PRELIMINARIES ON DEMAND DRIVEN VALUE NETWORKS: IMPLICATIONS OF INFORMATION TECHNOLOGY

by

Natasha D. Diaz, B.B.A.

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Committee Members:

Temponi, Cecilia, Chair

Blanco, R. Ivan

Ramachandran, Indu

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LIST OF ABBREVIATIONS

Abbreviation	Description
BPR	Business Process Reengineering
DDSC	Demand Driven Supply Chain
DDSN	Demand Driven Supply Network
DDVN	Demand Driven Value Network
ERP	Enterprise Resource Planning
IoT	Internet of Things
JIT	Just-in-time
NPDL	New Product Development and Launch
R&D	Research and Development
RFID	Radio Frequency Identification Device
SC	Supply Chain
SCM	Supply Chain Management
TQM	Total Quality Management

ABSTRACT

For the past couple of decades supply chain management has experienced many changes and challenges that have given way to its transformation. Operating a successful organization today requires the involvement of both suppliers and customers. Globalization, technological advances, uncertain life cycles, high competition, increasing supply chain risks, environmental issues, customer expectations, and consumer demand are some of the many factors that have lead the supply chain to evolve. Organizations have realized the importance of becoming more focused on their core capabilities while creating strategic partners, distributors, suppliers, and customers. These collaborative relationships have been a key factor in determining an organizations' competitive advantage. The supply chain has transitioned from production driven (push strategy) to demand driven (pull strategy). Demand Driven Value Network (DDVN) has given way to a new age of supply chain. New technologies have been created to facilitate the interaction along the supply chain. The purpose of this research is to analyze the transition of the traditional supply chain to the modern supply chain, propose a preliminary maturity model to transition to the modern supply chain and analyze the importance of information technology in transforming and sustaining the modern supply chain.

1. INTRODUCTION

Organizations today operate in an extremely competitive business environment driven by the emphasis on time and quality based competition, market uncertainties, and globalization (Chong 2014, 48-58). Organizations not only compete with each other but rather compete as supply chain networks. Supply chains are pressured to deliver products and services at the right time, right quality and quantity, at the right cost, and to the right place (Santhanam 2008, 19-20). Organizations are looking for ways to become more competitive in today's uncertain environments. Industry leaders are those with the best and most efficient supply chains. These challenges must be addressed for organizations, along with all of their partners, to be able to predict demand and have the ability to change and adapt quickly to demand.

Leaders in the 21st century have realized that supply chain management (SCM) is a prime source of competitive advantage and has transformed into the newest driver of business value (Friscia 2005, 15-16). SCM has been evolving for the past thirty years. The supply chain (SC) has transformed from its traditional factory-driven, push model to a more customer-centric, demand driven approach (O'Marah 2005b, 30-36). Customers now dictate what products they desire and when they want them. Supply chain leaders are pressured to improve service and support new growth initiatives while reducing and controlling costs (Dominy 2014). SC leaders alongside executives must work together to find the best overall business strategy to be successful. Becoming demand driven has marked the difference between the leaders and the laggards in any industry. Leaders realize that it is important to transform to new supply chains that leverage the latest technology platforms to enable real-time decision-making and visibility to drive

predictive demand planning and response orchestration (Thalbauer 2014). The modern supply chain is no longer a chain but a network. Transformation requires mobilizing and coordinating people, process, partners and technologies to dramatically improve supply chain performance (Dominy 2014). Collaboration throughout the entire supply chain is very important to be a leader. Information technology has played a significant role in the transforming the supply chain. Recent advances in supply chain technology, offer a near-real time demand response for managers to make decisions across production networks.

The objective of this research is to analyze how the supply chain has evolved in the past decades and to define Demand Driven Value Networks. This research presents the preliminaries for a model that could guide in transforming organizations' supply chains. This study also aims to identify the importance of information technology within the supply chain.

1.1 Research Objectives

- Analyze the traditional supply chain
- Define Demand Driven Value Networks
- Describe the importance of transforming the traditional supply chain into a Demand Driven Value Network
- Review a model that aids in the transformation of the supply chain
- Analyze the importance information technology has on integrating the supply chain

1.2 Research Questions

- What challenges affected the traditional supply chain that led to its need for transformation?
- Does transforming the traditional supply chain into the new supply chain model translate into success in today's uncertain business environment?
- What is the role of information technology in a Demand Driven Value Network?

2. METHODOLOGY

2.1 Methods

The findings in this research are the result of a comprehensive search of business journals, books, academic papers, reports, and previous research, etc. First, a general search of various databases was used to help define the most relevant articles for my research. After reviewing selected articles, information was gathered to narrow down the topics of interest. Secondly, that information was used to conduct further investigations in those areas. After reviewing several areas, a methodology was developed for grouping and analyzing the information based upon the three areas of the supply chain that were identified: the traditional supply chain, Demand Driven Value Networks, and the importance of Information Technology. The modern supply chain model researched was identified as a significant contribution to the supply chain's development.

2.2 Sources of Data

The following is a list of the different databases and journals where information was collected and then used in this research.

Databases - ABI/Inform, Business Source Complete, Ebsco, Emerald, Garner, JSTOR, Lexis-Nexis Science Direct

Journals – Applied Mechanics and Materials, Industry Week**,** Industrial Management**,** International Journal of Distributed Sensor Networks, Supply Chain Management Review, Harvard Business Review, International Journal of Operations & Production Management, International Journal of Advanced

Research in Computer Science, International Journal of Distributed Sensor Networks, Information Systems Research

2.3 Limitations

This research is limited to secondary data. Due to limited time, this research focused on analyzing the differences and advances between the 20th century supply chain and the 21st century Demand Driven Value Network. Because of the vast array and constant changing trends of technologies used in supply chain only four existing technologies were chosen to be reviewed.

2.4 Implications

This study provides insight for organizations and supply chain leaders by identifying the importance transitioning from a traditional linear supply chain to a demand driven value network. The findings indicate the necessity for implementing the correct technologies to integrate the supply chain and its partners into a network. This research has also identified areas for further research.

3. THE TRADITIONAL SUPPLY CHAIN

3.1 Traditional Supply Chain

The 20th century was all about the factory. Many advances were made possible through the application of mass production techniques. The traditional supply chain was focused around a factory centered and push driven model. The goal of the organization was cost optimization and supply. Historically, companies would build vertical supply chains within the organization and/or created them through acquisitions and mergers (Santhanam 2008, 19-20). Figure 1 illustrates an example of a linear supply chain. The illustration shows how the product is pushed downstream to the end costumer. An example of a leader in push driven supply chain management would be Henry Ford, a legend of productive efficiency in the automobile industry in the early 20th century. Products that were offered to consumers were "Any color you want, as long as it's black" (O'Marah 2005b, 30-36). Ford acquired different companies, distributions, and suppliers to build a highly integrated supply chain that controlled business processes. Industrial engineering of the 20th century harnessed fundamental innovations such as the assembly line which drove productivity. Because of this breakthrough, the average task cycle time for assemblers was reduced from 51.4 minutes to 2.3 minutes via perfect part interchangeability between the years of 1908 and 1913 (O'Marah 2005a, 8-13). Among other successes Ford had with the innovation of the assembly line and mass production techniques, the company successfully reduced total assembly cycle time for completing cars from 750 minutes to 93 minutes in the mid-1910s (O'Marah 2005a, 8-13). The fundamental technologies used during this time were based on engineering advances used in mass production that defined American society and economies. Although, the push

strategy was successful for the moment, it was not enough to maintain sustainability with evolving business environments and the start of globalization.

