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The Challenges and Barriers Facing Successful Lean Implementation in the Qatari Manufacturing Organizations

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**THE CHALLENGES AND BARRIERS FACING SUCCESSFUL LEAN
IMPLEMENTATION IN THE QATARI MANUFACTURING ORGANIZATIONS**

by

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ABSTRACT

The success of Toyota, the inventor of Lean Systems has drawn the attention of academics, researchers, and executives in the last decades. However, existing lean research is largely focused on developed economies in Europe, the Americas, and in Southeast Asia with little focus on the Arab world in general and Qatar specifically. There has been an emergence of manufacturing organizations and Small and Medium- sized Enterprises (SME) in Qatar recently which was the focus of this research. Despite the many attempts to implement lean in organizations, there have been a large number of failed attempts.

This research aims to study the Qatari Manufacturing Organizations attempts in implementing lean. The main goal of the thesis is to shed a light on the current state of awareness of lean in Qatari Manufacturing Industry and SME and the potential barriers and challenges that prevent the successful adoption of lean. In order to do so, an online survey was designed through the SurveyMonkey tool and organizations were asked to participate.

Numerical and statistical results from the survey are discussed along with Pareto charts and two hypothesis tests. The finding indicates that there is no difference between ISO certified and Non-ISO certified organizations in lean implementation. Further, it is understood that most of the manufacturing organizations in Qatar have some level of awareness of lean concepts/tools and practices. The results also show that organizations are not implementing lean concepts and are not using quality management practices effectively. The main obstacle that manufacturing organizations in Qatar face when implementing lean is "Lack of Employee Engagement" and "Unsupportive Organization Culture". However, it is noted that the research has some limitations such as having most participating organizations in the survey from specific sectors.

ACKNOWLEDGEMENTS

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CHAPTER ONE: INTRODUCTION

In the last two decades, lean systems (LS) implementation in the indusial industry has made a significant improvement to the industrial community. The success of Toyota (the inventor of LS) has drawn the attention of academics, researchers, and executives seeking to benchmark the company's famous Toyota production system. Interest in lean process improvement has rapidly spread beyond the automotive industry into fields including healthcare, construction management, and general product manufacturing. Existing lean process improvement research largely focuses on developed economies in Europe, the Americas, and in Southeast Asia (Mady, 2009). However, the subject of LS implementation and the awareness of such practices has not been studied within the Qatari context to date.

In order to evaluate the applicability of lean within the Qatari Manufacturing Industry and through identifying their readiness towards LS we need to look for how much implementation exists today. Along with that, understanding the level of awareness of lean in the Qatari Manufacturing Industry will help shed a light on the factors that may impede the success of lean systems within the manufacturing organizations.

The fact is, in some parts of the world, such as Qatar or Kuwait, the term "lean" is still relatively new and might be unheard of, which can raise a red flag on how much organizations actually understand lean. In fact, according to Tannock and Ahmed (2008), very limited resources cover Quality Management (QM) in the Arab world. Furthermore, researchers have shown that despite the many benefits that LS can offer to organizations, there have been a large number of failed implementations of lean (Balle, 2005; Papadopoulou & Ozbayrak, 2005). This means that even if an organization claims to have implemented lean, it may be failing to implement it correctly. According to Pay, in 2007, 70% of all United States based manufacturing plants

attempted to implement LS in their organizations. Of those organizations only 2% achieved a full successful Lean implementation along with another 24% achieving a partially successful implementation of LS (Pay, 2008). According to Bhasin and Burcher (2006), less than 10 % of the United Kingdom organizations managed to accomplish a successful lean implementation in the manufacturing industry.

To see if the manufacturing industry in Qatar has adopted the lean system concepts and successfully implemented the fundamentals we need to explore the different organizations in Qatar and what they actually manufacture. The industry in Qatar is composed of oil and gas companies and non-oil and gas companies. Non-oil and gas companies include those involved in general manufacturing, chemicals and petrochemicals production, metals production, construction, food and beverage production, and other service operations (Salem, Musharavati & Hamouda, 2016). Most of the non-oil organizations in Qatar tend to be categorized as Small and Medium- sized Enterprises (SME). Since Qatar, as a developing country, has a vision to be a leader in the region in the manufacturing industry, and due to the current political blockade on Qatar, there has been a huge emergence of small and medium- sized manufacturing organizations to cover the needs of the country in the current crisis. On the plus side, this crisis seems to be a huge step forward for Qatar in general as it starts to be a self-centric and a more independent country that relies on its production recourses rather than importing from others. In the current state, emerging small and medium manufacturing organizations mostly operate on very small scale of manufacturing with some organizations planning to grow and compete in outside markets (QDB, 2016; Al Kuwari, 2018). Despite the large number of articles on LS that have emerged over the past four decades, lean practices within the SME context is a very under-researched area (Boughton & Arokiam, 2000; Stone, 2012).

1.1. Motivation

Quality Management is a major part of any organization that strives to be successful. Applying quality improvement strategies is common in many industries such as the hospitality industry, the healthcare industry, and the manufacturing industry (Salem, Musharavati, Hamouda, & Al-Khalifa, 2016). There are different quality management methods adapted by these industries, like Six Sigma, Total Quality Management, and Lean systems. Furthermore, there are very limited resources that cover QM in the Arab world (Tannock & Ahmed, 2008).

For the advancement of Qatar in this area, this study focuses on the status of Quality Management in Qatar and the areas of needed improvement. There are not many studies that cover the Qatari Manufacturing Industry, and thus, it was a motivation to be one of the few to explore area. After reviewing QM literature, I chose the topic of lean implementation in the manufacturing industry for this thesis. As a point of reference compared to western industries, I decided to assess the level of awareness about lean in the Qatari Manufacturing Organizations and address the challenges and barriers that they face to successfully implement lean.

1.2 Objective

The main objective of this thesis is to investigate the current state of the Qatari Manufacturing Industry and look for areas that need improvements. The thesis also aims to assess the level of lean implementation in the Qatari Manufacturing Organizations and SME as well. This is due to the recent increase in the SME in Qatar. In order to do so, this research explores three main objectives. The first objective is to research the state of applications of lean in the Qatari Manufacturing Industry and assessing the extent of the LS implementation in the manufacturing industry and SME. The second objective is to evaluate the level of awareness about lean concepts/tools and practices in the Qatari Manufacturing Industry and assessing if there is evidence

of successful lean implementation. and assess if there is evidence of successful lean implementation. The third objective is to address the reasons that impact the success or failure of lean implementation by understanding the challenges facing the organizations and exploring ways to prevent failure in lean implementation within the Qatari Manufacturing Industry and SME.

1.3 Qatar Manufacturing Industry

An organization that produces any kind of product or service has to be registered with the Ministry of Commerce and Industry (MOCI). According to Qatar Development Bank (QDB) in Qatar, to be a considered a Small and Medium- sized Enterprise a company must be registered in accordance with the laws of state of Qatar with:

- The number of employees does not exceed 250 employees; with the exception of the creative industry sector where the number of employees must not exceed 100 employees.

- The annual turnover does not exceed 100 million Qatari Riyals.

Table 1– Classifications of SMEs in accordance to the laws of state of Qatar (QDB,2016)

(Employees are measured by staff headcount and annual turnover is measured in million Qatari Riyals)

Sector	Criteria	Micro	Small	Medium
Agriculture	No. of Employees	1-5	6-30	31-250
	Annual Turnover	Less than 1	1 – less than 20	20-100
Manufacturing	No. of Employees	1-5	6-50	51-250
	Annual Turnover	Less than 3	1 – less than 20	20-100
Creative Industries	No. of Employees	1-5	6-30	31-250
	Annual Turnover	Less than 1	1 – less than 20	20-100
Construction	No. of Employees	1-10	6-50	51-250
	Annual Turnover	Less than 3	1 – less than 20	20-100
Trade	No. of Employees	1-5	6-50	51-250
	Annual Turnover	Less than 3	1 – less than 20	20-100
Other Services	No. of Employees	1-5	6-50	51-250
	Annual Turnover	Less than 3	1 – less than 20	20-100

In order to assess the extent of the LS implementation in the manufacturing industry and SMEs in Qatar and the level of awareness of lean concepts, practices and tools, a survey was developed. By doing the survey we can learn more about the current lean practices and performance measures that are used to when implementing lean. The survey can help us understand the level of successful LS implementation by analyzing the data. Furthermore, the survey gives an indication of the struggles that made the Qatari organizations succeed or fail to implement LS.

<div align="center">

1.4 Research questions

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The purpose of this study is to shed light on the current state of the Qatari Manufacturing Industry and SME. In order to do so the study attempts to answer the following questions:

- What is the level of awareness of "lean systems" in the Qatari Manufacturing Industry?

- Is there success in the implementation of lean practices in the Qatari Manufacturing Industry?

- What are the potential barriers and challenges faced that prevent the successful adoption of lean in the Qatari Manufacturing Industry?

<div align="center">

1.5 Assumptions

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In order to attempt to answer these questions two main assumptions were created for the purpose of the study. The first assumption is that all Qatari Manufacturing Organizations have access to phones, emails, and internet for contact purposes in order to participate in the study. The second assumption is that the survey provided clearly written questions, description of the purpose of the study, and instructions of what how to answer the questions, and that all responses given are based on a clear understanding of the questions. This in turn means that honest answers that truly represent the current state of the organization were given as a result.

CHAPTER TWO: LITERATURE REVIEW

The phrase "lean" or "lean systems" is often associated with Toyota. This is because the beginning of lean as a concept for production lines was developed by Toyota in Japan during the 1940s. At that time, Toyota Production System wanted to produce an efficient continuous flow of products without relying on very long production runs. This is because Toyota realized that only a small fraction of the total time and effort they took to produce their products added little value to the end customer. This concept was not utilized in the United States and Europe as they relied on a mass production method where there is high volume production with minimal product turnover (Melton, 2005).

Fast forward to 1990, James Womack, Daniel Ross, and Daniel Jones in "*The Machine that Changed the World*" compared the two methods of the Mass Production System used in Europe and the United States, with the Japanese Lean Production System developed by Toyota within the automotive industry. This book became the most-used reference by researchers and practitioners in the area of lean (Al-Najem, 2014). The phrase "lean" was not used to reference Toyota production until 1988 when a Massachusetts Institute of Technology (MIT) graduate named John Krafcik used it to describe Toyota's use of less capital, human efforts and space in their production line (Brophy, 2012). The book, "*The Machine that Changed the World*", used the phrase "lean" and showed that there is a big gap between the Toyota lean system and compared to the Western production system (Al-Najem, 2014). Later in 1996, James Womack and Daniel Jones wrote another book about lean systems named "*Lean Thinking: Banish Waste and Create Wealth in your Organization*". This book covers the core principles of LS like identifying the value stream, specifying the value, creating a product flow, responding to customer pull and continuous improvement (Al-Najem, 2014).

In the wake of the success of Toyotas method, many companies around the world were aspiring to replicate this success and adopt the LS. However, not all of these attempts to adopt LS were successful (Balle, 2005; Emiliani, 2008). In fact, an *Industry Week* survey in November 2007 showed that more than 70% of United States companies have adopted Lean System in their manufacturing plants. However, only 2% of those companies have fully achieved their objectives from LS adaptation. Furthermore, only 24% of those companies reported partial success in achieving their set objectives. These poor results were because many in senior management in these companies are not willing to accept the cultural change that is required for lean methods to be a successfully implemented. Another reason is that many of these companies that failed to implement the LS failed to recognize the short-term priorities and the importance of putting the right people in the correct positions to achieve these priorities (Pay, 2008). These results mean that in order to successfully implement LS there has to be a certain level of required awareness. As a result, we can say that understanding the definition of lean and its concepts is the most important step to the road for successful implementation.

2.1 The meaning of the word "Lean"

One of the reasons that there is confusion in the application of lean is that there is no precise definition of the phrase "lean" because many researchers have commented and explained "lean" using their own background or through their own point of view (Al-Najem, 2014). One of the most frequently used definitions of "lean" is "*an integrated sociotechnical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer, and internal variability*" (Rotter, Plishka, Lawal, Harrison, Sari, Goodridge, 2018). MIT defined LS as aiming to eliminate wastes in a production area, including wastes regarding customer relations, product design, management and suppliers, wherein the main objective is to provide the customer with a

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good-quality product at minimum cost by using less of everything, including inventory, human effort, lead time to develop the product, and space (Papadopoulou & Ozbayrak, 2005). Other like Atkinson (2010) explained lean as: *"a commitment, a process of continuous improvement that can significantly impact an organization's competitiveness. Lean is a strategic tool for resolving severe organizational problems and can unite several change initiatives that are running currently in a business."*.

