Intrapreneurship as a tool for lean transformation: Case study of VBS, intrapreneurship in IT space

By

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Submitted to the MIT Sloan School of Management and the Department of Engineering Systems in Partial Fulfillment of the Requirements for Degrees of

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ABSTRACT

Lean is heralded as the driving methodology for successful organizations ranging from defense to consumer industries. Its approach to reduction of waste and continuous process improvement allows a company to reduce cost, meet customer needs, and sustain growth.

As companies embark on transforming their organizations into more efficient, nimble, and high velocity organizations through integration of lean they face severe inertia. The process of lean transformation and integrating lean is an arduous task at which most companies falter on for a number of reasons. These reasons are strategic (costs and time to implement changes), political (decision making process delays), and cultural (company norms and employee motivation).

Promoting intrapreneurship in organizations can serve as a driving mechanism to ensure change goals and objectives are met and are sustainable. Intrapreneurial entities are able to cut through silos within an organization and meet the needs of its direct customers. The survival of an intrapreneurial organization is solely dependent on meeting customer needs. Therefore, the cost and time delay to meet the needs of its customers for an intrapreneurial organization is much less than other established functional and support groups within the organization.

The hypothesis was that incorporating intrapreneurship into a transformation plan will aid in successful integration of lean in the organization. VBS, an intrapreneurial group within Raytheon IDS, is used as a case example of the impact of intrapreneurship on lean transformation. VBS has played a key role in monitoring and promoting lean culture at IADC (Integrated Air Defense Center and manufacturing site for IDS) at Raytheon. Using real-time metrics, the group has implemented many essential performance and behavioral feedback loops. These real-time metrics and behavioral results continuously drive operations to converge on lean behavior. This has resulted in a 20 % reduction in operating costs for four years running from its lean transformation.

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1. Introduction

1.1. Problem Statement

Lean operations (lean) is at the forefront of methodologies used by a number of companies to greatly transform operations, especially in manufacturing aspects. Transforming a company through lean, like any change, is an arduous task. It requires changing employee behavior, organization structures, and group processes. If lean change is not done properly, companies are unable to move from their current state to a future state of lean that significantly improves the operations. Despite the benefits of lean, many companies struggle to transform their manufacturing activities as well as expand lean to other parts of the corporation. The purpose of this business case is to highlight the benefits of intrapreneurship within a lean transformation using Raytheon's virtual business system (VBS) as a model intrapreneurial group. The case study demonstrates that companies that enact policies that foster intrapreneurship in lean transformation activities can greatly increase the likelihood of success and sustainment of such success.

1.2. Thesis Overview

The motivation for this thesis is based on the success of multiple LGO internships at Raytheon Integrated Defense System (IDS) aimed at promoting lean through VBS and the significant cost improvement by the Virtual Business System group.

The thesis is structured as follows

Chapter 1: Outlines the problem statement and general motivation and provides an overview of the thesis content.

Chapter 2: Provides background of the defense industry, the company, the intrapreneurial group, and its formal organizational counterpart, and articulates the difficulties and benefits of a lean transformation.

Chapter 3: Presents the hypothesis for the study undertaken

Chapter 4: Describes the general approach to data collection as well as the conceptual framework applied in the development of the business case.

Chapter 5: Provides examples of intrapreneurship and its use in lean transformation using a case study of VBS.

Chapter 6: Compares and contrasts an institutionalized entity like the IT department with an intrapreneurial one like VBS.

Chapter 7: Discusses a system dynamic model to show the benefits of intrapreneurship factors to lean transformation and generalize the benefits of lean beyond IT and Raytheon

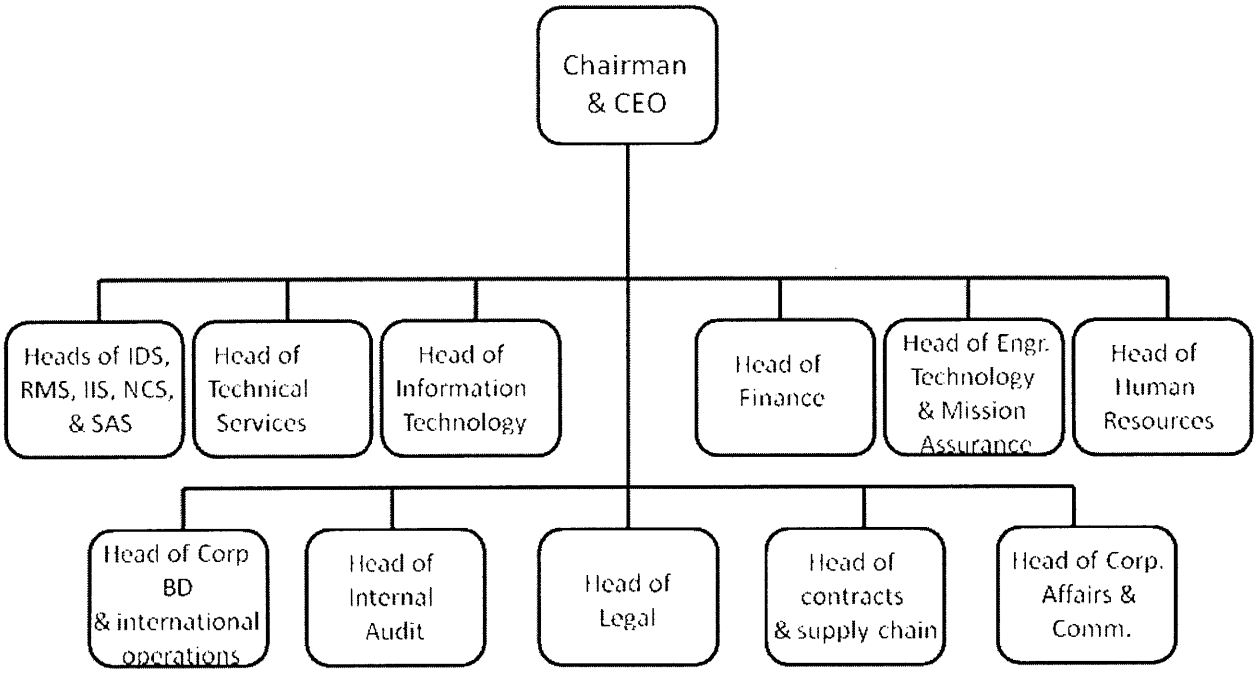
Chapter 8: Summarizes the findings of the thesis and articulates the contributions of the project. This chapter also documents recommendations, future areas of study, and methods to transfer the proposed solution to other applications in any industry.

2. Background

2.1. About Raytheon Company

Raytheon Company is one of the largest defense contractors in the world. It was founded in 1922 in Cambridge, MA by Laurence K. Marshall, Vannevar Bush and Charles G. Smith. (Raytheon Company: History). Over its 87-year history, Raytheon has established itself as an industry leader, successfully integrating the products, capabilities and talents of multiple legacy corporations. Raytheon is a technology and innovation leader specializing in defense, homeland security, and other government contracts throughout the world (Raytheon Company: Our Company). In 2008, it had net sales of $23.2 billion and currently has 73,000 employees worldwide (Raytheon Company: Our Company). Raytheon aspires to be the most admired defense and aerospace systems supplier through world-class people and technology. It provides state-of-the-art electronics, mission systems integration and other capabilities in the areas of sensing; effects; and command, control, communications and intelligence systems, as well as a broad range of mission support services (Raytheon Company: Our Company).

Figure 1: Organization Chart for Raytheon Company (Raytheon Company: Leadership)



As shown in Figure 1, Raytheon Company is grouped by different business units with their own suite of defense products and by support groups to enable business units. For example, the head of Raytheon IDS, which manufactures defense items like radars, reports to the CEO and obtains support from groups like IT.

Raytheon is comprised of six integrated business units, each focused on meeting and exceeding the needs of customers that represent different segments of the Defense and Aerospace Industry. The following is a short description of each business unit and its specific mission. (Raytheon: Businesses)

- **Integrated Defense Systems (IDS)** – IDS is tasked with providing "affordable, integrated solutions to customers in the U.S. and abroad." Its 13,500 plus employees are based in Tewksbury, Massachusetts and in 2008 IDS accounted for $5.2 billion in revenue. (Raytheon: IDS)

- **Intelligence and Information Systems (IIS)** – IIS is tasked with providing the solutions that provide the "right knowledge at the right time" to enable global customers to make the decisions necessary to meet their goals. Its 9,200 plus employees are based in Garland, Texas and in 2008 IIS accounted for $3.1 billion in revenue. (Raytheon: IIS)
- **Missile Systems (MS)** – MS is tasked with designing, developing and producing "missile systems for U.S. and allied forces". Its 12,500 plus employees are based in Tucson, Arizona and in 2008 MS accounted for $5.4 billion in revenue. (Raytheon: MS)
- **Network Centric Systems (NCS)** – NCS is tasked with developing and producing solutions "for networking, command and control, battlespace awareness, and air traffic management". Its 12,400 plus employees are based in McKinney, Texas and in 2008 NCS accounted for $4.5 billion in revenue. (Raytheon: NCS)
- **Space and Airborne Systems (SAS)** – SAS is tasked with "designing and developing advanced, integrated systems for crucial missions." Its 12,000 plus employees are based in El Segundo, California and in 2008 SAS accounted for $4.4 billion in revenue. (Raytheon: SAS)
- **Technical Services (TS)** – TS is tasked with providing "technical, scientific and professional services for defense, federal and commercial customers worldwide." Its 9,000 plus employees are based in Reston, Virginia and in 2008 TS accounted for $2.6 billion in revenue. (Raytheon: TS)Raytheon Information Solutions Group

These various business units use common organizational processes (that were observed during surveys, interviews, and interactions conducted for thesis research) that govern their operation. From the political perspective, hierarchy and function drive power dynamics; re-organizations cause frequent power shifts, and there is strong cooperation between teams (but not business units). Research from the cultural perspective revealed that Raytheon has a slow conservative nature compared to peers in other industries; a strong sense of community; and high appreciation for mathematics, science, and technology. Survey mechanism and interview procedure are outlined in the appendix.

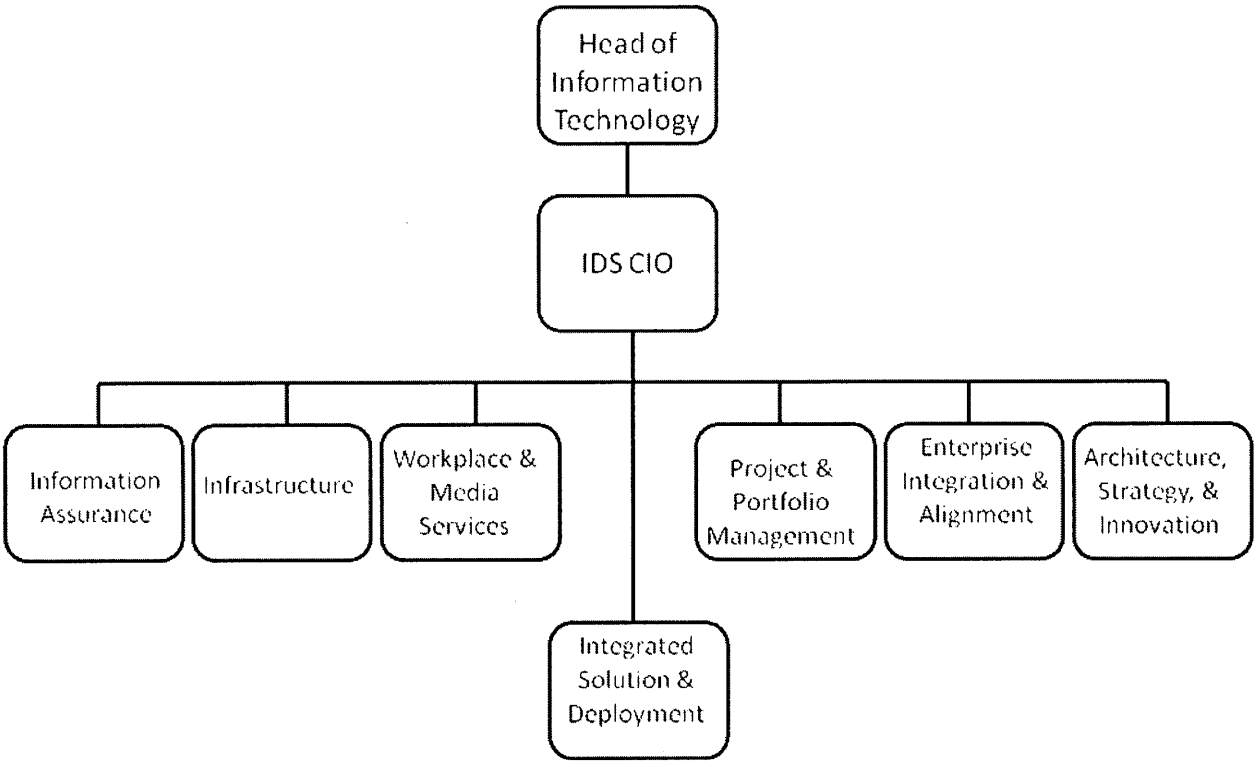
In 2000, Raytheon IDS's manufacturing facility at IADC faced a problem of high costs that could have caused the plant to close down. During this time of urgency, the company decided to embrace lean and improve the manufacturing processes through a more rigorous transformation or kaikaku. This was a daunting task due to the complexity of the products, large group of union and non-union workers, and inertia from old process culture, politics, and strategic design. One of the innovative approaches adopted at this time was to integrate an intrapreneurial IT group into the process transformation in order to improve and motivate positive employee behavior.

2.2. Raytheon Information Technology Group

2.2.1. IT Organizational Structure and Governance

Raytheon information solutions group (Raytheon IT) at IDS is responsible for developing and maintaining the information technology solutions at Raytheon IDS. The head of IT reports directly to the CEO of Raytheon Company. The group is organized by type of IT support and is broken down into the categories, shown on the organization chart in Figure 2 provided.