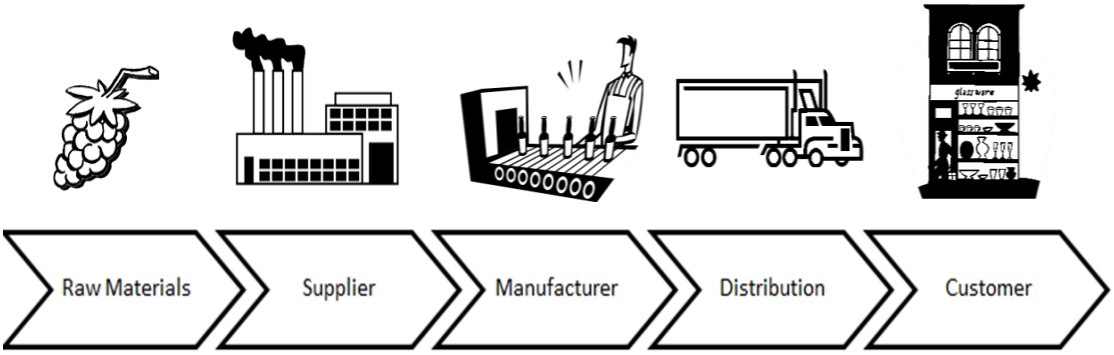

Figure 3.1. Linear Supply Chain

3.2 Challenges with the Traditional Supply Chain

The traditional supply chain had an inside-out business strategy. Collaboration from outside the organization was not a priority (Asgekar 2004, 15-16). The supply chain faced a lack of efficiency and management did not consider consumer demand as a key metric of supply chain performance (O'Marah 2005a, 8-13). The effects of this oversight are reflected in certain deficiencies which had an impact on supply chain performance. According to research conducted in 2005, the median time to market for a new product in consumer goods was 27.5 months, median days of supply on hand for manufacturers was 190 days, and the median order error rate for industrial electronic equipment suppliers was 26 percent (O'Marah 2005a, 8-13). Also, the traditional supply chain push strategy caused organizations to lose competitive pricing and the ability to leverage skill sets (Santhanam 2008, 19-20).

The traditional supply chain faced problems with variability, visibility, velocity, and gave little support to product innovation (O'Marah 2005b, 30-36; Santhanam 2008,

19-20). Variability can happen in demand and supply. The gaps between supply and demand would often lead to shortages or waste of finished products. Poor communication and inaccurate forecasts resonates all along the supply chain and results in the bullwhip effect (Wisner, Tan and Leong 2012). The bullwhip effect occurs when there is a lack of information, inaccurate demand data or forecasts that comes from the end customer that ripples back upstream through the supply chain and magnifies demand variability (Russell and Taylor III 2014, 422-450). The bullwhip effect causes stockouts, lost sales, high costs of inventory and obsolescence, material shortages, poor responsiveness to market dynamics, and poor profitability (Wisner, Tan and Leong 2011). There was a lack of visibility or transparency across the supply chain into data. Because of the lack of technology and infrastructure, businesses had difficulty communicating across the supply chain and information was not shared as quickly as desired. Also, product innovation was not supported. Businesses had a "black box" approach to R&D that assumed that new products would go through the same chain as existing products which lead to waste and error prone product launches (O'Marah 2005b, 30-36). The lack of support for product innovation resulted in 75 percent new product failure rate globally (O'Marah 2005a, 8-13).

3.3 Time for Change

Over the years, many organizations have implemented different methodologies such as Kaizen, Total Quality Management (TQM) and Six Sigma, where the emphasis was on local optimization, product quality improvement and minimizing waste (Santhanam 2008, 19-20). Although many of these approaches are still in use today, they are methodologies that focus on the inside of the organization and not externally. Other

methodologies that have transformed the supply chain include: inventory management, Just-in-time, Material Requirements Planning (MRP), Business Process Re-engineering (BPR) and many more (Wisner, Tan and Leong 2012). Table 3-1 defines the previously mentioned methodologies.

Towards the last quarter of the 20th century, organizations began to see the need for transforming the supply chain. In 1990s, supply chain professionals were beginning to write about the need to make supply meet demand. The phenomenon of growing global competition, shorter life cycles, and faster production development that led to the growth in variety of products made it difficult for organizations to predict which products would sell successfully in the market. Inaccurate forecasts became an increasing concern. Quick response programs like JIT and MRP, and other like tools were not efficient in solving the problems faced (Fisher, et al. 1994, 83-93). The most significant transformation in the beginning of the 21st century has been shifting towards the demand side and focusing on demand creation. Wal-Mart and Toyota were among the first organizations to engage in the creation of "boundary-less" organizations and the development of new technologies that manage processes for low cost, speed, flexibility and customer service operations (Hastings and Sapersteing 2010, 21-26).

Moreover, with the emergence of information technologies as the Internet in 1995, connectivity, parallel processing, and wireless messaging has become the 21st century's successor to the 20th century supply chain (O'Marah 2005a, 8-13). Because of an ever changing and complex business environment, organizations have felt the pressure to optimize their supply chains and technologies to improve performance. Organizations today are still focused on supply but have now realized the need to include the end-to end

processes from customer to supplier to become successful (Barrett 2007, 14-19). Organizations have and are continuing to transition to an outside-in approach that maximizes customer value.

Table 3-1. Supply Chain Management Methodology Definitions

Keyword	Definition	Some Sources
Kaizen	The Japanese philosophy of continuous improvement practices to improve efficiency and quality that includes business processes and personal efficiency involving executives to the lowest level workers.	(Business Dictionary 2014)
Inventory Management	The management and controlling of the ordering, storage and use of components that an organization will use when producing products and the management of controlling of quantities of finished products for sale.	(Jacobs and Chase 2013)
Just-In-Time (JIT)	An approach of sequencing the arrival of material to a work center just prior to consumption to avoid large work-in-process inventories.	(Jacobs and Chase 2013)
Material Requirements Planning (MRP)	A production planning and inventory control system that is used to manage manufacturing processes.	(Jacobs and Chase 2013)
Business Process Reengineering (BPR)	Process to reduce waste and increase performance.	(Wisner, Tan and Leong 2012).
Six Sigma	Techniques and tools that seek to improve the quality of process outputs by identifying and removing the causes of defects and minimizing variability.	(Jacobs and Chase 2013)
Total Quality Management (TQM)	Management approach to long–term success through customer satisfaction. All members of an organization participate in improving processes, products, services, and the culture.	(American Society for Quality 2014)

4. DEMAND DRIVEN VALUE NETWORK

4.1 Push to Pull

The traditional supply chain was focused on activities and processes associated with material management and logistics that converted raw materials into manufactured products (Russell and Taylor III 2014, 422-450). Traditionally, the supply chain was push driven – plan, source, make, and deliver. The end customer was not taken into consideration. The traditional push driven supply chain has transitioned to a pull driven supply chain which is known as Demand Driven Value Network.

The key to performance excellence today is a demand driven value network (Stewart 2012, 80-81). The globalization of the supply chain requires organizations to understand the implications of factors that impact performance, such as: how to become more demand driven, understanding how the supply chain creates and delivers products and services, how to mitigate risk, and how the demand of customers will be met. Demand-driven value network (DDVN) is a system designed to maximize value and optimize risk across the set of extended supply chain processes and technologies that sense and orchestrate demand based on a near-zero-latency demand signal across multiple networks of corporate stakeholders and trading partners (Gartner Inc. 2013). Both SCM and DDVN have a relatively same meaning and are frequently used interchangeably. Supply Chain Management (SCM) is an integrated group of business processes and activities with the common goal of providing customer satisfaction (Russell and Taylor III 2014, 422-450). The objective of the supply chain is to increase or add value to any part of the supply chain. The modern supply chain is thought to be more of a value chain and also has the goal of maximizing value to the end customer.