These different understandings of "lean" leads us to explain LS with reference to all of the above definitions depending on where it is going to be utilized and what needs to be accomplished from its application in each organization. Although the definitions are different, they are consistent with Toyota's main principles because organizations, like Toyota, are developing an organizational culture that is flexible, always pursuing perfection through the elimination of all forms of wastes, and are focused on responding to customer demands (Vermaak, 2010).

2.2 Lean Principles

To successfully apply lean in an organization, there needs to be an understanding of the lean principles, tools, and techniques. In LS, there are a number of techniques and tools that can be used. Many studies have identified the correct techniques and tools as Critical Success Factors (CSFs). This means that understanding critical factors for the success of LS is important for any organization that intends to adopt lean. However, since lean definition is malleable to what organization's needs, each implementation depends on the organization knowing exactly what they require and expect from LS first and then choosing the tools and techniques that best fit their situation (Balle, 2005). This requires each organization to have strategic thinking, awareness of various lean tools and their benefits, have commitment, and are willing to improve the relationship with external factors affecting their process like suppliers and customers, or build one. In *"The*

Machine that Changed the World" Womack, Jones, and Ross state "*we are convinced that the chances of lean production prevailing depend critically on a wide public understanding of its benefit*" (1990).

According to Mirdad and Eseonu (2015), lean principles are the set of values that drive the appropriate implementation of lean processes. These principles are the fundamental rules that manage proper implementation and operation in a lean process. Both Mirdad and Eseonu (2015) and Womack, Jones and Ross (1990) identified five lean principles: Specify Value, Identify the Value Stream, Flow, Pull Production and Continuous Improvement. Furthermore, Mirdad and Eseonu (2015) discuss more principles across literature that includes Zero Defects, Supplier Integration, and Multifunctional Teams. It is not shocking to know that across different literature there isn't an agreement of what is considered a principle and what is a tool or performance measure. For example, Anand and Kodali (2009) and Liker (2004) classify Visual Management System (VMS) as a lean principle, while other researchers consider VMS to be a lean practice, which are tangible mechanisms used to operationalize and implement lean principles (Mirdad & Eseonu, 2015). Figure 2 showcases the occurrence of lean principles across different literature. Figure 3 showcases the findings of Mirdad and Eseonu (2015) and what the experts defined as lean principles compared to what the literature categorizes as principles.

	Womack & Jones,2003	Liker, 2004	Shah & Ward, 2007	Karlsson & Åhlström , 1996	Sánchez & Pérez , 2001	Anand & Kodali, 2009	Frequency
Identify the Value Stream	*		*	*	*	*	5
Pull	*	*	*	*		*	5
Continuous Improvement	*	*		*	*	*	5
Supplier Integration		*	*		*	*	4
Specify Value	*		*			*	3
Flow	*	*	*				3
Multifunctional Teams		*		*	*		3
Zero Defects		*		*		*	3
JIT Production and Delivery				*	*		2
Employee Training and Growth		*		*			2
Visual Management System		*				*	2
Decentralization Responsibilities				*			1
Vertical Information System				*			1
Respect of Humanity						*	1
Setup Time Reduction			*				1
Statistical Process Control			*				1
Total Production Maintenance			*				1
Employee Involvement			*				1
Long Term Philosophy		*					1
Workload Levelling (Heijunka)		*					1
Standard Work		*					1
Reliable Technology		*					1
Genchi Genbutsu: Thoroughly understand the situation through direct observation		*					1
Nemawash: Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly		*					1

Figure 1– Frequency of Occurrence of Lean Principles in literature (Mirdad & Eseonu, 2015)

Lean principles outlined in the literature	Level of expert agreement with the literature on the list of Lean principles	Womack & Jones,2003	Liker, 2004	Shah & Ward, 2007	Karlsson & Åhlström , 1996	Sánchez & Pérez , 2001	Anand & Kodali, 2009	Frequency
Identify the Value Stream	37.9%	*		*	*	*	*	5
Pull	72.4%	*	*	*	*		*	5
Continuous Improvement	79.3%	*	*		*	*	*	5
Supplier Integration	28.6%		*	*		*	*	4
Specify Value	71.4%	*		*			*	3
Flow	85.2%	*	*	*				3
Multifunctional Teams	21.4%		*		*	*		3
Zero Defects	53.6%		*		*		*	3
Respect of Humanity	60.7%						*	1

Figure 2 - A Comparison of the Definition of Lean Principle by the Literature and Lean Experts (Mirdad & Eseonu, 2015).

These differences in interpretations are in tune with how many definitions lean has across literature and helps explain the reason not all implementations of lean are understood and implemented successfully. The most common principles that are presented by Mirdad and Eseonu (2015) are explained further in the following sections.

2.2.1 Specify Value

Specify Value is considered to be the most crucial point in LS implementation because it is related to the customer. Basically, it means identifying what the customer wants or what the customer is willing to pay. For that to be accurate, the organization must be fully aware of all customer needs and demands. Customers can be divided into two groups; internal and external

customers. The internal customers are the customers that are waiting for the next process; while the external customers are those who are waiting to pay for the end product (Liker, 2004). If an organization fails to correctly specify value, then there will be waste and the more waste there I, the higher it can cost the organization. Hence, specifying the value is the most important lean principles as it focuses only on the value adding process and eliminates non-value adding steps before proceeding on to the next phase (Al Najem, 2014).

2.2.2 Identify the Value Stream

A value stream is the identification of the all activities/step needed in a process that adds value. In other words, identifying the activities needed to satisfy the demands of the customers (Mirdad & Eseonu, 2015). To accomplish that, an organization needs to map the value stream of a product and gather all of the information from the beginning of a process or step and look at the value adding activities and eliminate the non-value adding activities. This detailed overview should cover the whole manufacturing process from the concept of the product to taking orders, scheduling and delivery, and launching phase. This value stream is important because it will show the waste activities that need to be eliminated in the process (Al Najem, 2014).

2.2.3 Flow

This principle has to come after an organization specifies the value by knowing what the customer wants and is willing to pay and identifies the value stream (Al Najem, 2014). Creating a flow means the creation of a continuous, uninterrupted work processes across the value-adding activities (Mirdad & Eseonu, 2015). One main aims of LS is to develop a system where the production follows a continuous flow beginning from acquiring the raw materials all the way to finalizing the end product and delivering it to customers (Rother & Harris, 2001). This is not easily done because removing obstructions from the whole value stream to maintain a continues flow

needs specific work practices and tools to remove all the rework, backflows and idle time that cause the flow to stop. In addition, all departments in the organization from design, order taking to production, and distribution need to participate in creating the continuous flow (Womack & Jones, 2003). According to Al Najem (2014), this is because there will be no point if just one department accomplishes a continuous flow while the others do not since the continuous flow depends on the whole process being continuous not just a part of it.

2.2.4 Pull Production

Pull production is a principle that means to produce only in response to the customer demand (Mirdad & Eseonu, 2015). According to Shah and Ward (2007), pull production is time-based manufacturing, meaning it all depends on time. To further illustrate, pull is when a manufacturing organization begins producing their products on time, based on the time the customer asks for the product. This also results in less inventory since the raw materials will only be ordered to fit the customer demand for the product. Once an organization adapts pull production, there will be no need for forecasting the demands, which can lead to overproduction with some of the extra products left on the shelf (Al Najem, 2014). According to Hopp and Spearman (2004), pull production is a principle that focuses on decreasing the organization's inventory, decreasing the work in progress (WIP) cap, and producing only based on customer orders.

2.2.5 Continuous Improvement

Continuous improvement is a principle that means the organization must generate, test, and implement process refinements with an ongoing desire for perfection (Mirdad & Eseonu, 2015). After successfully applying all the previous principles of specify value, identify the value stream, achieve a continuous flow, and pull production that result in the increase of productivity and the elimination of non-value added activities, it does not mean the end of implementation of lean. It is

critical to adopt a mentality of continuous improvement as a strategy and create a work environment that is always motivated to sustain the improvement. If this principle is ignored, the organization will sustain success in the short term but would revert to creating waste. In order to sustain the successful results, these principles must be revisited to look for small slips and cracks that may have been missed or may have newly developed that must be handled in order to maintain a lean system (Al Najem, 2014).

2.2.6 Zero Defect

Not all literature considers zero defects as a lean principle. According to Mirdad and Eseonu (2015), over 50% of experts classify it as a principle. Anand and Kodali (2009) think that Zero Defect is a principle which can be achieved through 100% inspection of all practices. Furthermore, Karlsson and Åhlström (1996) state that zero defect means being able to attain high productivity by way of continuous improvement. To have this, an organization must put in measures of quality control and defect detection. The first stage of inspection for defects is the workers since they can stop the line of production if a defect is spotted. The workers should also be looking at the cause of the defect and fix it if possible before the product is passed to the quality control department (Karlsson & Åhlström, 1996). In order to be successful in zero defect implementation, it is important to monitor the process through quality control measures and check for errors that can lead to defects in the future (Karlsson & Åhlström, 1996).

2.2.7 Respect for Humanity

According to Mirdad and Eseonu (2015), some literature considers respect for humanity as a lean principle. Overall, 60% of the experts agree that it can be classified as such. Respect for humanity is basically empowering employees and allowing them to develop their skills. Respect for humanity means creating a culture and work environment that is encourages employee

participation, free integration with management, rewards and recognition for jobs well done, and flexible job requirements and responsibilities (Anand & Kodali, 2009).

<div align="center">**2.3 The most common Lean Practices**</div>

Lean practices are a set of methods and tools when implemented successfully, help an organization attain the fundamental principles of lean. For instance, pull production is a principle that can be operationalized by using different practices such as Kanban and Setup Time Reduction, known also as Single Minute Exchange of Die (SMED). Figure 4 showcases the most cited lean practices across literature (Mirdad & Eseonu, 2015). Table 2 explains each of those 10 lean practices found across literature and categorizes them with the lean principle with which it corresponds.

<div align="center">**Table 2 – The most cited lean practices across literature (Mirdad & Eseonu, 2015).**</div>

Practice	**Frequency**
Total Productive Maintenance	19
Setup Time Reduction (SMED)	19
Cellular Manufacturing	13
Kanban	13
Standard Work	10
Small Lot Sizes	10
Poke Yoke (Mistake Proofing)	10
5 S	9
Total Quality Management	9
Quality Circles	8

Table 3– Common lean practices definition found across literature.

Lean practices	Definition	Reference
5S	A tool to reduce search time. Consists of: sort, set in order, shine, standardize and sustain	(Mirdad & Eseonu, 2015)
Total Productive Maintenance (TPM)	A predictive or preventive process of maintaining equipment at maximum equipment at maximum functionality. Its main goal is to minimize downtime	(Yusup, Mahmood, & Salleh, 2015)
Setup Time Reduction (SMED)	Attempts to reduce the time and costs involved changing from the tool, layout, etc	(White, 1999)
Cellular manufacturing	The arrangement of machine in small cells mostly in a U or O shape	(Pavanaskar, Gershenson, & Jambekar, 2003)
Kanban	An approach to pull materials and parts through just-in-time basis. E.g: transmitting a replenishment signal to outside suppliers	(Mirdad & Eseonu ,2015)
Standard work	Makes sure that each job is organized and carried out in a consistent and effective manner	(Mirdad & Eseonu ,2015)
Small lot/batch size	Producing is small lots to keep the production process continuously moving	(Mirdad & Eseonu ,2015)
Poka Yoka (mistake-proofing)	Failure prevention, mistake-proofing, or autonomous defect control	(Karlsson & AAhlström, 1996)
Total Quality Management	A management approach to focus all functions of an organization on quality and continuous improvement	(Shah & Ward, 2007)
Quality Circles	A program that attempts to involve employee in problem solving and decision making by scheduling group meeting	(White, 1999)

2.4 Common Lean Performance measures

Most organizations have realized that in order to evolve into an efficient and effective lean system, they need to be assessed for their performance (Gunasekaran, Patel, & McGaughey, 2001). This realization also comes with the fact that it is not possible to manage and operate successfully without measuring and evaluating the work done (Behrouzi & Wong, 2011). To evaluate the success of lean practices and see if the lean system is working, every organization needs to have set performance measures. A performance measure is a set of indicators that overlooks the data and information to measure and assess the organizational performance in lean manufacturing and sheds light on improvement opportunities. In fact, one of the main benefits of performance

measures is to identify opportunities to make significant improvements, and hence, increasing efficiency and productivity. This is because measurement is vital to improvement, and improvements can only occur after measuring the current state of performance, and consequently, doing required corrective actions to improve it (Choothian, 2014; Haddadi & Yaghoobi, 2014; Meybodi, 2013; Behrouzi & Wong, 2011). Performance measures also allow the organization to specify the goals clearly and can in turn help create strategies that can be implemented to improve work. Declaring a metric as a performance measures serves as a feedback instrument on both financial and non-financial metrics because they are important in evaluating the performance of lean implementation (Fullerton & Wempe, 2009; Meybodi, 2013). Table 4 showcases the performance measures found across literature.

