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ADVANTAGES AND DISADVANTAGES OF CENTRALIZED VERSUS DECENTRALIZED INFORMATION SYSTEMS AND SERVICES FROM A PROJECT MANAGEMENT PERSPECTIVE

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A Project

Presented to the

Faculty of

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San Bernardino

In Partial Fulfillment

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ABSTRACT

After an extensive review of the available literature, it is evident that within the Information Systems and Technology (IT) field, project managers are still debating whether to centralize or decentralize IT systems and services personnel. This decision can have a major impact on the effectiveness of the project management process with both organizational structures having advantages and disadvantages. The study examines two real-world examples of projects in the aerospace and defense technology industry that were performed from either a centralized or decentralized organizational structure. Using an industry standard project management methodology (i.e., Agile and Scrum), the study clearly identified the advantages and disadvantages of each organizational structure. A centralized organizational structure can reduce costs at the expense of meeting all the customer's needs, while a decentralized organizational structure meets all the customer's needs, it risks significant time delays and cost overruns. Based on the study's findings, a hybrid approach to organizational structure is proposed incorporating the advantages of both centralized and decentralized organizational structures while lessening their noted disadvantages. Future research should also explore the viability of applying a hybrid approach to organizational structure across different industries.

ACKNOWLEDGEMENTS

Throughout the writing of this culminating experience project, I have received a great deal of support and assistance. I would first like to thank my committee Chair, Dr. Conrad Shayo, whose expertise was invaluable in formulating the research question and methodology. Your insightful feedback pushed me to sharpen my thinking and brought my work to a higher level. In addition, I would like to thank my wife, Dr. Samantha Cuillier for her wise counsel and sympathetic ear. Thank you for always being there for me. Moreover, I look forward to the day my one-year-old son, Archer, can read my culminating experience project and understand the numerous late nights and weekends spent were to provide him a better life. And finally, I could not have completed this culminating experience project without the support of my family and friends, who provided stimulating discussions as well as happy distractions to rest my mind outside of my academics.

DEDICATION

For my wife, Samantha and son, Archer.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Overview

After an extensive review of the available literature, it is evident within the Information Systems and Technology (IT) field, project managers are still debating whether to centralize or decentralize IT systems and services personnel. A debate that has been long, withstanding in the IT community for nearly 50 years (Bloomfield & Coombs, 1992; Campbell et al., 2021; Dadashpoor & Yousefi, 2018; Hirschheim & Lacity, 2000; King, 1984; Tiwana et al., 2013). The debate hinges on determining the most effective organizational structure for the deployment of IT systems and services personnel to meet specific client needs as well as maintaining the projects' cost, quality, scope, and deadline. Centralized IT systems and services, a commonly seen business model in which selected IT systems and services are concentrated into "semi-autonomous" business units (Janssen, 2005), have greater flexibility to innovate, reduce costs, and increase client service levels (Janssen, 2005). However, implementing a centralized IT system and service to achieve these benefits is often difficult for project managers to accomplish, since it often requires numerous trade-offs between time, cost, quality, and risk (Barnes, 1988; Campbell et. al., Vahidi & Greenwood, 2009); and an effective, efficient project management structure (Burger et al., 2019; Janssen, 2005). Therefore, many project managers take the path of least resistance and choose to keep their IT systems and services decentralized within the organization (Janssen, 2005), leading to an increase in

project failure (Keider, 1984). Keider (1984) found most systems projects fail because basic project management principles (i.e., planning and control) are violated. This problem is further exasperated within extremely large corporations as seen in the aerospace and defense technology field (e.g., Northrop Grumman Corporation, Lockheed Martin Corporation, Boeing Company, etc.), who employee thousands upon thousands of IT systems and services personnel. In sum, the study will build upon previous literature by methodically identifying key factors that contribute to both the success and failure of organizational structures in centralized and decentralized IT systems and services using two observational case studies within the aerospace and defense technology industry and if applicable, use the results to propose an innovative hybrid approach to IT organization configuration for real-world implementation by future project managers. The analytical results will be derived from industry standard software development methodologies (i.e., Agile and Scrum). The hope is to propel the IT field forward through the analysis of real projects occurring outside a synthetic, controlled lab that will clearly identify an organizational structure as superior to the other (i.e., centralized or decentralized), or provided a solid, data-driven foundation to assert another viable solution for future research, all-in-all ending the current debate.

Problem Statement

This study focuses on the lingering ineffective project management issues such as cost overruns, quality issues, slower than expected progress, missed

deadlines, and lack of engagement from stakeholders that stem from centralized and decentralized IT systems and services organizational structures (Everitt, 2020). To better understand the problem, a culminating experience project that utilizes a foundation built on previous research and industry standard methodologies to identify key factors for the success and failure of two real word projects selected to represent both centralized and decentralized IT systems and services organization structures. The methodologies — AGILE and SCRUM — are used to identify the advantages and disadvantages of centralized and decentralized IT systems and services organizational structure. A thorough review of the problem and observational analysis using the Agile and Scrum methodologies could possibly offer unique insights into the advantages and disadvantages of centralized and decentralized IT system and services organizational structures for project managers within a specified IT leadership and governance structure (i.e., the aerospace and defense technology industry). Therefore, the project potentially offers a crucial step forward for future researchers in resolving the debate.

Research Questions

There are five research questions this project will attempt to answer:

1. Using a software development framework, what advantages are identified in the organizational structure of a centralized IT systems and services?

2. Using a software development framework, what disadvantages are identified in the organizational structure of a centralized IT systems and services?
3. Using a software development framework, what advantages are identified in the organizational structure of a decentralized IT systems and services?
4. Using a software development framework, what disadvantages are identified in the organizational structure of a decentralized IT systems and services?
5. Ultimately, does the answers to the first four research questions listed above clearly establish one organizational structure as superior to the other (i.e., the centralized versus decentralized debate) and if not, is there another alternative solution derived from the study's findings?

Organization of the Project

Chapter One summarizes the relevant literature related to the problem, identifies the areas for further study and outlines a methodological approach to examine the problem more closely. Chapter Two will implement the methodological approach in two observational case studies based upon firsthand knowledge and experience of the author. The first observational case study analyzed a project implemented by the centralized IT system and service personnel at Orbital Sciences Corporation where the Launch Vehicle business unit onboarded onto the enterprise's Manufacturing Execution System (MES) application. The second case study analyzed a project implemented by the

decentralized IT system and service personnel created by a merger of Orbital Sciences Corporation and Alliant Techsystems Incorporated where the Aerospace Structures business unit needed to convert their existing Enterprise Resource Planning (ERP) to Costpoint, to match the enterprise's application setting the example for the remaining business units to merge to the enterprise's application. Chapter Three will discuss the findings from each case study through a project management perspective and discuss implications for future research.

CHAPTER ONE

LITERATURE REVIEW

IT Leadership and Governance Structures

IT leadership and governance can be described as either defensive or offensive in their strategic approach (Nolan & McFarlan, 2005). There are four types of approaches: strategic, turnaround, factory, and support. Each is broadly defined below; however, the scope of this project is limited to the strategic approach to IT leadership and governance in the aerospace and defense technology industry.

