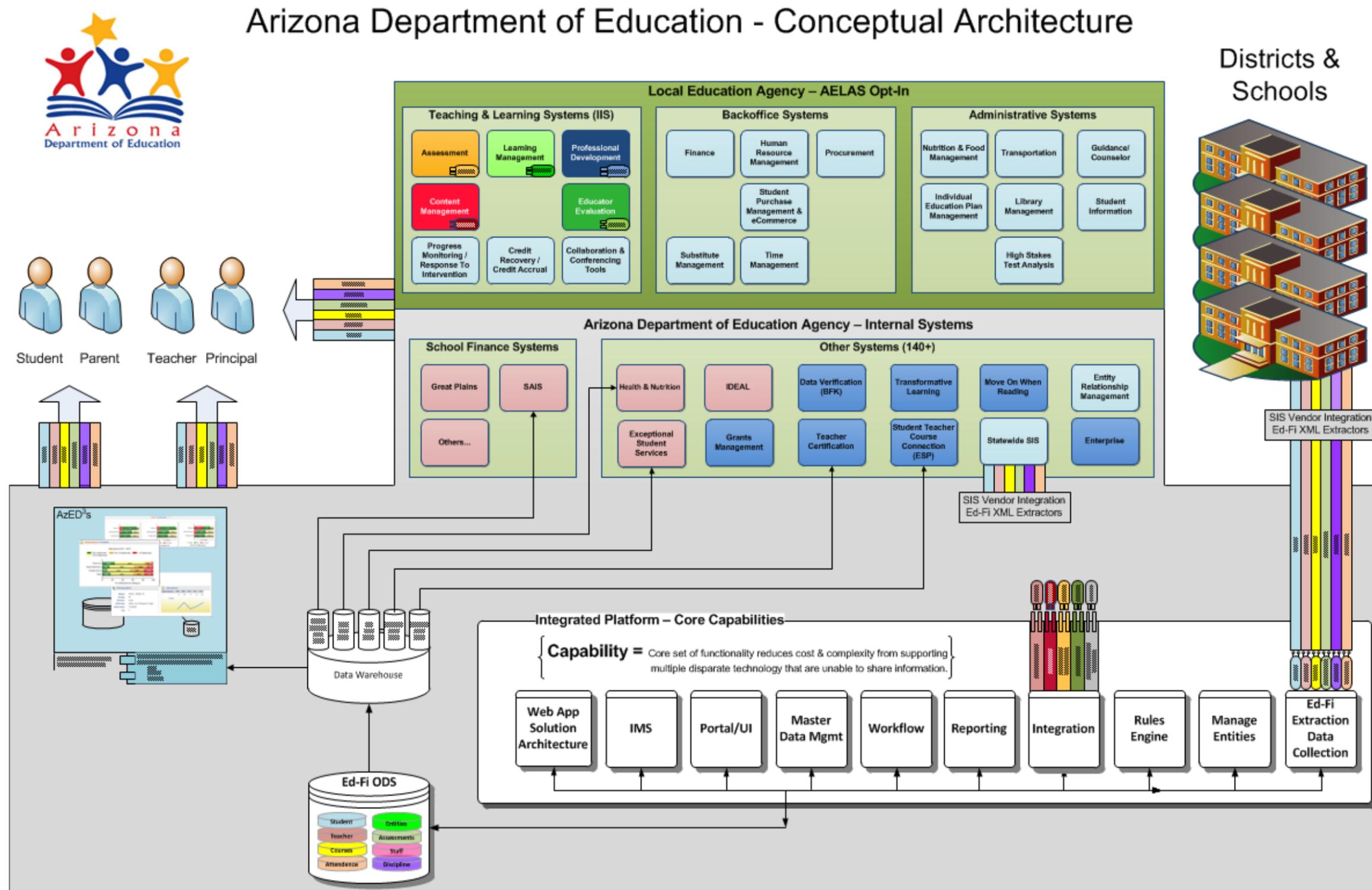
The following are the highlights of the findings from all of the focus group sessions:

- Interest in systems as part of a statewide centralized, opt-in system:
 - The following systems have a significant amount of support in a first phase: Assessment, Student Information System, Teacher/Principal Observation and Evaluation, Credit Recovery/Credit Accrual, Individualized Education Plan Management, and Test Analysis
 - The remaining systems, while they had a lower ranking, still held some level of interest in adoption in a second phase: Student Information System, Content Management, Learning Management, and Collaboration and Conferencing
 - Many very small and small LEAs indicated that they would be very interested in accessing a Student Information System as part of a statewide opt-in solution, especially if it meant that they would not have to deal with submission of data to the Student Accountability Information System. They would see an immediate benefit in the ability to shift more of their resources into instructional areas
 - Four out of the six size categories showed a 50 percent or greater interest in adopting one or more systems
- Ranking of high-level capabilities for all 10 systems was completed by the focus group participants, providing broader LEA validation from the field of the importance of key system capabilities

- Online focus groups were well received by the participants, and should be considered in the future as a good way to get feedback from the field. Interaction and engagement of participants were key factors to success
- Based on focus group participation and input, a core group of LEAs were identified that the ADE could work closely with to build upon their early interest in AELAS
- Although LEAs want to benefit from AELAS, there is skepticism that the ADE is capable of implementing AELAS and doing it well. At the same time, written comments were made that state that the fact that site visits and focus groups are being held gives them hope that this could be "... a sign that the future may hold a different level of quality of service"

13.0 Appendix E – Arizona Education Learning and Accountability System Architecture Conceptual Design

Figure 37



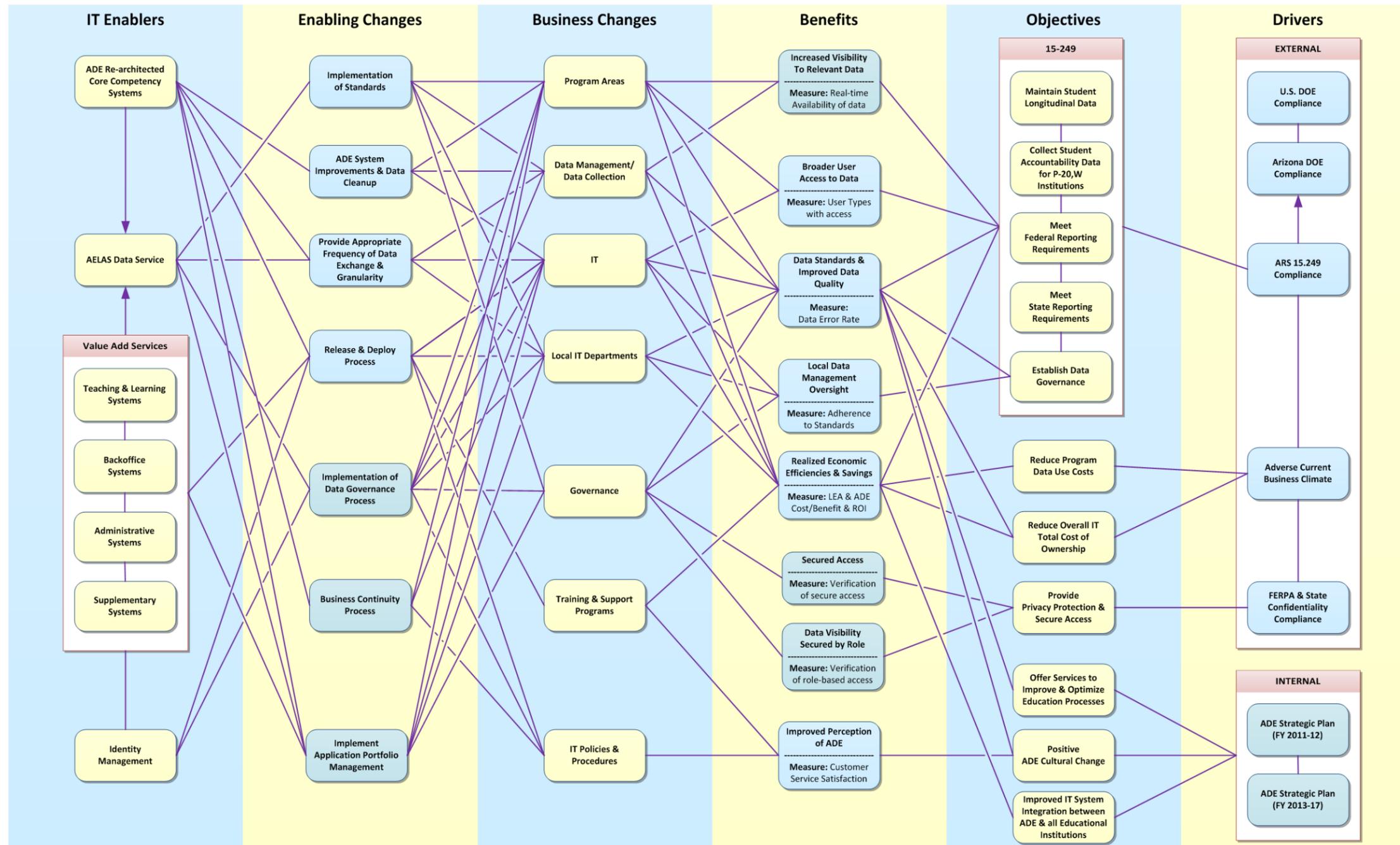
14.0 Appendix F – Benefits Dependency Network Model Diagrams

14.1 Benefits Dependency Network – A.R.S. § 15-249 (Arizona Education Learning and Accountability System)

Figure 38



A.R.S. 15-249 – Arizona Education, Learning & Accountability System (AELAS)