For many years, AMR Research has been researching and reporting on a relatively new topic in the supply chain known the demand driven supply network (Friscia, Hofman and O'Marah 2007). In 2003, the concept of demand driven supply network (DDSN) was introduced by AMR Research (Barrett 2007, 14-19). DDSN is defined as a system of integrated technologies and processes that "senses and reacts to real-time signals across a network of customers, suppliers, and employees" (Asgekar 2004, 15-16). The term DDSN is also referenced with different names such as Demand Driven Supply Chain (DDSC) and the term currently used today, Demand Driven Value Network. In 2009, Gartner acquired AMR Research and has continued to research and report on the topic (Payne 2010). Many articles were used for this research that referred to the name differently, DDVN and DDSN will be the terms used interchangeable throughout as to avoid confusion. While the term has been refined over time, the basic definition among the terms remains constant. Table 4-2 defines the different concepts that share the common goal of delivering value to the end user. Value for the end user means offering good quality product or service, at a fair price, and delivering the product fast and accurately (Russell and Taylor III 2014, 422-450).

Table 4-2. Demand Driven Definitions

Concept	Definition	Source
Demand Driven Value Network (DDVN)	A business environment entirely designed to maximize value of and optimize risk across the set of extended supply chain processes and technologies that senses and orchestrates demand based on a near-zero-latency demand signal across multiple networks of corporate stakeholders and trading partners.	(Gartner,Inc. 2013)
Demand Driven Supply Network (DDSN)	A system of technologies, processes, and organization that senses and responds to zero latency demand signals across a value driven network of customers, suppliers, and employees.	(Barrett 2007, 14-19)
Demand Driven Supply Chains (DDSC)	A multi-tier supply network that eliminates information latency and unnecessary touch point that reduces operating costs and improves profitability and customer service.	(KPMG International 2013)
Supply Chain Management (SCM)	The management of the flow of information through the supply chain in order to attain the level of synchronization that will make it more responsive to customer needs while lowering costs.	(Russell and Taylor III 2014, 422-450)

4.2 Importance of being Demand-Driven

The DDVN focuses on consumer needs with a more important and visible corporate presence that includes functions such as customer management, new product development and launch (NPDL), post-sales support and change management. The ultimate goal of DDVN is to deliver maximum value to the end user (Russell and Taylor III 2014, 422-450; Temponi 2012; Temponi and Fernando 2012). It is valuable to any organization to have the ability to sense, translate, and shape actual demand into operations plans, processes, technologies and external partners into a relationship-based structure organized from minimum waste and optimized working capital (Barrett 2007, 14-19).

Some goals sought to be accomplished by a DDVN include preventing shortages, reducing inventory investment, and reducing supply side lead times (Despres 2006).

DDVN aligns planning, procurement, and replenishment processes to actual consumer demand and consumption (KPMG International 2013). This network allows for organizations to improve their operational excellence as well as innovation excellence (Temponi 2012). By having a common shared platform throughout the entire organization, information can be synchronized across partner tiers that will provide real-time visibility of total demand, supply, and capacity information (KPMG International 2013). Organizations that face inaccurate forecasts incur higher costs for errors made. Transforming the traditional supply chain into an integrated multi-tier supply network, DDVN, will eliminate information latency and unnecessary touch points, thus reducing operating costs and improving customer service and profitability (KPMG International 2013). An AMR Research study conducted in 2004, found that companies in the US manufacturing industry that had transformed their supply chains to become more demand driven a $488 million increase in operating margins (Friscia 2005, 15-16).

4.3 The DDVN Model

The traditional supply chain, focused on the supply side of business, but now the supply chain includes the end-to-end processes from the customer to the supplier (Barrett 2007, 14-19). A demand driven value network is considered to be a global supply chain that is organized by three overlapping responsibilities (Russell and Taylor III 2014, 422-450). The DDVN model, illustrated in Figure 4.2, focuses on three overlapping areas of business; supply management, demand management, and product management (Friscia, Hofman and O'Marah 2007). Demand management is a set of activities that shapes, senses, and responds to consumer demand. This process includes functions in marketing, sales, demand planning, price management, and service (O'Marah 2005a, 8-13). Supply

management includes manufacturing, logistics, and supply planning and sourcing (Russell and Taylor III 2014, 422-450). Product innovation was not a focus of the traditional supply chain. Product innovation is the main source of new profits and growth of a company. Product management proactively manages product life cycles, engineering, research and development (R&D), and product development (O'Marah 2005a, 8-13). When the three areas work together, are visible to each other, and communicate, the organization can manage demand instead of just responding to it. The organization can also sense, shape, and respond quickly and profitability to market or customer demand, and furthermore has the ability to embed innovation in operations, instead of keeping it isolated in a laboratory (Aronow, Burkett, et al. 2014). The DDVN model is curricular and self-renewing as opposed to the traditional supply chain linear model (Friscia, Hofman and O'Marah 2007). The goal of this integrated vision of supply chain are operational and innovation excellence (Russell and Taylor III 2014, 422-450).

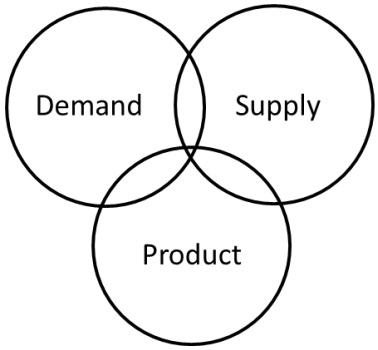

Figure 4.2. DDVN Model (adapted from O'Marah 2005b)

4.3 Metrics for Operational and Innovation Excellence

The DDVN model is formed of integrated business planning and business improvement activities that are linked to a demand driven strategic performance action plan (Stewart 2012, 80-81). DDVN allows for improvements in operational efficiency, it streamlines innovative product development, and maximizes profit margins (Asgekar 2004, 15-16).Organizations need to do more with less. DDVN helps with lowering inventory, delivering more perfect orders, shortening cash-to cycle time, and allows for higher revenue and profit margins (Barrett 2007, 14-19).

Demand-Driven Excellence is measured by two dimension metrics; operational excellence and innovative excellence (Aronow, Hofman and Nilles 2013). Operational excellence occurs when products are delivered to customers as promised and reducing costs (Russell and Taylor III 2014, 422-450). Operational excellence pushes productivity. Operational excellence can only be achieved if an organization is making what the customer wants. To make what the customer wants; innovation needs to be taken into account (Stewart 2012, 80-81). Operational excellence is measured by two metrics. First, is perfect order rates, a customer service metric that measures to see if orders were received at the right time, right place, right quantity, and right price (O'Marah 2005b, 30-36). Delivery performance and cycle time's aids with on-time performance fill rate, lead times, and supply chain cycle time, and return rate. Also covered is inventory and cash management which looks at cash to cash cycles and inventory days of supply (Stewart 2012, 80-81). The second metric is total supply chain costs. This metric covers order management and material acquisitions systems which pertains to rent and utility efforts,

inventory, shrinkage, finance, planning and information technology initiatives (Stewart 2012, 80-81).

Innovation excellence is measured by two metrics as well, time to value and return on new product development and launch (NPDL) (Stewart 2012, 80-81). NPDL means staying ahead of the design side as well as having the ability to quickly respond to demand changes at either the beginning or the end of the product life cycle. Organizations that have effective NPDL execution will have the distinct advantage of getting to the market first and building a larger market share, which in turn results in profitability (Woodward 2014). Table 5-3 defines the performance metrics in greater detail. It is important to find the right balance between the dimensions. Too much emphasis on one performance metric at the expense of the other could hurt innovation and slow growth (Aronow, Hofman and Nilles 2013).