Strategic

Strategic-mode businesses need as much reliability as factory-mode businesses do, but they also aggressively pursue systems and services, cost reductions, and competitive advantages like that of turnaround-mode business wherein their IT expenditures are quite large (Nolan & McFarlan, 2005). Not every business wants or needs to be in this mode; however, some business may be forced into it by competitive pressures. As is the case for businesses in turnaround-mode, IT leadership and governance is critical in strategic-mode. Businesses require fully formed IT systems and services.

The aerospace and defense technology industry, specifically businesses like Northrop Grumman Corporation, Lockheed Martin Corporation, Boeing Company, are examples of a strategic approach to IT leadership and governance. In 2019, the aerospace and defense industry reported $697 billion

of revenue employing nearly 2.2 million strong (Deloitte Development LLC, 2021). A&D workers represent 1.4% of America's total workforce (Deloitte Development LLC, 2021). In 2022, A&D companies are expected to focus new and existing projects on innovation to develop new technologies and solutions, create new markets, and expand growth opportunities (Deloitte Development LLC, 2021).

Turnaround

Businesses in a turnaround-mode typically have their IT systems and structures account for “more than 50% of capital expenditures and more than 15% of corporate costs” (Nolan & McFarlan, 2005). New IT systems and structures promise significant process and service improvements, cost reductions, and a competitive edge (Nolan & McFarlan, 2005). Businesses in this mode have a comparatively low need for reliability similar to businesses in support-mode (Nolan & McFarlan, 2005). These businesses can “withstand repeated service interruptions of up to 12 hours without serious consequences, and core business activities remain on a batch cycle” (Nolan & McFarlan, 2005). Once the new IT systems and structures are installed though, there is “no possible reversion to manual systems because all procedures have been captured into databases” (Nolan & McFarlan, 2005).

Factory

Businesses in a factory-mode need highly reliable systems but do not require advanced computing power (Nolan & McFarlan, 2005). Businesses in this

mode are much more dependent on the smooth operation of their technology as most of their core business systems and structures are online. They could suffer an immediate loss of business if their IT systems and structures fail even for a minute. Characteristically, factory-mode businesses are not interested in implementing the newest technology.

Support

Businesses in the support-mode have both a relatively low need for reliability and a low need for strategic IT systems and structures (Nolan & McFarlan, 2005); IT systems and structures fundamentally exist to support employees' actions. Though technology is used, the business will not suffer terribly if a system goes down. Core business IT systems and structures are "generally run on a batch cycle; most error correction and backup work is done manually" (Nolan & McFarlan, 2005). Clients don't have access to internal IT systems and structures (Nolan & McFarlan, 2005). Businesses in support-mode can "suffer repeated service interruptions of up to 12 hours without consequence, and often high-speed Internet response time isn't critical" (Nolan & McFarlan, 2005).

The Importance of Effective Project Management in a Strategic IT Leadership and Governance Structure

The importance of project management in the IT field, particularly within the aerospace and defense technology industry, can't be exaggerated (Phan & Nunamaker, 1988). When there is an effective project manager, every part of the

business runs more easily allowing each business unit to focus on the work that matters (i.e., client needs) free from distractions (e.g., tasks going off track or budgets spinning out of control) empowering each business unit to deliver results that impact the company's strategic goals (Keil et. al., 2003; Schmitt & Kozar, 1978).

Effective project management can reduce monetary costs (Keil et. al., 2003; Schmitt & Kozar, 1978). Specifically, when a project manager uses a project management framework, each project is outlined from project onset to completion, which allows business to know in advance where the deadlines and projected spends may exist, so project managers can more efficiently allocate resources (Keil et. al., 2003; Phan & Nunamaker, 1988; Schmitt & Kozar, 1978). Furthermore, an effective project manager can improve internal communication, which inherently increases collaboration, transparency, and accountability across business units (Keil et. al., 2003; Schmitt & Kozar, 1978). All in all, an effective project manager can allow leadership to make better business decisions leading to greater overall business success.

IT Systems and Services Debate

Within the Information Systems and Technology (IT) field, project managers currently debate whether to centralize or decentralize IT systems and services. A debate that has been long, withstanding in the information systems community for nearly 50 years (Bloomfield & Coombs, 1992; Campbell et. al.,

2021; Dadashpoor & Yousefi, 2018; Hirschheim & Lacity, 2000; King, 1984; Tiwana et al., 2013).

Centralized versus Decentralized

Most conceptualizations of organizational structure as centralization and decentralization rely on some concept of “distance”: the distance between organizational sites, the distance between organizational functions, structures and operations, or the distance between where decisions are made and where they are employed (King, 1984).

Centralization versus decentralization of physical location is concerned by the locationuiiuof facilities and personnel. When IT systems and services are centralized by physical location then all facilities are in one site, whereas decentralized IT systems and services can be spread out across the region, the country, or even internationally (King, 1984). Moreover, in a decentralized, distributed world, IT systems and services personnel can be offsite and remote (Barrenechea, 2021). Centralization of physical location takes advantage of “economies of scale” and is better equipped to preserve the integrity of the organization’s operations (Dewatripont & Maskin, 1995; King, 1984). “The economies of scale” arise from exploiting the full potential of available technology causing output to increase more rapidly than costs (Dewatripont & Maskin, 1995; King, 1984). The costs of duplicating overhead and facilities seen in decentralized IT systems and services can be avoided, and organizational procedures and operations are easier to enforce when IT systems and services

are centralized (King, 1984). However, these advantages can at times be outweighed by clearer communication and availability to support clients' needs by being physically present.

Centralization versus decentralization of function refers to the position of activity within the organizational structure (King, 1984). Centralization of function keeps performance in line with organizational procedures and operations, constrains labor cost escalation, and allows close monitoring and if needed, adjustment of work activities to better correspond with overall organizational structure. Decentralization of functions can be more advantageous when the functions being performed require close cooperation with other units, or when the tasks being done require great worker discretion and less central guidance.

The tensest argument between centralization versus decentralization is centered around power and control, which is often dictated by the decision-making activity in the organization (Campbell et. al., 2021; King, 1984). Centralization of IT systems and services implies the concentration of decision-making power and control lies within a single person or small group, whereas decentralization of IT systems and services implies that decisions are made at various levels in the organization (King, 1984; Zabojnik, 2002). Centralization of power and control often preserves top-level management's interests in most decisions, whereas decentralization allows lower-level project managers discretion to choose among options (King, 1984). If decisions are made by poor top-level understanding of the problem or poor enforcement by lower-level

project management, centralization can be disadvantageous (King, 1984; Zabojnik, 2002). Decentralization of power and control makes lower-level project managers take responsibility for their decisions directly contributing to their success or failure, which may consequently improve their overall work performance (King, 1984; Zabojnik, 2002). Lower-level project managers may also be encouraged to take advantage of innovative opportunities to improve overall unit-level performance (King, 1984; Zabojnik, 2002). However, decentralization of power and control can create problems if lower-level project managers are inept, are not appropriately held accountable for their decisions by top-level management or make decisions that result in problems for other organizational units or for top-level management (King, 1984; Zabojnik, 2002).