14.2 Benefits Dependency Network – Statewide Longitudinal Data System Grant Program

Figure 39



AZ SLDS Grant – Statewide Longitudinal Data System

Parent Driver



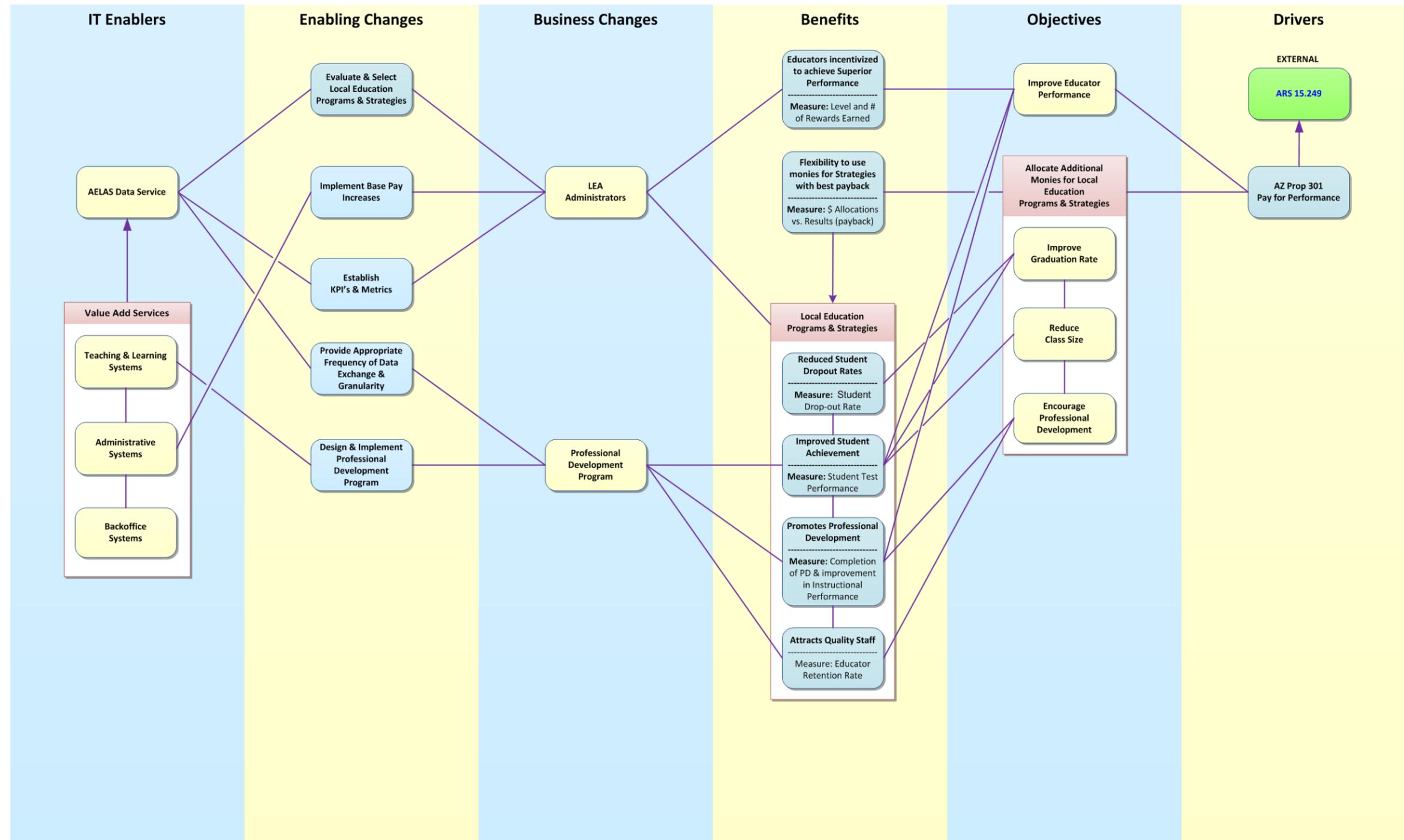
14.3 Benefits Dependency Network – Arizona Proposition 301 (Pay for Performance)

Figure 40



AZ Prop 301 – Pay for Performance

Parent Driver

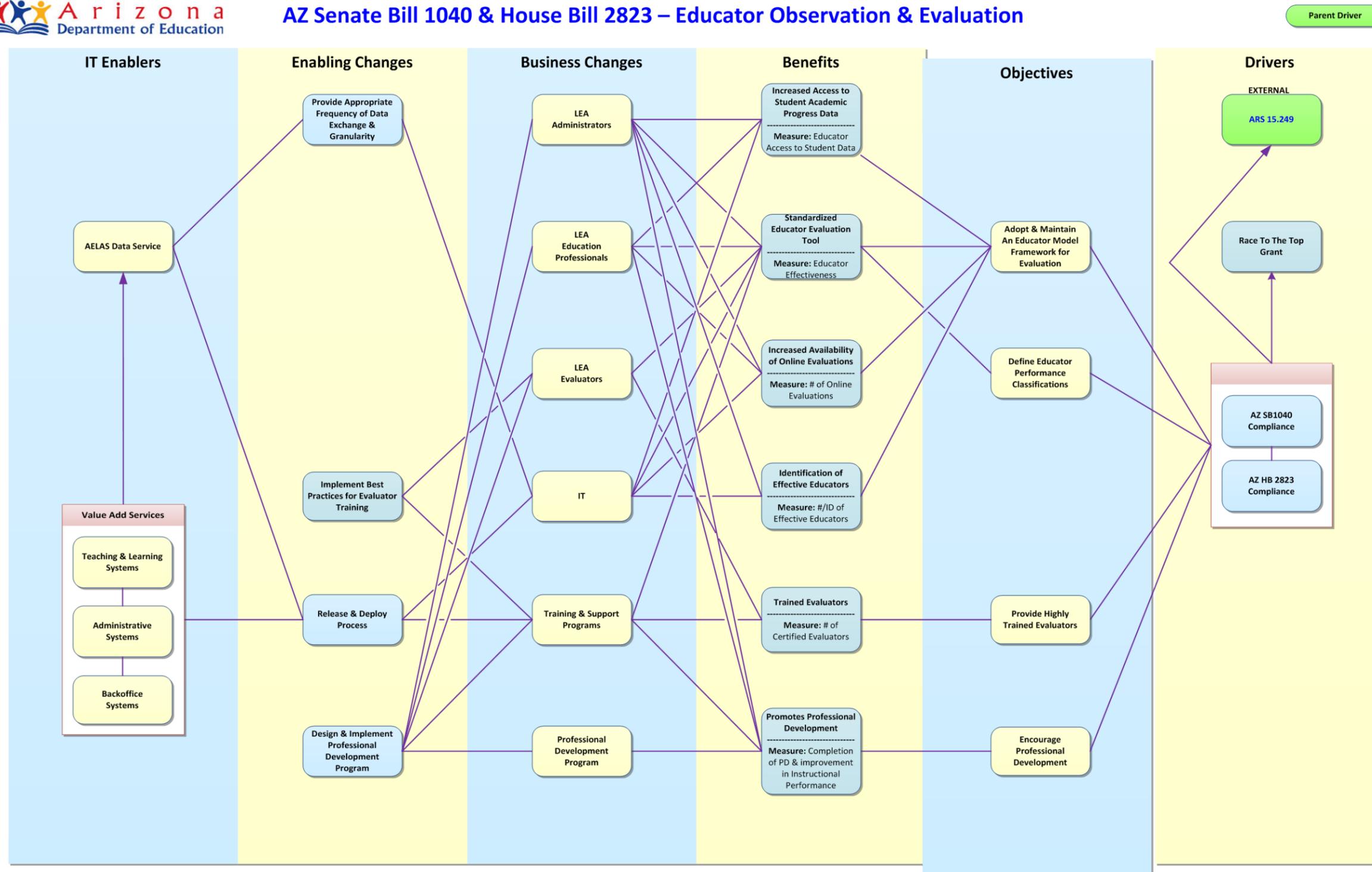


14.4 Benefits Dependency Network – Arizona SB 1040 & HB 2823 (Educator Observation and Evaluation)

Figure 41



AZ Senate Bill 1040 & House Bill 2823 – Educator Observation & Evaluation



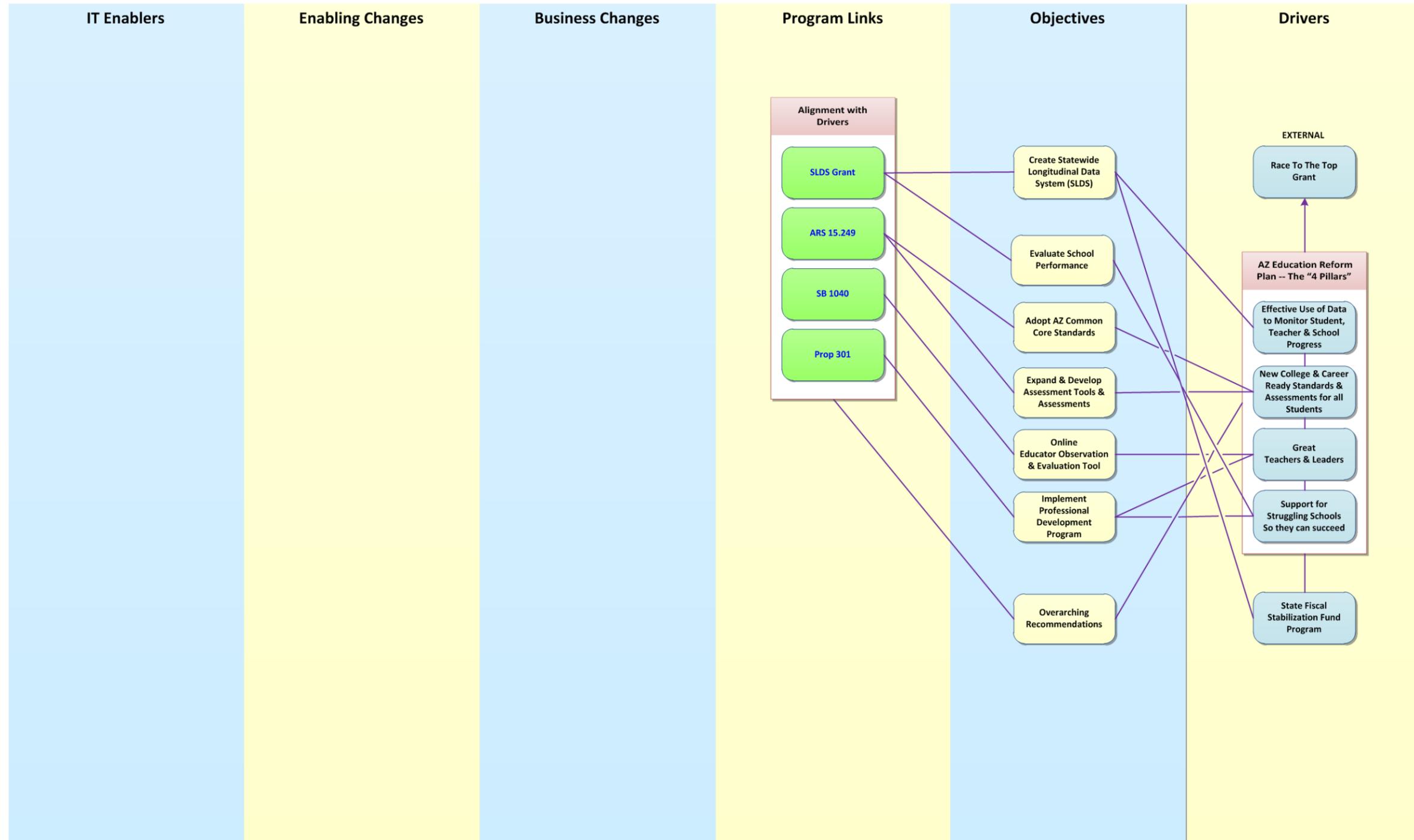
14.5 Benefits Dependency Network – Arizona Education Reform Plan – ‘Four Pillars’

Figure 42



AZ Education Reform Plan (a.k.a. “4 Pillars”)

Parent Driver



15.0 Appendix G – A.R.S. § 15-249 – Arizona Education Learning and Accountability System

Arizona Revised Statute § 15-249, also known as the Arizona Education Learning and Accountability System (AELAS) is considered to be the key driver for organizational change at the Arizona Department of Education (ADE). It is the Arizona legislative mandate to develop and implement a statewide education Learning and Accountability system. AELAS will also ultimately support compliance and alignment with both state and federal reporting requirements.