Table 5-3. Metrics for Operational and Innovation Excellence

Performance Dimension	Performance Metric	Definition
Operational Excellence	Perfect Order rate	The average percentage of orders among supply chain members that arrive on time, complete and without damage (Wisner, Tan and Leong 2012).
	Total Supply Chain Costs	The costs to process orders, purchase materials, purchase energy, comply with environmental regulations, manage inventories and returns and supply chain finance, planning and information systems (Wisner, Tan and Leong 2012).
Innovation Excellence	Time to Value	The period of time between an order for a product/service and the initial delivery of product/service requested (Aronow, Hofman and Nilles 2013)
	Return on New Product Development and Launch (NPDL)	The period of time to develop and manage a product (Aronow, Burkett, et al. 2014)

4.4 Supply Chain Leaders

The most advanced and leading supply chain companies are those that are always looking for ways to innovate the design of their supply networks (Temponi 2011). Many organizations have transitioned into vertical integration where leaders are collaborating with their customers and suppliers in an attempt to dominate their value chains and outperform the competition (Aronow, Burkett, et al. 2014). A few of the top 25 supply chain leaders reported by Gartner in 2014 include Apple, McDonald's, Amazon, Unilever, P&G, the Coca Cola Co, Walmart, and Starbucks. Ranked No.1 on the Gartner list of the best supply chains in 2014, for a record breaking seven years, Apple has been the leader in product innovation and customer satisfaction (Aronow, Burkett, et al. 2014). Apple is a great example of an organization that has tailored its business strategies around product innovation, integration and collaboration, and most importantly, the customer. Apple's supply chain has centered itself around orchestrating the delivery of "winning customer solutions" as well as creating transparency throughout manufacturing partners and suppliers (Aronow, Hofman and Nilles 2013). Another renowned supply chain leader is McDonald's. McDonald's, ranked No. 2, is known for its "excellence in execution consistency", strong customer experience, advanced demand sensing and forecasting capabilities around the world, and also has an extraordinary supplier collaboration framework.

Although not all twenty five companies are mentioned, they are considered leaders because of how they have illuminated the path to demand driven excellence, stimulated growth and success as well as driven innovation. Supply chain leaders have thought about the design of their global supply networks. The redesign of supply

networks, in some cases, has led to the increase in vertical integration of leaders, involving themselves with their customers' and suppliers' in order to dominate value chains (Aronow, Burkett, et al. 2014). To become a leader and become more productive, efficient, and overall more successful, organizations must make the transition to a DDVN.

5. TRANSITIONING TO A DEMAND DRIVEN VALUE NETWORK

To survive in today's volatile business environment, organizations are transforming traditional supply chains to outside-in demand-driven value networks that focus on creating customer value (Barrett 2007, 14-19). The transformation to a DDVN has been difficult for several companies, as have most supply chain project implementations have been. Each industry and organization faces different challenges while going through the transformation. In the past, there had been a lack of collaboration from outside and inside the organization. Today, companies are moving toward more collaborative relationships between all partners to attain operational and innovation excellence.

5.1 Starting from Within

Companies around the world operate under different environments, cultures, constraints, processes, and people. This means that the way or processes used to transform an organizations' supply chain most likely varies. What does remain constant is that changing tradition requires transformation from within the organization (Barrett 2007, 14-19). This may be the biggest challenge organizations confront when initiating the transition. To transform from an inwardly oriented and isolated traditional supply chain to an internally integrated and externally aware DDVN means having effective leadership and superior relationship management within the organization and with external partners (Dominy 2014). Transforming the supply chain means significantly enhancing the supply chain organization and capabilities that enterprises need when attempting to transition from internally push driven focused to a DDVN (Dominy 2014). Leaders need tools, frameworks, and advice on how to transform the supply chain.

Challenges faced while transforming the supply chain include: leadership change, metrics and measurement strategy, enterprise architecture planning, IT realization, value chain organization, collaboration, and talent development (Barrett 2007, 14-19). Before initiating any changes organizations must self-assess to discern its strengths and gaps, and also to define improvement strategies (Mendes 2011, 18-23). Supply Chain leaders must use a strategic portfolio of prioritized projects to drive supply chain capabilities to the outside-in DDVN. The business projects can include organizational design, business processes, performance management and metrics, and technology components that evolve the culture of the organization to value-driven maturity by changing behaviors and capabilities (Barrett 2007, 14-19). Becoming demand driven begins with having a clear understanding of the customer, market, business goals, performance metrics, and product priorities (Barrett 2007, 14-19). Aligning supply chain strategy with business strategy is a push in transforming from the traditional supply chain that allows the supply chain to be agile and responsive to support profitable growth (Burkett, et al. 2011). The supply chain should be segmented to determine what channels and customers are and are not profitable. Because customers now decide when they have a need and when they are ready to listen to information or receive a service, organizations must restructure themselves to anticipate and respond to those needs (Hastings and Sapersteing 2010, 21-26)

Leaders must also identify and introduce skills, talent and innovations necessary to reach highly performance (Dominy 2014). The processes integrated in a DDVN create demand signals that help share communication among all partners. Collaboration internally and externally is very important in creating a successful value chain. According

to challenges still faced by SC leaders in 2014, many organizations are still struggling to orchestrate a profitable response to demand. Many organizations still operate in silos. This continues to be a challenge because silos set their own goals and they sometimes do not match with the organizations goals. This can result in a sub-optimized end-to-end supply chain.

A demand driven supply network is not build overnight. Executives must show discipline and patience while leading the organization across multiple stages of maturity. There is a common understanding across industries that it is valuable to any business to have the ability to sense and translate actual demand into operations plans, processes, and external partner relationships to minimize waste and optimize working capital (Barrett 2007, 14-19).

5.2 Proposed DDVN Maturity Framework

Before embarking on any transformation, supply chain leaders must evaluate their organizations' readiness to start transforming their supply chain. An organization goes through several stages of maturity as it goes throughout its journey of transforming its supply chain. Originally developed and researched by AMR Research, Gartner has continued to expand on the DDVN maturity model (Payne 2010). The maturity model defines the maturity of an organization's supply network in terms of information and process (O'Marah 2005a, 8-13). The DDVN maturity framework has four stages: react, anticipate, collaborate, and orchestrate. The framework looks at a mix of business processes, technology, innovation, organization and leadership, culture, vision, response model talent, metrics, and risk (Barrett 2007, 14-19; Payne 2010). In stage 1, reacting, a company is in the first step to developing basic supply chain capabilities and is still a

traditional supply chain where integration barely occurs (Payne 2010). Stage 2, anticipate, at this stage, the organization is becoming more internally integrating, and is beginning to align supply and demand (O'Marah 2005a, 8-13). At stage 3, the organization has matured to have a demand driven supply network with strong collaborations internally and externally (Payne 2010). In stage 4, orchestrate, the organization has achieved a DDVN successfully. The organization focuses on value creation across the entire supply chain and incorporates operational excellence and innovation excellence (Payne 2010). By orchestrating demand at the mature stage, it allows organizations' to effectively balance growth and efficiency, costs, customer service, agility, and demand variability while reducing costs. Figure 3 describes each stage in greater detail.

According to Gartner's most recent research, despite all the advancements in SCM in the last decades, research shows that 65% of organizations are still in Stage 1, react, or Stage 2 anticipate of the DDVN maturity model (Hofman 2014)Organizations are still operating in silos. Silos set personal goals that often work against each other; this in turn leads to an inefficient supply chain. Every organization is different, transforming the supply chain involves assessing what the customer wants, and then satisfying those want by adjusting the organization in the capabilities of the supply chain (Chakravarty 2014). For organizations to transform successfully it is required to restructure relationships with suppliers and customers, eliminate barriers, access new technology and its implementation, and have a customer driven mindset (Chakravarty 2014).