Table 4– Common performance measures found across literature

Common performance measures	References
Lead time	*(Choothian, 2014 ; Mirdad & Eseonu, 2015)*
Total product manufacturing time	*(Choothian, 2014 ; Mirdad & Eseonu, 2015)*
Actual cost compared to budget	*(Choothian, 2014)*
Cycle time	*(Choothian, 2014; Al-Najem, 2014)*
Number of projects delivered on time	*(Anand & Kodali, 2008)*
Percentage of parts delivered just-in-time in the production line	*(Martinez Sánchez & Pérez Pérez, 2001)*

2.5 Challenges faced in Lean Implementation

Given that an organization is willing to adopt LS, there are bound to be some challenges shifting to this new method of work. As previously stated, there have been a significant number of failed attempts to implement lean found across literature. According to Pay, in 2007, 70% of all United States based manufacturing plants attempted to implement lean system concepts. Of those companies only 2% achieved a full successful lean implementation and 24% achieved a partially

successful implementation of LS (Pay, 2008). Even outside the United States, according to Bhasin and Burcher (2006), less than 10% of organizations in the United Kingdom have accomplished lean manufacturing implementation successfully. Furthermore, even if an organization claims to implement lean, there may be evidence that it is not implemented properly (Balle, 2005; Papadopoulou & Ozbayrak, 2005). According to Bhasin (2012), the implementation of lean, like any other new system brings many obstacles that hinders its successful application. These obstacles can be cultural, technical, and organizational or based on economic factors. In addition to all that, there are limited resources covering quality management (QM) in the Arab world (Tannock & Ahmed, 2008). All of these factors can be detrimental to the success of LS implementation in an organization. To have a better chance of success, an organization must know what the top challenges are that they face and how to overcome such challenges. Table 5 list the most common challenges that organizations face when implementing lean.

Table 5– Common challenges that organizations face when implementing lean found across literature

Common lean challenges	**Definition**	**References**
Lack of Top Management and Commitment	Top management is not fully supporting lean implementation and does not provide strategies, goals, or plans for a proper lean implementation.	Bamber and Dale, 2000; Boyer and Sovilla, 2003; Worley & Doolen, 2006)
Lack of Effective Communication Across the Organization	The organization does not have a good mechanism to communicate to employees, across all levels, about lean.	(Worley & Doolen, 2006; Al-Najem, 2014)
Lack of Employee Engagement	The organization's employees do not have sufficient training or knowledge to implement lean properly and effectively.	(Ahmad, 2013; Al-Najem, 2014)
Unsupportive Organizational Culture	The organization doesn't have good collaboration between the different departments and facilities. In addition, organization has many employees who resist change and do not understand the benefit of lean.	(Wong, 2007; Atkinson, 2010; Ahmad, 2013; Al-Najem, 2014)
Lack of Connection with Stakeholders	The organization has a lack of collaboration with their stakeholders. Stakeholders are not provided with sufficient information about lean	(Worley & Doolen, 2006: Bhasin, 2012; Al-Najem, 2014)

2.5.1 Lack of Top Management and Commitment

Although implementing lean comes with many variables that can have an effect on the success of a lean manufacturing implementation, not many researchers dispute the fact that the commitment by top management is the most important factor. Many researchers believe that a management that fails to fully embrace the implementation process and all its values may

intentionally or unintentionally sabotage their effort to actually succeed in the implementation (Womack & Jones, 1996; Bamber & Dale, 2000; Boyer & Sovilla, 2003; Parks, 2002; Worley & Doolen, 2006). In any organization that wants to succeed in implementing lean, their top management should not only demonstrate their commitment and leadership, but they must also work together in creating interest in the implementation process and communicate the change effectively to everyone within the organization (Boyer & Sovilla, 2003). According to Parks (2002), a good strategy to implement lean is to instill lean thinking from top management down and guide them in their thinking towards lean.

Lean manufacturing requires a major change in the attitude and behavior of not only the managers but also the employees. Hence, the role of the upper management in any organization that wants to adapt lean system is vital to the success of the implementation of the concepts and practices. Management must lead by example and consider their employees as cooperative and willing, and in turn, management must respond by demonstrating initiative and commitment (Bamber & Dale, 2000). Any lack of investment by upper management during the process of lean implementation can also affect the success of the implementation in less visible ways. For instance, if an employee feels that the executive team in charge does not respect their efforts and dismiss their input, it will make it harder to create a positive atmosphere for successful implementation. Even though many organizations often desire to drive change beginning from the factory floor and lower level employees, it is essential to the success of the change that the transition to lean be driven by the upper management (Boyer & Sovilla, 2003).

A case study was conducted by Worley and Doolen in an electronics manufacturing company in the northwestern United States. The study focused on multiple variables that can be affected by upper management support that included: employees attitude, improved employee's

skills and adaptation of lean manufacturing concepts/tools, etc. Evidence was found from this study that supports the notion that top management support does indeed play a role in driving the lean implementation process in an organization. The study found that top management support impacted the lean implementation both in a negative and positive way. The employee attitude category in the study illustrated that there was some frustration experienced by some employees regarding the new changes within the work area because they did not understand the reasons behind the organization starting a lean manufacturing initiative. The employee skills category in the study highlights the amount of times employees completed activities that were associated with the lean manufacturing implementation. In this category, the study showed that some employees felt that there was time pressure that did not allow them to fully develop the skills needed to continue the lean implementation initiative. In addition, the study found evidence that some operators felt that top management did not provide the needed help implementing changes within the work area and that there was a lack of participation in some work areas due to the management's decision not to force the employee to participate in activities that were associated with the lean implementation initiative. Finally, the study also found that there was evidence that improved communication was needed in the organization to better implement lean (Worley & Doolen, 2006).

2.5.2 Lack of Effective Communication Across the Organization

Another variable that can potentially affect the implementation of lean is the effective communication across the organization or lack thereof. Although many organizations claim to have very good communication across all departments, miscommunications can affect the success of lean implementation. In fact, according to Worley and Doolen (2006), a key benefit gained if lean is implemented properly and successfully is increased communication. On the other hand,

when communication does not occur, both the production and the quality of work can suffer. Furthermore, resentment between workers may occur when miscommunication happens between workers in shift changes in an organization where multiple shift changes are a must (Al-Najem, 2014).

Since lean implementation requires a major change and since change can be hard to accept for people used to working in a certain way, the communication process helps in paving the way for people to accept the new lean concept and helps in overcoming any employee resistance towards these new changes in their work. As stated earlier, in order to implement lean, it is vital that every employee in the organization from top management to lower levels is made aware of and understands lean concepts, lean practices, and the process of implementation. This is where effective communication plays a crucial role in ensuring that lean implementation is successful. Establishing effective communication is also important because it ensures that the changes are being fully accepted and implemented by every employee at all levels of the organization, thus, preventing a failure in lean implementation (Puvanasvaran, Megat, Tang, & Razali, 2009). Communication is also important when dealing with customers and suppliers. Any customer-supplier communication happening within the organization must be dealt with clearly with an effective process for sending and receiving responses to any problems that may occur. All lean manufacturing organizations and enterprises must have communication pathways that are broad and efficient to successfully implement lean (Worley & Doolen, 2006).

In the case study that was conducted by Worley and Doolen (2006), communication had an impact on lean implementation both in a negative and positive way. The positive impact was with the communication lines with management while poor communication was found in the communication between departments across the organization. Employees expressed that

communication with management had improved with the lean initiative but was poor when communicating with other departments.

<center>2.5.3 Lack of Employee Engagement</center>

In any organizations, the employees are considered the backbone that keeps the organization going; therefore, they are very important to the success of lean implementation. According to Al-Najem (2014), if an organization wants to be successful in adapting lean, workers need to participate in the change and drive Continuous Improvement, which is a core principle of lean. By encouraging employees to accept the changes in their work and adopting a lean initiative, the organization will create a healthy lean culture with workers and managers motivated towards the change with mindsets always moving towards Continuous Improvement. Without the engagement of the employees, the driver for lean in the organization is dead and the implementation of lean will be considered a failure. Moreover, resentment from workers who do not understand the reason for change and resist the lean implementation process is detrimental to the success of the lean adaptation.

A healthy lean enterprise must consist of strong beliefs and support of the lean shift with motivated employees that understand their organization's goals and objectives and the reason that they are important. Employees should also have an understanding of the purpose of lean improvements and have all the needed tools at their disposal to prevent the system from failing. With that consistency and engagement from employees a healthy lean enterprise will develop and there will be more innovation, lower employee turnover, a greater number of improvement actions taken, and a better chance of success at sustaining these improvements (Ahmad, 2013). What is even more important is the empowerment of employees and allowing them to be part of the future vision of the organization and participate in the decision-making process. Lean emphasizes the

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importance of employees in order to achieve success and depends on having a strong lean organizational culture that thrives for Continuous Improvement, elimination of non-value adding activities, and reducing waste. Without employee acceptance, participation, and engagement in the process, it is impossible to attain a healthy lean system (Bhasin, 2012; Ahmad, 2013; Al-Najem, 2014).

2.5.4 Unsupportive Organizational Culture

Another variable that threatens the success of implementing lean is the organizational culture. As established above, when adopting lean, it means there will be changes in organizational practices in order to have a better organizational effectiveness, efficiency, and enhancement of customer satisfaction. To achieve that, the organization needs to increase productivity, reduce inventory and lead time, improve product quality, and manage manufacturing cycle effectively. To reach that well-established healthy lean system, the organization must be driven by continuous improvement processes across all levels of the organization. This is supported by an organizational lean culture that adapts these concepts and drives the organization's engine forward to achieve these objectives (Ahmad, 2013). According to Wong (2007), the cultural adaption to lean is key to having a successful implementation. This means that in order to build a successful lean enterprise, an organization must create an organizational culture that is built on trust through the empowerment of employees, partnership and support of stakeholders, and thriving on Continuous Improvement programs. The organization should develop their organizational culture and building trust by allowing all to employees to participate in the decision-making process, providing suggestions to improve work and supporting them in all phases of the process (Ahmad, 2013; Al-Najem, 2014).

This may look easy to do, but it is considerably difficult. According to Al-Najem (2014), establishing the organizational culture is one of the hardest stages in the lean adaptation process and can lead to its failure. According to Atkinson (2010), organizations are basically a social system composed of conflicting interests that are working together to achieve their set strategic objectives. Having an organization cultural shift is about driving the overall performance across all levels of an organization. This change is a shift in the behavioral, emotional, and the political structure of the whole system. Many organizations who want to adapt lean invest a lot of time, money, and resources in lean efforts but fail in the process. This is due to the fact that people working for an organization without embracing it eventually go back to their old ways and the benefit from adapting lean that was gained is reversed over time. The end result is that organization lean efforts fail. In addition to that, implementing lean concepts is also more difficult in certain regions and countries due to the societal cultural differences and the way business is done in these regions and countries which in turn make the culture change within the organization difficult. In some cases, the national culture is more effective in shaping employees attitude and behavior than the organizational culture. This means that the national culture and the organizational culture cannot be separated when it comes to the lean transformation. A lean enterprise must adopt a philosophy that requires a long-term approach to business and respect for the individual. This entails valuing and understanding where the individual is in their development. This can be an alien concept in some cultures. This complex issue is something that all organizations aspiring to adopt lean must overcome to be a successful lean enterprise (Atkinson, 2010; Bhasin, 2012; Ahmad, 2013; Al-Najem, 2014).