The most common arguments in favor of centralized IT systems and services have focused on location and function (King, 1984). Arguments favoring decentralization tended to focus not on economies, but on improved IT systems and services for clients' needs (Campbell et. al., 2021; Dewatripont & Maskin, 1995; King, 1984). The centralization debate has tended towards trade-offs, in which the organizational advantages of centralized control, uniformed procedures and operations, and "economies of scale" have competed against the opportunity for fitting IT system and service capabilities to specific client needs (Burger et. al., 2019; Dewatripont & Maskin, 1995; King, 1984). The trade-off can be simply reduced to one of "efficiency versus effectiveness" (Burger et. al., 2019; King, 1984). The proponents of centralization have argued that centralized IT systems

and services ensure efficiency and permits effective adherence to clients' needs as long as there are clear communications (King, 1984). The proponents of decentralization have argued that properly developed, decentralized IT system and service organizational structures are profitable, even if at times more costly in terms of dollars and cents, because they improve the IT systems and services to better meet clients' needs directly tied to overall client satisfaction (King, 1984).

Many organizations have become increasingly displeased with the returns obtained from their investments in IT systems and services because costs are rising too rapidly and technology changing so quickly that organizations cannot effectively or efficiently keep up (Dewatripont & Maskin, 1995; Janssen & Joha, 2004). Overtime, this displeasure has forced many project managers to centralize IT systems and services attempting to avoid duplication of efforts and to establish "one shared back-office" (Janssen & Joha, 2004) and yet in an effort to become more effective and efficient, many may have inadvertently lost sight of their client's needs.

Centralized IT systems and services have been argued to have a greater ability to develop and maintain organizational procedures and operations. From a project management perspective, consistent procedures and operations create uniformed client experiences and predictable service outcomes (Zucker, 2017). Moreover, consistent procedures and operations significantly increase the likelihood of a project's success and in tandem, lower overall business costs over

time. In addition, standardization almost always leads to greater system effectiveness and efficiency.

However, centralized IT systems and services can fall into the “one-size-fits-all trap” (Zucker, 2017). It is possible that through greater consistency and standardization of IT systems and services, some organizations will be unable to provide the flexibility required by individual projects or specific client needs (Zucker, 2017). Therefore, it has been argued that centralized organizations can run the risk of not being client focused, being overly focused on procedure and operation, lacking domain expertise, and not adding incremental value.

Transparency is a key role for project managers. Successful project managers will ensure their team’s progress is accurately reported to top-level management or stakeholders (Zucker, 2017). Project managers that are part of a centralized IT system and service often experience greater freedom to provide an impartial and at times if needed, opposing point of view because their management chain is a separate entity; whereas project managers that are embedded within their functional teams as seen in decentralized IT systems and services may be less independent and impartial because their individual job performance and success is inherently intertwined with the project’s performance and success (Zucker, 2017).

With that said, clients often appreciate and value project managers that have technical domain knowledge. Project managers in decentralized IT systems and services often have greater domain knowledge because they are members

of the particular functional team assigned to address that particular client's needs, whereas project managers in centralized IT systems and services may not have the same level of expertise (Zucker, 2017), which may increase the risk of inept decision-making due to poor understanding of the problem (King, 1984).

Often organizations have many projects occurring simultaneously and effective, efficient staffing is a critical function of project managers (Zucker, 2017). The effort required by project managers to manage staffing is often underestimated. Centralized IT systems and services have "economies of scale" (Dewatripont & Maskin, 1995; King, 1984; Zucker, 2017). They have defined processes for staffing and managing the resource needs (Zucker, 2017). They are better at flexing their resources to cover partial resource allocations and fluctuations in demand (Zucker, 2017) unlike decentralized IT systems and services.

Software Development Framework

A project management framework is a set of processes, tasks and tools that provide guidance and structure for the execution of a project. A project management framework helps organizations map out the progression of the individual project steps, from beginning to completion (see Figure 1; Chai, 2020).

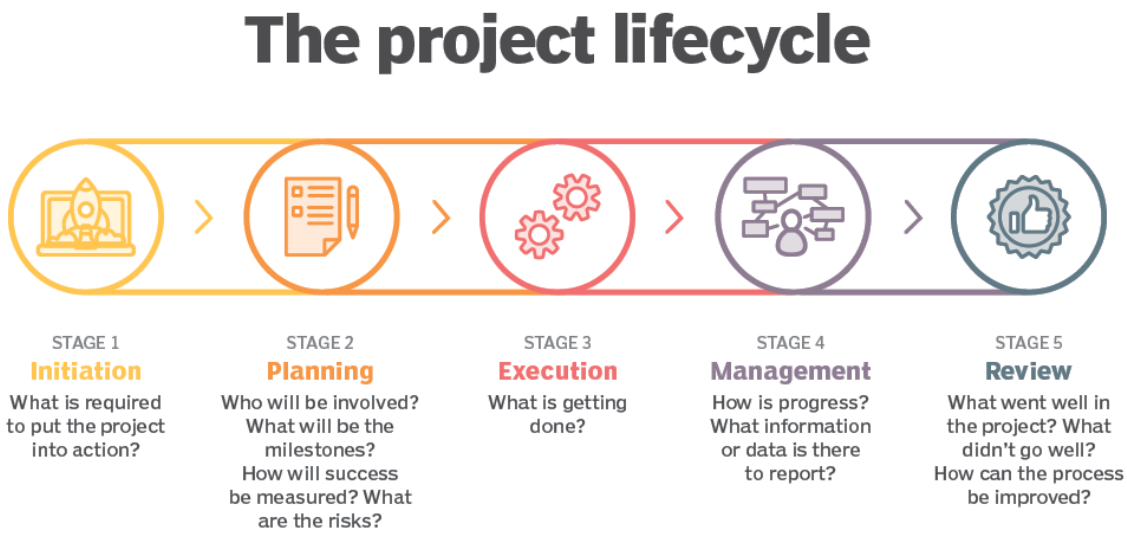

Figure 1. The 5 Stages of the Project Control Cycle.

A project management framework includes all aspects of the project, from required resources and tools to specific processes and tasks. While some frameworks were designed with general project management in mind, others originated for specific purposes such as software development. A common project management framework for IT professionals is a software development framework called AGILE using a methodology called SCRUM.

When it comes to project management, the terms "framework" and "methodology" are often used interchangeably, leading to confusion because frameworks and methodologies do have differences (Chai, 2020). A project management methodology is less flexible than a framework; it is a set of defined practices, steps, and rules, for specific use cases (Chai, 2020). Methodologies are inherently more prescriptive. Methodologies are very specific steps that must be strictly followed. Project management frameworks, on the other hand, provide

structure and guidance while also allowing for more freedom. They are flexible by nature and should be used as looser guidelines. Rules can be changed, adopted, or abandoned as needed.