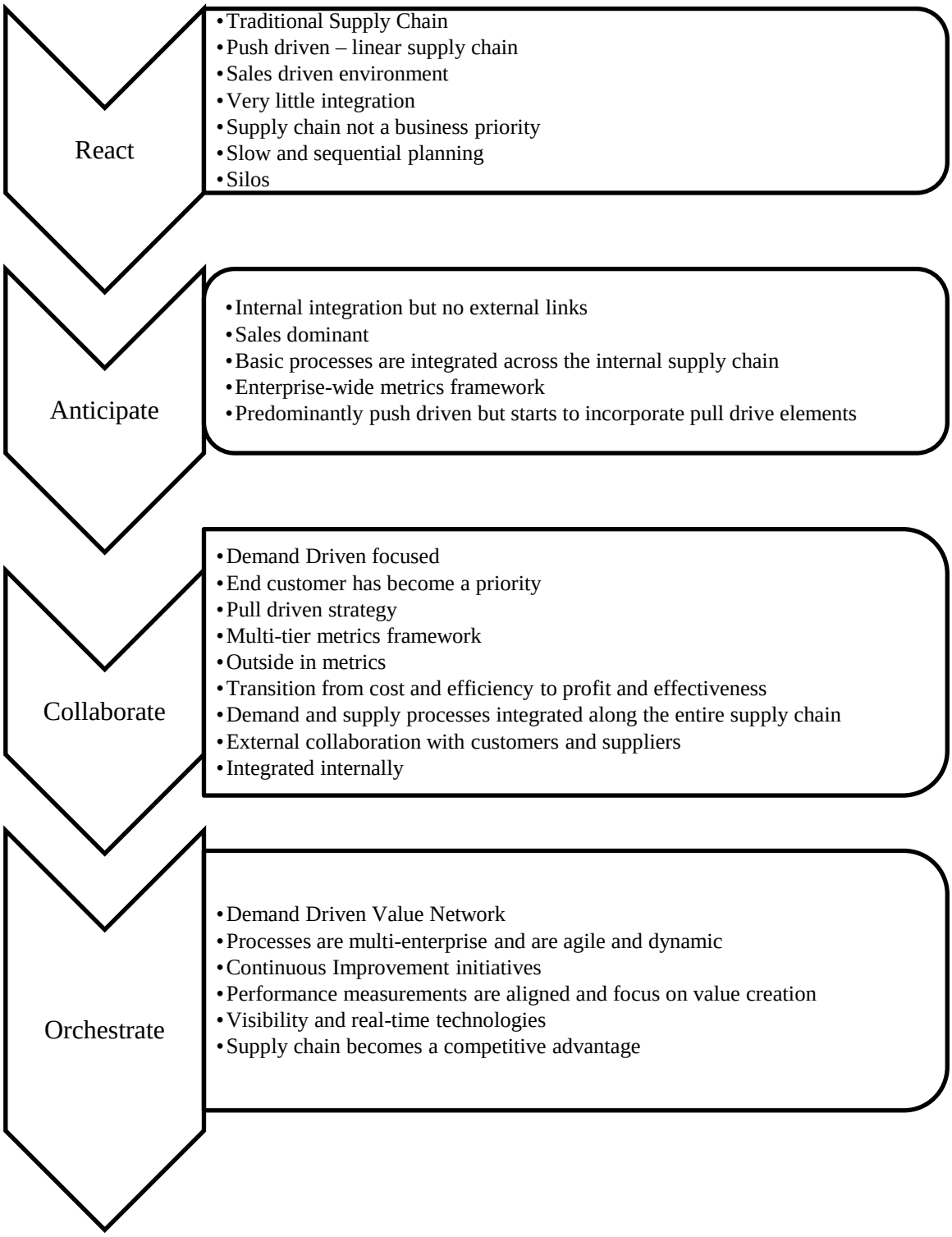

Figure 5.3. DDVN Maturity Model (adapted from Payne 2010)

6. IMPLEMENTING CHANGE: THE IMPORTANCE OF INFORMATION TECHNOLOGY

Traditional supply chains communicated with their partners via phone, fax, and e-mail. Trading partners used spreadsheets and manual reports. These processes were slow and could no longer support today's demand driven companies (Despres 2006). Supply chain managers focused more on reacting to daily problems instead of being proactive. It was difficult for organizations to make strategic relationships with suppliers and partners and deploy improved business processes that eliminated inefficiencies (Despres 2006). One of the most prevalent challenges encountered by today's supply chains is matching the speed with which trends and technologies emerge (Woodward 2014).

As organizations transform their supply chains towards becoming demand driven, there are technologies that are required to support the processes and best practices needed at each stage of maturity (Payne 2010). Information technology (IT) is critical to transforming into and sustaining a DDVN. Information is the most important link between every partner in the supply chain along with the supply chain processes. IT allows for real-time communication among every member. Managing an end-to-end supply chain is not possible without the aid of IT to enable it. Technologies that facilitate the efficient flow of products and services are referred to as "enablers", and IT has become the most important enabler of the modern supply chain (Russell and Taylor III 2014, 422-450). The collaboration between IT and business operations are imperative to maximizing return (Sherman 2012). Supply chain technology applications are needed to support business strategies that align supply with demand. This ensures that products and services are delivered to the correct location, at the right time, and at the right cost (McNeill 2014). Investing in technology is a critical success factor in becoming a leader.

The cost of lagging is much greater than the cost of piloting new technologies. Adopting new technologies to support best practices at a faster rate than competitors most likely translates into lower costs, expanded margins, increase revenue, and competitive leverage in the market (Sherman 2012).

6.1 Information Technology

Information technology is computer science and communication technology to design, develop, install and implement information systems and application software (Yuan and Jiang 2014, 6727-6730). To fully understand the importance of IT in a DDVN, an organization must understand the premise of a demand driven value network. DDVN is a system of technologies and processes that sense and reacts to real-time demand across a network of employees, suppliers and customers (O'Marah 2005b, 30-36). As previously mentioned, technologies are needed to enable the efficient flow of products and services throughout the supply chain. To transform from a traditional supply chain and sustain a successful DDVN, every aspect of the supply chain must be linked together. Advances in technology have allowed for this to happen. More specifically, advances in IT have been the most important enabler of effective supply chain management (Russell and Taylor III 2014, 422-450). A demand driven network also needs a system architecture that can scale without compromising flexibility. The systems needed should comprise technology that incorporates applications and databases with business-processes (O'Marah 2005b, 30-36).

Current research has viewed SCM as a “digitally enabled inter-firm process capability” (Dong, Xin Xu and Zhu 2009, 18-32). “Digitally enabled” refers to the integration of an organizations’ processes through the use of IT on an Internet platform,

with the integration spanning thought the entire supply chain, both up and downstream (Dong, Xin Xu and Zhu 2009, 18-32). Information is the biggest link between all aspects of the supply chain. The "digitally enabled" supply chain differs from the traditionally supply chain in that supply chain partners are integrated via "information flows" rather than ownership. Also, coordination of the supply chain also differs in that the traditional supply chain relied on linkages of physical processes such as shipment, inventory, and warehousing (Dong, Xin Xu and Zhu 2009, 18-32).

IT enables different areas of supply chain management including: strategic planning, virtual enterprise, e-commerce, infrastructure, knowledge and IT management and also aid with implementation (Prajago and Sohal 2013, 1532-1554)The strategic investment in information technology and IT innovation enables organizations to move forward on their supply chain transformation journey (Sherman 2012). IT investments must be aligned with strategic corporate and business goals. Furthermore, IT advancements must be accompanied by IT alignment before supply chain capabilities can perform as effective resources. In forming IT alignment, organizations must integrate both internally-focused and externally-focused supply chain technologies (Prajago and Sohal 2013, 1532-1554). The implementation of these technologies requires the assistance of competent supply chain professionals.

6. 2 Integration

IT is the fundamental element in achieving supply chain integration trough information sharing and the adoption of new technologies to develop a successful network (Russell and Taylor III 2014, 422-450). Supply chain integration is accomplished by collaboration from inside and outside the organization. Real-time

business networks allow for companies to connect, discover, and collaborate with tier trading partners and resources to operate in today's dynamic world (Moody 2015).