2.5.5 Lack of Connection with Stakeholders

Like any other variable that can potentially affect the implementation of lean support including the organization's major stakeholders is vital in the lean process implementation. For many organizations, the inclusion of the stakeholder is central to everything done in the organization. Most organizations can't make any major spending decisions without approval from the stakeholders, especially where money spent is not directly customer focused. When the idea of lean and the restructuring process is not clearly presented to stakeholders, it may be viewed as too risky to undertake (Ezzamel, Willmott, & Worthington, 2008). This is why it is very important for the organization's mangers to guide their stakeholders to accept the lean implementation by explaining the concepts and tools of lean and how it would benefit the organization. In order to successfully implement lean, there must be commitment and support across all levels in the organization which include the stakeholders. Moreover, key to the success of the lean system is effective communication with stakeholders. This includes updating them about the success of the implementation and the positive results. With the stakeholders buy-in and support of lean implementation and the organization's workers reassurance of plans for their future work, resistance to major change is lessened (Bhasin, 2012; Worley & Doolen, 2006).

As stated previously, having a cultural acceptance in the organization that is willing to adapt lean is key to having a successful implementation (Wong, 2007). In order to build a successful lean enterprise, the organizational culture should be built on the empowerment of workers with the partnership and support of stakeholders. This includes striving for continuous improvement by allowing all to employees participate in the decision-making process. It means that stakeholders are partners in this lean enterprise and, therefore, should be included in the

communications to promote a healthy culture in which every person working for the organization

regardless of their position is included in the future vision (Bhasin, 2012; Al-Najem, 2014).

CHAPTER THREE: METHODOLOGY

In this research, the objective is to evaluate the level of awareness the organizations have about lean systems, lean tools and lean practices. A second object is to see if there is evidence of successful lean implementations in any organization. Another main objective is to identify potential barriers and challenges preventing the successful adoption of Lean across all organizations. In order to do so, the study focuses on the current state of lean implementation in the Qatari Manufacturing Industry and SME. All organizations that participated in this study are registered with the Ministry of Commerce and Industry (MOCI) in Qatar. The study also summarizes the barriers and challenges that the Qatari Manufacturing Industry and SME face to adopt a successful LS and provides suggestions to improve the future state of the Qatari Manufacturing Industry and SME. The study gathered information from the Qatari Manufacturing Industry and SME by doing an online survey that was distributed through different methods and had a total of 82 respondents participating. 53 of those completed the whole survey. The full survey questionnaire is found in the Appendix B.

3.1 The design of the survey

To study the current state of the Qatari Manufacturing Industry and SME, an online survey was designed through the SurveyMonkey tool. This survey sheds light on the current state of the Qatari Manufacturing Industry and SME through the identification of the current practices used and to what extent they are useful. The survey also helps in assessing the general level of awareness about lean concepts, tools and practices in the Qatari Manufacturing Industry and SME. Moreover, the survey gathered information about the current performance measures used in organizations along with information about the potential improvements needed to successfully adopt lean in the future.

The survey was divided into nine different sections with a cover page. At the beginning of the survey, the participant read the cover letter that states general information about the research including the purpose of the survey, confidentiality information, voluntary participation, and the researcher's university and contact information. Section 1 is titled "About you" and focuses on the participant's background. Section 2 is titled "Organization information" and it covers basic background on the organization participating. and it covers basic background on the participating organization. Section 3 covers lean awareness in the organization and to what extent employees are knowledgeable of lean concepts, tools, and practices. Section 4 covers the ISO 9000/9001 certification and the reasons and benefits for adoption of ISO. Section 5 covers the scale of the lean tools/practices are used by the organization, what performance measures are relayed on for evaluations and to what extent each of those are useful. Section 5 also covers the challenges that impact the organizations and prevents the success of lean implementation and what is the level of impact each challenge affects the lean efforts. Section 6,7, 8 and 9 cover suppliers, work process, customer relations and rewards in the organizations respectively. These final sections give an understanding of the inner workings of the organizations in Qatar and are used as comparative standpoint evaluate the status of LS in each organization. The full survey questionnaire is found in the Appendix B.

Information for survey development was gleaned from previous studies on lean awareness, lean implementation, and challenges that prevent the successful adoption of LS. The following are the main studies that helped shape the survey questionnaire.

- Investigating the factors affecting readiness for lean system adoption within Kuwaiti small and medium-sized manufacturing industries (Al-Najem, 2014).

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- A Conceptual Map of the Lean Nomenclature: Comparing Expert Classification to the Lean Literature (Mirdad & Eseonu, 2015).

- A study of the application of lean practices to new product development processes (Choothian, 2014).

- An empirical study on lean awareness and potential for lean implementation in Qatar industries (Salem, Musharavati, Hamouda, & Al-Khalifa, 2015)

- The development of Total Quality Management in Qatar (Al-khalifa & Aspinwall, 2000)

- Lean and Virginia's wood industry: lean awareness and implementation (Fricke & Buehlmann, 2012)

3.2 Survey Distribution

To distribute this online survey, a survey link was generated through the SurveyMonkey tool that allows participant volulnteers access to the survey. The link was then given to participants from different organizations with the limitation of a single response representing a single organization. There were two methods used to reach the participants and get in contact with these different organizations. The first method was contacting organizations found on the official lists that contains all the organizations that manufacture products and services in Qatar. These lists were taken from the Ministry of Commerce and Industry (MOCI) in Qatar and Qatar's Exporter Directory found in Qatar Development Bank (QDB). The second method was reaching out to local organizations by contacting affiliates and contacting employees within the MOCI to get different contact information in case the first method failed. Other methods used, if the first two methods failed, were personally going to the different organizations in the industrial area at random and seeking participants, asking previous participants to connect us with their suppliers / competitor's

information, and distributing the link to the survey through WhatsApp groups to reach local manufacturers.

The most successful method was the first method since it was an official list from the ministry of commerce and industry. There were two options given if an organization was willing to participate; either meeting in person to conduct the survey or sending the survey via email or WhatsApp. The latter two were for the convenience of the participant who could reply as their time permitted. Almost all of the participants that agreed to do the survey were willing to meet in person (the preferable way). The second method was by contacting current employees at the ministry and asking for their help in the process to reach organizations. Only one out of five organizations in the industrial area that were visited randomly. Most of the organizations preferred previously scheduled meetings. In addition, two organizations that participated in the survey were reached through the distribution of survey link in different WhatsApp groups. By using all of these methods, a total of 82 respondents participated in the survey with a 65% completion rate, and 53 completed responses.

3.3 Survey analysis

In order to evaluate the information gathered from the participating organizations, graphical and numerical data were developed along with Pareto charts and two hypothesis tests. The goal of the survey is to determine if there is significant evidence that the organizations in Qatar are not implementing lean concepts and are not using Quality Management practices. That information plus the data helps in the understanding if there is a significant difference between organizations with ISO certification and Non-ISO certified organization. Furthermore, the survey data helps us see if there is a significant difference between the different industry sectors in the implementation of lean concepts and quality management practices. This will help evaluate the

level of successful implementation of lean practices in Qatar. The hypothesis will be tested using statistical methods; independent sample t-test and a one-way ANOVA test. The two hypothesis tests developed are the following:

- H1: There is a significant difference in the success of lean implementation and the quality management practices used by ISO certified organizations compared to non-ISO certified organizations in Qatar.

- H2: Organizations in different sectors in Qatar differ significantly in terms of their lean implementation and quality management practices.

In addition to that, analyzing the Pareto Charts and the graphs from the data collected helps in answering the following questions:

- What is the level of awareness of the term lean in Qatari Manufacturing Industry?

- What are the challenges that is preventing the successfully implementation of lean?

CHAPTER FOUR: FINDINGS

This chapter summarizes the data collected through the survey. The chapter consists of different sections that discuss the finding. The first section summarizes the response rate, the organizational information of participants and different sectors of the Qatari Manufacturing Industry that are represented in this study. Section two summarize the statistical results and provides numerical and graphical data covering the data from the survey's nine sections. This numerical and graphical data summarized the practices, performance measures and strategies used in the Qatari Manufacturing Industry. The final section in this chapter has the statistical data that were put in Pareto Charts and used to do two hypothesis tests along with descriptive summarization of the results of each statistical data.

4.1 Organizational and Participant's Information

From all of the organizations that were contacted to participate in the study, a total of 82 respondents agreed to participate. From those 82 respondents who participated in the survey, 53 completed all sections, which makes the response rate for this survey 65%. In the following graphical and numerical analysis, the sample size varies depending on the number of responses given to the specific section in the survey. These following tables and figures represent the organizational and participant information data collected along with a descriptive summary explaining the findings from each table and figure.

What is your Job Position?

- Quality Control Manager 5%
- Supervisor 28%
- Other 35%
- Project Manger 4%
- CEO / Managing Director 25%
- HR Manger 1%
- Training Officer 1%
- Inventory Manager 1%

Figure 3 – Job positions of respondents

Figure 3 was generated from 82 responses that participated in the survey. The graph shows the different job positions of the participants in their respective organizations. The participant's positions varied from CEO/ managing directors, Supervisors, Project Managers to training officers and HR mangers. Out of 82 participants, the highest number of participants choose "other (please specify)" The majority of the participants who chose this option specified their position as a factory/ plant manager, an operation manager / engineer and a production manager / engineer. A few others specified their position as engineer, technician and operators. The second highest number of participants identified their position as "Supervisors" while the third highest number of participants identified their position as "CEO / managing directors". From this graph, we can conclude that most of the participants are in a good position to assess the state of their organizations implementation of lean.

Table 6 – Educational level of respondents

Education Level	Percentage (%)
Bachelor's Degree	*39(73.58%)*
Master's / PhD	*11(20.75%)*
Other	*3(5.66%)*

Table 6 above represents the data of 53 participants that completed all the sections of the survey. Although this question had a total of 82 responses, not all responses were not included. This is due to the fact that the intent of the question was to see if the education level affected the participant's awareness of lean manufacturing. Since all the lean related questions were not completed by the entire group of 82 participants, the table only represents the participants who answered all lean related questions. This will give an accurate representation of level of awareness about lean compared to education level. From the table, we can see that the highest number of participants had a Bachelor's degree with Master's/PhD being second highest. The percentage of participants with Bachelor's degree and are aware of lean is while the percentage of participants with Master's/PhD and are aware of lean is.
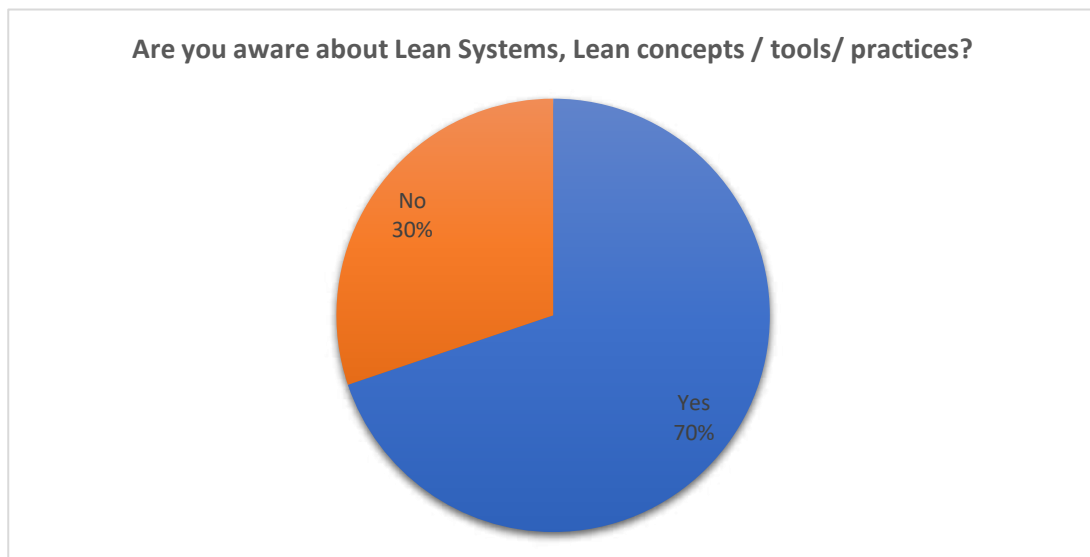
Figure 4 – Responses to the question "Are you aware about Lean Systems, Lean concepts / tools/ practices"