A project manager chooses the framework for their team. As the person who oversees all project progress, they know best how their colleagues work and are, therefore, best suited to choosing a project management framework that matches the team's working style. The project manager will outline the framework to be followed, host regular meetings in line with this methodology, and monitor progress to ensure it is the right project management framework to achieve key deliverables.

AGILE

AGILE is one of the world's most widely used and recognized software development frameworks (see Figure 2; Hema et al., 2020; Shrivastava & Srivastava, 2022).

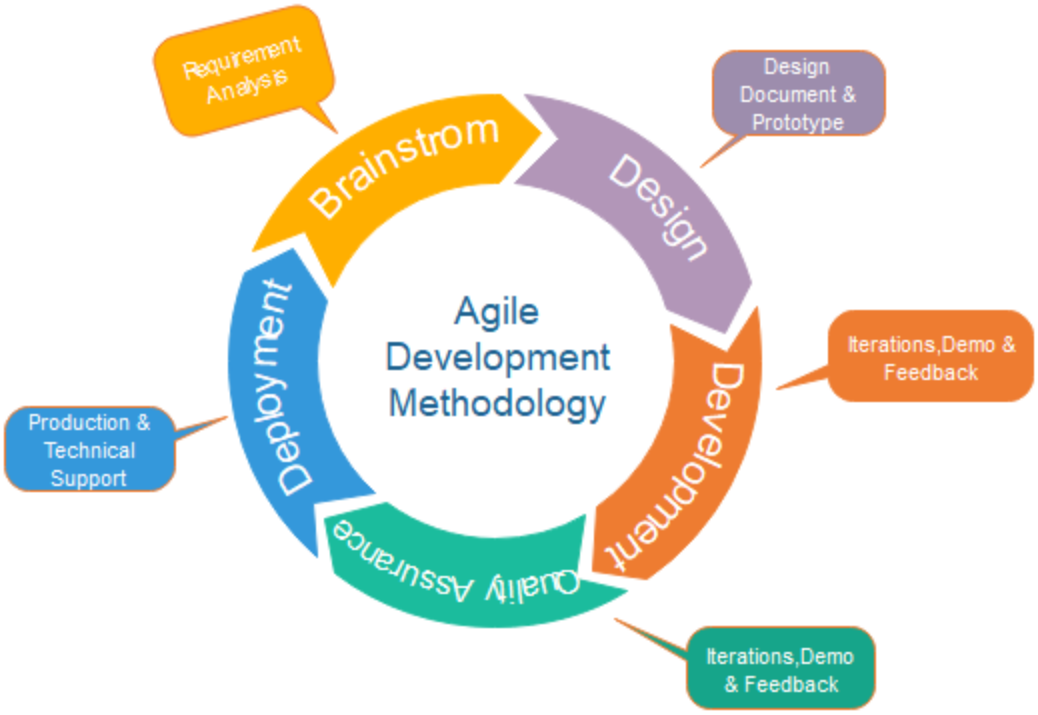

Figure 2. The AGILE Framework.

AGILE is a set of principles that encourage flexibility, adaptability, communication and working software over plans and processes (Shrivastava & Srivastava, 2022). AGILE software development allows the team to work together more efficiently and effectively in developing complex projects. It consists of practices that exercise iterative and incremental techniques which are easily adopted and display great results.

SCRUM

SCRUM can easily be the most popular AGILE framework (see Figure 3).

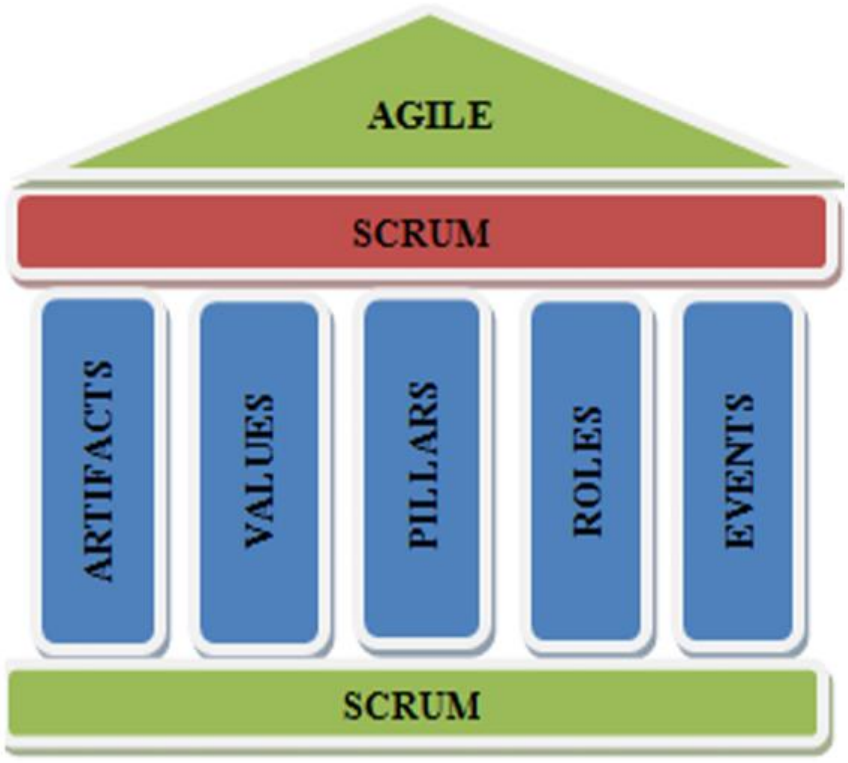

Figure 3. SCRUM within AGILE Framework (Hema et. al., 2020; Lei et al., 2017; Sliger, 2011).

Traditional project management methods fix requirements to control time and cost (Sliger, 2011); SCRUM on the reverse, fixes time and cost to control requirements. The word SCRUM comes from sports rugby. Where the players huddle together in an interlocked position pushing against the opponents. Each player has a defined role in their position and can play both offensive and defensive as per the demand of the situation. Similarly, SCRUM in the information systems community is believed to empower self-managed development teams with three specific and clearly defined roles (Sliger, 2011). Each role works together in iterative time boxed durations called “sprints” (see

Figure 3; Hema et. al., 2020; Sliger, 2011). The easiest way to remember all the SCRUM elements is to remember the “3-3-5 framework” (Sliger, 2011). A SCRUM analyses is composed of three roles (i.e., product owner, SCRUM master and development team), three artifacts (i.e., product backlog, sprint backlog and product increment), and five events (i.e., sprint, sprint planning, daily SCRUM, sprint review and sprint retrospective; as shown in Figure 4.)