Secondary drivers for AELAS' program include the adverse current business climate and the Family Educational Rights and Privacy Act (FERPA), and state confidentiality compliance. Other secondary drivers are ADE's Strategic Plans for the fiscal years 2011-2012 and the five-year plan covering fiscal years 2013–2017. AELAS is expected to conform to Information Technology (IT) strategies, as well as their department policies, guidelines and procedures.

See the model diagrams (Appendix F) to which the narrative in the following sections pertain.

15.1 Drivers – Objectives Linkage

The following objectives are directly linked to AELAS, which is indirectly linked or associated with U.S. Department of Education compliance and ADE Title 15 compliance. There are other drivers that have been included with AELAS' driver, since they cover some crucial aspects that may have been implied but not clearly specified in the legislation.

- **Maintaining and Collecting Statewide Longitudinal Data** should bring more visibility to each student's complete historical record, including schools attended within the state of Arizona, attendance, testing and progress, as well as their performance and educational achievements.
- **Collecting Student Accountability Data for P-20 and Workforce Institutions** should bring more visibility to each student's historical record from preschool to post-secondary education and into the workforce, within the state of Arizona.
- **Meet Federal Reporting Requirements.** While AELAS contains a reference to this, there is nothing specific. The assumption being made is that the federal requirement is for longitudinal student-level data, but it could also be one of the many files created by the ADE and submitted to *EdFacts*, etc. *EdFacts* is the system through which State Education Agencies report the majority of their data.
- **Meet State Reporting Requirements.** While this legislation also contains a reference to this, again, there is nothing specific. The state reporting requirements may include, but is not necessarily limited to, school report card grades.
- **Establish Data Governance**, which has the capability to enforce adherence to data quality and other related standards by LEAs as well as at the ADE.

The following objectives, while linked to the adverse current business climate driver, should always be a consideration when there is a need for a technology solution to improve or enable a business capability or solve a business problem.

- **Reduce Program Data Use Costs** within program areas, where possible.

- **Reduce Overall IT Total Cost of Ownership** for various education technology products and systems, both internal and external, as well as infrastructure, maintenance, and support costs, where and as applicable.

The following objective is linked to the FERPA and state confidentiality compliance driver.

- **Provide Privacy Protection and Secure Access** to users, where and as applicable, in order to maintain compliance with the FERPA and state confidentiality policy guidelines.

The following objectives are linked to the internal drivers, ADE's Strategic Plans for the fiscal years covering 2011-2012 and 2013-2017.

- **Offer Services to Improve and Optimize Education Processes**, meaning the appropriate level of customer service and support.
- **Implement Positive ADE Cultural Change** in the way that ADE is perceived by all its customers.
- **Provide Improved IT System Integration between ADE and LEAs**, meaning improved, seamless integration and interoperability between the various systems and products, of which AELAS may be comprised

15.2 Objectives – Benefits Linkage

The benefits are described in more detail, along with their expected measurement. They are then linked to associated objectives that were fully described in the Appendix F. For a given objective to be fully realized, it may require that all benefits to which it is linked have been achieved.

- **Increased Visibility to Relevant Data**

Benefit: Meeting local, federal and state reporting requirements, with respect to statewide longitudinal and accountability data

Measurement: Real-time availability of data

- **Broader User Access to Data**

Benefit: Meeting local, federal and state reporting requirements, with respect to statewide longitudinal and accountability data

Measurement: User types with access

- **Data Standards and Improved Data Quality**

Benefits: Maintaining and collecting statewide longitudinal and accountability data; meeting local, federal and state reporting requirements; the establishment of data governance; reduction in overall IT total cost of ownership; services to improve and optimize educational processes; and positive ADE cultural change.

Measurement: Data error rate

- **Local Data Management Oversight**

Benefit: The establishment of data governance

Measurement: Adherence to standards

- **Realized Economic Efficiencies and Savings**

Benefits: Maintaining and collecting statewide longitudinal data; meeting local, federal and state reporting requirements; the reduction of program data use costs and overall IT total cost of ownership; and improved IT system integration between the ADE and LEAs.

Measurement: LEA and ADE cost/benefit and return on investment

- **Secured Access**

Benefits: Privacy protection and secure access

Measurement: Verification of secure access

- **Data Visibility Secured by Role**

Benefits: Privacy protection and secure access

Measurement: Verification of role-based access

- **Improved Perception of the ADE**

Benefit: Positive ADE cultural change.

Measurement: Customer service satisfaction rating

15.3 Benefits – Business Changes Linkage

This section lists the business process changes and links them to their associated benefits.

- **Enable Business Changes to Program Areas**

Benefits: Increased visibility to relevant data; broader user access to data; data standards in place and improved data quality; local data management oversight; and realized economic efficiencies and savings (Note: program areas are referred to 'business units' in the private sector.)

- **Enable Business Changes to Data Management/Data Collection**

Benefits: Increased visibility to relevant data; broader user access to data; data standards in place and improved data quality; and realized economic efficiencies and savings (Note: data management/data collection manages the collections and exchange of all data.)

- **Enable Business Changes to IT**

Benefits: Broader user access to data; data standards in place and improved data quality; local data management oversight; and realized economic efficiencies and savings

- **Enable Business Changes to Local IT Departments**

Benefits: Data standards in place and improved data quality; local data management; and realized economic efficiencies and savings.

- **Enable Business Changes to Governance**

Benefits: Data standards in place and improved data quality; local data management oversight; and secured access and data visibility security by role (Note: Governance also manages awards and sanctions for data accuracy.)

- **Enable Business Changes to Training and Support Programs**

Benefits: Realized economic efficiencies and savings; and improved perception of the ADE

- **Enable Business Changes to IT Policies and Procedures**

Benefit: Improved perception of the ADE (Note: Key Performance Indicators = customer service ratings.)

15.4 Enabling Changes – Business Changes Linkage

This section lists the enabling changes and links them to their associated business process changes.

- **Implementation of Standards** (e.g., Common Education Data Standards/Ed-Fi) must be completed in order to affect business changes in Program Areas, Data Management/Data Collection, Local Information Technology Departments, and Governance, since they each will rely on or monitor the consistent and universal language of data.
- **ADE System Improvements and Data Cleanup** changes must be completed in order to affect business changes in Program Areas, Data Management/Data Collection, and IT, since they each will all rely on improved system functionality, workflow management, data accuracy, etc.
- **Appropriate Frequency of Data Exchange and Granularity** must be completed in order to affect business changes in Data Management/Data Collection, IT, and Local Information Technology Departments, since they each will rely on the delivery of the right amount and level of data at the right time to the right audience.
- **Release and Deployment of Process** documentation must be completed in order to affect business changes in IT, Local Information Technology Departments, Training and Support Programs, and Information Technology Policies and Procedures, since they will be guided by this set of organizational policies.
- **Implementation of Data Governance Process**, including the establishment of a Data Governance Board, must be completed in order to affect business changes in Program Areas, Data Management/Data Collection, IT, Local Information Technology Departments, and Governance, since they each will need to be compliant with the data governance process.
- **Business Continuity Process** must be completed in order to affect business changes in Program Areas, IT, Local Information Technology Departments, and Policies and Procedures, since they each must conform with these new processes.
- **Implementation of Application Portfolio Management** must be completed in order to affect business changes in Program Areas, IT, Local Information Technology Departments, and Governance, since they each must conform to this new process.

15.5 Information Technology Enablers

The following IT enablers are necessary to enable changes to the business in order to achieve the benefits and objectives linked to their respective drivers.

- **ADE Re-architected Core Competency Systems** refer to central foundation and support systems (e.g., Student Accountability Information System, Grants Management, Teacher Certification, etc.) that will undergo a significant transformation or replacement as part of AELAS' program.
- **AELAS Data Service** is generally referred to as ADE's central data warehouse system known as Education Data Driven Decision Systems (Az ED³S), but which includes a data management component that allows the exchange of data between systems used by LEAs and the ADE.
- **Value-Added Services** refer to those systems, applications and/or products utilized by educational institutions (i.e., LEAs, etc.) outside of the ADE, and which include supplementary systems (e.g., Department of Economic Security, Arizona State University, etc.). LEA systems are categorized in either of the following areas:
 - Teaching and Learning Systems
 - Administrative Systems
 - Back Office Systems
 - Supplementary Systems
- **Identity Management.** The Identity Management System should provide and support Single Sign-On/Interoperability.

16.0 Appendix H – Statewide Longitudinal Data System Grant Program

The Statewide Longitudinal Data System (SLDS) is a secondary driver that aligns within the overall Arizona Education Learning and Accountability System (AELAS) program associated with the U.S. Department of Education SLDS grant program.

The SLDS is intended to enhance the ability of schools to efficiently and accurately manage, analyze and use education data, including individual student records. The SLDS will help state governments, districts, Local Education Agencies (LEAs), and teachers make data-driven decisions to improve student learning, as well as facilitate research to increase student achievement and close achievement gaps.