Figure 4 above represents all 53 participants that completed all sections of the survey. The response to the question "Are you aware about Lean Systems, Lean concepts / tools/ practices?" regardless of their educational level are in the graph.
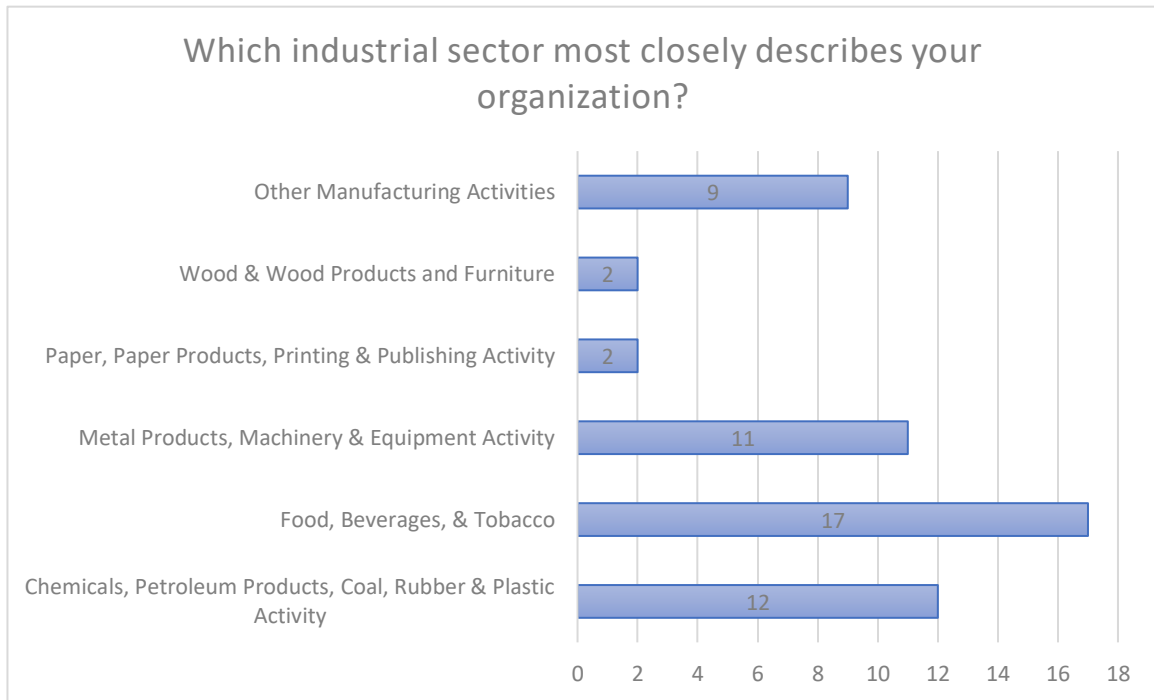
Figure 5 – The number of organization in the different industrial sectors that participated in the study

Figure 5 above was generated from the 53 completed responses. This graph is a breakdown of the different manufacturing sectors that participated in the study. The most represented sector was the "Food, Beverages & Tobacco" sector with the 53 completed responses. However, adding the other non-completed responses would change the most represented industrial sector in the survey to the "Chemicals, Petroleum Products, Coal, Rubber & Plastic Activity" sector. This comes to no surprise as Qatar's economy is dominated by the oil and gas/ petroleum industries (Salem, Musharavati, Hamouda, & Al-Khalifa, 2015). In addition, the Food and Bevrages sector had a recent growth due to the recent dispute with neighboring countries. The participants who responded with "Other Manufacturing Activities (please specify)" specified themselves as either "Manufacturing of pipes", "Glass/ Glass glazing" or "Precast".

Table 7 – The number of participating organizations in each sector with the classification of each organization in the sector

Sector	Number of Responses	Large	Medium	Small	Micro
Chemicals, Petroleum Products, Coal, Rubber & Plastic Activity	12	6	4	1	1
Food, Beverages, & Tobacco	17	3	13	1	-
Metal Products, Machinery & Equipment Activity	11	2	8	1	-
Paper, Paper Products, Printing & Publishing Activity	2	-	2	-	-
Wood & Wood Products and Furniture	2	-	2	-	-
Other Manufacturing Activities	9	1	8	-	-
Total Number of Organization	**53**	**12**	**37**	**3**	**1**

Table 7 represents the data of 53 participants that completed all the sections of the survey. The table represents the total number of respondents in each sector along with the classification of each organization in each sector. This classification is based on the number of employees shown in Figure 1 according to the laws of state of Qatar as explained in the introduction.

<u>4.2 Survey Reponses Data Analysis</u>

In this section, the numerical and graphical data are focused on analyzing the data from the survey's nine sections that are related to lean implementation. Most of these represent the 53 completed responses, but some cover more responses. The purpose of this is see the level of

awareness of "lean systems" in the Qatari Manufacturing Industry and to see what are the most commonly used practices, performance measures and strategies implemented in Qatar. The data in this section also covers the major challenges that organizations in Qatar face when trying to adopt lean. Some findings that are not represented by a table or graph and can be useful can be found at the end of this section.
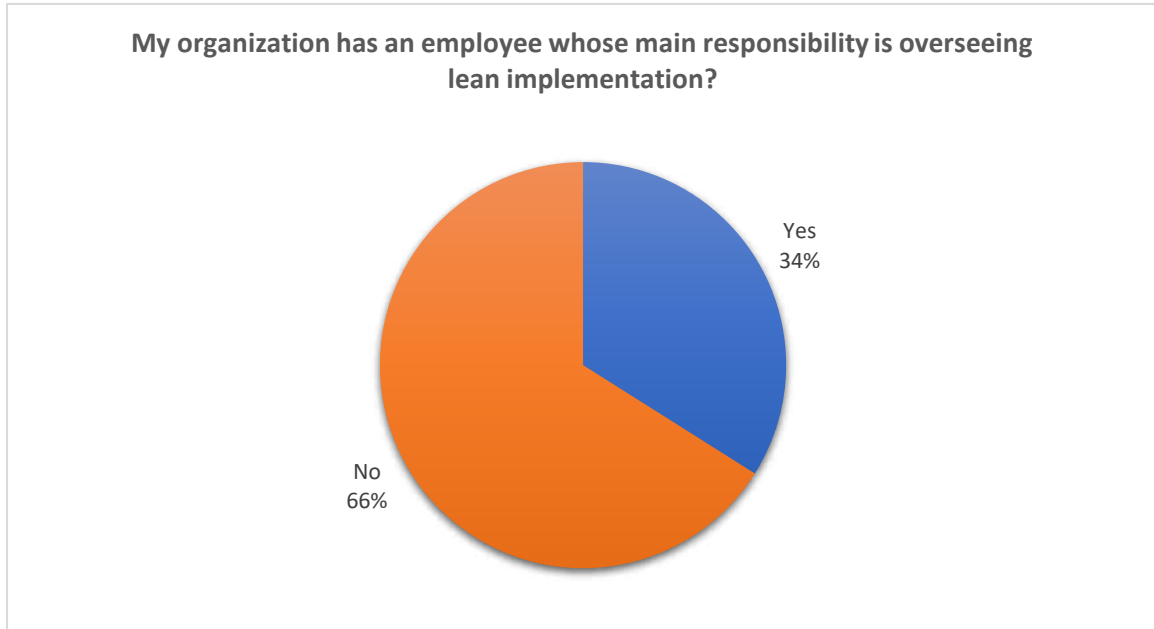
Figure 6 –   Organizations that have an employee whose main responsibility is overseeing lean implementation

Figure 6 above represents 53 organizations that completed the full survey. Since most organizations in Qatar do not have an employee whose main responsibility is overseeing lean implementation, we can detect that there is a lack of commitment to adopting lean. As stated in the literature review, lean is a commitment to a process of continuous improvement that can significantly impact an organization's way of thinking. To achieve successful lean implementation, each organization should have strategic thinking, awareness of various lean tools and their benefits, and have commitment (Womack, Jones, & Ross, 1990; Boyer & Sovilla, 2003; Worley & Doolen, 2006; Atkinson, 2010). By having an employee whose main responsibility is overseeing lean

implementation, the organization is demonstrating a commitment to adopt lean, which is not the case based on the data.
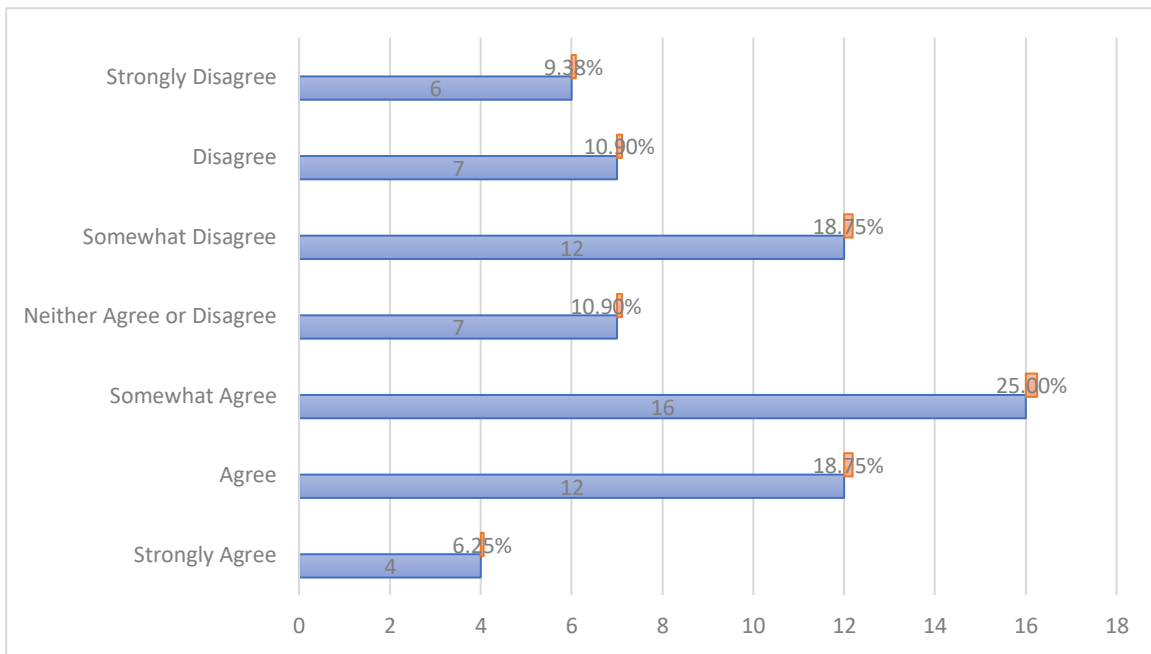
Figure 7 – Participants response on the statement "In my organization, most people have an awareness of Lean concepts / tools/ practices"

Figure 7 above represents 64 responses that answered the question "In my organization, most people have an awareness of Lean concepts / tools/ practices?". As we can see, about 50% of the organizations that responded to the question agree that most employees have some awareness of lean with varying degrees of agreement. Out of the that 50%, The highest number of participants somewhat agree while only 6% strongly agrees. Neutral was 11% while 39% believe that most of their employees have no awareness of lean. This leads us to understand that there is a lack of understanding of lean across all levels in many organizations, which can mean failure in lean implementation. As established before, it is vital that every employee in the organization from top management to lower level workers is made aware of and understands lean concepts, lean practices and the process of implementation. Furthermore, any organization that wants to be successful in adopting lean must be driven by Continuous Improvement processes across all levels

of the organization. This is supported by an organizational lean culture that adapts these concepts and drives the organizations engine forward to achieve these objectives (Ahmad, 2013; Al-Najem, 2014).

Figure 8 – Participants that have had some success in lean implementation

Figure 8 above represents 53 organizations that completed the full survey. The graph shows that most organizations think that have had some sort of success in implementing some lean concepts / tools / practices. However, this does not mean for certain that organizations are 100% successful in adopting a lean system.