Figure 2: I.T. organization chart



Corporate IT leadership defines the vision, mission, and creates the information technology strategy and architecture that the different IT groups follow. Corporate IT leadership also creates the security and documentation guidelines that all groups are required to follow for compliance with government standards. Each business unit and group has some input on adapting the architecture for their group. Variation of IT tools and objectives within groups is based on revenue generating business units and group acquisition history. Information Technology has a budget that is sourced from a percentage of the operations budget of respective business units. The information technology group is central to the development of any information technology system and has received numerous awards for its excellence. However, according to its customers, IT still faces issues delivering adequate solutions in a short amount of time (Raytheon-Employees, 2009)

2.2.2. Product Development Process

In developing products for the customer, IT follows the conventional approach of either using their insights to define and deploy corporate-wide solutions, seeking opportunities within groups and developing a set of requirements from the customer or waiting for a requirements proposal from customer. In certain cases that affect the entire enterprise, IT works with unit leaders to develop entire solutions. In all these case, business units or groups provide funding for these efforts.

IT follows the Raytheon-wide methodology of using Integrated Product Development System (IPDS) to create a standardized workflow management. After engaging with THE project manager, IT develops a proposal with requirements, approach, and estimate of resources. After the proposal is approved work begins and the expected turnaround time for an average proposal of about $200,000 is one month. During the design phase, IT develops wireframes or proof of concept. After the project is ready, it is validated and goes through the "waterfall method" - waiting for the appropriate time to deploy the product to the customer or enterprise. In developing these solutions, IT performs agile development to address business needs but prefer not to have an iterative process (due to time constraints) as customers may not fully understand their needs or change their needs later on. Initially, IT did not adopt lean in performing their day to day operations but are currently working on integrating lean into the IT enterprise. IT like most support organizations has to deal with strategic, political, and cultural biases that include

- Strategic: business strategy, structure, IT systems, vision, plans, processes, project
- Political: self interests and coalitions among groups
- Cultural: Network of relationship with implicit assumptions, shared values, informal rules, and sanctions (with a VBS they have ability to work with/maneuver between different groups and work closely with target to share values

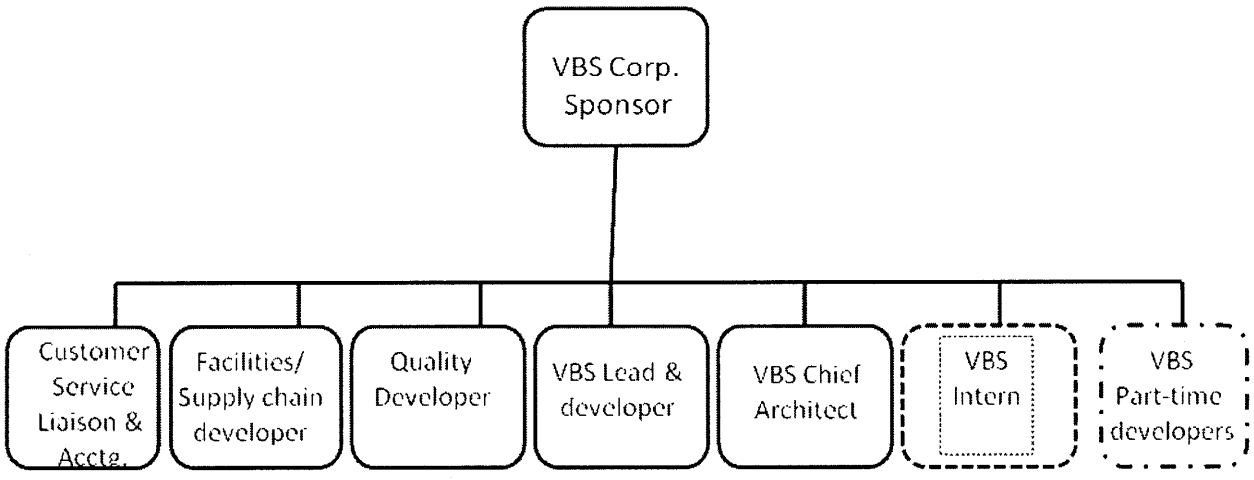
2.3. Virtual Business System (VBS)

The Virtual Business Group (VBS) is an intrapreneurial group that does not reside within any formal organization structure; however, it is sponsored by corporate leadership. It emerged

during the lean transformation at Raytheon IDS's manufacturing facility. VBS develops software tools to promote lean using real-time metrics, thereby creating many essential performance and behavioral feedback loops. These real-time metrics and behavioral results continuously drive operations to converge on lean behavior. Manufacturing groups across Raytheon depend on VBS tools to accomplish tasks like measuring processes in real-time, discovering areas for improvement, and establishing communication with front-line workers. In the journey of delivering transformative solution, users are able to develop a better understanding of and motivation for transforming their operations. VBS also has infrastructure monitors and computers for measuring environmental data like energy usage and humidity. Prior to the VBS initiative, there was minimal real time feedback on the performance of processes at the IADC facility. As is common in many manufacturing environments, process data was collected in a legacy system and reports were generated in batches later in the day or week[1].

The organization chart for the Virtual Business System as shown in Figure 3 is relatively flat with the lead also playing the developer role. Each member works collaboratively to design and deploy real-time information solutions. The group is not incorporated in any organization structure but report to a corporate sponsor who represents them and ensures they have access to resources.

Figure 3: VBS organization structure



[1] (Wolbert, 2007)

Currently, IT works mostly with engineering for information technology solutions while manufacturing/quality/operations tend to work closely with VBS. IT strives to have better engagement with groups in developing solutions instead of being perceived as an overhead cost that forces solutions on groups. IT uses funding from the overhead cost to create and manage data warehouse solutions, which is relevant to business groups. There is currently competition between VBS and IT over different dashboards, and such competition has created tools that meet customer needs but are redundant. Both groups could benefit from focusing on their core areas of expertise.

2.4. Intrapreneurship

Intrapreneurship, a term defined by Gifford Pinchot III[2], and shortened from intracorporate entrepreneurship, refers to entrepreneurial activities of employees within the boundaries and auspices of a larger organization. A Harvard Management Update article describes intrapreneurship as "...bottom-up, off-the-beaten-track business building, spearheaded by people who were working as line managers or employees."[3] A popular example of intrapreneurship is Skunk Works, alias for Lockheed Martin's advanced development program, where a group of engineers step outside the bureaucratic environment of the corporation to develop successful and innovative products. One of the major benefits of intrapreneurship is the freedom to work independently on tasks defined by the group but still aligned to the needs of the organization.

Benefits for employees

Intrapreneurship serves to motivate employees by providing them freedom to devote their time to accomplish tasks that they find interesting. In addition, intrapreneurs are required to develop products and/or services that provide customer value as the funding and/or sponsorship depends on customer support.

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[2] (Pinchot & Pinchot, THE INTELLIGENT ORGANIZATION: Engaging the Talent & Initiative of Everyone in the Workplace, 1996)

[3] (Starting New Businesses - Inside the Organization, 1999)

Benefits for leadership

Intrapreneurship serves to foster creative solutions to the company's bottom line. It is a low cost approach because it does not require large financial investments to organize a team to solve a critical problem or develop new ideas.

Creating a new group or mandating a group to make changes can be done as well but such an approach, as found in situation with VBS and IT, is not as efficient at certain tasks as an intrapreneurial group. Intrapreneurs are well suited to transform an organization more quickly and effectively because they are motivated, free to engage in activities, and are less restricted by bureaucratic and political inertia. Intrapreneurship allows companies to grow the business, find and retain talent, and compete with peer companies[4]. Intrapreneurship involves a bottom-up approach to excite and motivate the creation of innovative products or processes that have led to creative innovations in companies like Raytheon, 3M, Nokia, and Polaroid over a short time with minimal resources.

2.5. Lean Transformation

Lean is based on the work of W. Edwards Deming in total quality management and propelled by James Womack and Daniel Jones. According to Womack, lean is "a way to do more with less and less – less human effort, less equipment, less time, and less space – while coming closer to providing customers with exactly what they want"[5]. Lean is a methodology that fosters removal of non-valued added activities and embraces a mindset of continuous improvement. It is through the lean tools, support of leadership, and activities of frontline workers that a lean culture can be established. Lean thinking highlights as some of its principles of understanding customer value, value stream, flow, pull, and listening to create continuous improvement[6]. It has been instrumental in aiding companies of varying sizes to deliver quality, cost-effective, and timely products or services to customers.

[4] (Starting New Businesses - Inside the Organization, 1999)
[5] (Womack & Jones, 1996)
[6] (Womack & Jones, 1996)

As companies embark on improving operations and providing value to stakeholders, there is a realization that change or transformation is needed. This is the same for companies that decide to embrace lean; transforming and sustaining lean organization is an onerous task and companies need to follow certain key steps to ensure success. In the book "Lean Transformation"[7], Womack and Jones describe five key factors for success:

- Vision of the future state
- Leadership commitment to change
- Expert training and support
- Lean performance targets
- Impatience

Four of the five factors point towards having a strong leadership and management push to enable the transformation. The leaders set the vision, commit to the transformation, establish performance metrics, and drive strong efforts to engage in the transformation. Outside of leadership, there is a strong need for expert training for the workers on lean principles, lean tools, and lean processes. In addition, support is needed from internal or external organizations to deliver these services to employees, suppliers, and customers.

Organizational change is usually motivated by such issues as competition, market pressure, customer demand, or change in leadership that forces firms to reduce cost, improve quality, or expand target markets. Many companies are not able to meet these requirements in their current state for various reasons such as inadequate processes and incorrect strategy. They have to evolve the current group, organization, or enterprise structure. Even though changes can be conceived by those outside of the leadership team, the driving force for the change is upper management. Leadership at Raytheon IDS was able to use lean transformation to provide a tremendous 20% cost reduction for four straight years throughout the manufacturing groups at Raytheon IDS facilities.

[7] (Henderson & Larco, 2002)

3. Hypothesis for this document

Lean transformation, as with any change, poses a plethora of roadblocks that companies will face during organizational transformations. A number of organizations have failed as they struggle to change; John Kotter cites the reasons as allowing too much complacency, failing to create a sufficiently powerful guiding coalition, underestimating the power of vision, and under communicating the vision[8]. He also adds that permitting obstacles to block the new vision, failing to create short-term wins, declaring victory too soon, and neglecting to anchor firms firmly in the corporate culture are barriers to change[9].

John Kotter defines an eight stage process to change as follows:

1. Establishing a sense of urgency
2. Creating the guiding coalition
3. Developing a vision and strategy
4. Communicating the change vision
5. Empowering employees for broad based action
6. Generating short term wins
7. Consolidating gains and producing more change
8. Anchoring new approaches in the culture

Kotter concludes by stating that "the key to creating and sustaining the kind of successful 21st century organization ...is leadership...at the top of the hierarchy...also in a moderate sense throughout the enterprise"[10]. Other than the core leadership support that is needed for lean transformation, there are also a few factors needed for this change.

This thesis will use the political, cultural, and strategic design perspectives to highlight the benefits of an intrapreneurial group in fostering lean transformation. Intrapreneurship can create change by using intrapreneurs to create lean tools or processes or by using more and intrapreneurs as lean change agents. However, this thesis will place more emphasis on the former for driving efficient organization process and behavior change. Intrapreneurship alone

[8] (Kotter, Leading Change, 1996)
[9] (Kotter, Leading Change, 1996)
[10] (Kotter, Leading Change, 1996)

does not solve the issues encountered in lean transformation. However, it does address some of the concerns listed earlier: expert training and support, creating the guiding coalition, empowering employees for broad based action, generating short term wins, consolidating gains and producing more change, and anchoring new approaches in the culture.

An intrapreneurial venture can assuage these barriers to change by being the conduit for expert training and support, creating the guiding coalition to create guidelines, empowering employees by fostering a more direct engagement with employees, and create short term wins at low cost. In addition, as the venture becomes rooted, it builds off the learning from customers to craft the appropriate execution of the change and after such long term customer tailoring; it can become a norm for the organization. This is due to the advantage of not having to completely overhaul an enterprise in order to link directly to both internal and external customers. It also permits select experts to establish the change guidelines needed. By not being anchored in a specific group, it is able to bridge across different departments. However, it will also need strong leadership support and sponsorship to provide value. The author's research at Raytheon confirmed the aforementioned benefits of intrapreneurship, thereby leading to the hypothesis that intrapreneurship can serve as a tool for improving lean transformation.

4. Methodology

Interviews, data collection, direct observation, surveys (sent to VBS and across various business units at Raytheon) and analyses at various Raytheon facilities in Massachusetts were used to garner a deep perspective on VBS, Raytheon IT, and Raytheon IDS business unit groups. Table 1 shows the breakdown of interviews conducted at Raytheon.

Table 1: In-person Interview Detail

Interviewee Category	Average length of Interview	# of individuals interviewed	Interview focus
VBS Employees	40 minutes	5	Information on history and current practices
IT Employees	45 minutes	2	Information current practices
Manufacturing / Engineering Employees	40 minutes	10	Information on challenges and views of VBS
Corporate Leadership (phone interview only)	45 minutes	2	Information on challenges and views of VBS

Interviews covered VBS's customers, its formal counterpart: IT, and the VBS group itself. As VBS interacts with various customers, members of key groups within Raytheon IDS including supply chain, engineering, and manufacturing were interviewed to gain perspective on their roles, benefits of VBS on the group's lean journey, and the limitations of VBS. In addition, all VBS core team members were interviewed to gain their perspective of the benefits of the VBS group and the future of the VBS group. Finally, VBS's formal counterpart, Raytheon's Information Technology (IT) group, members were also interviewed to gain an understanding of their policies, customer support, path on the lean journey, interaction with VBS, advantages and

disadvantages of VBS. The appendix lists out the interview questions used to understand culture, politics, and strategic processes at various units of Raytheon and Virtual Business System Group (VBS).

Data was collected on different historical changes as the manufacturing groups proceeded on their lean journey of transformation. Information was gathered on the tools developed by VBS, particularly usage of tools and the number of tools developed. Data was also collected on the impact of the various lean tools both by VBS and the operations group. The author spent six months observing the team's various processes, interactions, and customer solutions. The author also worked as a team member to develop and deploy solutions for the engineering process group at Raytheon IDS.

As stated in the previous chapter, this document looks at the lean transformation in terms of people and processes: specifically measurable behavior change of employees towards lean and lean processes implemented. These two were chosen as the principal challenges to lean transformation due to the availability of measurable data.

Given the large number of interactions, the analysis was not exhaustive; instead, it is focused on key areas common to VBS engagements. This analysis includes development of a system dynamics model that outlines the benefits of intrapreneurship to lean transformation, and which can be applied to other companies and industries.