The Arizona Department of Education (ADE) will develop and implement a statewide longitudinal education data system called Az ED³S. Once launched, this redesigned student data system will provide parents, teachers and school leaders with the information they need to make the informed, strategic decisions necessary to increase student academic growth and enhance student learning environments. Better information leads to better decisions, which ultimately will lead to a better education for all of Arizona's students.

See the model diagrams (Appendix F) to which the narrative in the following sections pertain.

16.1 Drivers – Objectives Linkage

The following objectives are linked to the SLDS grant.

- **Provide Timely Access to Information** to statewide longitudinal data system.
- **Provide Increased Volume of Actionable Data to Stakeholders** of the statewide longitudinal data system.
- **Support Increasing P-20 and Workforce Data Demands** on the statewide longitudinal data system.
- **Drive Instructional, Program and Policy Decisions, Best Practices, Etc.** for a statewide longitudinal data system.
- **Improve Student Achievement and Educator Performance**
- **Improve Statewide School Performance** and education achievements.

16.2 Objectives – Benefits Linkage

The benefits are described in more detail, along with their expected measurement. They are then linked to associated objectives that were fully described in Section 17.0. For a given objective to be fully realized, it may require that all benefits to which it is linked have been achieved.

- **Provide Actionable Education Decision-Driven Support Data**

Benefit: Increased volume of actionable data to stakeholders; instructional, program and policy decisions and best practices

Measurement: Ability to make strategic and tactical decisions

- **Provide Improved Throughput and Capacity**

Benefits: Timely access to information; increased volume of actionable data to stakeholders; and support of increasing P-20 and Workforce data demands

Measurement: System performance and throughput

- **Provide Real-Time Access to Data**

Benefit: Timely access to up-to-date information

Measurement: Availability of up-to-date data

- **Provide Increased Visibility to Relevant Data**

Benefits: Increased volume of actionable data to stakeholders; support of increasing P-20 and Workforce data demands; instructional, program and policy decisions and best practices; improved student achievement and educator performance; and improved LEA performance

Measurement: Availability of performance data

- **Provide Broader User Access to Data**

Benefit: Support of increasing P-20 and Workforce data demands

Measurement: User types with access

- **Deploy Superior-Performing Systems/Products**

Benefits: Improved student achievement and educator performance; and improved LEA performance

Measurement: Product capability scorecard

- **Improve Quality of Education**

Benefits: Improved student achievement and educator performance; and improved LEA performance

Measurement: Education performance improvement

16.3 Benefits – Business Changes Linkage

This section lists the business process changes and links them to their associated benefits.

- **Application Portfolio Management Execution**

Benefits: Provide actionable education-decision support data; improved throughput and capacity; ensure real-time access to data; ensure the deployment of superior-performing systems and products; and improve the quality of education

- **Create Service-Level Agreements**

Benefits: Ensure real-time access to data; broader user access to data; and ensure the deployment of superior-performing systems and products

- **Implement IT Master Data Management Policies and Procedures**

Benefits: Provide actionable education decision support data; increased visibility to relevant data; broader user access to data; and improved quality of education

- **Enable Business Changes in Training and Support Programs**

Benefit: Improved quality of education

- **Establish Regional Education Centers**

Benefit: Improved quality of education, since these structures provide supplemental, but locally defined and accessible professional development, educational services and technical services for high-priority initiatives. (Note: Each LEA will also manage capacity issues within their region.)

- **Establish Centers of Education Excellence**

Benefit: Improved quality of education since these institutions excel in their delivery of education whether or not they utilize a significant level of technology

16.4 Enabling Changes – Business Changes Linkage

This section lists the enabling changes and links them to their associated business process changes.

- **Deploy and Manage Data Service Program** in order to effect business changes in Application Portfolio Management, Service-Level Agreements, IT Master Data Management Policies and Procedures, as well as Training and Support Programs.
- **Create Regional Education Centers** in order to effect business changes owned by these same entities.
- **Identify or Establish Centers of Excellence.** The ADE could leverage LEAs' unique and demonstrated capabilities, systems, and/or processes for others within the state.

16.5 Information Technology Enablers

The following IT enablers are necessary to enable changes to the business in order to achieve the benefits and objectives linked to their respective drivers.

- **AELAS Data Service**, generally referred to as ADE's central data warehouse system known as Education Data Driven Decision Systems (Az ED³S), but which includes a data management component that allows the exchange of data between systems used by schools and the ADE.
 - Supporting network capacity for LEAs and ADE
 - Information visualization platform (e.g., Dashboard and Reporting)
 - Arizona Operational Data Store Infrastructure
 - Data Service Platform

17.0 Appendix I – Arizona Proposition 301

Arizona Proposition 301 (Prop 301) is a secondary driver that aligns within the overall Arizona Education Learning and Accountability System (AELAS) program. It was the proposition for Educator Performance-Based Pay that was voter-approved in November of 2000. Arizona Proposition 204 was on the ballot in November 6, 2012 to make permanent a one-cent tax increase that includes some monies for education.

See the model diagrams (Appendix F) to which the narrative in the following sections pertain.

17.1 Drivers – Objectives Linkage

The following objectives are linked to Arizona Proposition 301. There were two overarching objectives of this legislation.

- **Improve Educator Performance**, such as teachers and principals.
- **Allocate Additional Monies for Local Education Programs and Strategies** that could be determined by each LEA constrained by the allocation percentages as noted below in parentheses. The additional monies for LEAs were dedicated for three main purposes:
 - Teacher base-pay increases (20 percent)
 - Teacher performance pay (40 percent)
 - Maintenance and operations menu options (40 percent)
 - Increase graduation rate and reduce dropout rate
 - Reduce the ratio of the number of students under the direction of a teacher in a class/section
 - Encourage educators to strive for professional development

17.2 Objectives – Benefits Linkage

The benefits are described in more detail along with their expected measurement. They are then linked to associated objectives that were fully described in Section 17.0. For a given objective to be fully realized, it may require that all benefits to which it is linked have been achieved.

- **Educators Incentivized to Achieve Superior Performance incentivized by bonuses and reward**

Benefit: Improved educator performance

Measurement: Level and number of rewards earned by an educators

- **LEAs' Flexibility to Use Monies for Programs and Strategies with Best Payback for Their Situation**

Benefit: This objective may be realized by using either of the following Maintenance and Operations options for LEA strategies: Arizona Instrument to Measure Standards intervention, class-size reduction, dropout prevention, teacher compensation, teacher development, and teacher liability insurance. Since 'teacher' was not defined, LEAs have determined that librarian, counselors and even others were included. The three most targeted choices were:

- Improved graduation rate
- Reduce the ratio of the number of students under the direction of a teacher in a class/section
- Encourage educators to strive for professional development

Measurement: Financial allocations vs. financial results (payback)

- **Reduced Student Dropout Rates**

Benefit: Improved graduation rate as part of local education programs and strategies

Measurement: Student dropout rate

- **Improved Student Achievement**

Benefit: Improved graduation rate and class size as part of local education programs and strategies

Measurement: Student test performance and achievement

- **Promotes Professional Development**

Benefit: Encouraging professional development as part of local education programs and strategies

Measurement: Completion of Personal Development and improvement in instructional performance

- **Attracts Quality Staff**

Benefit: Encouraging professional development as part of local education programs and strategies

Measurement: Educator retention rate

17.3 Benefits – Business Changes Linkage

This section lists the business process changes and links them to their associated benefits.

- **Enabling Business Changes for School Administrators**

Benefits: Educators incentivized to achieve superior performance; flexibility to use monies for local education programs and strategies with the best payback

- **Enabling Business Changes for the Professional Development Program**

Benefits: Improved student achievement; promotes professional development; and attracts quality staff

17.4 Enabling Changes – Business Changes Linkage

This section lists the enabling changes and links them to their associated business process changes.

- **Evaluation and Selection of Local Education Programs and Strategies** for spending additional Prop 301 monies must be completed and approved before the business change can be utilized by school administrators or the appropriate authorized personnel
- **Determination and Implementation of Base Pay Increases** needs to be completed in order before the business change can be utilized by school administrators or the appropriate authorized personnel
- **Establishment of Key Performance Indicators and Metrics** covering educator pay and performance; student achievement, attendance and performance; and school and district performance must be completed and approved before the business change can be utilized by school administrators or the appropriate authorized personnel.
- **Provision of Appropriate Frequency of Data Exchange and Granularity** must be completed in order to effect business changes to the Professional Development program, since it will rely on the delivery of the right amount of data, at the right level, at the right time to the right audience
- **Design and Implementation of Professional Development Program** will need to be completed in order for the business changes to be available to the school administrators and the Professional Development program.

17.5 Information Technology Enablers

The following IT enablers are necessary to enable changes to the business in order to achieve the benefits and objectives linked to their respective drivers.

- **AELAS Data Service**, generally referred to as ADE's central data warehouse system known as Education Data Driven Decision Systems (Az ED³S), but which includes a data management component that allows the exchange of data between systems used by schools and the ADE.
- **Value-Added Services** refer to those systems, applications and/or products utilized by educational institutions (i.e., districts, charters, etc.) outside of the ADE, and which may include supplementary systems (e.g., Department of Security, Arizona State University, etc.). School systems are categorized in either of the following areas:
 - Teaching and Learning Systems
 - Administrative System
 - Back Office Systems

18.0 Appendix J – SB 1040 and HB 2823

Arizona Senate Bill 1040 and House Bill amendment 2823, collectively referred to as 'SB 1040,' is another secondary driver that fits within the overall Arizona Education Learning and Accountability System (AELAS) program. It aligned Arizona with the necessary requirements in its application for the Race To The Top (RTTT) grant program and mandated the adoption and maintenance of an educator model framework for evaluation of teachers and principals.

Through RTTT, the U.S. Department of Education was asking states to advance reforms around four specific areas:

- Adopting standards and assessments that prepare students to succeed in college and the workplace and to compete in the global economy
- Building data systems that measure student growth and success, and inform teachers and principals about how they can improve instruction
- Recruiting, developing, rewarding and retaining effective teachers and principals, especially where they are needed most
- Turning around the lowest-achieving schools

18.1 Drivers – Objectives Linkage

The following objectives are linked to the SB 1040 legislation including its associated HB 2823 amendment.