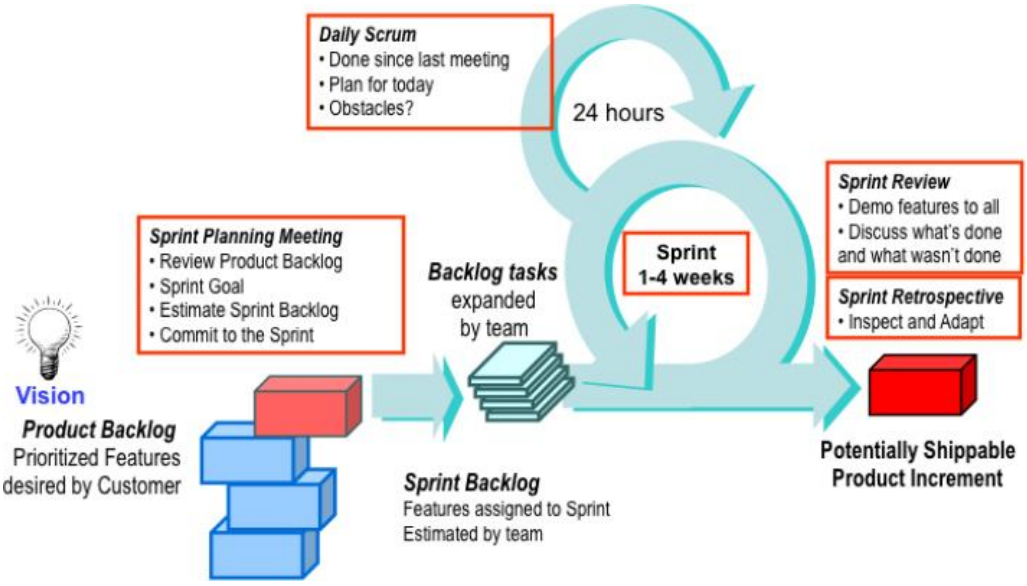

Figure 4. The SCRUM Framework (Hema et. al., 2020; Sliger, 2011).

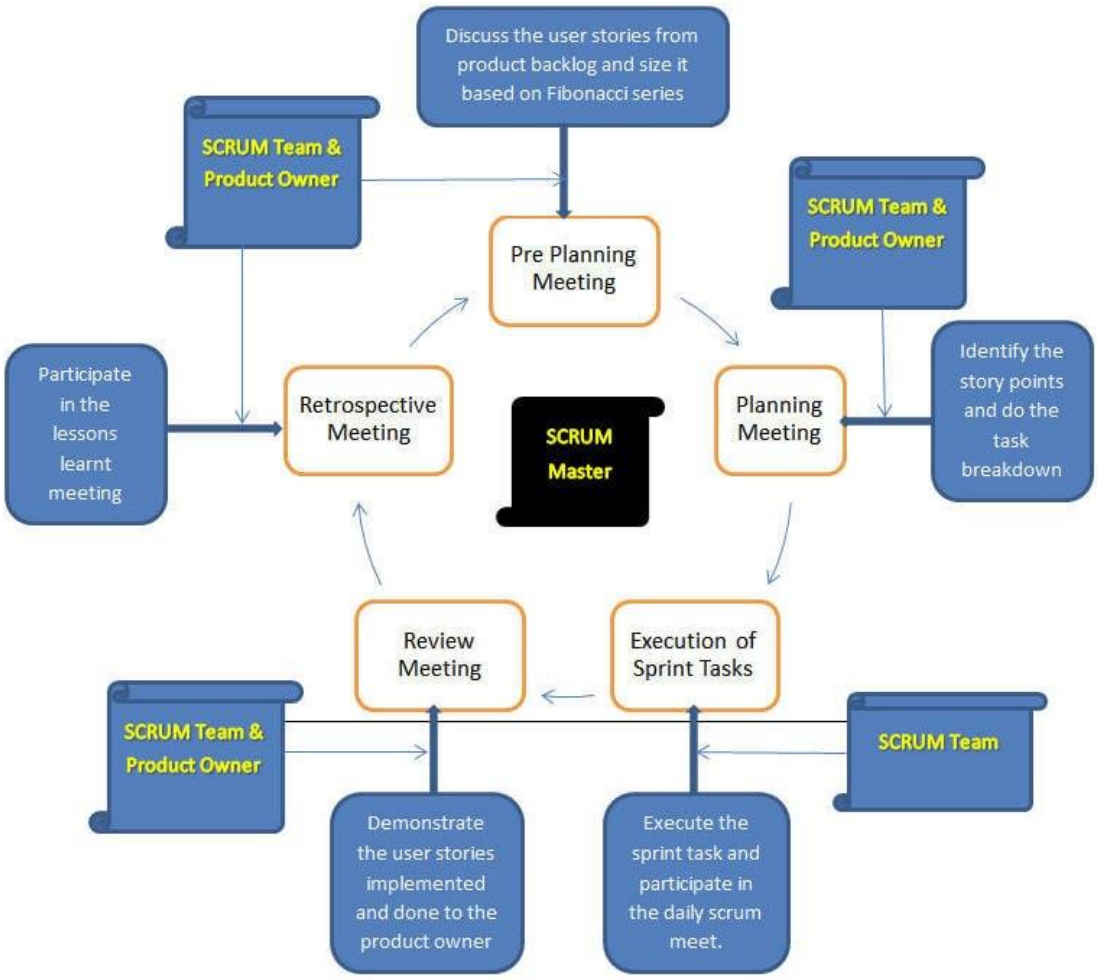

Figure 5. The SCRUM Process (Shrivastava & Srivastava, 2022).

Benefits of Using a Project Management Framework

There are several benefits that have been identified when a project manager uses a project management framework. First, with a project management framework, processes are consistent across the organization (Naybour, 2013). Consistency allows for greater precision in planning projects and setting deadlines (Naybour, 2013). Second, a project management framework clearly lays out all project tasks and the tools needed to complete

them, meaning there is no confusion when teams get to the execution stage (Naybour, 2013). Third, when large projects are broken down into smaller tasks, it is easier for project managers to delegate tasks and teams to tackle the workload creating greater simplification. Fourth, a project management framework can help managers assess how much time and money is spent on each project. Optimization enables them to successfully allocate and optimize resources for future projects. Lastly, by meeting regularly with teams as outlined in their chosen framework, project managers can effectively communicate with colleagues and boost information flow.

CHAPTER TWO

OBSERVATIONAL STUDY

Orbital Sciences Corporation (“Orbital”)

Orbital Sciences Corporation, commonly referred to as “Orbital,” was founded and incorporated in 1982 (Paynter, 2004). Orbital was an American company specializing in the design, manufacture and launch of small- and medium-class space and launch vehicle systems for commercial, military, and other government clients (Paynter, 2004). A major milestone in the company's history was in 2008 when it received a long-term NASA contract to provide cargo transportation services to and from the International Space Station (ISS) with a value of approximately 1.9 billion U.S. dollars for missions taking place between 2011 to 2015 (Orbital Sciences Corporation, 2014). In 2014, Orbital merged with Alliant Techsystems (“ATK”) to create a new company called Orbital ATK, Inc., which in turn was purchased by Northrop Grumman in 2018 (Orbital Sciences Corporation, 2014). Northrop Grumman has over approximately 90,000 employees with more than 550 facilities in all 50 U.S. states and in more than 25 countries around the world and an annual revenue more than 30 billion U.S. dollars making it is one of the world's largest weapons manufacturers and military technology providers (Northrop Grumman, 2021). Today, the remnants of Orbital are considered a subsidiary of Northrop Grumman known as Northrop Grumman Space Systems (Northrop Grumman, 2021).