Figure 9 – Organizations that are ISO certified

Figure 9 above represents 62 responses that answered the question "Are you ISO 9000 / 9001 Certified Organization?". Most of the organizations in Qatar are ISO certified organizations with many of them in the process of getting certified.
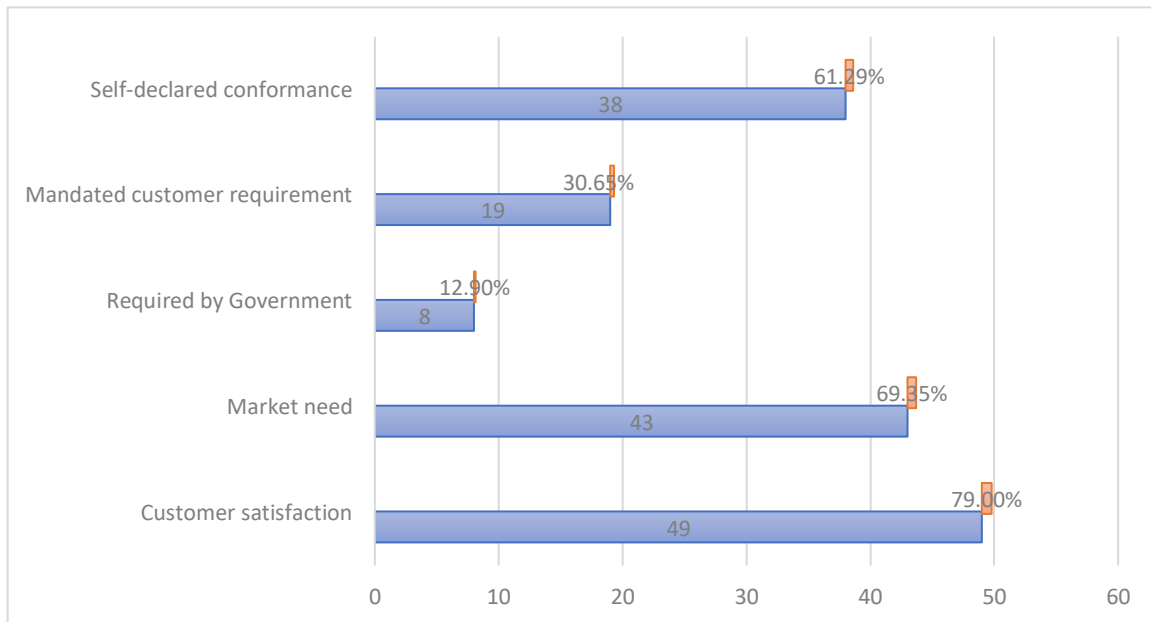
Figure 10– The driver for adopting ISO certification

Figure 10 above represents 62 responses that answered the question "What was the driver for adopting or choosing ISO 9000 / 9001 for future implementation". In this question, there was an option to choose all that applies. Most of the organizations in Qatar were ISO certified organization because of multiple drivers. Customer satisfaction and market need were the top drivers to seek ISO certification.
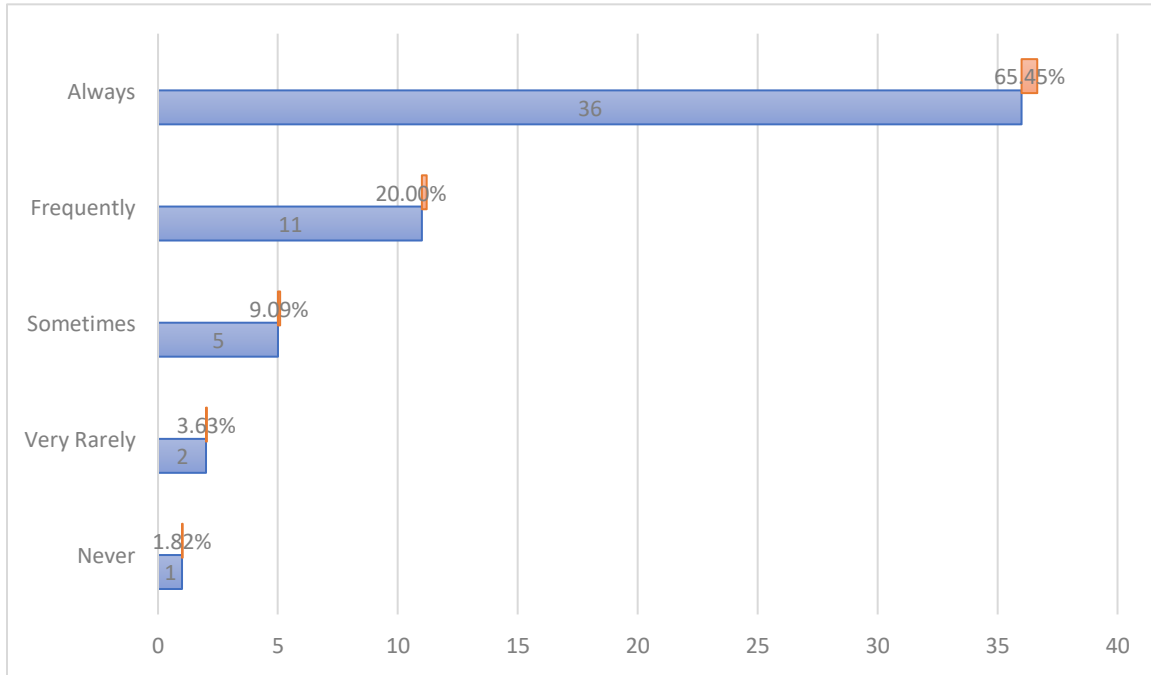
Figure 11 – Participants response to the statement "Raw materials and purchased parts are not subject to incoming inspection as they come from qualified suppliers"

Figure 11 above represents 55 responses that answered the question "Raw materials and purchased parts are not subject to incoming inspection as they come from qualified suppliers". All most all of the organizations in Qatar are inspecting most, if not all, of the materials they get from the different suppliers. This leads us to understand that most of the organizations are making sure that they use the best material in their end product. This in turn means that there is an internal process of quality check in most of the organizations in Qatar.
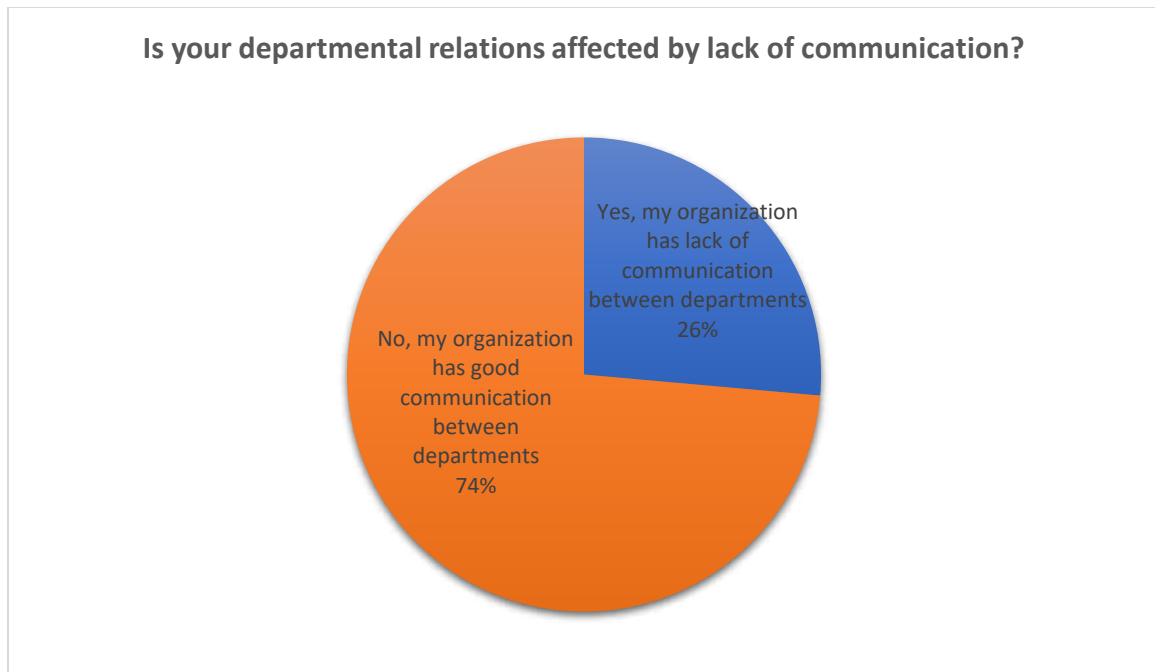
Figure 12 – Organizations that face a lack of communication between departments

Figure 12 above represents 53 organizations that completed the full questionnaire. The graph shows that most organizations think that they have good communications between departments. This is a good sign as lean implementation relies on it to ensure that lean is successfully implemented. Establishing effective communication is vital because the changes have to be fully accepted and implemented by every employee at all levels of the organization (Puvanasvaran, Megat, Tan g, & Razali, 2009). Other data from the survey also shows that 38% of organizations are facing language barriers. Most of the respondents that do not deal with language barriers stated that they either require a certain language to get the job (mostly English) or have a translator present when needed. These methods help in overcoming the language barrier and establishing effective communications.

Table 8 – Participants response to the question "How Do You Specify Customer Needs?"

Methods used to Specify customer needs	Organizations that use it
Interviewing customers	35
Analysing your competition	6
Conducting voice of customer surveys	4
Interviewing stakeholders	2
Analysing cause-and-effect relationship	2
Integration workflows and satisfaction surveys	1
Other	3

Table 8 above represents 53 organizations that completed the full survey. The table shows that "Interviewing customers" is the most used method organizations in Qatar use to specify customer needs. The second highest response is "Analyzing your competition" and the respondents that choose "Other" replied with using multiple ways like interviewing and analyzing. Customers are important factor in any lean implementation since it related to the lean principle Specify Value. This principle is considered the most crucial point in lean implementation. Organizations should identify what the customers want or what the customer is willing to pay for a service or product. To do that, organizations need some way to communicate with customers in order to determine their needs and identify the value that the customer is willing to pay for said service or product. Applying this principle also means focusing on only the value adding process and eliminates non-value adding steps before proceeding on to the next phase (Al Najem, 2014).
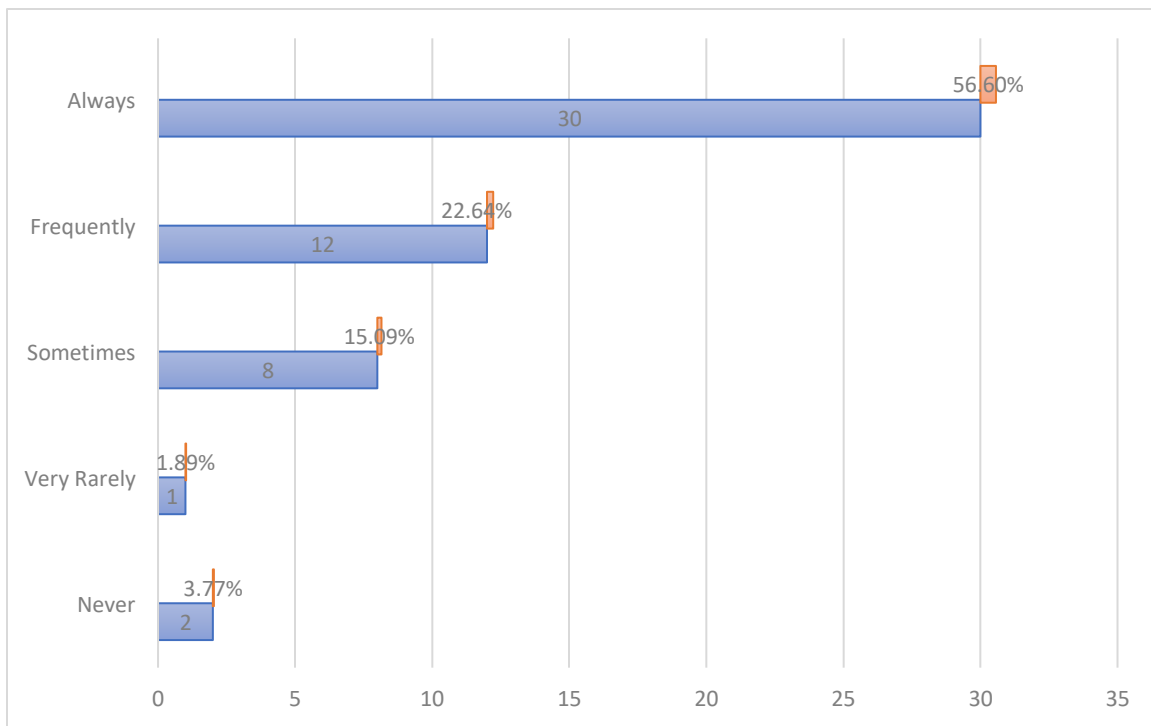
Figure 13 – Participants response to the statement "In my organization, there is a system in place for collecting customer complaints so that problems can be avoided in the future"

Figure 13 above represents 53 organizations that completed the full survey. The graph shows that about 80% of organizations have some sort of system in place for collecting customer complaints which operates frequently if not always. Only about 6% either very rarely or never have a system to collect customer complaints. It is a good sign to learn that customer can communicate with their different product providers and give their feedback and suggestion. This communication with customers is important and any customer-supplier communication happening should be dealt with clearly with an effective process for sending and receiving responses to any problems that may occur. All lean manufacturing organization and enterprises must have effective communication pathways that are broad and efficient to successfully implement lean (Worley & Doolen, 2006).