- **Adopt and Maintain an Educator Model Framework for Evaluation**

Benefit: There should be more emphasis on including quantitative data on student academic progress for at least 33 to 50 percent of the evaluation outcomes and best practices for professional development and evaluator training

- **Define Educator Performance Classifications.** By December 1, 2012, the State Board of Education required the four performance classifications be included in the model framework for teacher and principal evaluations, and guidelines to be provided for school districts and charter schools to use in their evaluation instruments. These four performance classifications are designated as highly effective, effective, developing and ineffective.
- **Provide Highly-Trained Evaluators** to ensure fair, accurate and complete educator evaluations
- **Encourage Professional Development** of teachers and principals in order to increase their effectiveness and performance

18.2 Objectives – Benefits Linkage

The benefits are described in more detail, along with their expected measurement. They are then linked to associated objectives that were fully described in Section 17.0. For a given objective to be fully realized, it may require that all benefits to which it is linked have been achieved.

- **Increased Access to Student Academic Progress Data that is Accurate, Timely and Complete**

Benefit: Its inclusion in an educator model framework

Measurement: Educator access to student data

- **Standardized Educator Evaluation Tool**
Benefit: Educator model framework; implementation of the educator performance classifications
Measurement: Educator effectiveness
- **Increased Availability of Online Evaluations to those that should have access**
Benefit: An educator model framework
Measurement: Number of online evaluations
- **Identification of Effective Educators**
Benefit: The adopted educator model framework
Measurement: Number/Identification of effective educators
- **Sufficient Number of Trained Evaluators**
Benefit: Providing highly qualified evaluators who can complete fair and objective online evaluations for teachers and principals
Measurement: Number of certified evaluators
- **Promotes Professional Development**
Benefit: Encouraging professional development
Measurement: Completion of personal development and improvement in instructional performance

18.3 Benefits – Business Changes Linkage

This section lists the business process changes and links them to their associated benefits.

- **Enabling Business Changes in Local Education Agency Administrators**

Benefits: Increased access to student academic progress data; access to a standardized educator evaluation tool; increased availability of online evaluations; the identification of the number and identity of effective educators; and the promotion of professional development
- **Enabling Business Changes for LEA Education Professionals**

Benefits: Increased access to student academic progress data; access to a standardized educator evaluation tool; increased availability of online evaluations; the identification of the number and identity of effective educators; and the promotion of professional development
- **Enabling Business Changes for LEA Evaluators**

Benefit: Access to a standardized educator evaluation tool, and trained evaluators
- **Enabling Business Changes in Information Technology (IT)**

Benefits: Increased access to student academic progress data; standardized educator evaluation tool; increased availability of online evaluations; and the identification of the number and identity of effective educators
- **Enabling Business Changes in Training and Support Programs**

Benefits: Training and supporting the educator evaluation tool and professional development program; and trained and certified evaluators

- **Enabling Business Changes for the Professional Development Program, Including Best Practices**

Benefit: Promoting professional development of teachers and principals

18.4 Enabling Changes – Business Changes Linkage

This section lists the enabling changes and links them to their associated business process changes.

- **Provision of Appropriate Frequency of Data Exchange and Granularity** must be completed in order to effect business changes in IT
- **Implementation of Best Practices for Evaluator Training** must be completed in order to effect business changes for LEA evaluators and for its inclusion in training and support programs
- **Release and Deploy Process** Documentation must be completed in order to effect business changes in IT and Training and Support programs, since they will be guided by this new set of organizational policies
- **Design and Implementation of the Professional Development Program** will need to be completed in order for the business changes to be available to LEA administrators and the Professional Development program.

18.5 Information Technology Enablers

The following IT enablers are necessary to enable changes to the business in order to achieve the benefits and objectives linked to their respective drivers.

- **AELAS Data Service**, generally referred to as ADE's central data warehouse system, known as Education Data Driven Decision Systems (Az ED³S), but which includes a data management component that allows the exchange of data between systems used by LEAs and the Arizona Department of Education (ADE).
- **Value-Added Services** refer to those systems, applications and/or products utilized by educational institutions (i.e., districts, charters, etc.) outside of the LEA systems are categorized in either of the following areas:
 - Teaching and Learning Systems
 - Administrative Systems
 - Back Office Systems

19.0 Appendix K – Arizona Education Reform Plan

Governor Janice K. Brewer's Education Reform plan, also known as the 'Four Pillars,' has this vision statement, "A future where all Arizona students are prepared to succeed in college and careers and lead this state in the next 100 years and beyond." The 'Four Pillars' is clearly aligned with A.R.S. § 15-249, the Statewide Longitudinal Data System (SLDS) grant programs, Prop 301 and SB 1040. Thus, the focal point of the plan is for Arizona students to be prepared to succeed in college and careers around these key areas:

- Effective use of data to monitor student, teacher and school progress
- New college and career-ready standards and assessments for all students
- Great teachers and leaders
- Support for struggling schools so they can succeed

See the model diagrams (Appendix F) to which the narrative in the following sections pertain.

19.1 Drivers – Objectives Linkage

The following objectives, referred to here as recommendations, are linked to the 'Four Pillars' and aligned to drivers of organizational change where noted in parenthesis.

- **Create SLDS Grant**

Recommendation #1: Create a SLDS that spans P-20 and beyond.

Recommendation #2: Expand SLDS reach into the Workforce, and support more than P-20.

Recommendation #3: Move data systems from compliance to use with a focus on teachers and teacher leaders.

- Recommendation #4: Ensure that the SLDS links student performance data to specific classrooms and teachers, districts and schools, and teacher-preparation programs. **Adopt Arizona Common Core Standards (A.R.S. § 15-249)**

Recommendation #5: Make the Common Core State Standards and the accompanying assessment a high priority.

Recommendation #6: Communicate to schools the transition plan from current Arizona Instrument to Measure Standards items based on state standards, to assessments based on the Common Core State Standards.

- **Expand and Develop Assessment Tools and Assessments (A.R.S. § 15-249)**

Recommendation #7: Expand formative assessment tools and development of interim assessments. This may be accomplished through the International Digital Electronic Access Library, the Partnership for Assessment of Readiness for College and Careers consortium, current district systems, etc.

- **Online Educator Observation and Evaluation Tool (SB 1040)**

Recommendation #8: Establish the use of educator evaluations to facilitate continuous improvement at all levels of a school.

- **Implement Professional Development Program (Prop 301)**

Professional development will be particularly focused on maximizing the use of assessment data to improve instructional practice:

Recommendation #9: Enhance incentives for alternative pathways.

Recommendation #10: Provide pre-service and new teachers and administrators with meaningful mentorship and induction experiences.

Recommendation #11: Provide incentives for highly effective educators to work in struggling schools.

Recommendation #12: Grow a cadre of turnaround experts at the teacher, principal and district levels through a turnaround leadership training program that coordinates various leadership training opportunities.

- **Evaluate School Performance (SLDS Grant)**

Recommendation #13: Create a unified accountability system.

Recommendation #14: Evaluate the need to modify the academic receivership statutes to ensure that the state has sufficient remediation authority at the school and district level.

- **Overarching Recommendations (All Drivers)**

Recommendation #15: Support Arizona's education reform plan through reallocation and multipurpose funding.

Recommendation #16: Create Regional Education Centers to address and support school capacity issues.

Recommendation #17: Engage higher education at a deep level in the implementation of Arizona's education reform plan.

Recommendation #18: Establish, monitor and report performance measures and benchmarks that are public and transparent.

Recommendation #19: Clearly articulate the role of the P-20 Coordinating Council in implementing Arizona's education reform plan.

20.0 Appendix L – High-Level Capabilities

This section summarizes the high-level list of capabilities for Teaching and Learning, Administrative and Back Office systems desired by Local Education Agencies (LEAs) in the state of Arizona. These systems will ultimately be found in the new Arizona Department of Education (ADE) application portfolio.

There are some general features and high-level capabilities that should be available in any system that won't be included in the set of capabilities in each system in the subsections that follow. Capabilities of this type may include a Single Sign-On/Interoperability, such as found in an Identity Management system component; seamless integration with other systems where appropriate; a standard set of reports, browse and search capability for items and/or content in libraries; management of the configuration options if there are any; electronic or email alert notifications; and lastly, the ability to exchange data with a centralized data management system repository (or data warehouse) to the extent necessary, sometimes referred to as a Data Management system.

20.1 Core Services

20.1.1 Identity Management System

- Provide user and data security across all systems
- User and password management
- Role-based user access across all systems

20.1.2 Data Management System

- Able to load and update content data from any system
- Search, index, browse and retrieve content data elements
- Analysis of education data from other systems
- Maintain auditing data across systems
- Reporting with education data from other systems

20.2 Teaching and Learning Systems

20.2.1 Instructional Improvement System

For purposes of the ADE, an Instructional Improvement system will consist of the following systems: Assessment, Learning Management, Professional Development, Content Management, and Educator Evaluation—and generally provides the following features:

- Technology-based tools providing teachers, principals and administrators with actionable data
- Systemically manages continuous instructional improvement
- Promotes collaborative problem-solving and action planning
- Integrates instructional data with student-level data
- Provides early warning indicators of a student's risk of educational failure

20.2.1.1 Assessment System – Student Centric

- Manage, assign, deliver and score assessments
- Manage test items and forms including question types, questions, answers, rationale, etc.
- Authoring, reviewer and approver workflows and tools
- Scoring tools
- Manage test set-up options

20.2.1.2 Learning Management System – Teacher Centric

- Browse/search course catalog and view course description/content
- Complete pretest/posttest
- Complete course evaluation
- View/print transcript and certificate
- Manage learning activities (e.g., online courses, training, webinars, etc.), assign/schedule or publish, and archive
- Course/section self-registration and payment

20.2.1.3 Professional Development

- View/print calendar including scheduled and completed evaluations, course sections, etc.
- Brick and mortar classroom, online, and asynchronous learning
- View/print certificate and transcripts
- Progress reports
- Override class enrollment
- Manage educator goal plans and coaching plans

20.2.1.4 Content Management System

- Manage content and content types (e.g., videos, illustrations, textual, etc.)
- Upload external files (e.g., videos, illustrations, attachments, etc.)
- Publish, deliver and archive content
- Authoring, reviewer and approver workflows and tools

20.2.1.5 Educator Evaluation System

- View, complete, submit and approve an evaluation
- Create and schedule cycles and individual evaluations for educators (i.e., teachers and principals)
- Manage evaluation model frameworks and tools
- Manage and deliver surveys
- Administer and assign evaluations to educators
- Monitor progress