Project Summary to Onboard Launch Vehicles Business Unit to MES Application

The first observational case study examined a project undertaken at Orbital to onboard the Launch Vehicles business unit into the existing enterprise's Manufacturing Execution System (MES). The project was managed by the Enterprise Information Systems team that maintained the MES application. The condition of the project was for the application to be owned by the centralized enterprise Information Systems team who then manage the project, and since this application contained sensitive client data from other business units, Launch Vehicles would be required to adhere to the governing policies and procedures already established by the centralized Information Systems team prior to application installation. The project is detailed below in distinct phases (i.e., Initiation, Planning, Execution, and Management; the review phases is detailed in Chapter Four) outlined in Figure 1: The Project Lifecycle. Each phase is further analyzed by an AGILE framework using SCRUM methodology.

SCRUM requires three roles in its participants: 1. a product owner, who owns the scope, the backlog, and can clarify all questions; 2. a SCRUM Master, who facilitates the standup meetings and finds the most efficient way for the team to get work done; and 3. the team members, who are typically cross-functional and are under pressure to deliver

The SCRUM process itself involves: 1. the board where the team can see what tasks are being worked on, by whom, and the status of each task; 2. the

product owner breaking down a massive project into individual tasks (i.e., the backlog) and prioritizing which tasks in the backlog must be dealt with first; 3. the team members working on their priorities for a specific duration, known as a sprint (i.e., a day, a week, two weeks, a month); 4. the SCRUM Master leading a daily standup meeting of no more than 10 minutes where each team member updates the team on his or her work progress; and 5. a retrospective at the end of each SCRUM period to evaluate what worked and what can be improved in the future (see Chapter Three).

Initiation Phase. As seen in Table 1, the first task in the initiation phase was to identify which programs within the Launch Vehicles business unit would be the first to “go live” on the new centralized enterprise MES application. Project prioritization as seen as the first step in Figure 4 was determined by each separate “Cabling” team, who were the initial requestors for the use of the centralized enterprise MES application. Once the project was initiated, the project manager needed to determine how each “Cabling” team within the Launch Vehicle business unit would be using the new application. Project prioritization was then determined through pre-planning meetings as seen as the first step in Figure 5 with the “Cabling” team determining project scope. Finally, client data, roles, privileges, and reporting requirements were determined by the SCRUM Master as part of the continuation of project lifecycle.

Table 1. SCRUM Board for Initiation Phase for Orbital's Project to Onboard Launch Vehicle Business Unit to MES Application

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
What are the infrastructure requirements?	Network Cabling	Mobile Carts	Client Machine Builds	Number of Clients
What are the program requirements?	Reporting Requirements	Client Data	Workflows	Roles and Privileges

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

Planning Phase. The planning phase is a continuation of the project after the initiation phase wherein the feasibility of the requirements determined during the conception phase are realized. In some tasks seen in Table 1, it was determined by the project manager (i.e., SCRUM master) that new reports would need to be created to meet a "Cabling" team's requirements while for other tasks the "Cabling" team could use existing reports. These existing reports would need to be copied and modified for the business unit and access to the reporting engine, IBM Cognos, would need to be given to users. As seen in Table 2, the addition of tasks: disaster recovery and business continuity were discussed. Using SCRUM methodology, it was determined by the project manager (i.e., SCRUM master) that the Launch Vehicle business unit could utilized the already existing disaster recovery plan in the centralized enterprise, which included an offsite datacenter with hot backups. For the business continuity task, it was further determined by the project manager (i.e., SCRUM master) that the Launch

Vehicle business unit could work on pen and paper in the event of a system outage and “catch-up” the MES application once it was back up with the client data that had been manually recorded by each “Cabling” team affected by the outage. Lasty, no additional custom configurations were considered, and the MES application would rely solely on the configurations already in place by the centralized Information Systems team. For example, this issue forced the Launch Vehicles business unit into a one-size-fits-all information system and while it met most of their clients’ needs, it could not be adapted to meet all needs due to limitations from other business units such as merchant supplier agreements.

Table 2. SCRUM Board for Planning Phase for Orbital’s Project to Onboard Launch Vehicle Business Unit to MES Application

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
What reports do the users need?	BOM Report	Assembly Report	Final Build Report	Cognos Access
How do users keep working during a system outage?				Paper Plan Procedure
How do we rebuild the system in the event of a disaster?	Client Switchover Procedure	Data Validation Procedure		Offsite Backup

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

Execution Phase. The initiation phase clearly outlined the parameters of the system and the execution phase determined when each “Cabling” team would “go live” within the centralized MES application. As seen in Table 3, training was scheduled for the new users (i.e., engineers) within each “Cabling” team and their respective program’s production data was loaded into the centralized MES application. On the day of each “Cabling” team’s “go live” date, the project manager (i.e., SCRUM master) developed an execution plan to import each program into the application when the first manufacturing order (MO) was cut. The engineers were able to enter the new centralized MES application and continue their work creating products as they had in the old, decentralized MES application. Any “Day 1” problems were addressed appropriately and influenced the planning and execution phases of next patch cycle.

Table 3. SCRUM Board for Execution Phase for Orbital’s Project to Onboard Launch Vehicle Business Unit to MES Application

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
Administrators load program data.				Initial Data Load
How do user’s login to the application?				User Training
A user can’t UPREV and order.	Implement Fix	Create Vendor Case	Log Data Sent to Vendor	User Interview Complete

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

Management Phase. After the execution phase, the new centralized MES application was live, the project entered the management phase. Any “Day 1” problems arisen in the execution phase were addressed appropriately with scripts or tickets opened with the application vendor to be fixed future patches to the application. As seen in Table 4, patching the centralized MES application by the centralized Information Systems team was tasked shortly after “go live.” Problems and patch fixes were identified by the application vendor, who collaborated closely with the centralized Information Systems team to complete each task. Once a patch fix was built by the application vendor, it was sent to the centralized Information Systems team to be tasked to install and test. Application testing involved regression testing the application’s functionality, verifying the patch fix was accepted by the application and fixed the problem before promotion to production. In this instance, the management phase of the project lifecycle continues until the application end of life, while simultaneously entering the review phase discussed in Chapter Three

Table 4. SCRUM Board for Management Phase for Orbital's Project to Onboard Launch Vehicle Business Unit to MES Application

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
A user can't UPREV and order.		Implement Fix		Interview User, Create Case, Gather Log Data
Program test latest patch.	Go Vote	Regression Testing	Testing Scope	Patch Applied to Test
Users report additional issue.	Implement Fix	Create Vendor Case	Gather Log Data	Interview Users

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

Alliant Techsystems ("ATK")

Alliant Techsystems Incorporated, commonly referred to as "ATK," was an American aerospace, defense, and sporting goods company (Alliant Techsystems, 2014). ATK was launched as an independent company in 1990 after Honeywell spun off its defense business to shareholders (Alliant Techsystems, 2014). The company operated in 22 states, Puerto Rico, and other countries with an annual revenue of approximately 4.78 billion U.S. dollars in 2014 (Alliant Techsystems, 2014), ATK's Aerospace Group covered space, defense and commercial aerospace products and capabilities, which offered propulsion for space exploration, commercial launch vehicles and strategic and missile defense (Alliant Techsystems, 2014). ATK's Defense Group produced

ammunition, precision and strike weapons, missile-warning solutions, and tactical rocket motors across air-, sea-, and land-based systems (Alliant Techsystems, 2014).