How do you deal with customer complaints?

Reestablishing the needs and requirements of the customers and conforming to their demands
30%

Addressing the complaints internally and finding a solution
36%

Following up with the customer to hear their suggestions
34%

Figure 14 – Participants response to the question "How do you deal with customer complaints?"

Figure 14 above represents 53 organizations that completed the full survey. The graph shows that all organizations are not ignoring the received complaints and are do not have a slow response to those complaints. It is a very good sign that communication with customers is fast and effective and that complaints are always addressed internally and with the customers. This question had the option to choose multiple answers which means that some organizations apply all methods when dealing with complaints. Only 68% chose "Reestablishing the needs and requirements of the customers and conforming to their demands" as a method to deal with customers, which should be a priority when dealing with customer demands. As mentioned above, having an effective process for sending and receiving responses to any complaints is important for successfully implementing lean in any organization (Worley & Doolen, 2006).

Does your organization have rewards for the workers (e.g. monthly, annual, employee of the month)?

No
28%

Yes
72%

Figure 15 – Organizations that give rewards to excelling workers

Figure 15 above represents 53 organizations that completed the full questionnaire. The graph shows 72% of the organizations are providing employees with rewards and recognition in some way. Out of those organizations that provided rewards, 7% stated that the winner of the reward does not receive benefits other than recognition like a financial reward or extra days off. This means that most organizations not only recognize hard workers but also give them an extra incentive to work harder. This can lead to a healthy work environment and a good worker-management relationship. Having a healthy lean culture with workers and managers motivated towards the change with mindsets always moving towards adopting lean concepts like continuous improvement can lead to success in lean implementation (Al-Najem, 2014).
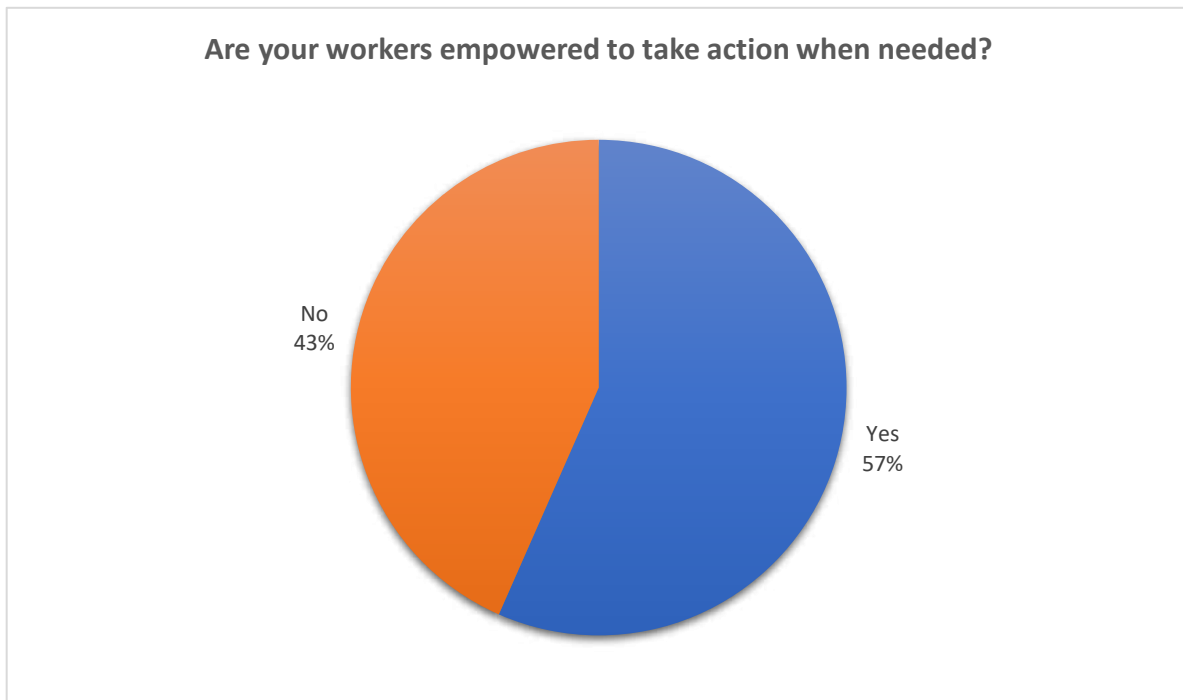
Figure 16 – Participants response to the question "Are your workers empowered to take action when needed?"

Figure 16 above represents 53 organizations that completed the full questionnaire. The graph shows that only 57% of organizations are empowering workers to take action when needed. Most respondents noted that there are certain limitations with what workers are allowed to take action and what they have to get approved. The graph leads to an understanding that most organizations are willing to empower worker so long as their actions are within their role in the organizations. As an employee receives promotions or is given more responsibility, the limitations are fewer and are able to take actions as needed in response to concerns. The responses do not clearly show that this is a significant problem in preventing lean implementation. However, there also needs to be clear guidelines that all worker follow to make sure processes are efficiently working in every stage of the lean implementation.

Table 9 - Methods used to drive continuous improvements

How do you drive continuous improvement programs?	Number of organization that agreed	Percentage %
Identifying non-value adding actives and eliminating them	*40*	*75.47%*
Pursue improvements in in term of quality/design/cost and delivery	*46*	*86.79%*
Eliminating delays in change/over times	*43*	*81.13%*
Reducing waiting/ transport / processing time	*39*	*73.58%*
Developing multi-functional teams	*23*	*43.40%*
Specifying the value that the customer will pay for and eliminating wastes	*25*	*47.17%*
Other	*3*	*5.66%*

Table 9 above represents 53 organizations that completed the full survey and shows the responses to the question "How do you drive continuous improvement programs?". This question had the option to choose all that applies. As can be seen, most organizations drive continuous improvement by pursuing improvements in in term of quality/design/cost and delivery. The second method organizations use to drive continuous improvement is to work toward reducing the delays in change/over times. Other popular ways currently used to drive continuous improvement are: identifying non-value adding actives and eliminating them, reducing waiting/ transport / processing time and process mapping to eliminate unnecessary steps. It is critical to adopt a mentality of continuous improvement as it a key principle of lean (Al-Najem, 2014). The table

shows us that multiple methods are been applied by the Qatari Manufacturing Organizations to drive that principle. The Pareto Chat in figure 20 expands on this further.

<div align="center">4.2.1 Other findings</div>

Most of the organizations that adapted ISO state that it had an effect on their internal processes. The top replies were that they had improved customer satisfaction, better standardized business processes, effective use of data as business management tool, more effective management reviews and improved customer communication. Furthermore, all of the participants stated that they rely on local suppliers with most of agreeing that it is because they can avoid shipment delays and in order to show support to the local market. Another important finding based on the data is that suppliers are provided feedback regarding quality and delivery performance frequently by 49% of organizations. Another finding is that most organizations study their plant's layout and make adjustments to streamline processes and eliminate unnecessary steps and activities. Most organizations rely on qualified and well-trained operators. However, an alarming finding for the survey is that most shop-floor workers don't have the desire to participate and provide us with suggestions or rarely participate and provide suggestions. When asked why, most of replies were that workers are just working for pay without actual care if the organization is growing, succeeding, or failing. Some organizations said that it is partially their fault because there are no anonymous suggestion boxes and no incentives for low level employees to participate.

Another thing that the survey showed was that only 66% of organizations apply pull production in some sort, which is not a good sign if they want to adopt lean. Moreover, most organizations agree that their workplace is clean and all tools and pieces of equipment are put back in their appropriate places, but there are a few organizations that have no dedicated person(s) that makes sure that happens. In addition, all most all organizations produce produces only when

customers order products, but there are a few that produce and store them to stay functional. Problem-solving techniques such as fishbone diagrams are used by 79% of organizations to identify the causes of quality problems. The most skipped optional question was "What is your recruitment strategy?" with 45 participants not willing to give a response. As for the customer's relations, 98% of respondents are aware of the customers' needs and aware of product features that our customer's value and are willing to pay for. 91% of respondents seek feedback from customers regularly through either surveys or meetings with most customers being a part of the initial design process, especially in food and beverage manufacturing organizations. Furthermore, valued customers are often brought in to visit the plant / work site to seek their input and ideas to improve the quality in the organization. Finally, the survey data showed that most Qatari Manufacturing Organizations have training programs with 42% of them sending employees for outside training course
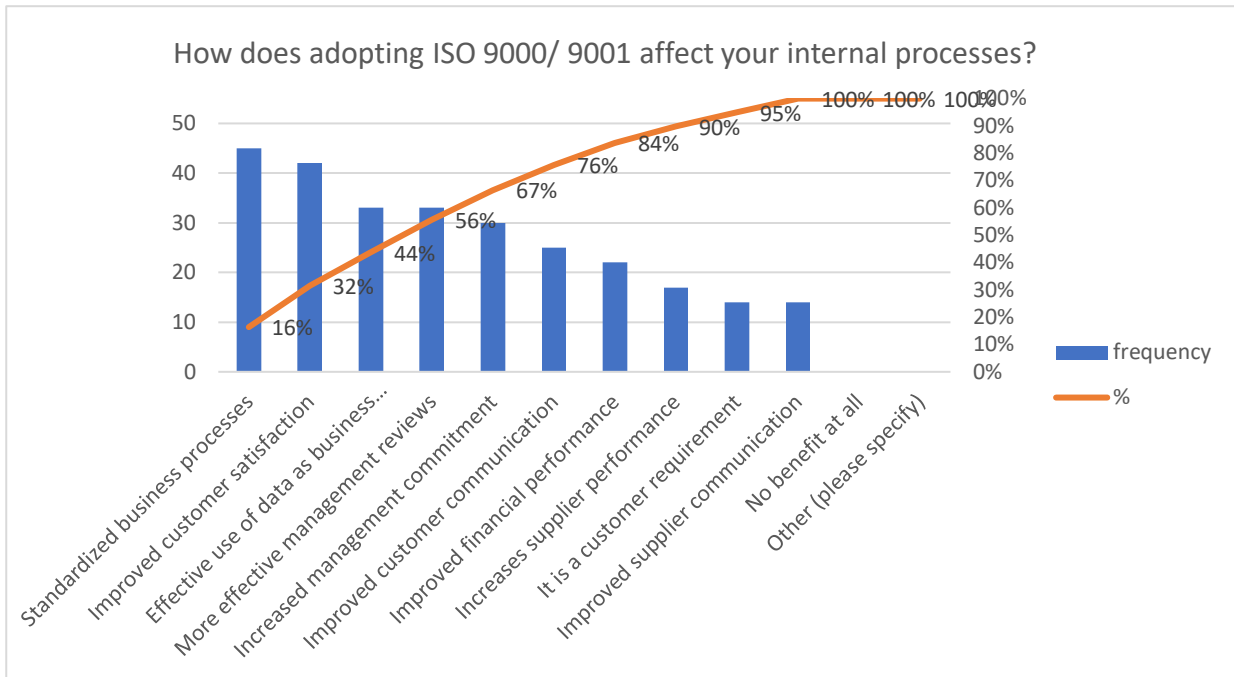
Figure 17 – Pareto Chart of how adopting ISO certification affect internal processes