The DDVN is about maximizing value, sensing and orchestrating demand based on a near-zero-latency demand signal across multiple networks of corporate stakeholders and trading partners (Gartner, Inc. 2013). Integration and integrated processes is the core of the DDVN. Processes and technologies must be capable of generating a credible demand signal, sharing that signal across partners, and coordinating work flows and activities among all partners (Asgekar 2004, 15-16). Integration is vital to transform from a vertical network toward core competence based networks. For such networks to be successful, communication must be prevalent and reliable (O'Marah 2005b, 30-36). The supply chain must be managed with a highly integrated supply network where all tiers of partners have visibility to the different changes in end customer demand and all movements of materials and inventory decisions are driven by demand signals close to the consumer that is able to capture actual consumption and changes in demand (KPMG International 2013).

6.3 Information Sharing

Globalization has presented many opportunities for companies to expand around the world. With partners on opposite sides of the globe, companies need a way to communicate with their partners. Supply chain management focuses on managing and integrating the flow of information goods and services through the supply chain to be able to lower costs while responding to customer needs (Russell and Taylor III 2014, 422-450). Collaboration, cooperation, and communication among all partners are needed to be effective.

The biggest problems the traditional supply chain encountered were a lack of transparency throughout the supply chain and the ability to sense and respond to demand. Inaccurate demand information or lack of information that moved through the supply chain, i.e. the bullwhip effect, was also an issue. The distorted information rippled upstream through the supply chain and magnified demand variability at each stage of the supply chain (Russell and Taylor III 2014, 422-450). It is important to have real-time visibility of demand and also have the ability to shape demand by capturing, cleansing, harmonizing, and mining demand signals with speed and intelligence (Thalbauer 2014). IT has allowed for such advancements to be possible in today's volatile business environment.

DDVN leaders have discovered the importance of building a system across their network to share information about both demand and supply. Information is an important supply chain driver that functions as the glue that allows other supply chain drivers to work together towards the common goal of creating an integrated supply chain (Chopra and Meindl 2013). An organization cannot "beam" a product into the hands of consumers, but can "beam" information about consumer demand and the product as it goes from point of origin to its destination (Sherman 2012).

6.4 Technologies

With the use of new technologies, companies can improve quality, increase processing speed, facilitate real time execution, support visibility, improve coordination and real time decision making, and can create new capabilities through remote control (Chakravarty 2014). As technologies are updated and new ones are introduced, the supply chain structure must be aligned with support initiatives (Russell and Taylor III 2014, 422-

450). In 2014, according to a CEO survey conducted by Gartner, it showed that out of a list of investment priorities, IT was the first and biggest priority before others like R&D capabilities and innovation (Da Rold and Karamouzis 2014). No technology has had a greater impact on business and supply chains than the Internet has. Through the Internet organizations have the ability to communicate with their partners, supply chains, and customers around the world in real time (Russell and Taylor III 2014, 422-450). The Internet helps transform supply chains from the traditional linear supply chain to a network. There are several technologies that can make a significant impact on supply chain performance by aiding with collaboration and integration. These technologies include ERP systems, cloud computing technology, Web 2.0 and Internet of Things (IoT) (Chakravarty 2014). The convergence of emerging technologies will lead to new applications for SC visibility, integration, and execution results in a "smart supply network" (Sherman 2012).

6.4.1. ERP Systems

Organizations for many years have invested in SCM software solutions like enterprise resource planning (ERP) systems. An ERP system stores information and manages processes from each area of the organization by implementing a structure in which strategy, processes, and the organization are closely aligned (Stanciu and Tinca 2013, 626-649). An ERP system enables the integration of all the parts of the organization, including integration of customer demand with the organization and resources of suppliers, and supply chain processes, by sharing information and data with all of the supply chain partners (Russell and Taylor III 2014, 422-450). ERP systems have key features such as integration, systematic, flexibility, and real-time controllable

(Yuan and Jiang 2014, 6727-6730). ERP providers include systems like SAP, ORACLE, SSA Global, and many more that focus on integrating supply network operations (O'Marah 2005a, 8-13). ERP systems promote a "deeper connotation change" of the organization, design the optimization and configuration of the organizational structure, core business processes and also established the integration of logistics, information flow, capital flow (Yuan and Jiang 2014, 6727-6730). The internet has allowed for applications to become more accessible. The ERP market continues to grow due to its proven performance benefits. ERP systems used to be thought of as just for big and complex companies, but new applications from ERP systems have emerged. ERP applications in the "cloud" have become more viable for smaller and medium sized organizations who seek to control IT costs (Stanciu and Tinca 2013, 626-649).

Although ERP systems have many benefits and contributes value to the organization, it also has many disadvantages. Implementation projects of ERP systems are complex, demanding, expensive, time consuming, and risky (Stanciu and Tinca 2013, 626-649). ERP systems can be adapted to every organization, because of this, the changes and lack of competent professionals leads employees to slowly and inefficiently. According to related statistics, the ERP implementation success rate is only of 10% to 20% (Yuan and Jiang 2014, 6727-6730). A survey conducted in 2011, revealed that 61.1 % of ERP projects took longer than expected; ERP implementation on average takes around 1 to 3 years, and 74.1 % of project costs exceeded budget (Stanciu and Tinca 2013, 626-649). Many of the issues faced by the traditional ERP systems have been resolved by cloud computing.

6.4.2. Cloud Computing Technology

Cloud computing technology provides a shared platform where organizations can be interconnected on-demand through information exchange on configurable computing resources (e.g., networks, servers, storage, applications, and services) (Chakravarty 2014) (Dubey and Rawat 2014, 74-78). Cloud technology has emerged over the past decade and the adoption of this SCM solution has increased steadily, with a 40% increase in 2013 alone (Hofman and Tohamy 2014). Cloud based technology has become more affordable which has resulted in wider technology adoption. With cloud computing, an organization can rent space in a supercomputer only for the time needed (Sherman 2012). With the cloud, organizations have the ability to enhance collaboration, agility, scalability, availability, ability to adapt to variations associated with demand, accelerate development, and also provides the potential for cost reduction through optimized and efficient computing (Dubey and Rawat 2014, 74-78). In 2013 alone, cloud technology solutions increased 40% (Hofman and Tohamy 2014).

6.4.3. Internet of Things (IoT)

With the declining cost of technology by the continuing expansion of the Internet, there has been a stable increase in the "intelligence" of different types of digital devices that contribute toward growing data (Prentice 2011). As physical objects and an increase need for connectivity through the Internet, the Internet of Things was created. The Internet of Things (IoT) allows for organizations to monitor performance across the value chain and in the field at customer sites. Also, IoT allows connecting and analyzing the big data that is generated as a part of upstream manufacturing and logistic flows (Aronow, Burkett, et al. 2014). The application IoT in the organization has the ability to

enhance visibility of the supply chain, improve management of information transparency across the supply chain, improve resource utilization, reduce operating costs, improve ability to respond to the market demands, and meeting the customer's individual requirements (Liu and Gong 2014, 4118-4121)Technologies applied in the supply chain include RFID, data base technology, electronic code technology, and global positioning system (GPS) technologies that are integrated into ERP systems (Liu and Gong 2014, 4118-4121). Radio frequency identification (RFID) has been known to be a key enabler of the pull-based demand driven networks (Zeier, et al. 2009, 57-74). RFID helps with the collection of product information and keeping it updated throughout its life-cycle (Chakravarty 2014). Walmart was one of the first to use RFID technology. RFID has many benefits including: Tracking pallets annually will reduce distribution costs, the labor to scan bar codes on pallets and cases is eliminated, RFID provides inventory visibility which enables a 20% reduction in inventory levels, and savings of over $8 billion per year are projected (Russell and Taylor III 2014, 422-450).