Project Summary to Convert Applications from ERP to Costpoint

The second observational case study examined a project undertaken at ATK to convert the Aerospace Structure ERP to Costpoint platform commonly used by the rest of the enterprise. The project mandated that all client data that existed in the Aerospace structure ERP be converted into the Costpoint platform while maintaining all customized functionality to suit decentralized business units' needs. The project was managed by the Aerospace Structures Information Systems team whose sole focus was building and maintaining the business unit ERP system. The condition of the project was for the application to match, both in software version and configuration, and the larger Enterprise ERP application. The resulting system would then have to match the same policies, principles, and guidelines set forth by the Enterprise organization. The project is detailed below in distinct phases (i.e., Initiation, Planning, Execution, and Management; the review phases is detailed in Chapter Four) outlined in Figure 1: The Project Lifecycle. Each phase is further analyzed by an AGILE framework using SCRUM methodology.

SCRUM requires three roles in its participants: 1. a product owner, who owns the scope, the backlog, and can clarify all questions; 2. a SCRUM Master, who facilitates the standup meetings and finds the most efficient way for the team

to get work done; and 3. the team members, who are typically cross-functional and are under pressure to deliver

The SCRUM process itself involves: 1. the board where the team can see what tasks are being worked on, by whom, and the status of each task; 2. the product owner breaking down a massive project into individual tasks (i.e., the backlog) and prioritizing which tasks in the backlog must be dealt with first; 3. the team members working on their priorities for a specific duration, known as a sprint (i.e., a day, a week, two weeks, a month); 4. the SCRUM Master leading a daily standup meeting of no more than 10 minutes where each team member updates the team on his or her work progress; and 5. a retrospective at the end of each SCRUM period to evaluate what worked and what can be improved in the future (see Chapter Four).

Initiation Phase. As seen in Table 5, the first task in the initiation phase was to identify what data would be converted as part of the migration (i.e., project codes) as well as what data could be migrated as is (i.e., personnel information). The project was the first in a larger enterprise goal to merge all the company's ERP systems to Costpoint; therefore, all project management decisions needed to be discussed in detail to ensure the final format of the data could be utilized by others later down the road. It was determined that the Aerospace Structures business unit would be project manager and utilize their own personnel i.e., data owners. Data owners were declared and appointed to be the primary point of contact for any data changes in the informational system.

Table 5. SCRUM Board for Initiation Phase for ATK's Project to Convert Applications from ERP to Costpoint

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
What data needs to be migrated?	Identify Data Owners	Identify Data to Convert, Identify Data to Copy	Identify Data to not be Migrated	Project Scope

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

Planning Phase. The planning phase is a continuation of the project after the initiation phase wherein the feasibility of the requirements determined during the conception phase are realized. One of the primary goals of the planning phase for this project was determining what data would need to be migrated into the new environment, and how, whether it is a direct copy, or a conversion needs to be done. Once the data had been categorized, "crosswalks" would need to be planned for the data conversion. "Cross walks" are where the project first encountered issues. The project manager did not have the necessary resources or expertise to identify what data needed to be converted and how, which resulted in a roadblock that set the project back 6 months to the tune of millions of dollars. Eventually, experts were brought in from the central enterprise information systems team to take over the data conversion process. Once centralized, the enterprise team managed to get the project back on track by successfully managing the entire data conversion process and building the crosswalks. Data would then be run through these crosswalks many times to pick

out data that would be considered “bad” and need to be addressed on an individual datapoint basis. Once the data conversion process was complete then the cutover could be planned which included an outage, data load, data conversion, and then establishing a backup system.

Finally, as part of the planning phase, user training was scheduled for all the data owners that would be in the new information system. Training was determined to be led by the Aerospace Structures business unit. Therefore, the centralized enterprise information systems team then returned the project to the project manager to complete user training.

Table 6. SCRUM Board for Planning Phase for ATK’s Project to Convert Applications from ERP to Costpoint

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
Convert data.	Test Crosswalks	Identify Business Rules	Crosswalks	Project Scope
Iterate data conversion.	Go Vote	Regression Testing	Testing Scope	Identify Data Conversions
Build test environment.	Identify Final Patch Level	Application Build	Database Conversion	

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

Execution Phase. With the data transfer planned and the cutover scheduled, the project entered the execution phase. This phase started with building out the new Costpoint application servers and database. Once built, the project needed to stop all accounting activity in the old ERP application to create

a “hard-stop” in the data. Once complete, the project stopped the old ERP application and started loading the intact data into the new Costpoint application while running the crosswalks in parallel. Once all the data was loaded, the project ran data validations on every aspect of the new Costpoint application. Data validation tests determine if the data crossed over as expected with no corruption due to the transfer process. Once data validations were complete and the project manager gave the green light to proceed, centralized enterprise policies and rules could be put in place. Those new policies and rules would be implemented and then the new centralized application would repeat the validation process to again ensure data was uncorrupted. Data was uncorrupted and the project manager determined backup servers could be turned on and the new Costpoint application could be open to the date owners.

Table 7. SCRUM Board for Execution Phase for ATK’s Project to Convert Applications from ERP to Costpoint

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
Convert data.			Data Validation	Crosswalks, Import Data
Deploy Costpoint ERP.	Go Vote	Functional Validation	Data Conversion	Servers and Databases Built
Retire old ERP application.	Decommission Infrastructure	Data Validation	Data Integrity	Data Migration

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

Management Phase. After the execution phase, the new Costpoint application was “live” and entered the management phase. In this phase, any Day 1 issues would be addressed. Issues are addressed through the transition team composed of data owners and the project manager with the support of the vendor. In addition, any gaps in user training would be corrected where necessary. To fix Day 1 issues, a new patching outage was scheduled in advance to be complete shortly after going “live” in order to be proactive in fixing and Day 1 issues found in the management phase. Once patching was complete, the application would be kept at the same patch level as the enterprise Costpoint system while keeping all controls the same.