5. Setting the Stage – the Challenges & Opportunities of an Intrapreneurial Organization

In order to highlight the effects of an intrapreneurial group on a lean transformation, this chapter will outline the examples of VBS success with two key business units: manufacturing (early and mature stage) and engineering (early stage).

5.1. VBS role in transforming manufacturing groups

In 2001 the Raytheon leadership (including IDS Vice President of Operations) was deciding whether to close the manufacturing plant at IADC as the site was not providing adequate return on investment for the company. The Vice President of Operations saw this urgency and sought to transform the manufacturing organization through lean. He created a leadership team from various groups to create a lean strategy and vision for the organization. By 2004, he also communicated the lean transformation to all employees. The founder of VBS, who had created a tool to manage information from multiple databases, saw this as an opportunity for process innovation and improvement. He developed the intrapreneurship group, VBS, in order to develop information technology tools to foster lean transformation. VBS and its tools are instrumental to the effectiveness of the manufacturing group at IADC. A recent thesis by an LGO (Leaders for Global Operations) alum indicates "VBS is part of a larger LIVE (Lean Initiative for Value Excellence) initiative at IADC, which recently was recognized as one of the top 4 Six Sigma projects companywide with the CEO award. In addition, the LIVE initiative was credited with creating increased productivity, resulting in significant cost reductions. These cost reductions were then returned to the customer in the form of a give back, which occurs when actual expenses are less than anticipated."[11] IDS Vice President of Operations made the statement 'VBS is vital to achieving Total Employee Involvement by connecting every employee to their performance every minute of the day.'

[11] (Wolbert, 2007)

VBS affects lean activities in a variety of operations in manufacturing: shop floor activities, supply chain planning, quality management, and manufacturing operations management.

- Shop floor activities: During lean transformation but before the establishment of the VBS group, there was limited access to data between shop floor workers and supervisors creating a somewhat distant relationship (with senior personnel and between the shop floor employees) that limited sharing of ideas and improvements. While lean manufacturing tools like *Andon* were showing improvements there were still some challenges to improve the efficacy of the lean transformation. In order to improve this situation quickly and cheaply, there needed to be an innovative strategic design of a lean tool to improve information flow, a cultural understanding of the activities of the frontline workers, and an ability to navigate political barriers. Following the VBS intervention, a feedback system allowed employees to gain better access to information to improve the efficiency of their day-to-day operations. Employees, especially union workers, are now able to connect with other employees and seek support in their day-to-day activities. They also use it to suggest areas and ideas for improvement. The access to real-time data on their work area allows for a pull for information that helps employees feel empowered and motivated to improve performance and execute value-added work. Prior to this, union workers did not have computers or a means to get real-time data. During an interview, a shop floor worker indicated that VBS had been effective at tracking activities and improving learning among peer workers[12]. The employee said "[the solutions] opened up a whole new world to me it has made my job easier...amazes me, all I have to do is [contact] VBS and within minutes they have taken care of my needs...stuck with [another employee] through thick and thin with VBS solutions and it hasn't been an easy road. I enjoy coming to meeting with VBS every week and as a team we get a lot done."[13]
- Supply Chain planning: While the shift towards lean transformation was occurring in the supply chain group to ensure that the inventory was appropriately managed and non-

[12] (Raytheon-Employees, 2009)
[13] (Raytheon-Employees, 2009)

value added tasks were removed, it became clear that a modified IT system would be needed. A major issue indicated by a supply chain manager was the lack of a system that could be quickly created, adopted, and redesigned to meet their needs. The ability to view and track supply chain development was helpful in understanding the value stream for accomplishing tasks and reinforced positive lean behaviors. However, creating this quick win was expensive and would take time to develop at this critical point. VBS was able to create and affordable solution that the supply chain could modify quickly to suit their needs. A Raytheon manager complemented the VBS tool stating that VBS "give[s] flexibility to see information in a way that best suits their needs ... they can show or teach others how to [use the tool to get and analyze information on their own]... easy to test small chunks than large chunks ...get information faster and make decisions faster."[14]

- Quality management: The quality team ensures that products meet customer needs and processes follow company and industry standards. In transitioning towards a leaner organization the quality group wanted to easily track major issues and monitor progress for Raytheon IDS programs (i.e. programs are complete defense systems like a radar that are sold to the government). The VBS group had to work closely with the quality team to develop tools that would track items to reduce inefficiencies and encourage positive reactions to crisis. An example of such a situation was the problem of late audits and so there was a mandate that there would be no late audits but this only changed the behavior to shifting the date. It was only after the VBS were able to redesign the tool to restrict date shifting that the behavior changed.
- Manufacturing Operations Management: An important aspect of a lean environment is flow, which means working on a one-piece item (or not working in batches) and pull, which involves getting information or units only when they are needed by another person on the line. These two aspects of lean can be monitored with work in progress (WIP) rates. High levels of WIP indicate wasteful and costly practices and can be quite cumbersome to control. Most groups find it difficult to move from a batch process to a

[14] (Raytheon-Employees, 2009)

continuous flow because it is not intuitive. One would expect moving as much as possible from one to the next would increase throughput; however, it creates work piled up by stations taking up space and time thus costing money. The VBS group created a dashboard to show the effects of reduction in WIP rates and to help workers understand the benefits of flow and pull while allowing managers to effectively track to provide feedback to workers. A manufacturing manager stated the benefits of the tool; "quickly understand how your value stream is running...can make a determination in minutes where [previously] it might take days."[15] The manufacturing manager also stated the benefits of team; "worked with VBS on what they needed to do...a lot of it was within VBS...we have continuously fed information to the VBS folks over the last five years to get it as accurate...and as user friendly as possible"[16]

5.2. VBS role in assisting Engineering towards a lean path

The book, Lean Enterprise Value, provides a bold vision and argues for the benefits of lean across the enterprise to reduce costs[17]. Raytheon, like other firms in the industry, is adopting lean across the enterprise and has already begun using enterprise tools like the Lean Enterprise Self Assessment Tool (LESAT) to measure and track its progress. Across industries, engineering (particularly design engineering) is still at the early stages of lean adoption. In an article by McManus et al, the authors mention that migrating lean to engineering processes is ongoing in the [aerospace] industry[18]. Manufacturing engineering, a group that works closely with the manufacturing group, is further along on the lean journey and is akin to the manufacturing group described in the previous section. The group has undergone a similar behavior change and uses similar tools. A similar effort was started with the design engineering group to encourage a lean adoption as show by the work done by Purdy Ho: "Using Virtual Business Systems to Drive Lean Behavior in Engineering Design

[15] (Raytheon-Employees, 2009)
[16] (Raytheon-Employees, 2009)
[17] (Nightingale, et al., 2002)
[18] (McManus, Haggerty, & Murman, 2005)

and Support"[19]. This section outlines the challenges and opportunities for VBS in supporting the engineering group in lean adoption.

Unlike the manufacturing group, there is less leadership support and minimal sense of urgency to create a lean transformation especially since engineering uses CMMI, R6S, and IPDS for its product development. Both R6S (Raytheon Six Sigma, which is a modified version of six sigma) and IPDS (Integrated Product Development System is a set of steps for product development process) are Raytheon specific methodologies. However, senior Raytheon leaders believed that adding lean engineering to the methodologies used would greatly enhance quality and improve company profits.

- CMMI: Capability Maturity Model Integration is a model based on software engineering that assists with process improvement in organizations. Process Improvements can be staged (focused on a project or organization unit) or continuous (focused on a process area). Raytheon chose staged model. There are five levels for CMMI
    - Level 1: Initial stage (starting point)
    - Level 2: Managed (characterized but still reactive)
    - Level 3: Defined (institutionalized and proactive)
    - Level 4: Quantitatively managed (measured and controlled)
    - Level 5: Optimizing (continuous improvement)

Each level has generic goals, goals that apply to different process areas, and specific goals, goals that are defined for process areas. Raytheon engineering extensively uses CMMI for their various engineering processes. The government requires engineering to be at level 3 to be approved for contracts. Currently, systems engineering, hardware engineering, and software engineering have achieved a CMMI-DEV level 5, while whole life engineering (engineering group focused on supporting product from conception to use in the field) has achieved a CMMI-SVC level 3 (CMMI- ACQ is used for product and service acquisitions;

[19] (Ho, 2008)

CMMI-DEV is used for product development activities; CMMI-SVC is used for service management)

- Lean Engineering: This is a more focused approach of lean to apply to engineering activities. It has three goals: creating the right products, with effective lifecycle and enterprise integration, using efficient engineering processes[20].

The first step for VBS in engaging with engineering was discussing with current engineering employees to understand the current state. Gaining access to this information was enhanced by the open and peer-type relationship of an intrapreneurial group. Next, a sponsor within the engineering group was found to assist with removing roadblocks to an engagement. After this research and relationship building, the urgent need of the engineering group was found to be in stakeholder planning. In order to highlight this need as an opportunity and develop an appreciation for lean among process leaders, which is critical for transformation, this CMMI generic goal (CMMI generic goal 2.6: identify and involve relevant stakeholders was analyzed for improvement) was chosen to test out the idea. In working with this group, it became apparent that there were multiple ways in which CMMI and lean could merge to provide better solutions. In comparing the two, we used the theories in an article by Dr. Boehm et al[21], which discusses the underlying assumptions in the models to see where they conflict or where they converge. Table 1 compares the two methodologies, looking at the underlying assumptions in each, as a basis for integrating lean into engineering practices.

[20] (McManus, Haggerty, & Murman, 2005)
[21] (Boehm, Port, & Al-Said, 2000)

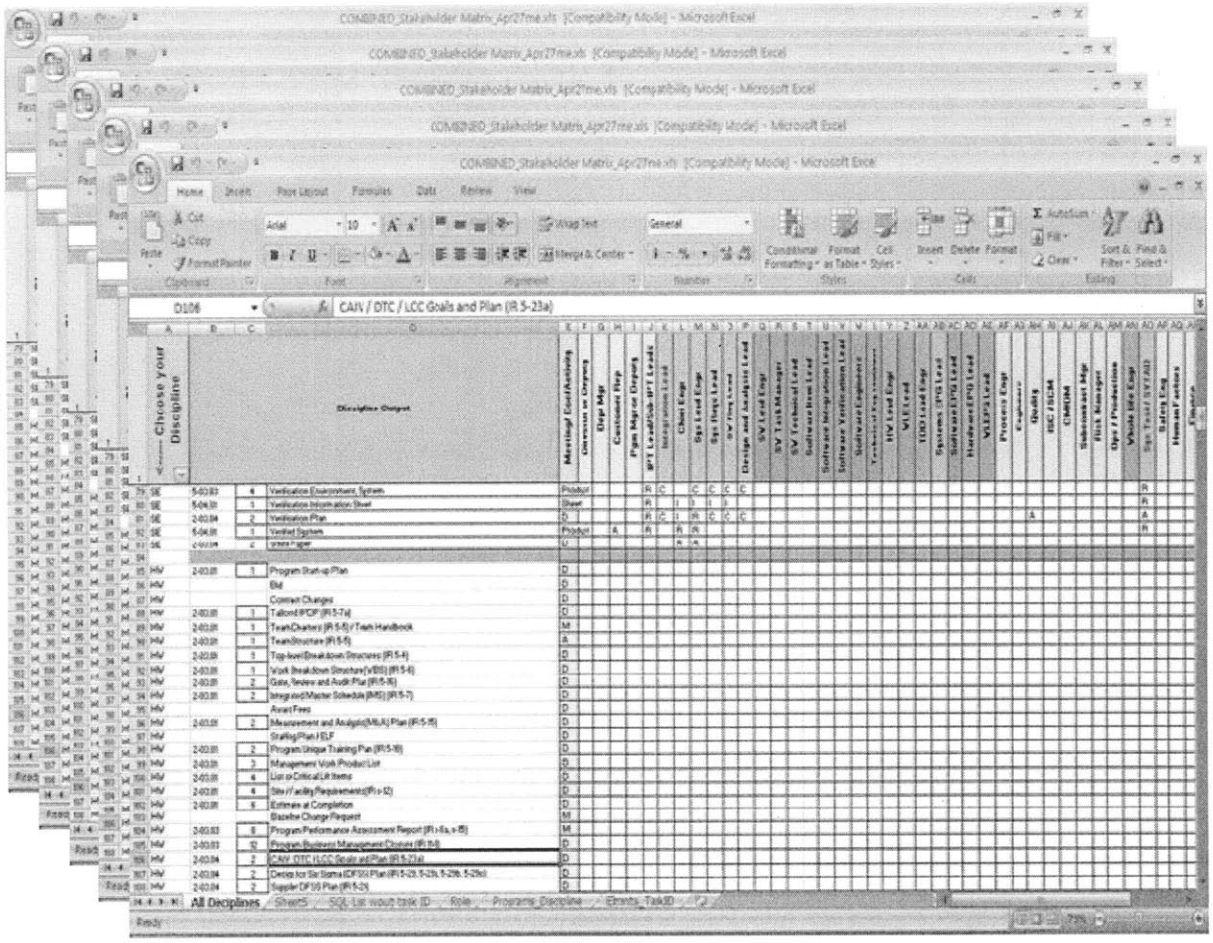
Table 2: Lean and CMMI Comparison

CMMI	LEAN
+ Focus on "what" (non-prescriptive)	+ Focus on "how & why"
+ Building Block approach to add processes as maturity increases	+ Iterative process relying on existing processes to reduce waste, improve flow etc
Process Consistency driven culture, Top and Bottom work together to align processes that are important	Cost driven culture, bottom-driven with support from top
Both are useful beyond their traditional areas (CMMI can work in manufacturing / Lean can work in engineering) and can function for an enterprise using SCAMPI and LESAT for CMMI & Lean respectively to appraise their maturity.	

Afterwards, we built on the open engagement environment with VBS to garner a deep understanding of the current state of stakeholder planning using a value stream map as shown in Figure 4. This map was also shown and taught to the engineering process group to highlight a lean framework for evaluating the processes.