6.4.4. Web Technology 2.0

Web 2.0 is a social web, where people connect with others to share information (Chakravarty 2014). It comprises a variety of new tools for enabling collaboration among different individuals and groups. Tools that are used are familiar to Internet users. They include blogs, wikis, podcast, RSS feeds, social networking sites like Facebook and LinkedIn, forums, multimedia sharing services, social tagging and bookmarking, text messaging, and instant messaging (Chakravarty 2014; Reese 2008, 20-22). The key features of Web 2.0 technologies are sharing, collaboration, interactivity and agility (Consoli 2012, 37-49). Web 2.0 can foster collaboration and communication with

customer, suppliers, and partners as well as internal collaboration with employees through training, dialogue, and knowledge management (Chakravarty 2014). The information gathered helps organization to develop next generation products.

7. DISCUSSION OF FINDINGS

The purpose of this chapter is to discuss the findings that support the stated objectives in Chapter 2. Each objective will be analyzed for how well it is supported according to the findings. The following table lists the research questions stated in Chapter 2 that will be analyzed.

Table 7-4. Research Questions

Q1	What challenges affected the traditional supply chain that led to its need for transformation?
Q2	Does transforming the traditional supply chain into the new supply chain model translate into success in today's uncertain business environment?
Q3	What is the role of information technology in a Demand Driven Value Network?

7.1 Question 1

What challenges affected the traditional supply chain that led to its need for transformation?

The 20th century was the age of mass production. Traditionally the supply chain was factory centered and push driven. The prominent business strategy was an inside-out view. Collaboration with partners and customers outside the organization were not a priority for making everyday business decisions. In the early 1900s, Henry Ford was changing the world with the revolutionary development of the assembly line. He was a legend of production efficiency, "rubber, glass, and iron went in one end, and cars came out the other" (O'Marah 2005b, 30-36). With the success of the assembly line, Ford was able to reduce task cycle times for assemblers by almost 99.6 percent, reduce assembly cycle time by 88 percent, and increase production by 160 percent in the first half of the 20th century (O'Marah 2005a, 8-13).

Although the Ford Motor Company was very successful, the products that were offered at the time were all the same. Consumers could purchase a vehicle "Any color you want, as long as it's black." (O'Marah 2005b, 30-36).Traditionally, the supply chain was driven internally, by manufacturers and producers "driving products to market" (Argaez 2014). The push driven strategy pushed products downstream to the end customers without feedback from what consumers actually wanted or needed. Consumer opinions were not important to businesses at the time which hurt their bottom line or worse, their existence.

The challenges the traditional supply chain encountered, discussed in Chapter 3, led to the need for supply chain transformation. The traditional supply chain (push model) was linear in its approach; Figure 3.1 illustrates a linear supply chain showing how products were pushed down to the consumer. Challenges encountered by the traditional supply chain included variability, visibility, velocity, and lack of product innovation and communication with the consumer. Due to the push strategy, problems with variability would cause gaps between supply and demand that would cause shortages or waste of finished products. The supply chain accepted demand from the business in front of them. The lack of transparency did not allow for organizations to gage what true market demand for products actually was. To reduce inventory investments in order to maintain downstream momentum, upstream businesses would have to exert pressure downstream to place orders (Argaez 2014). In this type of business environment, demand was very hard to predict. The lack of transparency and poor communication resulted in the bullwhip effect which occurs when there is a shortage of information, inaccurate demand data or forecasts that comes from the end

customer and ripples back upstream through the supply chain and magnifies demand variability (Russell and Taylor III 2014, 422-450). The traditional supply chain also faced the problem of an absence of technology and infrastructure. Organizations had difficulty communicating across the supply chain. Information was also not shared as quickly as desired. The traditional organization did not make it a priority to support product innovation. Businesses had a "black box" approach to R&D that assumed that new products would go through the same chain as existing products which led to waste and error prone product launches (O'Marah 2005b, 30-36). The lack of support for product innovation resulted in 75 percent new product failure rate on a global scale (O'Marah 2005a, 8-13).

As listed and defined in Table 3-1, there are several methodologies that organizations have used to improve their supply chain performance. Some methodologies include Kaizen, TQM, and Six Sigma. These methodologies focus on the organization internally and not externally. Other methodologies include inventory management, JIT, MRP, and BPR. Due to the aforementioned challenges and issues, organizations and their supply chains have seen the need to change and transform into a more networked and integrated supply chain that focuses on customer needs.

7.2 Question 2

Does transforming the traditional supply chain into a Demand Driven Value Network translate into success in today's uncertain business environment?

The traditional supply chain focused mainly on pushing products downstream to consumers, assessing actual consumer needs was not a priority for organizations. Figure 3.1 illustrates the traditional linear supply chain that displays the push strategy of pushing products onto consumers. The traditional supply chain faced several problems with variability, visibility, velocity, and gave little support to product innovation (O'Marah 2005b, 30-36; Santhanam 2008, 19-20). Due to the challenges discussed in Question 1, organizations have found the need to transform their supply chains to improve overall performance. It is critical for organizations to have the ability to detect and interpret real customer demand to create operations plans, processes, and external partnerships in a relationship-based structure organized for minimum waste and optimized working capital (Barrett 2007, 14-19). To be successful in today's uncertain business environment organizations must transition their supply chains to a demand driven value network (DDVN). Being demand driven means focusing on consumer wants and needs. The customer holds the power to decide the success of a product or service. Communicating with every area of the organization inside and out is imperative to create efficiency. The key to performance excellence today is a demand driven value network (Stewart 2012, 80-81).

As previously mentioned in Chapter 4, the goal of a DDVN is to optimize risk across the set of extended supply chain processes and technologies that senses and orchestrates demand based on a near-zero-latency demand signal across multiple networks of corporate stakeholders and trading partners (Gartner, Inc. 2013). DDVN also

aids in preventing shortages, reducing inventory investment, and reducing supply side lead times (Despres 2006). DDVN aligns planning, procurement, and replenishment processes to actual consumer demand and consumption (KPMG International 2013). A DDVN is considered to be a global supply chain that is organized by three overlapping responsibilities: demand management, supply management, and product management (Russell and Taylor III 2014, 422-450). Figure 4.2, the DDVN model, illustrates the relationships within the network. When demand, supply, and product management are integrated and work together, customer demand can be managed, instead of just responded. The integration of the three areas allows for the organization to sense, shape, and respond faster to demand as well as have the ability to embed innovation in operations (Aronow, et al. 2014).

The globalization of the supply chain requires organizations to understand the implications of factors that impact performance, such as: how to become more demand driven, understanding how the supply chain creates and delivers products and services, how to mitigate risk, and how the demand of customers will be met. This network allows for organizations to improve their operational excellence as well as innovation excellence. Demand-Driven Excellence is measured by two dimension metrics; operational excellence and innovative excellence (Aronow, Burkett, et al. 2014). As defined in Table 4-3, operational excellence is by two metrics, perfect order rates and total supply chain costs. Perfect order rates are measured by delivering products and services as promised to customers. Total supply chain costs metrics keep costs under control. Operational excellence only has value if consumers actually want what is being created and shipped. To address this concern, innovation excellence measures time to

value and return on product development and launch (NPDL). NPDL translates into staying ahead of the design game as well as having the ability to respond to market demand as it changes at either end of the product life cycle.

Simply defining the importance of a DDVN does not describe the steps an organization must take to become successful in transitioning. Every organization is different; transforming the supply chain involves assessing what the customer wants, and then satisfying those wants by adjusting the organization in the capabilities of the supply chain (Chakravarty 2014). Aligning supply chain strategy and business strategy is the first move into the right direction. Top executives and supply chain leaders must take the responsibility in initiating this alignment. Some challenges encountered while transforming the supply chain may include: leadership change, metrics and measurement strategy, enterprise architecture planning, IT realization, value chain organization, collaboration, and talent development (Barrett 2007, 14-19). Before initiating any changes, organizations must self-assess to discern its strengths and gaps, and also to define improvement strategies (Mendes 2011, 18-23). SC leaders must prioritize projects to drive supply chain capabilities to the outside-in DDVN. Projects can include organizational design, business processes, performance management and metrics, and technology components that evolve the culture of the organization to value-driven maturity by changing behaviors and capabilities (Barrett 2007, 14-19).