20.2.2 Progress Monitoring/Response to Intervention

- Student progress monitoring tools by stage of intervention
- Set intervention levels of intensity
- Manage resources: general education and special education teachers and specialists
- Monitor learning rate and level of individual student performance
- High-quality classroom instruction
- Ongoing student assessment
- Tiered instruction
- Parental reports on student progress

20.2.3 Credit Recovery

- Section scheduling supports students across multiple districts or schools, students within same district only, or students within same school only
- Pretest/Posttest
- Face-to-face student-teacher interaction
- Manage course catalog, including core and elective
- Independent completion option
- Accreditations

20.2.4 Collaboration and Conferencing Tools

- Chat, Wiki, blogs
- Discussion boards
- Staff collaboration and conferencing

20.3 Administrative Systems

20.3.1 Nutrition and Food Management

- Manage menus
- Manage inventory
- Manage costs and income

20.3.2 Transportation Management

- Manage drivers
- Manage buses and maintenance
- Manage students and routes
- Manage extracurricular activity traffic

20.3.3 Guidance/Counselor

- Manage and track each counseling contact including reason and outcome, anecdotal comments, etc. over the course of a school year, including history
- Configuration options including contact reasons, outcomes, follow-up date, etc.
- View/print cumulative counselor contact history for any student
- View/manage counseling records
- Print list of contacts
- Permit a follow-up date for any counseling contact
- Manage rules and guidelines
- Incident reports

20.3.4 Individual Education Plan Management

- Forms management including referrals, meeting notes, prior written notices as well as e-signatures, evaluations report forms and design forms
- Manage library content, including goals and prescriptions
- Manage plans such as student accommodation plan, individual language learner plan, individual compensatory plan, etc.

- Section 504 management compliance
- Monitor individual student progress

20.3.5 Library Management

- Acquisitions
- Book and content cataloging
- Circulation
- Serials: periodicals and other subscriptions
- Multimedia
- Overdue materials tracking
- Barcoding

20.3.6 Student Information System

- Components or modules should include the following features and capabilities:
 - Discipline and behavior management
 - Grade Book
 - Lessons
 - Assignments
 - Progress
 - Grades reporting and transcripts management
 - Health and Immunization records management
 - Class scheduling management
 - Parent portal
- Student personal information
- Manage student absences
- Messaging among stakeholders
- School calendar functions

20.3.7 Test Analysis

- Robust import capability (i.e., national, state and local assessments; information from a Student Information System; and student academic grades and attendance)
- Support report format and styles such as dashboards with drill-down, text, charts, graphs, etc.
- Support report groupings such as district, school, teacher, class and student; demographics or programs; cohorts; custom groupings; standards
- Support reporting periods such as single-year, multi-year, custom date ranges, etc.
- Support output medium for reports including print, PDF, Excel CSV and SAS

20.4 Back Office Systems

20.4.1 Finance

- General ledger capabilities
- Accounts payable capabilities
- Accounts receivable capabilities
- Controlling/budgeting capabilities
- Fixed assets management capabilities
- Other capabilities include calendar and support for parent and child account codes

20.4.2 Human Resource Management

- Personnel/employee administration including personal information, benefits and termination
- Time management (e.g., time clocks, etc.)
- Organization management
- Recruitment/talent management
- Training and development
- Payroll management
- Self-service center
- Manager center

20.4.3 Procurement

- Purchasing
- Inventory management
- Vendor management
- Materials planning
- Warehouse management
- Workflow/approval
- Plant maintenance

20.4.4 Substitute Management

- Substitute pool management
- Manage absences and substitute assignments
- Communication tools

21.0 Appendix M – Student Accountability Information System Appropriations and Efforts

Chart 45 details all the previous issues across the Arizona Department of Education (ADE) but specifically, in relation to the Information Technology (IT) department supporting ADE program areas, legislative mandates, and Local Education Agencies (LEAs). The left column outlines the issues already in play when new management took over in January 2011. The right column outlines the resolutions executed through November 2012 to correct the problems with the Arizona Education Learning and Accountability System (AELAS) appropriations.

Chart 45 – Performance Improvement Comparison from January 2011 to November 2012

January 2011	November 2012
<p>No Arizona Department of Education program Information Technology strategy alignment</p> <ul style="list-style-type: none"> Information Technology-set business priorities Not aligned to Arizona Department of Education goals 	<p>Tech alignment with a purpose</p> <ul style="list-style-type: none"> Aligned to Arizona Ready and Arizona Department of Education program areas Program areas dictate Information Technology work priorities
<p>Nearly \$6 billion student payments processed with obsolete/inadequate infrastructure and software</p> <ul style="list-style-type: none"> Unavailable 50% of the time Unsupported systems Agency vulnerable to cyber attacks (network, servers never patched) < 30% systems patched Manual processes caused Local Education Agencies significant payment delays 	<p>Institute</p> <ul style="list-style-type: none"> Obsolete Student Accountability Information system hardware replaced without interruption Customer availability now at 99.75% Fiscal year rollover completed in six days (down from six months) Supporting additional 73 School Finance systems without additional manpower Integrity increased to twice per week (from once per month) 90% of databases updated to supportable platform <ul style="list-style-type: none"> Security and Patch manager enables 98% of all systems patched November 2012
<p>No customer service</p> <ul style="list-style-type: none"> 800+ open customer issues Outstanding issues not addressed Phones never answered 	<p>Created SMART objectives for Service Center</p> <ul style="list-style-type: none"> Open customer issues reduced to 92 98% of phone calls are answered within 45 seconds Team answered 1,247 customer calls with 44% customer issues resolved immediately
<p>Inflexible systems that could not anticipate change</p> <ul style="list-style-type: none"> Legislative changes implemented late or never completed Local Education Agency requests never addressed 	<p>Systems</p> <ul style="list-style-type: none"> Legislative changes implemented on time, as directed Location Education Agency data needs are being studied to ensure proper deployment of systems
<p>Noncompliant software licensing put the Arizona Department of Education at risk</p>	<p>Inventoried Arizona Department of Education software use and purchased adequate licensing to support needs</p>
<p>State Auditor/Attorney General findings never addressed</p>	<p>Findings</p> <ul style="list-style-type: none"> Upgraded email (Exchange) to ensure

<ul style="list-style-type: none"> Email was not searchable Identity Management at risk (three separate hardcoded security systems) Any developer could make any change to any system without traceability 	<p>eDiscovery</p> <ul style="list-style-type: none"> Extensive work underway to replace Arizona Department of Education security systems Controlled access limited to only the user/system
<p>Information technology costs not evident to program areas</p> <ul style="list-style-type: none"> Funding does not meet demand 	<p>Shifted to a product-based model</p> <ul style="list-style-type: none"> Identified full-service cost to be transparent to all customers and program areas
<p>Information Technology lacked process and accountability</p> <ul style="list-style-type: none"> > 86% of all changes failed Software never tested (coded in production) 90% Information Technology labor not tracked Extensive labor just to keep lights on Customers had to notify the Arizona Department of Education when systems went down 	<p>Process and accountability</p> <ul style="list-style-type: none"> Automated system monitoring proactive reaction to system outages First state agency to use the Information Technology Infrastructure Library (best-in-class processes) Change management procedures leading to 125% increase in software change success <ul style="list-style-type: none"> Increase to 79 changes a month with less than 3% failure (above industry standard) Implemented Capacity Management; now able to predict server and storage capacity
<p>Software development did not follow standard methodologies</p> <ul style="list-style-type: none"> Developers used non-standard coding practices Software was not internally documented Quality assurance was never conducted 	<p>Software development</p> <ul style="list-style-type: none"> Creating common best practice standards, allowing for consistent support models and lower maintenance costs Extensive implementation of shared, locked-down development tools All software documented, tested and verified before put into production
<p>No data governance</p> <ul style="list-style-type: none"> Local Education Agencies constantly asked for duplicate data that the Arizona Department of Education had multiple copies of <ul style="list-style-type: none"> 57,000 data entities vs. 1,500 	<p>Complete data governance assessment underway</p> <ul style="list-style-type: none"> State Data Governance Commission launched Common Education Data Standards adopted Created state data officer position Hired industry expert to build data governance road map
<p>Systems were not documented</p> <ul style="list-style-type: none"> Extensive time to repair 	<p>Documenting all Information Technology systems</p> <ul style="list-style-type: none"> Reversed-engineered Student Accountability Information System Increases ability to support and build future road map
<p>Obsolete Website</p> <ul style="list-style-type: none"> Out-of-date content Lacked user-friendly design 	<p>Deployed open-source Website for < \$180,000</p> <ul style="list-style-type: none"> Ability to provide immediate content updates Redesigned layout for easier customer use
<p>Legacy financial system did not provide timely payments</p>	<p>New system enables daily grant payments and other disbursements</p> <ul style="list-style-type: none"> Easier Arizona Department of Education reporting

22.0 Appendix N – Financial Assumption

22.1 Assumptions, Drivers and Assertions

- Within each Arizona Department of Education (ADE) program area, the individual application/utility is grouped in accordance to program-specific dependency, then is prioritized as that combined group where needed to assure a single, workflow-based end-to-end service is developed.
- The projects related to the Information Technology (IT) areas (e.g., Data Governance), are run in parallel or prior to ADE's program area rebuilds, as necessary. For example, the ADE has begun Data Governance and Master Data Management; however, this is predominantly in the socialization stage. Its actual execution will occur in parallel with the rebuild of the Student Accountability Information System (SAIS).
- SAIS reverse engineering undertaken by the ADE in 2012 identified numerous gaps of knowledge, documentation, and hidden applications, which are believed to be a consistent issue across all program areas.
- SAIS' reverse engineering assessment was conducted at a cost of approximately \$1.5 million to document and identify its 20 functional modules, and numerous related hidden modules used in SAIS and School Finance. It is assumed that this represents a sufficiently accurate cost basis in which to estimate the needed reverse engineering of each and every function module across ADE's internal systems.
- The reverse engineering of existing program area applications/utilities will identify the requirements and business rules, and determine the needed data. It will also serve to drive the correction to the existing data infrastructure in order to conform to the Ed-Fi standard.
- The estimated cost to rebuild SAIS' modules, excluding School Finance function modules, in accordance with the Architecture proposition can be applied across each and every function module within the ADE.
- The annual cost of 'business as usual' maintenance and modifications of existing function modules reflects the investment costs made to the existing function module portfolio.
- The cost of implementing Data Governance includes the necessity of documenting the data assets across the ADE and represents approximately 15 percent of utility investment costs. This investment cost is comprised of the costs of assigning and training dedicated personnel to data collection; the cost of rebuilding existing databases; and the cost of migrating data to the Operational Data Store from extensive isolated sources.
- The costs associated with implementing the platform architecture requires only a few specific components (specifically, the workflow management capability and rules engines management capability) to be added as a result of ADE's existing Microsoft investment.
- The cost of implementing the Information Technology Infrastructure Library (ITIL) framework requires supporting technologies (e.g., environment monitoring system), as well as training, coaching and procedural developments.
- Several 'in-flight' application replacements (Teacher Certification, Grants Management, et al) provide representative baseline typical costs for application replacement within the ADE that are reflected within the cost estimates outlined in this document
- Costs for virtualizing/clouding applications and data will significantly reduce the costs and risks associated with business continuity planning. The goal of which will be to virtualize and replicate as much of the infrastructure as possible, which is only applied to data with the ADE at this point in time.
- Applications/utilities that are in flight for replacement—although not meeting all the desired and target architectural requirements—will not be considered for replacement within the horizon of this Business

Case, but will form part of the next five-year strategic review and will remain in the service catalog pipeline (e.g., Grants Management, Teacher Certification, etc.).