Figure 4: Value Stream Map of Stakeholder Planning Process

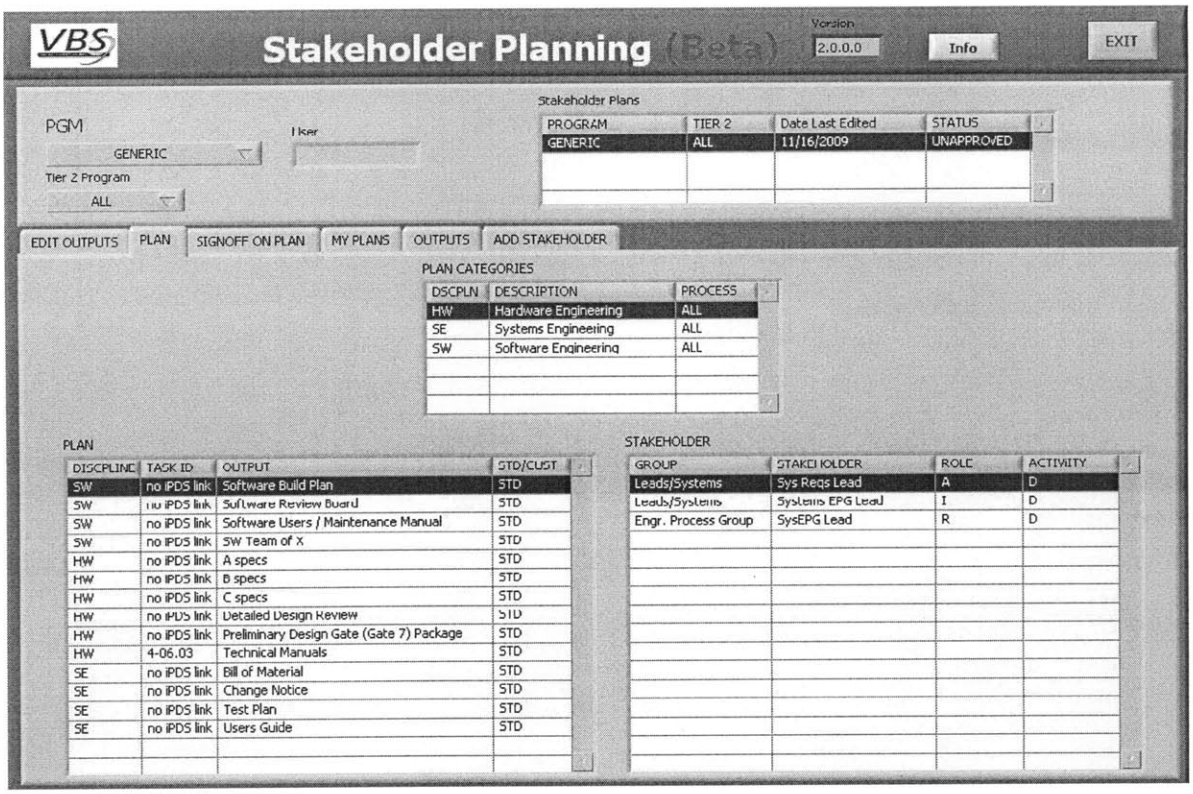
Figure 5: Visual representation of the old process with multiple spreadsheets



During both the value stream mapping and dashboard creation, the customer (engineering process group) was involved in understanding and developing the solution. The level of engagement by the VBS group assists the engineering group in embracing lean methodologies that will enhance current practices. The improved solution provided shortened hours due to the simple and consolidated format, reduced errors by enabling configuration management, and fostered continuous improvement with the ability to measure and monitor planning activities.

The old method is highlighted in Figure 5 and the sample dashboard that creates a more efficient method for stakeholder planning is shown in Figure 6.

Figure 6: New Stakeholder Planning Tool



While the lean transformation in engineering is still ongoing, VBS has demonstrated opportunities for lean to improve the operations within the engineering group. As an intrapreneurial group, VBS was recognized as being capable of quickly prototyping a solution, understanding the culture of the organization, and removing potential power struggles with established methodologies or practices. This process was more effective than it would have been with an institutionalized group like IT. Chapter 6 outlines the various reasons for this result. The next step for VBS on this journey is to consolidate the quick win into larger gains that will predispose the engineering group towards lean transformation.

6. Comparison of an intrapreneurial group and a formal group in making lean transformation

A lean transformation requires leveraging existing resources to transform the organization. However, existing organizational structures make it difficult to change behavior. The existing entities pose challenges in strategic design, culture, and politics, making it difficult to change employees' behaviors and activities. The strategic design hurdles include creating change agents, providing customer value, and enhancing time and cost to transform. Cultural restrictions include understanding norms, empowering employees, and modeling a lean culture. Finally, political barriers reflecting the decisions authority, organizational boundaries, and bureaucratic processes need to be removed. These perspectives draw on the benefits of the intrapreneurs and not the products (VBS software tools) that the VBS group creates. An article by W. Orlikowski indicates that "practitioners will be better able to manage their organizations' experience with [computer-aided software engineering tools] if they understand that such implementations involve a process of organizational change over time and not merely the installation of new technology".[22]

At certain aspects of this transformation especially at the early stage, it becomes advantageous and in some instances critical to build on intrapreneurs and intrapreneurial organizations to foster change in people and processes. In order to illustrate the relative benefits of intrapreneurship versus a formal group in removing the aforementioned barriers, this chapter will compare the intrapreneurship group, Virtual Business System, and its formal group counterpart, the corporate wide IT (information technology) group. Interviews and survey conducted by the author indicated the IT group is the closest contemporary or counterpart.

Drawing on evidence from research documents, interviews, and surveys, this chapter will outline the categories for comparing the effects the two groups have on lean transformation. These comparisons are made generically to VBS so they may be applicable to multiple corporations. Intrapreneurship allows for organizational change that is subtle but still

[22] (Orlikowski, CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in System Development, 1993)

makes a significant impact. W. Orlikowski discusses in her articles entitled improvising organizational transformation over time. She discusses "organizational transformation grounded in the ongoing practices of organizational actors, and emerges out of their accommodations to and experiments with the everyday contingencies, breakdowns, exceptions, opportunities, and unintended consequences that they encounter"[23]. This assists "[organizations] that stay flexible take advantage of new opportunities, explore new ways of working, and resolve unanticipated consequences...and actions that arise spontaneously from what is happening on the ground"[24].

6.1. Strategic Design Perspectives

6.1.1. Becoming and Creating Change Agents

In addition to leadership, another key element for making the lean leap according to Womack is a change agent[25]. This individual will need to have a "make-something happen-mindset" and be willing to break rules during moments of profound crisis. Change agents are able to understand the current situation, create a future state, and use their drive, skills, and influence to catalyze the transformation. Intrapreneurs possess these abilities to become successful change agents. The nature of intrapreneurs is to be able to create and manage value-added solutions within the company. Therefore, fostering an intrapreneurial atmosphere within an organization will encourage and create change agents that are critical for lean transformation.

The VBS intrapreneurs are change agents possessing the drive, vision, skills, and influence to change processes and behaviors. An article on intrapreneurship in the Journal of Strategic Change[26] listed intrapreneurs as possessing the following talents and skills:

1. an entrepreneur's ability to creatively visualize strategies which will succeed in the future;

[23] (Orlikowski, Improvising Organizational Transformation Over Time: A Situated Change Perspective, 1996)
[24] (Orlikowski, Jazz-Inspired: Manage Change by Improvising)
[25] (Womack & Jones, 1996)
[26] (Lombriser & Ansoff, 2005)

2. an organizational architect's skill in designing change seeking organizations; and
3. a [charismatic] leader's talent for piloting discontinuous changes through change resisting organizations. Thus, it is not an exaggeration to call the intrapreneur the business renaissance manager of the 21st century.[27]

During the early years of VBS, the VBS founder and intrapreneur saw the poor access to information available to measure processes (prior methods involved using printed charts that were often a day old). Along with other intrapreneurs, the founder and change agents worked tirelessly to change the norm of limited and untimely data access by providing shop floor employees with real-time measurement of their day to day operations. A shop floor employee stated that she now knows how she is performing without having to meet with her manager, "[VBS] has made my job easier...never see my boss...walking around with clipboard."[28] This new process is creating positive change in behavior that enhances productivity for Raytheon.

The IT (information technology) group can also be a change agent but such changes go through a more formal process before change can be implemented. As an organization geared to follow documented processes, it becomes difficult for groups to move outside of the norm. IT does not directly nurture change agents, even though intrapreneurs can come from established organization like IT (as was the case for the VBS founder). IT like other parts of the organization strives to ensure that the entire unit is functioning as a cohesive unit and that change is within certain bounds and approved by upper management

Change agents within a company can emerge from existing organizational units. Intrapreneurs are change agents and intrapreneurial organizations are excellent tools to create change agents to evoke the necessary mechanisms to propel the company. According to Pinchot, within companies that embrace intrapreneurship,

[27] (Lombriser & Ansoff, 2005)
[28] (Raytheon-Employees, 2009)

intrapreneurs create innovative changes in processes and products that grow the company[29].

6.1.2. Providing Customer Value

A customer centered approach is essential to ensure that lean transformation is tied to the customer needs and engages users in the transformation process. "Because people act towards technology on the basis of their understanding of it, people's technological frames often need to be changed to accommodate a new technology. Where people do not appreciate the premises and purposes of a technology they may use it in less effective ways."[30] An intrapreneurial group has to provide value for the business in order for it to retain sponsorship from senior leaders, support groups, and its customer base. In performing a lean transformation, it is also imperative that the organization and its employees are able to see the value of the transformation and to willingly participate in the transformation process.

VBS works closely with users to understand the current state and create solutions to help teams improve the current processes in contrast to the general product development process which involves working independently off a requirement or specification. When customers come to VBS with a lean initiative or process improvement idea, the team has expertise in manufacturing, engineering, and information technology to assist the requestor to root cause the problem and define the solution with the users' perspective in mind. Developers indicated that they realize that some customers approach the team without knowing what they want or realizing that what they want is not what they need.[31] A customer validated this statement stating that it is hard for them to properly articulate the need and sometimes there are changes as the solution is developed. A manager at Raytheon stated "it is good to have large system that collect data but [IT] is not very good at presenting it back in a usable format because the users' needs always change...on a day to day basis changes happen... [Also]IT is a lengthy expensive process that doesn't

[29] (Pinchot & Pellman, Intrapreneuring in Action: A Handbook for business Innovation, 2000)
[30] (Orlikowski, LEARNING FROM NOTES: Organizational Issues in Groupware Implementation, 1992)
[31] (VBS-Team, 2009)

support iterative development or frequent changes."[32] VBS developers attest to producing dashboards (VBS lean software solutions) that sometimes bring about unintended changes in behavior and the author observed the VBS team's effort to ensure there was an ongoing interaction with users. This ensures that users' interaction can be clearly observed and tools can be adjusted to create solutions that drive the appropriate behavior. Even after project completion, the customers can still work with VBS to make improvements on the project particularly as users requirements change. VBS developers use an iterative process to quickly understand and prototype a solution for customers thus allowing customers to quickly test their idea and improve the solution. VBS developers view themselves as not just programmers but as solution providers[33]. VBS does not only develop software tools but also focuses on understanding the customer needs and gearing the solution to provide customer and business value.

According to an MIT CISR research briefing, many firms have historically had limited engagement between IT and businesses and paid a heavy price for it[34]. An ideal model is outlined in Figure 7

[32] (Raytheon-Employees, 2009)
[33] (VBS-Team, 2009)
[34] (Nils Fonstad, 2005)

Figure 7: A General Example of an IT engagement model

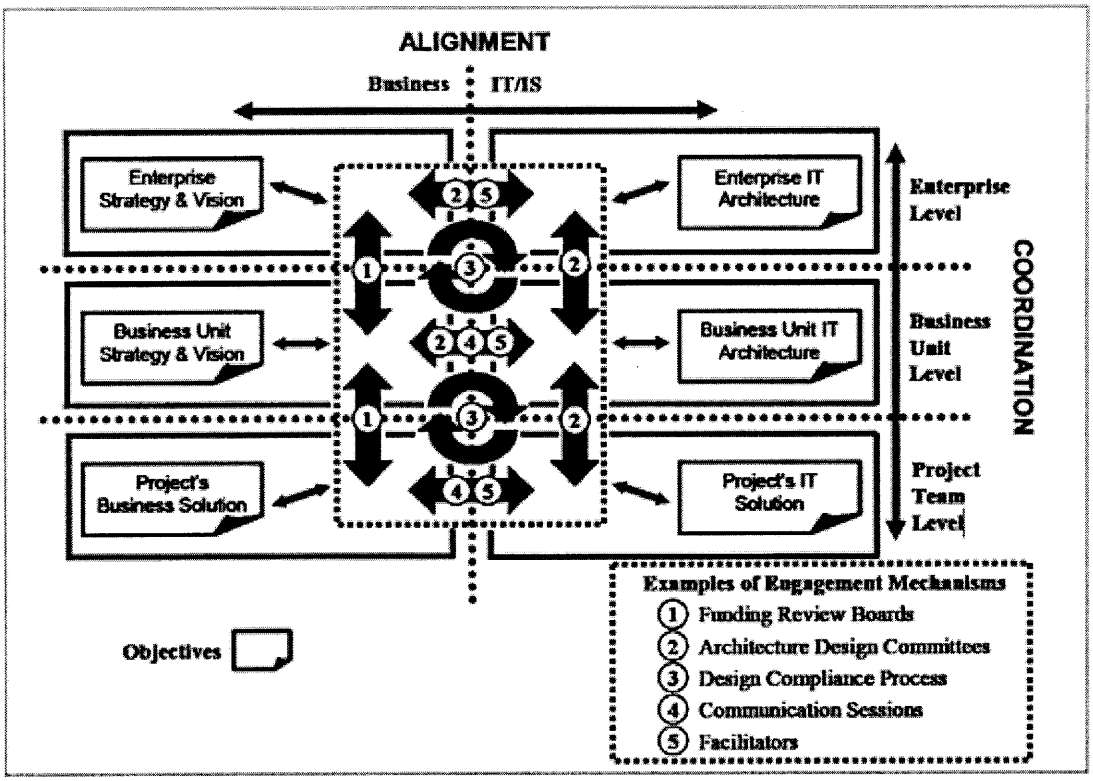


Figure 7 depicts a general example of an IT engagement model, which consists of three elements: stakeholder groups; their objectives; and a system of interconnected mechanisms that enables and constrains how they engage (Nils Fonstad, 2005).

Raytheon has an engagement model between IT and business units that involves clear objectives, motivation for objectives, enforcement authority, early intervention, and transparency. IT strives to understand the customers' needs and effectively delivers solutions to a customer. While this engagement model is a good starting point, it is lacking the type of engagement needed for a lean transformation. The IT group is structured to develop well defined problems but that is rarely the case when customers approach IT. The missing links to aid in proper solution development includes expertise in the area of concern, idea generation, modification, and feedback from the actual users, and quick prototyping and testing of solutions. IT is excellent at developing custom technology solutions but is challenged to understand the root issues, quickly prototype solutions, and modify the solutions based on feedback.