A demand driven value network is not build overnight. Gartner has proposed a DDVN Maturity Model that defines the maturity of an organization's value network in terms of process, strategies, and information (O'Marah 2005a, 8-13). Refer to figure 5.3 to review the different stages of DDVN maturity. Executives must show discipline and

patience while leading the organization across multiple stages of maturity. There is a common understanding across industries that it is valuable to any business to have the ability to sense and translate actual demand into operations plans, processes, and external partner relationships to minimize waste and optimize working capital (Barrett 2007, 14-19).

Becoming a demand driven organization is not easy. Transformation takes people, time, and money. Just because an organization is using the tools and frameworks defined by the individual company, doesn't mean that they will be successful. Organizations need proactive leadership from all levels. According to a study conducted by Gartner, despite all the advancements in SCM in the last decades, research still shows that 65% of organizations are still in Stage 1, react, or Stage 2 anticipate of the DDVN maturity model (Hofman and Tohamy 2014). This means that organizations still operate in silos even as organizations are globalizing and entering new markets. Continuous improvement needs to play a bigger role in supply chains. Organizations must continue the journey along the maturity framework. Although the importance of transforming the supply chain has been mentioned, the answer to Question 2 does not address how organizations make it possible to integrate processes and relationships across a network.

7.3 Question 3

What is the role of information technology in a Demand Driven Value Network?

The importance of transitioning from a traditional supply chain to a demand drive value network has been defined in the previous questions. Now we will answer the question of how and what can facilitate the transformation of the supply chain. The answer to this question is using IT as the enabler. DDVN is a system of technologies and processes that senses and reacts to real-time demand across a network of employees, suppliers and customers (O'Marah 2005b, 30-36). IT is the enabler of the demand driven transformation. IT allows for the creation of the network and integration with the use of technology. As previously mentioned in Chapter 4, for any transformation to be successful within an organization the culture and the business strategy must first align with the business goals.

Many of the traditional supply chain's issues, mentioned in Chapter 3, have been resolved with advancements in IT. Problems encountered include a lack of visibility up the supply chain, sensing demand, and distorted information. The lack or distortion of information leads to inaccurate forecasts and magnified demand variability at each stage of the supply chain, also known as the bullwhip effect (Russell and Taylor III 2014, 422-450). Managing an end-to-end supply chain is not possible without the aid of IT to enable it. Real-time visibility of demand allows for the ability to shape demand by capturing, cleansing, harmonizing, and mining demand signals with speed and intelligence. Along with supply chain processes, information is the most important link between every partner. IT facilitates supply chain integration through information sharing and the adoption of new technologies (Russell and Taylor III 2014, 422-450). IT also

enables different areas of supply chain management including: strategic planning, virtual enterprise, e-commerce, infrastructure, knowledge and IT management, and implementation (Prajago and Sohal 2013, 1532-1554).

The Internet has had the greatest impact on business and supply chains. The Internet helps transform supply chains from the traditional linear supply chain to a network. Through the connectivity of the internet, organizations have the ability to communicate with their partners, supply chains, and customers around the world in real time (Russell and Taylor III 2014, 422-450). Several technologies reviewed in this research have been enablers for DDVN's. With the use of new technologies, organizations can improve quality, reduce costs, increase processing speed, facilitate real-time execution, support visibility, improve coordination and real-time decision making, and creates new capabilities through remote control (Chakravarty 2014).

The technologies reviewed in Chapter 6 include ERP systems, cloud computing technology, the Internet of Things (IoT), and Web 2.0. ERP systems facilitate the integration of all the parts of the organization, including integration of customer demand with the organization and resources of suppliers, as well as with supply chain processes, by sharing information and data with all of the supply chain partners (Russell and Taylor III 2014, 422-450). Although ERP systems have had much success, it has also had high failure rates during implementation. Cloud computing allows for supply chain integration, real-time monitoring, and agility to meet various demands at a lower cost. The application IoT enhances visibility of the supply chain, improves management of information transparency across the supply chain, improves resource utilization, reduces operating costs, improves ability to respond to the market demands, and meets customer

requirements (Liu and Gong 2014, 4118-4121). The IoT has and will have a profound impact on supply chain on the development of processes, models, and moments (Hofman 2014). Web 2.0 fosters collaboration and communication with customers, suppliers, and partners as well as internal collaboration with employees through training, dialogue, and knowledge management (Chakravarty 2014). The key features of Web 2.0 technologies are sharing, collaboration, interactivity and agility (Consoli 2012, 37-49)

Only a few of the many technological trends were reviewed in this research. Executives and supply chain leaders must research the different technological trends to choose the best application needed for the business to succeed and transition across the DDVN maturity framework. The implementation of these technologies requires the assistance of competent supply chain professionals. IT advancements must be accompanied by IT alignment before supply chain capabilities can perform as effective resources. Investing in technology is a key success factor in becoming a leader. The cost of lagging is much greater than the cost of piloting new technologies. Adopting new technologies to support best practices at a faster rate than competitors most likely translates into lower costs, expanded margins, increased revenue, and competitive leverage in the market (Sherman 2012). The strategic investment in IT and IT innovation enables organizations to move forward on their supply chain transformation journey (Sherman 2012).

8. CONCLUSION

To survive and grow in today's ever changing, dynamic, and unpredictable business environment, organizations must adopt new business models and technologies to support and ensure competitive advantages. Continuous improvement should be the priority of any business, no matter the size or industry. The traditional supply chain evolved from a push driven, internally focused model to a pull driven, highly integrated, customer driven model. The modern supply chain known as DDVN is a system of technologies and processes aimed at sensing and responding to zero latency demand signals across a value driven network of stakeholders and trading partners. The DDVN simplifies the way in which organizations look to grow their revenue and implement strategies for their business development. Executives and supply chain leaders are needed to successfully improve and transform the supply chain. The success of any transformation depends largely on people. An organization's ability to change represents a significant factor in the success of implementation projects. Organizations must understand the importance of promoting necessary change to improve performance.

Without IT, supply chain management would not be possible on a global level. IT is the enabler of the demand driven transformation. IT facilitates supply chain integration through information sharing and the adoption of new technologies. New technologies allow for organizations can improve quality, reduce costs, increase processing speed, facilitate real-time execution, support visibility, improve coordination and real-time decision making, and creates new capabilities through remote control.

It is essential that organizations be made aware of weaknesses that exist within their business in regards to strategies, the use of technologies, internal operations, and

also knowing where they are along the DDVN maturity journey. It must be understood that supply chain technologies do not implement and improve an organization's supply chain performance on their own, no matter how advanced and expensive the technologies may be.

8.1 Recommendations for the Future

Organization must invest in their supply chains, while transforming throughout the entire organization. This will allow for silos to take down barriers and allow for information to flow through the entire organization and transform internally and externally to a DDVN. Organizations must continue to invest in implementing new technologies that will allow for the transformation of their supply chains to be more integrated. This will ultimately reduce cost and improve supply chain performance.

In addition to having competent supply chain professionals and highly involved executives to transform supply chains to improve organizational performance, universities and business organizations must work together to create leading edge training and educational programs that will produce knowledgeable and capable supply chain leaders of the present and future. In regards to the future of IT, taking DDVN to the next step could and will likely be 3-D printing. Although still in its early stages, 3-D printing will have a great impact on manufacturers' supply chain and business models, even though simply pushing "print" and having a product built on the other side of the world is still a dream (Moody 2015). This technology has the potential to accelerate the prototyping and manufacturing process and also support customization on a scale that has not been previously economically possible (Prentice 2011).

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