- A significant part of the existing data cost base includes a data footprint in excess of 14 terabytes, as a result of data duplication, which is part of the data cleanup effort contained within Data Governance and Master Data Management. Estimates show that the total footprint, based on data profiling, should be in the neighborhood of two to three terabytes,
- The service cost includes the following tasks or activities in Project Management
 - Requirements analysis
 - Design
 - Development
 - Testing
 - Defect removal
 - Implementation
 - Training
 - Five-year ongoing support ('business as usual')
- System or application costs are assumed to follow a 'build and replace' approach as much as possible. A different roll-out strategy could drive prices upward when needing to extend current application life spans and run in parallel to build-out efforts.
- A 'bucket' approach to the portfolio categories (consisting of 'simple,' average and complex) is used to determine which time line and base replacement costs (using numerous in-flight and prior estimates) are applied.
- Validation of the cost basis: Several independent baselines were taken when the cost model was constructed that included (1) elements of the Certification program that are being replaced by the in-flight application resulted in the same cost estimate as the actual project costs; (2) the replacement of SAIS and School Finance modules yielded the same estimate as that was provided during the re-engineering effort; and, (3) the cost of the Grants Management application.
- Savings are anticipated and evaluated, to accrue only after the expected release of e-architected applications, although there will be benefits during their replacement by new systems.
- Costs are assumed to be consistent across all application/utility replacement; however it is anticipated that improved learning, such as the improved maturity, procurement process, advanced tools, etc., will enable the ADE to reduce some costs over the five-year investment period.

In developing AELAS' costs, the team used three estimation techniques to derive the overall costs:

- 1) Analogous approach: actual costs of previous and similar projects were used as the basis for the 'replace' estimates
- 2) Bottom-up approach: estimated individual work items and aggregated them in order to achieve the targeted service configurations
- 3) Parametric approach: project characteristics, using (1) and (2), were injected within mathematical models to estimate costs

The justification for using these three approaches is that there is a patchwork of existing applications/utilities costs, in-flight development/implementation costs, blended applications/utilities costs (indices that cover several applications/utilities), as well as new capabilities for which costs can be derived based on anticipated adoption patterns using the focus group, survey, and site visit data to determine.

- The investment estimates provided reflect an accuracy of ± 20 percent, which reflects a Class B estimate; In Business Case analysis, there are typically three classes:

- Class A is \pm 5 percent (the final go ahead)
 - Class B is 15 to 20 percent
 - C- is \pm 30 to 40 percent (approximate estimate)
- The planning and strategic horizon of ADE's core services is limited to the next five years; however, the investment model projects out 10 years to include the full maturation of the benefits realized.
- Each ADE program area is prioritized for replacement to ensure that the data streams collected align with the needs of—and provide the highest value proposition for—SLDS-Az ED³S efforts.
- Inflation rate of 3 percent is used in net present value calculations.
- The current operational costs to support and sustain the environment is anticipated to shift from 'emergency repair improvement' toward 'sustain and improve'; however, little or no cost savings are anticipated, given that the current budget barely allows the ability to support the current environment.

23.0 Appendix O – Detailed Portfolio Road Map

Chart 46 lists the five-year road map for each and every application across the business units. The priority reflects the year at which the particular application/utility is scheduled for replacement. Note that the ordering is based on the strategic priority of the impact to the value proposition that the given data stream can provide to both the Arizona Department of Education as well as the Local Education Agencies. To provide a more condensed and readable version of these details, the applications/utilities are grouped by Program Area Units; however this table should be referred to for the specific task execution sequence.

Chart 46 – Arizona Department of Education Portfolio of Applications

TASK Identity	Priority	Program Area Unit	Current Application Name
	In-flight	Certification	Title II Higher Education Act
	In-flight	Certification	Certification Search
	In-flight	Certification	Department of Public Safety File Import Service
	In-flight	Certification	Institutional Recommendations
	In-flight	Exceptional Student Services	Transition Outcomes Project
	In-flight	Exceptional Student Services	EAPN Calendar Setup
	In-flight	Grants Management	Grants Management
	In-flight	Grants Management	ARRA Recipient Reporting
	In-flight	Maricopa County Education Service Agency	MCESA – Observation Data Capture Tool
	In-flight	Statewide Longitudinal Data System	Arizona Education Data Warehouse
1	1	Arizona Department of Education	Enterprise
2	1	Arizona Department of Education	Education Directory/School Search
3	1	Arizona Department of Education	Online Registration Internal Web – Online Registration
4	1	Arizona Department of Education	SelectSurvey.NET
5	1	Arizona Department of Education	Request Logins
6	1	Assessment	AIMS Matching
7	1	ASU/Educational Technology	IDEAL Admin (there are 6 applications in here)
8	1	Communications	azed.gov Website
9	1	Professional Development	CSPD Event Scheduling
10	1	Exceptional Student Services	Alternate Assessments
11	1	Exceptional Student Services	Exception to the 1% Cap
12	1	Exceptional Student Services	Alternate Assessments Report Utilities

TASK Identity	Priority	Program Area Unit	Current Application Name
13	1	Exceptional Student Services	Annual Site Visit
14	1	Exceptional Student Services	ESS Monitoring (Legacy)
15	1	Exceptional Student Services	ESS Monitoring + Admin Module
16	1	Exceptional Student Services	ESS Specialist
17	1	Exceptional Student Services	ESS Annual Data
18	1	Exceptional Student Services	ESS Census Verification
19	1	Exceptional Student Services	Post-School Outcomes Survey
20	1	Highly Qualified Professionals	Highly Qualified Teacher Application
21	1	Information Technology	Data Governance
22	1	Information Technology	Master Data Management
23	1	Information Technology	Network upgrade
24	1	Information Technology	ITIL Framework
25	1	Information Technology	Platforms Architecture build
26	1	Information Technology	Knowledge Platform build
27	1	Information Technology	Rules Engine build
28	1	No Child Left Behind	No Child Left Behind Monitoring
29	1	No Child Left Behind	No Child Left Behind Plans and Reports
30	1	School Finance	SAIS Integrity
31	1	School Finance	SAIS Transactions
32	1	School Finance	Student Detail Application Console
33	1	School Finance	School Finance File Upload (Student Counts)
34	1	School Finance	SAIS Online
35	1	School Finance	SAIS ID Number Search
36	1	School Finance	SAIS Aggregation
37	1	School Finance	Student Details Split and Merge
38	1	School Finance	Charter Estimated Counts
39	1	School Finance	Cutoff Maintenance
40	1	School Finance	Student Counts Administration
41	1	School Finance	Student Counts Systems
42	1	School Finance	LEA Calendar
43	1	School Finance	LEA Profile
44	1	School Finance	October Enrollment Aggregation Requestor
45	1	School Finance	SDER
46	2	Academic Achievement	Adult Education (AES)
47	2	Academic Achievement	High Honors Tuition
48	2	Academic Achievement	Student Detail Data Interchange (SDDI)
49	2	Academic Achievement	Academic Achievement Reports

TASK Identity	Priority	Program Area Unit	Current Application Name
50	2	Academic Achievement	ADE FormBuilder
51	2	Assessment	Testing Data Correction
52	2	Assessment	Student Demographics for Test Labels
53	2	Exceptional Student Services	CSPD Coaching and SUPPORT Cadre Management
54	2	Exceptional Student Services	CSPD Evaluation Tracking
55	2	Exceptional Student Services	ESS Dispute Tracking
56	2	Exceptional Student Services	ESS Grants
57	2	Exceptional Student Services	EssSurrogate
58	2	Exceptional Student Services	Parent Involvement Survey (ParIS)
59	2	Exceptional Student Services	Parent Survey Acct Allocator
60	2	Exceptional Student Services	ESS Vouchers + Admin Module
61	2	Exceptional Student Services	Educational Vouchers
62	2	Research and Evaluation	Arizona Growth Model Chart
63	2	Research and Evaluation	AZ LEARNS/Adequate Yearly Progress (NCLB)
64	2	Research and Evaluation	R & E Administration
65	2	Research and Evaluation	School Report Card
66	2	Research and Evaluation	SchoolReportCards datacollection
67	2	Research and Evaluation	State Report Card
68	2	School Finance	Transportation Routes
69	2	School Finance	Vehicle Inventory
70	2	School Finance	Budget Tools
71	2	School Finance	Budget Error/Suspense Maintenance
72	2	School Finance	School Finance File Upload (Budget/AFR)
73	2	School Finance	Object Run Manager
74	2	Special Populations/Projects	AIMS Certificate Generation
75	2	Standards and Assessments	Az SAFE
76	2	Standards and Assessments	Online Prevention Training
77	2	Standards and Assessments	AIMS/Data Extract
78	2	Standards and Assessments	Assessments Administration
79	2	Standards and Assessments	Graduation Rate/Dropout Rate Calculator
80	2	Standards and Assessments	Assessments Reports in SDDI
81	2	Standards and Assessments	Assessments StudentSelector
82	2	Title I	Title I School Status
83	2	Title I	State Tutor Fund
84	3	Audit Unit	Single Audit Tracking Database
85	3	Audit Unit	Indirect Costs
86	3	Career and Technical Education	CTE Assessment