Customers acknowledged IT's ability to develop technology solutions but struggle to develop a deeper understanding of the customer's processes. In an interview with an interview with an IT project manager, the intrapreneurs at VBS are acknowledged for having expertise in knowing the data, knowing the customers, knowing the customer needs, and co-locating themselves close to users. As indicated earlier, IT currently interacts primarily with project managers and they are less likely to obtain information about possible solutions from working with the frontline employees. While on internship, the author observed non-IT Raytheon employees mention that that support groups like IT get so busy with their day to day internal tasks and have different priorities, perspectives, and skills to adequately address some of their issues.

Like any intrapreneurial group, VBS understands the customer's value and processes and works closely with the customer to provide ultimate solution. VBS depends on delivering customer value for its success and survival, *ensuring that it encourages lean transformation*. One common phenomenon within organizations is for support groups to become too concerned with themselves than delivering value to customer.

Intrapreneurship offers a solution to this problem as evidenced by the success of Virtual Business System. Intrapreneurship creates a team around customer satisfaction whose success depends on the use of the product by the customer and the improvement made to the company's bottom line. Intrapreneurship for lean transformation in this case will need to embrace change, and follow lean methods in order for it to enhance a lean transformation.

6.1.3. Enhancing Time and Cost to Transform

Intrapreneurs take less time to develop a solution and cost less to manage due to the motivation, reduction in organizational barriers. Both VBS and IT employees agree that VBS achieves its objectives in less than half the time that IT takes with less

cost[35]. This is critical for lean transformation as sub-tasks that take too long tend to drag the process and increase the inertia. Womack and Kotter both state that quick wins are essential for building the momentum during a change[36]. In addition to time, a lower cost than other existing approaches also lets the intrapreneurial group stay competitive from other product or service providers in order to provide a palatable expense for group managers.

VBS developers are able to quickly develop dashboards from their vast expertise of over ten years each with using the tools. Their combined 50 years of experience within the company allows them to understand the business needs and group functions. The group had to become more efficient to service a large organization and only allow for value added work. There are also less formal procedures as the group has a simple form and dashboard to submit requests.

Since VBS developers are not within the IT group, they are not bound to the level of documentation and procedures required to develop products. The group came up with lean methods to create quick prototypes for users to test out ideas and refine along the way. These methods include using standard code format, developing solutions as requested by customers, understand the value stream for a process to remove non-value added tasks, and seeking continuous improvement in all activities.

The intrapreneurial group can be regarded as an X-team[37], a term coined by Deborah Ancona to define high performing teams. They adopt an integrated approach to be able to understand the needs of external stakeholders. In addition, VBS fosters collaboration and a focus on learning from the environment to diagnose and invent solutions for the organization. As a small team, it is easier to share ideas and build off each other's work.

On the other hand IT, with its high talent and ability, is unable to perform as quick and cost effective as VBS due its organizational charter and mission. This is essential for enterprise wide and large scale changes but not as effective for day-to-

[35] (VBS-Team, 2009) & (Raytheon-IT-Employees, 2009/2010)
[36] (Womack & Jones, 1996) & (Kotter, Leading Change, 1996)
[37] (Deborah Ancona, 2007)

day software solutions. IT is mandated to follow certain processes and procedures in developing solutions, some of which cannot be made lean and so add to the cost. It also uses more extensive tools that make the solution more expensive. IT is not able to deploy solutions as quickly as VBS because solutions have to wait for the necessary deployment date before they can be delivered to customers. A dashboard designed by VBS took 2 weeks to deliver while a similar dashboard took IT 2 months to develop[38].

VBS as an intrapreneurial organization is timely and cost effective. VBS takes less time and money to develop a comparable niche solution. However, IT is critical to producing the backbone system for VBS and all the IT tools, and is not designed to tackle some of the frontline employee solutions. IT has expertise in the backbone infrastructure and architecture that all systems organizations rely on for various activities.

6.2. Cultural Perspectives

6.2.1. Understanding the norms of the groups and motivating behavior change

As a small intrapreneurial group, it is essential to understand the organization culture and be well respected or accredited within the organization to be able to provide value.

The VBS team has worked in various parts of the company from facilities to silicon fabrication to testing to manufacturing floor. With one exception, VBS intrapreneurs have 25 years of experience working with Raytheon. They have created an open and transparent environment that builds trust with users, including an open door policy and close proximity and availability to clients.

Over the years, an unfortunate and unjustified perception has arisen that IT is ineffective and inefficient. Employees view IT as not being able to adapt to needs and understand the norms within certain business units[39]. This misunderstands the mission and agenda of IT. They are focused on enterprise wide systems and infrastructure

[38] (VBS-Team, 2009)
[39] (Raytheon-Employees, 2009)

issues, and so do not have the time or mandate to develop in-depth relationship with core users of lean products.

The understanding of the culture within the different groups and relationship built by intrapreneurs at VBS, from their combined 50 years of experience, allows them to be able to work well with users. Intrapreneurship allows for trust-building and a deeper understanding of the customer needs. It also lets the intrapreneurs have a better line of communication with the direct users of the product. Through these benefits lean transformation has a better chance of succeeding in practice.

6.2.2. Empowering Employees

Intrapreneurs are empowered and this significantly boosts morale and motivation. This creates a culture that is passionate and excited about making changes. Interestingly, this empowerment stretches beyond the borders of the intrapreneurs and affects other employees within the company. Kotter lists this as one of the key attributes for successful change.

All VBS employees stated that they feel empowered in the work that they do.[40] They feel trusted, unrestricted, and excited about helping their customers. This positive attitude creates a warm culture that customers value and appreciate. In addition, survey of VBS customers indicated that the customers feel empowered. This empowerment varies but a common theme is being valued and being included in the development of new tools and processes. VBS intrapreneurs are also incentivized through intrapreneurship because they see a strong connection between what they do and customer success, and are seen by customers as solution providers. VBS performance is measured by customer satisfaction.

IT employees feel empowered to do their work and are excited about working with customers and facing challenges. However, it becomes difficult to align the large number of employees, incentivize them, and keep them positively engaged in delivering customer solutions.

[40] (VBS-Team, 2009)

VBS intrapreneurs are empowered at a higher level than their IT counterparts due to the fewer restrictions that they have on their day to day activities. A VBS group member stated "[VBS] helped [me] to meet people in different orgs and different levels... great for building network...less intimidating than IT."[41] This in turn is able to drive and ensure positive changes especially in solution development needed in the lean transformation.

6.2.3. Modeling a lean culture

As a small group, it is easier to show the benefits of lean and influence a lean transformation that can be modeled by other groups. For a transformation to get a foothold or serve as a basis for learning, it is easier to create a culture within an intrapreneurial group.

Established on the premise of being a lean organization, VBS embodies all aspects of a lean enterprise. Its standardization of code for reuse allows the removal of non-value added work, developing software cheaply and swiftly, and fostering continuous improvement through group-wide code reviews to develop better code are all parts of its modeling lean. It is agile in embracing change from the company, IT, or its customers. Recently there has been a bigger push for security and documentation. One IT worker attested to VBS engagement in adapting to these needs stating "[VBS group] are great to work with."[42] There has also been a push for a web-based architectures and VBS has worked with IT to develop web-based tools quickly.

As indicated by IT project manager, "IT started lean a year ago...and don't have lean as a mindset yet...people have problems seeing it from manufacturing...how they can improve day to day work."[43] This is probably due to the size of the IT organization and the IT organizational structure that makes it difficult to transition into a lean enterprise. Since IT is a late adopter of lean in its product development and will be earlier on lean usage than its client, this has limiting contribution of lean training to its customers.

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[41] (VBS-Team, 2009)
[42] (Raytheon-IT-Employees, 2009/2010)
[43] (Raytheon-IT-Employees, 2009/2010)

In modeling the behavior change more easily, VBS is able to show the benefits of the change to its customers. VBS lean product development allows it to deliver timely and cost effective solutions that customers can learn from in doing their daily activities.

6.3. Political Perspective

6.3.1. Decision authority

Intrapreneurial organizations do not have hierarchal management as shown in Figure 3. These groups are relatively flat organizations with everyone having about equal voice. This leads to quicker decision making and customer support during a lean transformation.

Every VBS intrapreneur has the power to make decisions on area of work and make a certain amount of change.[44] As A VBS group member, the author found it easy to make decision on the approach to use to develop a tool for the engineering group. The VBS founder has authority to make final decisions on major changes or issues. Customers are free to talk to any member of VBS as there is no reporting mechanism and they may need to approach individuals that are more familiar with their concerns. This results in quicker issue resolution and close customer relationship. "like the old adage: better to beg for forgiveness than ask for permission...if they get too compliant they won't be able to get anything done...culture at Raytheon is that they need results and that's why [VBS] has been so successful."[45] A manager stated "team is great to work with, know the tool very well dedicated to helping the business improve, it is not a fight over direction, it's a small lean team which helps, [and] you don't have multiple layers of management."[46]

As a formal organization, those at the bottom have limited power to make decisions and have to go through the hierarchy to effect change. IT project manager stated in his restriction to change "I have a lot of influence above me that comes down

[44] (VBS-Team, 2009)
[45] (Raytheon-IT-Employees, 2009/2010)
[46] (Raytheon-Employees, 2009)

to me."[47] In addition, customers have to navigate the chain to determine the appropriate decision-making contact. Due to certain non value added activity to reach appropriate contact, the solution development is slowed down during a lean transformation. Another potential problem from a hierarchy is the disruption from limited customer engagement at the high level especially since IT head reports directly to CEO. This can remove IT from making customer based decisions as was the case during an investment on information technology enhancement that was hardly used by respective groups within Raytheon Company.[48]

Within an intrapreneurial organization like VBS, it has a flat organization chart as shown in Figure 3 creating low political turf wars or decision making confusion within the group while making every member accessible to assist a customer.

6.3.2. Organizational Boundaries

An intrapreneurial group is able to navigate the different environments. As the company grows, there can resistance to change when every group protects its own territory. An intrapreneurship group is generally not viewed as a threat because of a perceived lack of political agenda, thereby enabling intrapreneurs to work with different groups across organizational boundaries.

VBS has worked with all groups and as indicated, in preceding chapters, they are well received. VBS is viewed as a resource to achieve goals especially as VBS does not work for a particular group; they are not viewed as having a hidden agenda[49]. They have worked with shop floor employees, supply chain business groups, manufacturing groups, quality groups, and engineers. All customers are open to work with them and view interactions as positively impacting their groups[50].

- Customers are wary that IT decisions are usually pushed on them and will cost them a significant amount of funds. IT has a particular infrastructure mandate and is directly tied to the CEO as shown in the IT org chart in Figure 2. While IT is able to work with

[47] (Raytheon-IT-Employees, 2009/2010)
[48] (Raytheon-IT-Employees, 2009/2010)
[49] (VBS-Team, 2009)
[50] (Raytheon-Employees, 2009)

multiple groups, it develops different relationship with business units based on its enterprise-wide responsibilities.[51] Raytheon manager stated about the ability of IT to address needs of different business groups with the comment: "it is a fundamental change for a large IT structure and is very difficult."[52]

An intrapreneurial group can bridge improvements between groups and aid in creating lean transformations in both small and large groups within the enterprise. Customers feel there are no political agendas that might mitigate an open environment necessary for lean changes.

6.3.3. Bureaucratic processes

Intrapreneurs do not comply with certain formal processes. They are able to challenge some of the bureaucratic restrictions and highlight the non-value added activities.

As an intrapreneurial organization, Virtual Business System group removes bureaucratic restrictions in order to focus on value added activities. VBS intrapreneurs concur that there is no bureaucracy in their intraprise.[53] A manager a client of VBS stated "there isn't a large complex process that they use they manage themselves from a process perspective to make sure that what each developer is doing follows a set of standards."[54] There are certain practices that VBS are mandated to do such as revision control. VBS incorporates these practices into its operations and is working to include required and relevant mandates.[55]

The Raytheon Information Solutions group is mandated to follow all regulations and rules regardless of whether or not they are value-added activities. Some of these activities ensure that the organization processes are well documented and for credibility within the organization. IT project manager indicated that "[IT] has a lot of baggage from regulations from corporations" as certain processes that may appear non-value

[51] (VBS-Team, 2009) & (Raytheon-IT-Employees, 2009/2010)
[52] (Raytheon-Employees, 2009)
[53] (VBS-Team, 2009)
[54] (Raytheon-Employees, 2009)
[55] (Raytheon-IT-Employees, 2009/2010)

added but are required for security reasons.[56] A manager complained about IT processes stating "[with IT] nearly impossible to get change through... they have to be willing to step back and figure out how many of their processes they are willing to allow not be followed at the same level they are today."[57]

While intrapreneurship ventures stray from bureaucratic processes making it effective at change, they also need to stay abreast of IT mandates and incorporate needed activities to retain its validity within the organization.

As shown in the preceding sections, intrapreneurship offers a number of advantages as viewed through the lenses of strategic design, culture, and politics. Intrapreneurship offers strategic designed advantages like creating change agents, providing customer value, and enhancing time and cost to transform. Cultural restrictions that include understanding norms, empowering employees, and modeling a lean culture are overcome. Finally, political barriers produced by decision authority, organizational boundaries, and bureaucratic processes can be worked around.

6.4. Limitations of intrapreneurial groups and benefits of the formal groups

It is important to note that there are certain limitation indicated during interviews and observation of the intrapreneurial group, VBS as evident in the previous sections. These limitations are not restricted to VBS but affect any intrapreneurial group promoting lean transformation. These limitations are planning the succession of key intrapreneurs, acquiring resources, developing relationships with formal counterparts, adapting to change, and including intrapreneurs in decision making processes.

- **Planning succession of key intrapreneurs**[58]

  As the founder of VBS noted, the intrapreneurship venture will not survive if the key intrapreneurs leave the company. There are no organizational structures or mechanisms available to manage the group after key players leave.

[56] (Raytheon-IT-Employees, 2009/2010)
[57] (Raytheon-Employees, 2009)
[58] (VBS-Team, 2009)

- **Acquiring resources for the group**[59]

  Customers acknowledge that the group has been efficient at solving a large amount of tasks but they are concerned and believe that more resources will be needed to handle the workload even quicker. A manager stated "I think the VBS team needs to find a way to increase its resources without increasing the overhead."[60] Some of the intrapreneurs also state that their work could be improved with more people to assist with the tasks. Resources are limited due to the lack of funding to support a larger workforce.