Table 8. SCRUM Board for Management Phase for ATK’s Project to Convert Applications from ERP to Costpoint

Stories	**Not Started**	**In Progress**	**In Review**	**Complete**
User can’t see their data.	Implement Fix	Form Tiger Team	Scope of Data Loss	User Interview
Deploy maintenance patch.	Go Vote	Regression Testing	Testing Scope	Patch Applied to Test
Users report other issue.	Implement Fix	Create Vendor Case	Gather Log Data	Interview Users

Note: Each cell represents a task within the SCRUM project. Tasks that are yet to begin are under the not started column. Tasks that are in the works are under the in-progress column. Tasks that are in testing are under the in-review column and finally, tasks under the complete column represent tasks that have been completed.

CHAPTER THREE

ANALYSIS AND DISCUSSION FROM A PROJECT MANAGEMENT PERSPECTIVE

Advantages and Disadvantages of Centralized IT Systems and Services based on SCRUM Analyses

It is evident by review of Case Study 1 that a centralized IT system and service was able to effectively leverage highly trained personnel who had previous experience onboarding other business units within the enterprise into the Manufacturing Execution System (MES) application. These highly skilled personnel were able to effectively utilize existing resources (e.g., detailed documentation and training programs) and keep the project on track. Moreover, very little project artifacts had to be created net new as most were only slightly modified versions of an artifact that already existed from a previous onboarding project within the enterprise resulting in overall cost reduction.

However, one big disadvantage was observed in Case Study 1. It was evident that when utilizing a central IT system and service, an application is only as good as what had previously been implemented by personnel across other business units within the enterprise. First, for example, legal restrictions had been placed within the application by personnel from other business units within the enterprise that prevented the Launch Vehicle business unit from fully realizing the maximum potential of the new application. The application restricted what data the Launch Vehicle business unit could view as they built out their

application's business intelligence ("BI") and dashboards. However, because other business units within the enterprise had merchant supplier agreements already established that prevented any other business unit from viewing backend data in the application which resulted in their ability to create BI and dashboards as desired. Third, other business units limited the Launch Vehicle by having a standard set of policies and procedures for the application that each BU adhered including set universal roles and privileges, standard acceptance workflows, and universal units of measurement. The Launch Vehicle business unit suffered from added extra work because their manufacturing process differed greatly from other business units in workflows and units of measurement that had to be reconciled by the time of go-live causing significant delays. These examples demonstrate how a centralized IT system and service may prevent each business unit in the enterprise from getting the most out of the application and therefore, may not be able to address all client's needs and specifications.

Advantages and Disadvantages of Decentralized IT Systems and Services based on SCRUM Analyses

It is evident by review of Case Study 2 that an advantage to an organizational structure in a decentralized IT systems and services was the ability to prioritize the project as needed and control the overall project scope and data. For example, the Aerospace Structures business unit personnel already knew the data and processes that needed to be migrated to the new application better than any centralized IT systems and services personnel resulting in

greater specificity of project scope as well as deeper understanding of potential data migration issues that could arise. Moreover, due to greater control over the application, the Aerospace Structures business unit controlled how the new application would best serve their specific client needs without consideration of other business units' needs.

However, a major drawback to an organizational structure in a decentralized IT systems and services led to the project running significantly behind schedule and massively over budget. The Aerospace Structures business unit personnel knew their data very well, but they didn't have the necessary personnel or expertise to successfully convert data to the newly required formats within the application. The project began to experience significant delays when running crosswalks and the project manager was unable to get the timeline back on track. As the project started to run months behind schedule, it also started to run massively over budget to the tune of millions of dollars. Eventually, personnel resources from the centralized IT systems and services were brought in to take over the data conversion process and management of the project. Once centralized IT systems and services personnel took over the project, the project moved more quickly towards a relatively seamless deployment.

Hybrid Solution

A final takeaway from my culminating experience project is that the reason a debate still exists between centralized and decentralized IT systems and services is because they are inherently dependent on one another to

successfully complete a project. This study is the first of its kind to analyze the IT systems and service's organizational structure of two real world projects within the aerospace and defense technology industry using industry standard methodology. By reaffirming the advantages, and importantly the disadvantages of centralized and decentralized IT systems and services organizational structures found in the literature using real world examples created a solid foundation for the proposal of an alternative approach to organizational structure within IT systems and services. It is evident both philosophically and realistically that there is no superior option over the other in the current centralized versus decentralized debate rather the strengths of one can compensate for the weaknesses of the other. Therefore, I propose future project managers should employ a hybrid approach to organizational structure of IT systems and services. For example, instead of having a single application for the entire enterprise managed by centralized IT systems and services personnel, there could be at least two versions of the application wherein personnel from business units decentralized IT systems and services are grouped together in the application by the likeness of the products that they produce. In Case Study 1, a hybrid approach would split the central MES system into two separate applications managed by the centralized IT systems and services personnel. Splitting business units into two decentralized groups of IT systems and services personnel who build like products, would allow the centralized IT systems and services personnel to set more accurate guidelines to their specific business

units' manufacturing needs overseen by the expertise of the decentralized IT systems and services personnel eliminating the disadvantage seen above.

CONCLUSION

The debate between the efficacy of a centralized versus decentralized IT systems and services has been around since Information Systems started playing a much larger role in enterprises production and costs. The debate stems around the need to best serve the enterprises' overall needs while also maintaining reasonable timelines and budgets. To settle the debate, the author analyzed two observational case studies through the lens of a project manager utilizing the modern AGILE and SCRUM mythologies.

In Case Study #1, the project was owned by the centralized IT system and service, with the goal being to bring the Launch Vehicles business unit onboard the existing MES application currently being used by the entire enterprise. The findings identified both advantages and disadvantages of using a centralized IT system and service. Overall, the findings found that the project was completed on time and on budget, but the project did not meet all the business units' needs and some business units engineering teams sacrificed the quality of their use of the application for the betterment of other business units who came first.

In case Study 2, the project was implemented by the decentralized business unit's IT systems and services personnel with the goal to convert their existing ERP to the enterprise Costpoint ERP. The findings identified both advantages and disadvantages of using decentralized IT systems and services personnel. Overall, it was noted that an advantage of the business unit

implementing the project was their intimate knowledge of the data in the old ERP and what the requirements would need to be in the new Costpoint ERP. In the end, the decentralized IT systems and services personnel had to bring in the expertise of the centralized IT systems and services personnel to complete the project.

Both observational case studies give credence to the proposed solution of a hybrid approach to organizational structure for project managers future consideration. In both cases, a hybrid approach would have met the needs of the business units more accurately while leveraging existing expertise to keep the projects on time and on budget. The hybrid approach suggested having multiple versions of the application, grouping decentralized IT systems and services by product likeness, and managed by the centralized IT system and service. The hybrid approach eliminates many of the restrictions of a one-size-fits-all system while still allowing the most experienced personnel in the enterprise to manage future projects.

To conclude, there are many valid reasons to utilize both a centralized and decentralized IT systems and services organization structure in terms of project management. Both approaches have advantages, but also disadvantages that could be mitigated using a hybrid approach. In the end, it is up to each company to decide how their IT systems and services function, but the proposed hybrid approach outlined in this culminating experience project is the best approach to better serve their customers while controlling the project scope, timeline, and

cost and therefore, should be seriously considered as an effective management option for future research.

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