TASK Identity	Priority	Program Area Unit	Current Application Name
87	3	Career and Technical Education	AZ Heat
88	3	Career and Technical Education	Performance Measures
89	3	Early Childhood	Early Childhood Data Collection
90	3	Early Childhood	Even Start Family Literacy
91	3	Educational Technology	ALEAT
92	3	Educational Technology	ALEAT SharePoint Portal
93	3	Educational Technology	Ed Tech Survey
94	3	Educational Technology	IDEAL
95	3	Human Resources	Timesheets
96	4	Office of English Language Acquisition Services	OELAS
97	4	Office of English Language Acquisition Services	AMAO Admin Comments
98	4	Office of English Language Acquisition Services	AMAO Profiles
99	4	Office of English Language Acquisition Services	OELAS Common Logon Application
100	4	Office of English Language Acquisition Services	SEI Budget
101	4	Office of English Language Acquisition Services	SEI Budget Request Application 2.0
102	5	Health and Nutrition	Food Distribution Program
103	5	Health and Nutrition	NSLP Nutrition Calculator
104	5	Health and Nutrition	CACFP Nutrition Calculator
105	5	Health and Nutrition	CNP Annual Financial Report
106	5	Health and Nutrition	CNP Direct Certification/Direct Verification
107	5	Health and Nutrition	CNP Direct Verification
108	5	Health and Nutrition	CNPWeb
109	5	Health and Nutrition	CRE/SFSP Review Forms – SharePoint
110	5	Health and Nutrition	SFSP External Information Web
111	5	Human Resources	HR Online Registration
112	5	Human Resources	Intranet (Legacy)

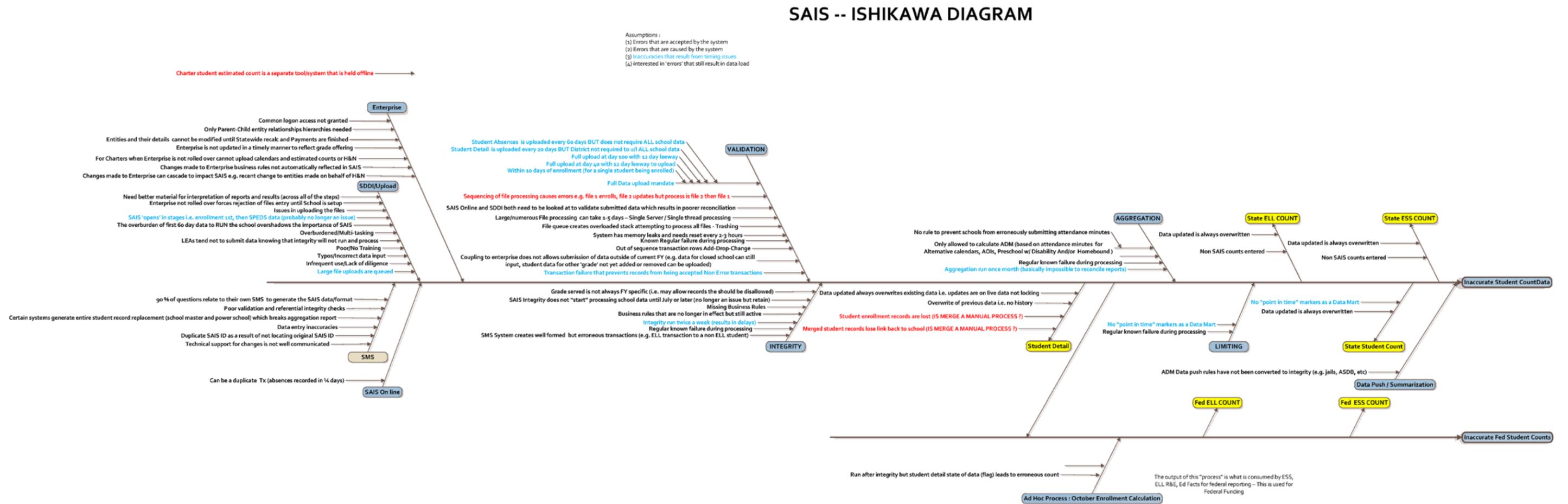
24.0 Appendix P – Ishikawa Diagram

Figure 38 depicts the root-cause analysis of the preponderance of data-related issues that occur within the Arizona Department of Education (ADE). The analysis was conducted by asking the entire consumer and support community about the 'errors' and 'inaccuracies' and their observed sources across the entire set of program area groups. These data issues were then mapped to the specific source modules within the Student Accountability Information System (SAIS) data collection system to identify the specific pieces that are responsible for causing the problems.

The conclusion reached from this analysis, as well as the main priority to drive ADE's program replacement initiative in the Arizona Education Learning and Accountability System (AELAS) road map, is the fact that SAIS' collection system, and in particular the first two main modules, known as Validation and Integrity, are the primary root causes of the majority of issues within and across ADE program areas. This is particularly critical as this is the data source for more than 90 percent of all payments made by the ADE.

The end result is the prioritization of the replacement of SAIS and subsequent finance capability as being the most critical and near term benefit that can be derived across all the programs in the ADE. The result of this analysis ties to the process maps that were created across the ADE that indicate how much manual work results because of poor data quality at this stage.

Figure 38 Ishikawa Diagram of SAIS



25.0 Appendix Q – Hosting Services and Private Cloud

Current research revealed that if storage and computing requirements are not proactively managed, they have the potential to cause unnecessary sprawl within the data center, which in turn exacerbates the usually lean technical support team required to maintain a prespecified level of service (Microsoft 4).

A recent visit to the Arizona Department of Administration (ADOA) data center, where ADE's servers and more than 120 applications are hosted, revealed they are experiencing the same issue with varying types of servers housed within a number of storage racks. One method of addressing this issue of server sprawl, application management, and other technical support issues would be to implement virtualization and private cloud technologies.

“The public cloud and private cloud share a key characteristic server virtualization at scale. No other technology has provided the data center with greater cost savings (in terms of increased hardware utilization) and agility (in terms of moving and scaling workloads) than server virtualization, but at a certain point, perhaps when hundreds of physical hosts and thousands of virtualized machines are reached, virtualization becomes hard to manage with default virtualization management software.”

Thus, alternative hosting service solutions other than the ADOA, offering virtualization and cloud solutions, were evaluated. Only three vendors responded correctly to the issued Request for Information and its requirements. As a result, additional research was performed to identify additional, well-established vendors that were identified as 'leaders' in the Gartner Magic Quadrant for managed hosting and public cloud IaaS categories. See Figure 39. Each vendor was then invited to demonstrate their respective solutions based on the following general criteria; Private Cloud, Data Store, Middleware, Infrastructure, Microsoft Service Level Agreement, and Support Service Level Agreement.

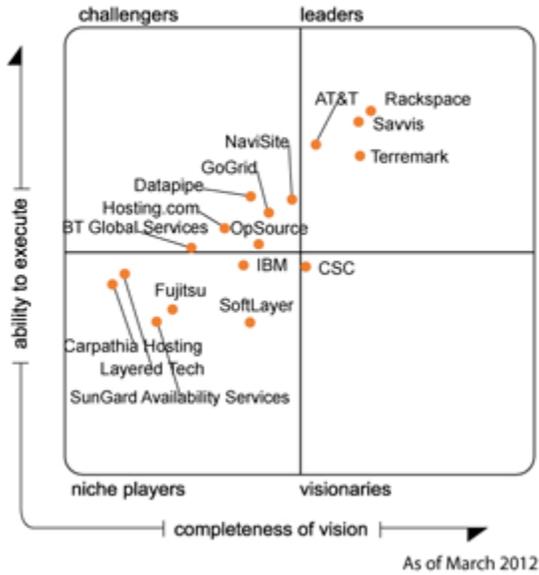
Other key considerations included:

- Sustainability
- Interoperability
- Scalability
- High availability
- Business continuity
- Security
- Infrastructure architecture

Of the five vendors, only three chose to make presentations: Amazon Web Services, Savvis, and Terremark. AT&T and Rackspace declined to present their solutions. For the full report see Chart 47.

Figure 43 – Gartner Magic Quarter Reports

Magic Quadrant for Managed Hosting



Magic Quadrant for Public Cloud Infrastructure as a Service

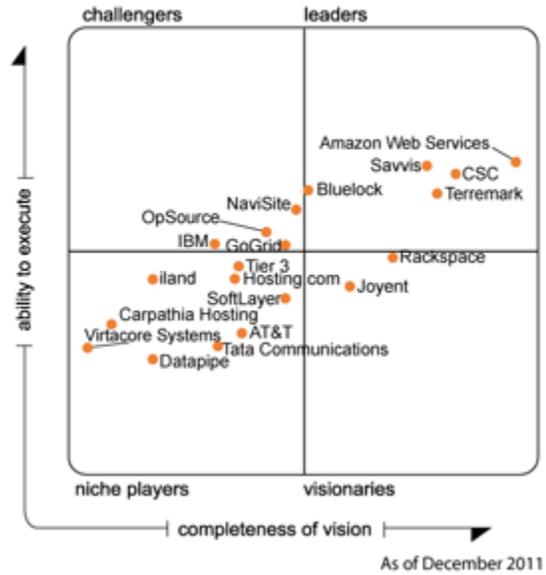


Chart 47 summarizes the findings from this series of vendor demonstrations.

Chart 47 – Vendor Private Cloud Analysis

Vendor	Pluses	Minuses
Amazon Web Services	<ul style="list-style-type: none"> • #1 ranking – IaaS • Data centers: California, Oregon and Virginia • Least expensive 	<ul style="list-style-type: none"> • Unranked – Managed hosting • The Arizona Department of Education responsible for any hosted application • Presentation only covered infrastructure and pricing but no management portal
CenturyLink/Savvis	<ul style="list-style-type: none"> • #2 ranking – IaaS • #2 ranking – Managed hosting • #2 regarding cost • 50+ data centers nationwide • Management portal very intuitive with easy-to-use tools • Solution includes managed applications, web hosting, SaaS enablement, business continuity, content management, and proximity hosting 	<ul style="list-style-type: none"> • None identified
Verizon/Terremark	<ul style="list-style-type: none"> • #4 ranking - Public Cloud IaaS • #4 ranking - Managed Hosting • #3 regarding costs • 20+ data centers nationwide 	<ul style="list-style-type: none"> • Unclear position 'Anything as a Service' • Unable to discuss Managed Applications