- **Developing relationship with formal group**[61]

  There is some tension that exists between an intrapreneurial group and the formal IT group. VBS is no exception. IT project manager stated "VBS is pretty agile and lean... getting things done quickly...[but]running under the radar... don't have to deal with all the compliance issues...some people in IT get upset with that" IT is concerned that VBS get things done quickly but do not follow all the guidelines required by IT. IT feels that they have to fix some of the work done by VBS to follow new standards thereby creating more work for IT. They also do not view VBS products as real solutions rather as prototypes or interim solutions that will need to be replaced. VBS believes they are within the IT software guidelines and that their customers are comfortable with the VBS solutions.

- **Adapting to change on which the systems are built**[62]

  As formal group process and tools change, there is a need for the intrapreneurs to adapt to these new developments in order to be in compliance. IT noted that VBS strays from the normal software tools passed down from corporate. IT project manager stated "[should be] retrained in new web-based tools...they have standard tools that [IT] want to promote" However, when these processes and tools change too frequently, it distorts the normal operation of the intrapreneurship and creates a distraction from their tasks.

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[59] (Raytheon-Employees, 2009)
[60] (Raytheon-Employees, 2009)
[61] (Raytheon-IT-Employees, 2009/2010)
[62] (Raytheon-IT-Employees, 2009/2010)

- **Including intrapreneurs in decision making process**[63]

  Since intrapreneurs are not in a formal organization they are sometimes are not valued in key decision-making processes.

In the short term, intrapreneurship is able to be adaptive to evoke a lean transformation. However, in the long term, such intrapreneurship loses its effects if sponsorship is lost or key intrapreneurial talent leaves.

6.5. Addressing limitations of Intrapreneurship

Despite having a longer life cycle than the other approaches to lean transformation, intrapreneurship has its own time limits. As an organization championed by a few, it runs the risk of being marginalized if the leadership or core team leaves or it gets subsumed into another organization thereby losing its key strengths. Another limitation is the support required to sustain it. If there is poor sponsorship or if the sponsorship declines, the intrapreneurial organization loses its effectiveness. It is also not immune to all general organization dynamics. The intrapreneurship venture finds it difficult to align with the main organization without being diverted by the political issues. Organizational structures are constantly changing and the intrapreneurs have to stay abreast of these changes. In addition, intrapreneurs must remain aligned to the mission or changing environment with the company and company's customers

In order for intrapreneurship to be able to assist the company on its lean journey for the long term, these limitations should be addressed. The time it takes for a complete lean transformation varies and tools to address it must be able to support the change over the long transformation period. One way to solve the limitations is to develop strong partnership agreements with the formal IT group. Over time, IT project manager indicated "VBS is slowly being brought in... think of them as an extension of [IT]."[64] This allows for better collaborative partnerships. An example of an interaction with IT is that VBS is hosted

[63] (Raytheon-IT-Employees, 2009/2010)
[64] (Raytheon-IT-Employees, 2009/2010)

on an IT server (extension of IT) so it fits within the corporate rules and infrastructure. They can split up so more of the backend infrastructure aspects are handled by IT while VBS owns delivery of data.

Another option is to transition a section of the company into an "intelligent organization consisting of intraprises, intrapreneurial enterprises, created by employees to empower them to address their needs as they see fit."[65] This would recreate a company like Raytheon to include multiple organizations like VBS. Each would have a succession plan, the ability to raise capital to acquire more resources, a strategy to adapt to environment change quicker, and not need to be part of a formal group. This ambidextrous organization, term coined by Michael Tushman et al, will allow the company manage its existing processes and structures while capturing on the benefits of the intrapreneurial processes and existing structures.

[65] (Pinchot & Pinchot, THE INTELLIGENT ORGANIZATION: Engaging the Talent & Initiative of Everyone in the Workplace, 1996)

7. System Dynamic Model of intrapreneurship benefits on lean transformation

The system dynamic models developed in this thesis shows how intrapreneurship has positive effects on key factors such as number of quick wins and number of longer wins and consolidated gains that are necessary for a lean transformation. The model will provide an understanding of the conceptual dynamics of intrapreneurship in lean transformation that will be useful to companies interested in lean transforming their organizations.

Figure 8 shows the lean change cycle consisting of a reinforcing loop leading to a growth in employee lean adoption rate. The model relies on Kotter's [66] eight steps to leading change and three lens analysis[67], which are described in previous chapters, as a basis for the change process. Leadership change enablers (creating a sense of urgency, creating a guiding coalition, creating a vision, and communicating the vision) begins the change process by reducing the obstacles to lean adoption while creating lean ideas. The strategic, political, and cultural barriers within the company increase the amount of obstacles to lean adoption. A portion of the lean ideas generated as long as it is greater than the amount of obstacles to lean adoption, lead to lean activities (based on actualization of lean ideas into lean activities), within the organization. These activities ensure quick wins that allow for longer wins and consolidated gains. Thus, an adoption fraction (influenced by activity acceptance) of employees and business groups is created that will increase the adoption of lean from interaction. This then leads to an increase in the rate of lean adoption by employees (depending on the number of employees with and without lean exposure). This ultimately creates a reinforcing loop that leads to an exponential growth in the number of employees embracing lean. Constants were used for the auxiliary variables and values are listed in the appendix.

This model uses the Bass diffusion model for the rate of lean adoption by employees. The reinforcing loop "Employee lean adoption rate" reduces the number of employees without lean exposure and increases the number of employees embracing lean. The balancing loops "Saturation" reduce the growth as there are fewer employees without lean exposure.

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[66] (Kotter, Leading Change, 1996)

[67] (Ancona, Kochan, Scully, Van Maanen, & Westney, 2004)

Figure 8: Lean change cycle

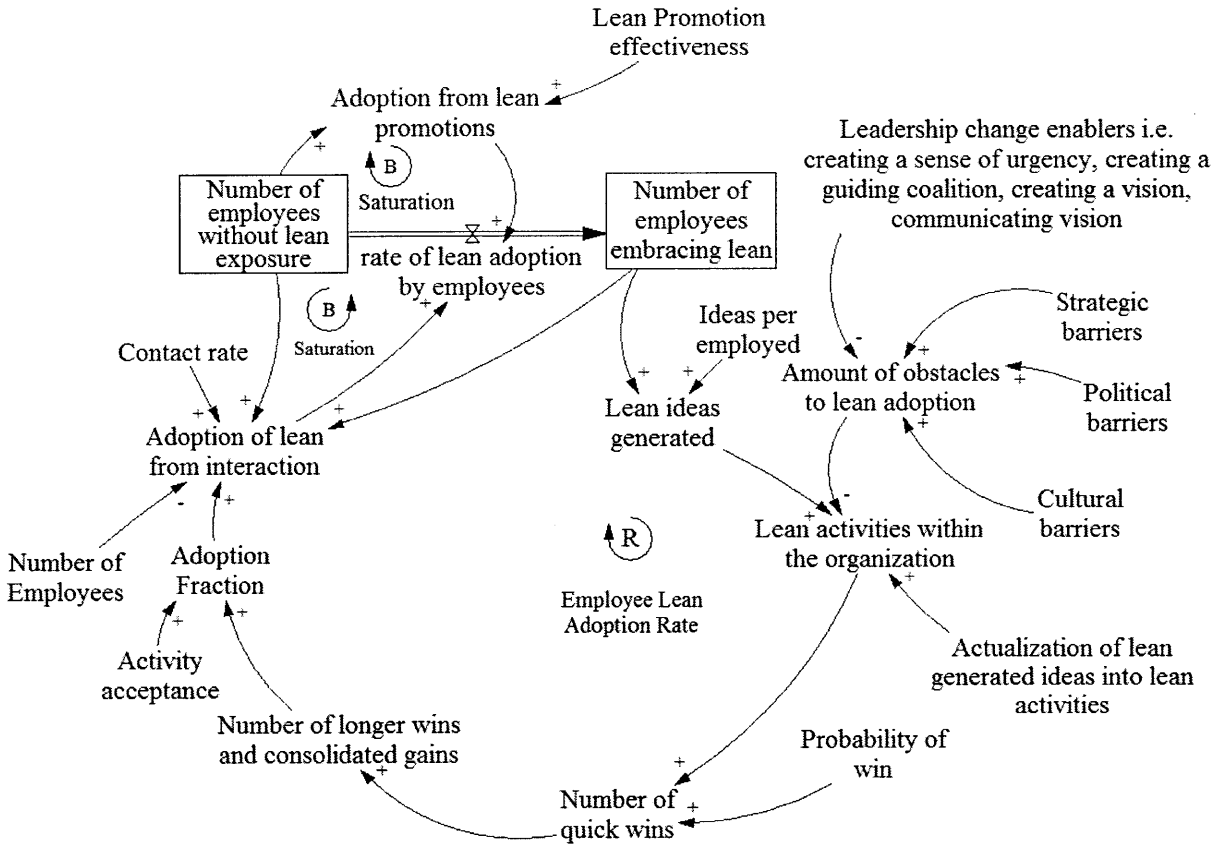
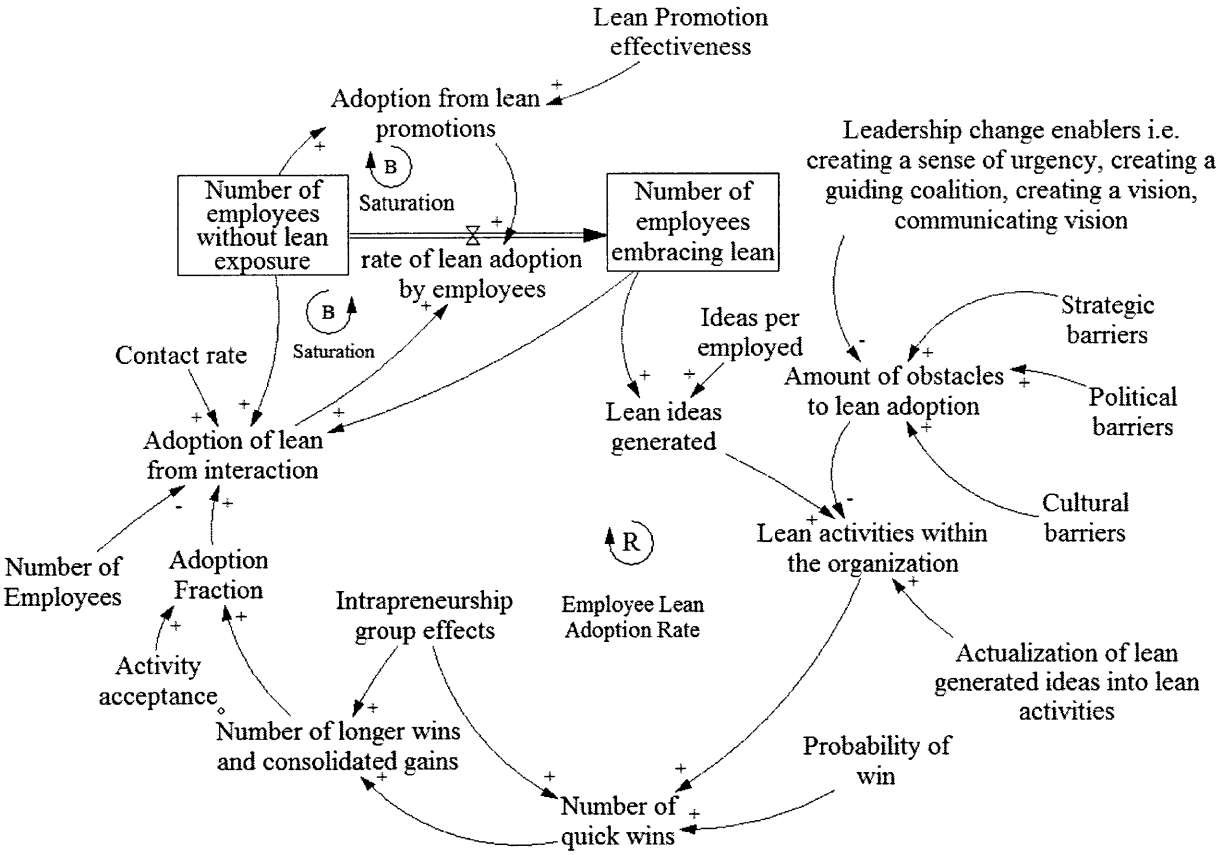


Figure 9 includes the intrapreneurship effects on the number of longer wins and consolidated gains especially as intraprises are not greatly affected by the strategic, political, and cultural barriers that limit lean activities within the organization. Thus leading to a quicker exponential growth in employee lean adoption rate

Figure 9: Lean change cycle with intrapreneurship effects



The results on simulating on number of employees embracing lean for both models are shown below in figures 10 and 11.

Figure 10: Growth in lean adoption with intrapreneurship

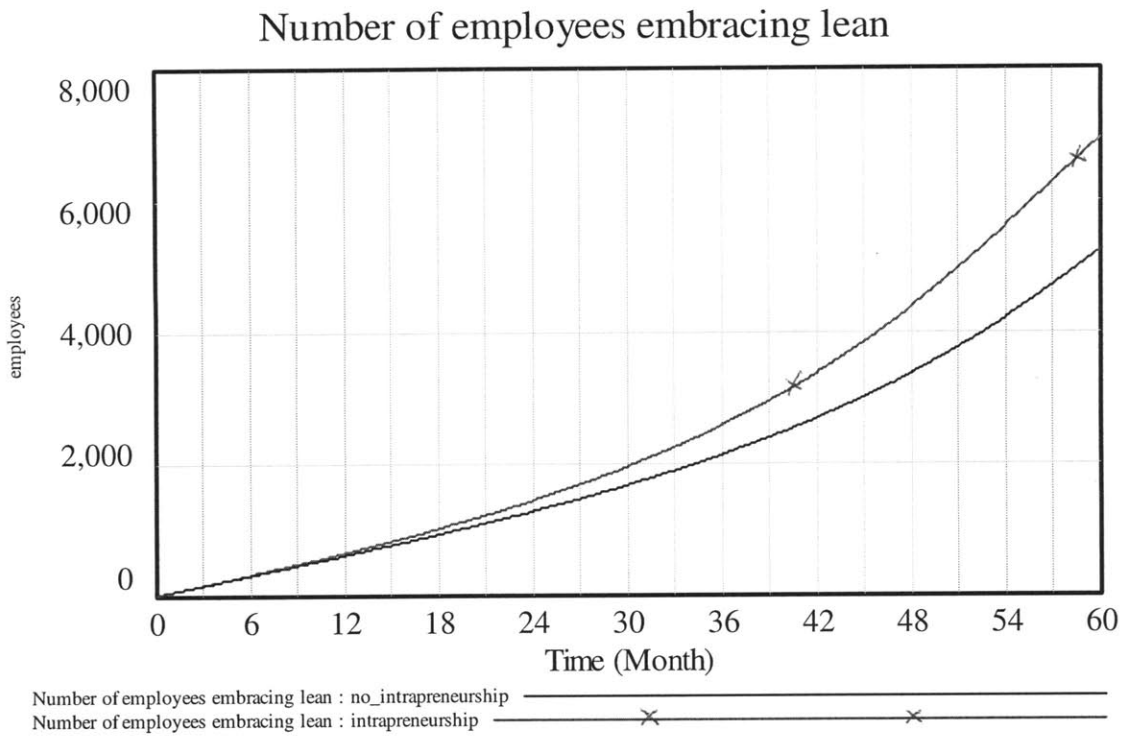
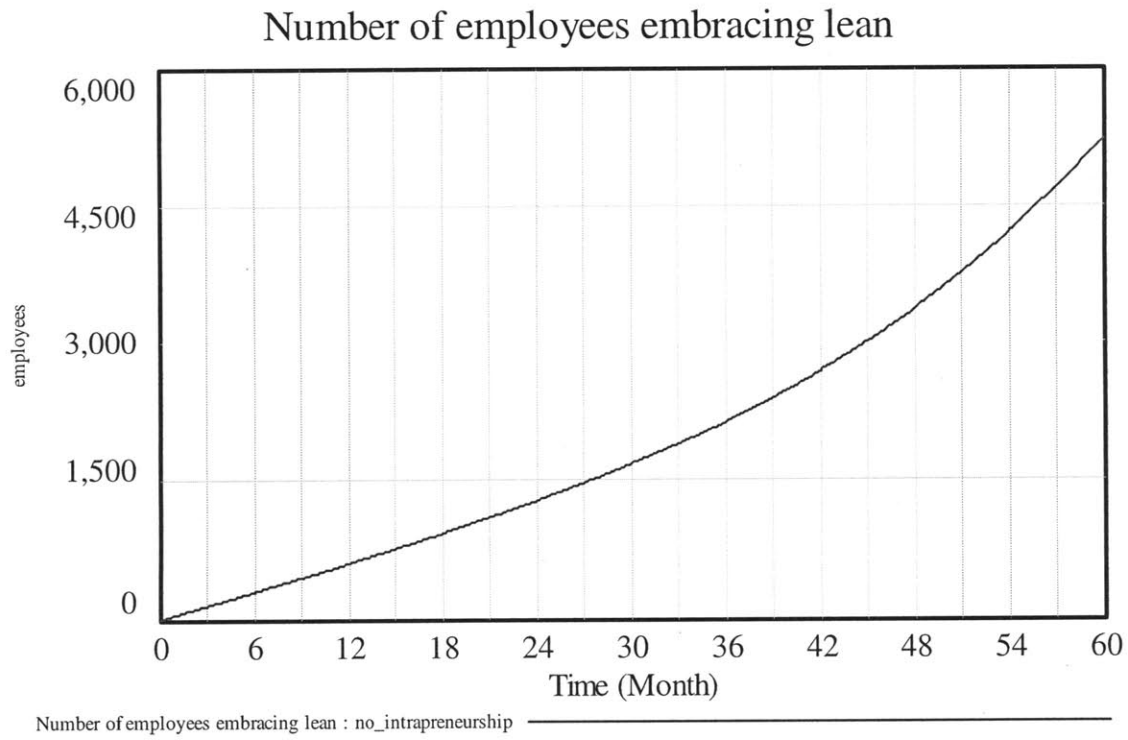


Figure 11: Growth in lean adoption without intrapreneurship

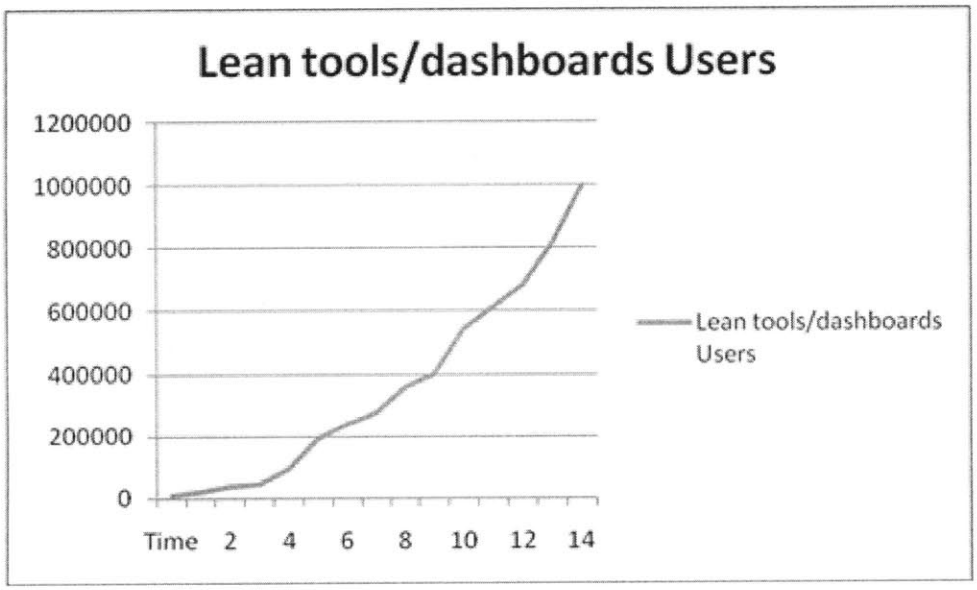


The model highlights the benefits of intrapreneurship contribute to a successful lean transformation because it strengthens the reinforcing that drives adoption. As shown in figure 10, the temporary burst of intrapreneurship activity will result in faster exponential growth because it stimulates the reinforcing loop.

In modeling intrapreneurship at a large organization using VBS as an example, the effects are in two categories: people and processes.

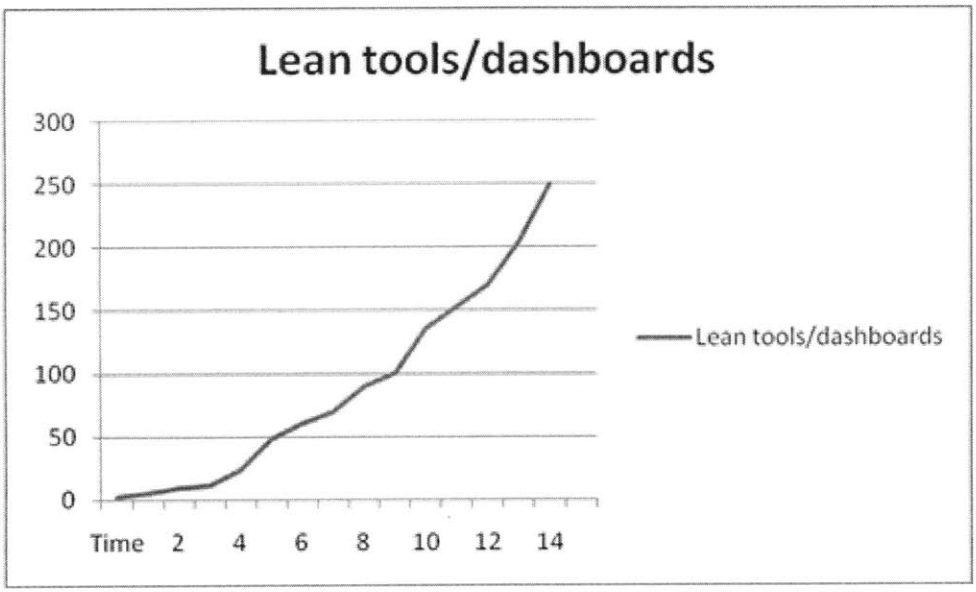
For the people aspect of the lean transformation, the number of users of the lean tools developed by the intrapreneurial organization, Virtual Business System (VBS) is used as a measure of process improvement on the lean journey. Figure 12 highlights these benefits through the growth in the number of users. (Note that the data reflects exponential trend and not actual data)

Figure 12: Growth in users of lean tools



For the process aspect of the lean transformation, the number of lean tools developed by the intrapreneurial organization, Virtual Business System (VBS) is used as a measure of process improvement on the lean journey. Figure 13 highlights the benefits through the growth in the number of tools developed (Note: data reflect exponential trend and not actual data)

Figure 13: Growth in the number of tools developed



In conclusion, the intrapreneurial group is able to garner a number of quick wins through rapid innovative and response to customer needs. These quick wins enable the intrapreneurial group to consolidate these gains to produce even larger impacts that address even bigger needs thus anchoring the customer into the lean culture that is shown by the increasing number lean processes, tools, or lean ideas. Intrapreneurship also affects the behavior of employees by increasing the number of change agents, which leads to a higher number of empowered and motivated employees. These engaged employees generate ideas that shorten the time it takes for a lean transformation. The reduction in time saves on cost for the lean change thereby increasing the number of users and lean tools. The behavior change from intrapreneurship creates a rising number of users of the lean processes, tools, or ideas.

8. Conclusion

Lean transformation enables organizations to provide improved quality, lowered cost, and shorter delivery time of products and services. However, such transformations often take too long to implement or are unable to be integrated within the organization. VBS provides a case example of the effectiveness of intrapreneurship on lean transformation. VBS is instrumental in lean transformation at the manufacturing area of Raytheon IDS. Fostering intrapreneurship and intrapreneurial organizations helps empower employees to change behavior and provides process improvement. Intrapreneurship creates change agents, provides customer value, and enhances time and cost to transform. In addition, intrapreneurs understand the local norms, empower employees, and model a lean culture to provide value and enhance lean adoption. Intrapreneurs are able to work around political barriers of the decision authority, organizational boundaries, and bureaucratic processes.

Unlike other approaches, where an existing group within an organization is devoted to solving the issue or a temporary group is created within the institution in order to transform the organization, intrapreneurship is more sustainable and has a better likelihood of success. Leaders and managers should promote intrapreneurship within their organizations by sponsoring events, providing structures to support it, etc. In enacting intrapreneurship policies, lean transformation will be more effective. Managers should encourage better incorporation of the intrapreneurial groups with existing organizations for their ability to enhance lean as doing so has the potential to yield lasting results by engaging a reinforcing loop that can stimulate adoption and propel the organization in the direction of lean.

In the preceding chapters, intrapreneurship has been proposed as an effective tool for lean transformation. However, there are certain research limitations that are not addressed in this thesis.

Opportunities for further research

- Quantitative data to prove the benefits of intrapreneurship: This thesis bases its argument on anecdotal evidence from interviews, surveys, and observations. While this

type of data is useful to provide the context, it lacks the quantifiable evidence to fully validate the benefits of intrapreneurship. The author recommends future work to involve quantifiable data on impact made by intrapreneurs and formal units by measuring results like cost and benefits of intrapreneurship compared with the cost of and benefits of the formal group.

- Examples of intrapreneurship outside the IT space: The thesis provides an example of intrapreneurship in lean transformation from an IT perspective. This case example was drawn for its relevance and author's internship observation but could be expanded to other groups. In order to further develop the thesis, more examples outside of the IT arena should be sought.
- Examples of intrapreneurship outside of Raytheon: The thesis provides an example of intrapreneurship in lean transformation within Raytheon Company. This case example was drawn for its relevance and author's internship observation but could be expanded to other companies and industries. In order to build on the thesis, more examples outside of the Raytheon and the defense industry can aid in developing the argument for intrapreneurship as a tool for lean transformation.
- Future of intrapreneurship in enterprise architecting: Another potential research opportunity is in incorporating intrapreneurship while architecting the enterprise. In creating a new or redefining an old enterprise, intrapreneurship may serve as an effective way to generate innovation in product, process, and value network by empowering employees to seek and generate growth. The author suggests looking for opportunities where intrapreneurship has been or could be used for enterprise architecting.

Glossary

Andon: A Japanese word and lean terminology for a system that notifies frontline workers of a problem on the manufacturing line.

Capability Maturity Model Integration (CMMI): A process improvement maturity model for the development of products and services. It consists of best practices that address development and maintenance activities that cover the product lifecycle from conception through delivery and maintenance

Integrated Air Defense Center (IADC): Raytheon IDS's major manufacturing facility located in Andover, MA. The VBS office resides within this facility.

Integrated Defense System (IDS): One of Raytheon's business units that provides defense solutions like radars, patriot defense missiles, etc. This research thesis is focused on activities within this business unit.

Integrated Product Development System (IPDS): A listing of the various activities that need to be undertaken to develop a product for Raytheon's customers. It was developed by Raytheon from best practices within different aspects of product development

Intrapreneurship: Refers to entrepreneurship within the boundaries of the corporation. It exists outside of the organizational structure and is driven by providing a product or service to customers.

Intraprise: Refers to the intrapreneurs' enterprise

Kaizen: A Japanese term used within lean to refer to continuous improvement

Kaikaku: A Japanese term used with lean to refer to radical improvement

Lean: A methodology derived from the Toyota Productions System. It is an operations mindset where every activity or process is optimized to provide customer value. The idea is to remove waste from each process because such waste causes poor quality, increases cost, and impacts the time for delivering products or services to customers.

Raytheon Six Sigma (R6S): A methodology based on the original Motorola "Six Sigma" methodology, which ensures high quality standard by reducing defects and variability. Raytheon builds on "Six Sigma" by adding certain aspects of lean such as value stream mapping (VSM).

System Dynamics: A method to enhance learning in complex systems. This method uses feedback control and nonlinear dynamics to understand the behavior of complex systems.

Value Stream Map (VSM): A lean methodology whereby the steps within a process or activity are mapped out in order to determine which activities provide value.

Virtual Business System (VBS): The name of the intrapreneurial group used for the case study of the thesis. It is also used to refer to the software solutions developed by the intrapreneurial group.

9. Bibliography

Ancona, D. G., Kochan, T. A., Scully, M., Van Maanen, J., & Westney, D. E. (2004). *Managing for the Future: Organizational Behavior and Processes* . South-Western College.

Boehm, B., Port, D., & Al-Said, M. (2000). Avoiding the Software Model_clash Spiderweb. *Computer* , 120-122.

Deborah Ancona, H. B. (2007). *X-teams: How to Build Teams That Lead, Innovate and Succeed.* Harvard Business School Press.

Henderson, B. A., & Larco, J. L. (2002). *Lean Transformation: How to change your business into a lean enterprise.* Richmond: The Oaklea Press.

Ho, P. (2008). *Using Virtual Business Systems to Drive Lean Behavior in Engineering Design and.* MIT Thesis.

Ichniowski, T. (2010). As Federal Dollars Pour Out, A Second Stimulus Plan Grows. *ENR* .

Kotter, J. P. (1996). *Leading Change.* HBS Press.

Kotter, J. P., & Cohen, D. (2002). *The Heart of Change.* Boston: HBS Press.

Lombriser, R., & Ansoff, I. (2005). How successful intrapreneurs pilot firms through the turbulent 1990s. *Journal of Strategic Change , 4*, 95-108.

McManus, H., Haggerty, A., & Murman, E. (2005). Lean Engineering: Doing the RIght THing Right. *1st International Conference on Innovation and Integration in Aerospace Sciences.* Northern Ireland: CEIAT.

Nightingale, D., Murman, E., Allen, T., Bozdogan, K., Cutcher-Gershenfeld, J., McManus, H., et al. (2002). *Lean Enterprise Value: insights from MIT's Lean Aerospace Initiative.* London: Palgrave Macmillan.

Nils Fonstad, D. R. (2005, March). Engaging for change: An Overview of IT Engagement Model. *Center for Information Systems Research MIT Sloan School of Management Research Briefing* . Cambridge, MA.

Orlikowski, W. J. (1993). CASE Tools as Organizational Change: Investigating Incremental and Radical Changes in System Development. *MIS Quarterly* , 309-340.

Orlikowski, W. J. (1996). Improvising Organizational Transformation Over Time: A Situated Change Perspective. *Information Systems Research* , 63-92.

Orlikowski, W. J. (n.d.). *Jazz-Inspired: Manage Change by Improvising.* Retrieved March 7, 2010, from MIT Leadership Center: http://mitleadership.mit.edu/pdf/Jazz_Inspired_final.pdf

Orlikowski, W. J. (1992). LEARNING FROM NOTES: Organizational Issues in Groupware Implementation. *Computer-Supported Conferece on Cooperative Work*, (pp. 362-369). Toronto.

Pinchot, G., & Pellman, R. (2000). *Intrapreneuring in Action: A Handbook for business Innovation.* San Francisco: Berrett-Koehler Publishers, Inc.

Pinchot, G., & Pinchot, E. (1996). *THE INTELLIGENT ORGANIZATION: Engaging the Talent & Initiative of Everyone in the Workplace.* San Francisco: Berrett-Koehler Publishers, Inc.

Raytheon Company: History. (n.d.). Retrieved February 25, 2010, from Raytheon Company: http://www.raytheon.com/ourcompany/history/index.html

Raytheon Company: Leadership. (n.d.). Retrieved February 25, 2010, from Raytheon Company: http://www.raytheon.com/ourcompany/leadership/index.html

Raytheon Company: Our Company. (n.d.). Retrieved February 25, 2010, from Raytheon Company: http://www.raytheon.com/ourcompany/index.html

Raytheon-Employees. (2009, December). Interview with employees using VBS to understand impact of VBS on people and processes. (O. Bakare, Interviewer)

Raytheon-IT-Employees. (2009/2010, December & February). Interview with Rayteon IT team to understand team processes and relationship with VBS. (O. Bakare, Interviewer)

Starting New Businesses - Inside the Organization. (1999, December). *Harvard Management Update* . Boston, MA, USA: Harvard Business School Publishing.

Sterman, J. D. (2000). *BUSINESS DYNAMICS: Systems Thinking and Modeling for a Complex World.* The McGraw-Hill Companies, Inc.

VBS-Team. (2009, November/December). Interview with VBS group members to understand their perspective. (O. Bakare, Interviewer)

Wolbert, D. (2007). *Utilization of Visual Metrics to Drive Intended Performance.* MIT Thesis.

Womack, J. P., & Jones, D. T. (1996). *LEAN THINKING.* New York: Simon & Schuster.

10. Appendix

Understanding business processes and VBS interaction Interview Questions

The core interview questions to understand the Raytheon business processes and the lean transformation experienced with VBS are outlined below

1. What is your job function?
2. What are your group's processes?
3. What has been your interaction been with VBS?
4. What has been delivered with VBS?
5. How has VBS assisted with lean transformation?
6. What makes VBS effective and in what ways was it like before?
7. Do you get a sense of empowerment or motivation with VBS?
8. How in your mind does VBS integrate with the rest of the organization?
9. How do you interact with IT?
10. How is VBS different from IT?

Raytheon Company 3 lens Survey

The survey questions in table 3 below were emailed to Raytheon employees to understand the culture, politics, and strategic design of the company. The responses are also outlined.

Table 3: Raytheon 3 lens survey questions and responses

				Total
POLITICAL LENS QUESTIONS	Question 1	How do decisions / approvals normally get made for moving forward with an initiative or project?	Based on directives from upper management	59%
			Approval by a standing committee	11%
			Group consensus (e.g. organizational team)	22%
			Individual initiative (no approval needed)	22%
			Other	8%
			Number of Survey Responses	37
	Question 2	What do you perceive dictates who has the "political power" within your organization?	Based entirely on organizational structure or hierarchy	80%
			Based on work experience	16%
			Based on academic credentials (e.g. PhD)	3%
			Other	13%
			Number of Survey Responses	101
	Question 3	How is your organization structured?	By project / product	0%
			By function	78%
			Matrix	17%
			Other	0%
			Number of Survey Responses	18
	Question 4	Does your organization have an accessible published organization	Yes	95%

		chart?	No	5%
			Number of Survey Responses	19
	Question 5	Is having an accessible published organization chart important to people?	Yes	74%
			No	26%
			Number of Survey Responses	19
	Question 6	Do you frequently go through re-organizations ?	Yes	59%
			No	41%
			Number of Survey Responses	27
	Question 7	How frequently do they occur?	Once per year	63%
			2 to 5 times per year	44%
			More than 5 times per year	0%
			Number of Survey Responses	16
	Question 8	Are the purposes / reasons for the re-organization explained to those impacted?	Yes	33%
			No	50%
			Number of Survey Responses	18
	Question 9	How / when is the re-organization information communicated (including new structure and purpose/reason for the re- organization)?	Never communicated	11%
			Via mass communication 2 or more weeks prior to the change	0%
			Via mass communication less than 2 weeks prior to the change	50%
			Via face-to-face communication 2 or more weeks prior to the change	0%
			Via face-to-face communication less than 2 weeks prior to the change	28%

		Other	11%
		Number of Survey Responses	18
Question 10	When implementing a past re-org was there a plan that helped to transition r&r if they were moving to different functional positions?	Yes	23%
		No	50%
		Number of Survey Responses	26
Question 11	Do you feel that, for the most part, past re-organizations have been beneficial (good for the company or business unit looking long-term)?	All have been beneficial	11%
		Some have been beneficial	61%
		None have been beneficial	6%
		Number of Survey Responses	18
Question 12	When you experience set-backs in your tasks/projects, whom do you turn to for guidance and/or advice?	Manager / supervisor	58%
		Friend / colleague / co-worker	56%
		Someone outside of your organization	7%
		A mentor	6%
		Other	6%
		Number of Survey Responses	101
Question 13	What is the level of cooperation between your team and other teams within your business unit?	High	51%
		Medium	41%
		Low	8%
		Number of Survey Responses	101
Question 14	What is the level of cooperation between your team and other teams outside of your business unit?	High	29%
		Medium	51%

			Low	20%
			Number of Survey Responses	83
CULTURAL LENS QUESTIONS	Question 15	Do you think Raytheon supports a culture of innovation, creativity or out-of-the-box thinking?	Yes	73%
			No	24%
			Doesn't matter	2%
			Number of Survey Responses	90
	Question 16	Where do you see Raytheon at on a scale from "nimble and enterprising" (1) to "slow and traditional" (5)?	1 (Nimble & Enterprising)	6%
			2	17%
			3	22%
			4	33%
			5 (Slow & Traditional)	22%
			Number of Survey Responses	18
	Question 17	Where would you like Raytheon to be on a scale from "nimble and enterprising" (1) to "slow and traditional" (5)?	1 (Nimble & Enterprising)	33%
			2	41%
			3	19%
			4	4%
			5 (Slow & Traditional)	0%
			Number of Survey Responses	27
	Question 18	How are new initiatives embraced by employees in your organization?	Fully embraced	29%
			Reluctantly	62%
			Openly resisted	13%

		Number of Survey Responses	91
Question 19	What has the biggest impact on the corporate culture?	Historical precedence	22%
		New leaders	35%
		Employees	22%
		First line managers	16%
		Geographical location	10%
		Other	8%
		Number of Survey Responses	101
Question 20	Do you see alignment between your organization's goals & values and those of the corporate goals & values?	No alignment	2%
		Some alignment	71%
		Fully aligned	26%
		Number of Survey Responses	100
Question 21	Do you feel separate cultures exist among the six Raytheon Business Units (IDS, IIS, MS, MCS, SAS and TX)?	Yes	82%
		No	16%
		Number of Survey Responses	101
Question 22	If yes, what does this difference stem from?	From different legacy companies	57%
		Geographical difference	41%
		Differences in products / services	46%
		Different customer basis	19%
		Other	16%
		Number of Survey Responses	83

STRATEGIC LENS QUESTIONS	Question 23	Is there a process to bring in LGO interns and to ensure that they are successful?	Yes	100%
			No	0%
			Somewhat	0%
			Number of Survey Responses	3
	Question 24	How does your organization ensure that new initiatives are integrated into the strategic direction of the overall Raytheon Company?	I'm only assigned projects that fit into the overall strategy	46%
			We don't worry about integrating our projects into the overall Raytheon strategy	21%
			Other	18%
			Number of Survey Responses	28
	Question 25	Does your Business Unit's strategy differ from Raytheon's overall strategy?	Yes	10%
			No	84%
			Number of Survey Responses	90
	Question 26	How often and in what format does each employee within the organization usually hear about Raytheon's corporate strategy and their specific Business Unit's strategy?	Never communicated	2%
			Via mass communication 3 or more times annually	55%
			Via mass communication less than 3 times annually	23%
			Via face-to-face communication 3 or more times annually	23%
			Via face-to-face communication less than 3 times annually	9%
			Other	8%
			Number of Survey Responses	93
	Question 27	From your experience, do organizations that exist in all of the Raytheon Business Units consistently follow standardized	Don't know - no experience with across-business-unit organizations	19%
			Hardly ever follow standardized policies and/or procedures	22%

		policies and/or procedures across all business units?	Mostly follow standardized policies and/or procedures	59%
			Always follow corporate wide policies and/or procedures	0%
			Number of Survey Responses	37
	Question 28	How important do you feel Raytheon's "On Company, One Vision" is to the corporation's future success?	Very important	67%
			Somewhat important	33%
			Not very important	0%
			Not important	0%
			Number of Survey Responses	101
	Question 29	How successful do you feel Raytheon has been in establishing and maintaining "One Company, One Vision"?	Very successful	9%
			Somewhat successful	71%
			Very little success	18%
			No success at all	1%
			Number of Survey Responses	91

System Dynamic Model Doc

(01) Activity acceptance=

0.01

Units: Dmnl

(02) Actualization of lean generated ideas into lean activities=

0.05

Units: lean activities / ideas

(03) Adoption Fraction=

Number of longer wins and consolidated gains*Activity acceptance

Units: lean activities/Month

(04) Adoption from lean promotions=

Lean Promotion effectiveness*Number of employees without lean exposure

Units: employees/Month

(05) Adoption of lean from interaction=

Contact rate*Adoption Fraction*Number of employees without lean exposure*

Number of employees embracing lean/Number of Employees

Units: employees/Month

(06) Amount of obstacles to lean adoption=

"Leadership change enablers i.e. creating a sense of urgency, creating a guiding coalition, creating a vision, communicating vision"

- (Political barriers+Strategic barriers+Cultural barriers)

Units: lean activities/Month

(07) Contact rate=

0.25

Units: 1/lean activities

(08) Cultural barriers=

0.2

Units: lean activities/Month

(09) FINAL TIME = 60

Units: Month

The final time for the simulation.

(10) Ideas per employed=

0.5

Units: ideas/employees/Month

(11) INITIAL TIME = 0

Units: Month

The initial time for the simulation.

(12) Intrapreneurship group effects=

2

Units: lean activities / Month [0,5]

(13) "Leadership change enablers i.e. creating a sense of urgency, creating a guiding coalition, creating a vision, communicating vision"

=

0.5

Units: lean activities/Month

(14) Lean activities within the organization=

(Lean ideas generated * Actualization of lean generated ideas into lean activities

)

- Amount of obstacles to lean adoption

Units: lean activities / Month

(15) Lean ideas generated=

Ideas per employed

* Number of employees embracing lean

Units: ideas / Month

(16) Lean Promotion effectiveness=

0.005

Units: 1/Month

(17) Number of Employees=

10000

Units: employees

(18) Number of employees embracing lean= INTEG (

rate of lean adoption by employees,

1)

Units: employees [1,100]

(19) Number of employees without lean exposure= INTEG (

-rate of lean adoption by employees,

Number of Employees)

Units: employees [1,?]

(20) Number of longer wins and consolidated gains=

Intrapreneurship group effects+Number of quick wins

Units: lean activities / Month

(21) Number of quick wins=

Intrapreneurship group effects+Probability of win*(Lean activities within the organization

)

Units: lean activities / Month

(22) Political barriers=

0.2

Units: lean activities/Month

(23) Probability of win=

0.2

Units: Dmnl

(24) rate of lean adoption by employees=

Adoption from lean promotions+Adoption of lean from interaction

Units: employees/Month

(25) SAVEPER =

TIME STEP

Units: Month [0,?]

The frequency with which output is stored.

(26) Strategic barriers=

0.2

Units: lean activities/Month

(27) TIME STEP = 0.125

Units: Month [0,?]

The time step for the simulation.