Figure 17 above represents 53 organizations that completed the full survey and shows the responses to the question "How does adopting ISO 9000/ 9001 affect your internal processes?". This question had the option to choose all answers that apply. As can be seen, the top reasons that contribute to adopting ISO certifications are: Standardized business processes, Improved customer satisfaction, Effective use of data as business management tool, More effective management reviews and Increased management commitment. This means that if any organization wants to gain these benefits, they should consider becoming ISO certified.
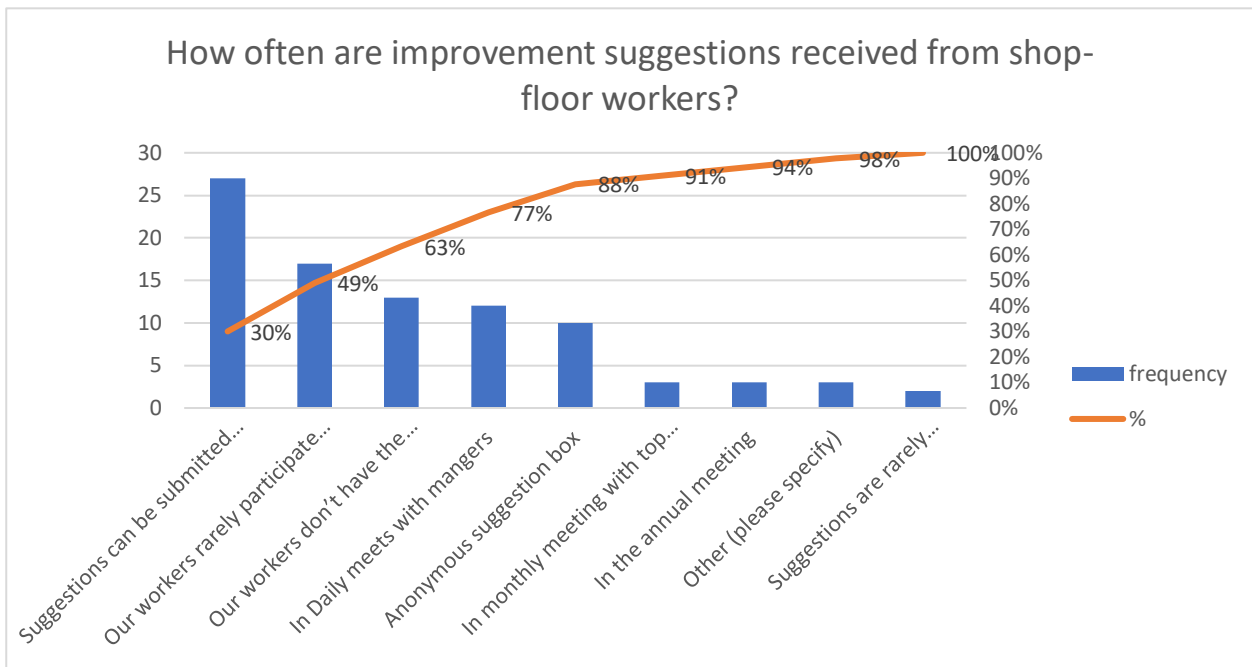
Figure 18– Pareto Chart of how often suggestions are received from workers

Figure 18 above represents 53 organizations that completed the full survey and shows the responses to the question "How often are improvement suggestions received from shop-floor workers?". This question had the option to choose all answers that apply. As can be seen, the most of the organizations are represented by two major positive responses and two major negative responses. The positive responses are: Suggestions can be submitted any time to the manager who moves it up in the chain of command or suggestions are provided in Daily meets with mangers. On the other side, the top negative responses are: Our workers rarely participate and provide us with suggestions or our workers don't have the desire to participate and provide us with suggestions. The data presents an interesting conclusion in that 30% organizations stated suggestions can be submitted any time to the manager and that he determines if it moves up the chain or not. However, this does not effectively represent the number of suggestions that are given or the number of suggestions that are actually moving up to top management. Further, the next top answers are very negative, workers either rarely participate or don't have the desire to participate

in suggestions. Further, the next top answers are very negative, workers either rarely participate or don't have the desire to participate in suggestions. These choices combined represent 33% of the organizations. This leads to the conclusion that most organizations in Qatar have issues with their management-employee relationships and how organizations can gain the trust of workers so that the employees can add a comment without being judged or that there will be no repercussions resulting from the suggestion. Organizations should investigate the reasons that workers lack motivation to participate because it is a major hindrance to lean efforts. The results form Figure 18 is supported also by the fact that the highest number of respondents chose is *Lack of effective Communication Across the Organization* as the challenge preventing them from successful lean implementation, which is shown in Table 12 later.
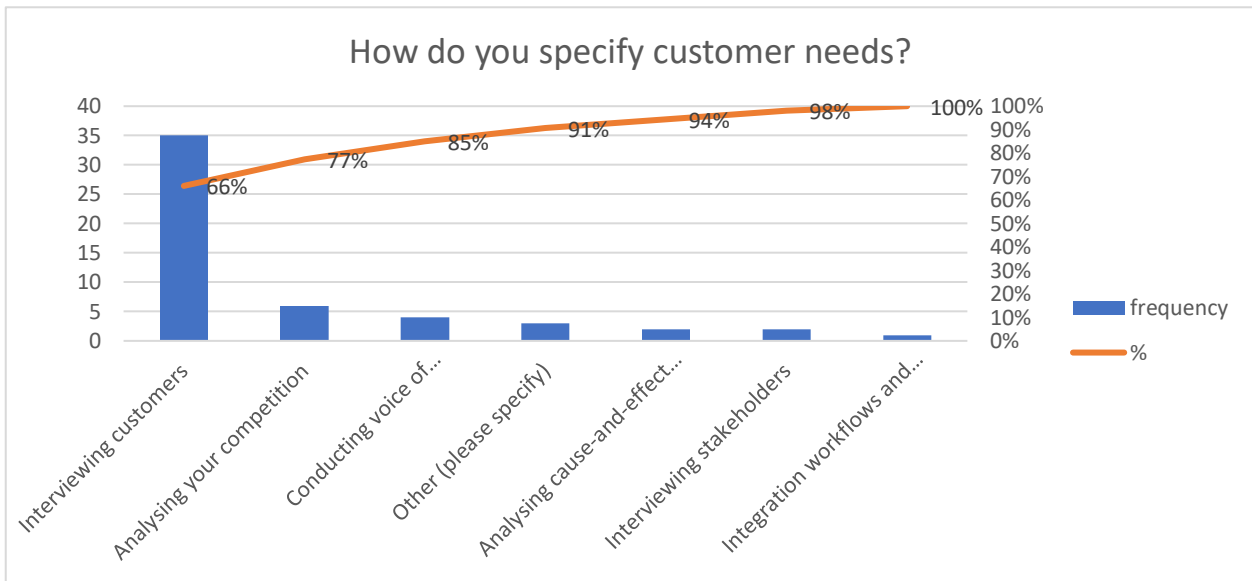
Figure 19 – Pareto Chart of methods that organizations use to specify the customer needs

Figure 19 represents 53 organizations that completed the full survey and shows the responses to the question "How do you specify customer needs?". From the Pareto chart, the top two methods used to specify customer needs are Interviewing customers or Analyzing your

competition, which represents 77% of organizations. These two choice represent the core methods that organizations can see what value their products provides and how to ensure it meets customer requirements. The leads to the conclusion that organizations are applying the main principle of lean, Specify Value, effectively and actively seeking improvements which also supports another core principle, which is Continuous Improvement. Any organization struggling to specify the value that their customers are paying for should adopts these two methods as ways to understand what the customer wants in the product and make any needed adaptions that more specifically meets the needs and requirements of the customer.
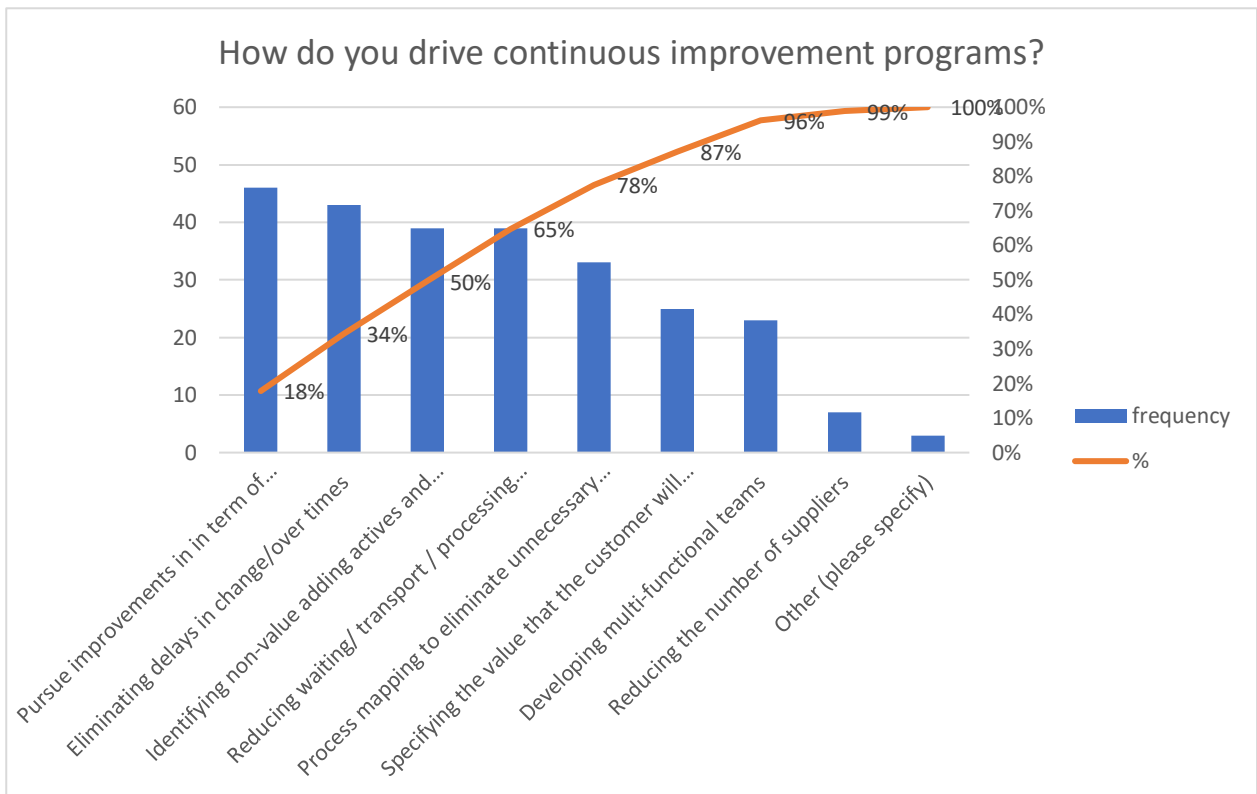
Figure 20 – Pareto Chart of methods used to drive continuous improvement programs

Figure 20 above represents 53 organizations that completed the full survey and shows the responses to the question "How do you drive continuous improvement programs?". This question had the option to choose all that applies. From Figure 20 Pareto chart, it can be seen that there are

multiple drivers for continuous improvement in the Qatari Manufacturing Industry. The top 5 methods that represent 78% of methods used are: Pursue improvements in in term of quality/design/cost and delivery, eliminating delays in change/over times, identifying non-value adding actives and eliminating them, reducing waiting/ transport / processing time and process mapping to eliminate unnecessary steps. These methods are used by most organizations and shows that organizations are applying a core lean principle, which is Continuous Improvement. As explained before, if this principle is ignored, the organization will sustain success in the short term and might revert back to the old ways. In order to sustain the good results from implementing lean, these methods must be revisited constantly to maintain a lean system (Al Najem, 2014).

Table 10 – Lean practices used in the Qatari Manufacturing Industry

Practice	Organizations that uses this practice	Percentage from 53 Total Responses
Setup Time Reduction	51	96.22%
Standard Work	50	94.34%
Total Quality Management	50	94.34%
Quality Circles	45	84.91%
Total production System	45	84.91%
Small lot/ Batch Size	37	69.81%
Poka Yoke (mistake proofing)	37	69.81%
Cellular Manufacturing	26	49.06%
Kanban	22	41.51 %
5S	22	41.51%

Table 10 above represents 53 organizations that completed the full survey. The table shows the different practices used in the Qatari Manufacturing Industry and the ranks the most used practices from the highest to the least. *Setup Time Reduction*, *Standard Work* and *Total Quality Management(TQM)* are used by most organizations with 96.22%, 94.34 and 94.34% respectively. The least common practice used were *5S* and *Kanban* with 41.51% for both.

Table 11– The usefulness of each lean practice used according to survey participants

Practice	Total number of organization that use this practice	A very small extent	A small extent	A moderate extent	A fairly large extent	A large extent	A very large extent	Percentage from 53 Total Responses
5S	22	5(22.73%)	0	4(18.18%)	**9(40.91%)**	2(9.09%)	2(9.09%)	41.51%
Total production System	45	3(6.67%)	2(4.44%)	10(22.22%)	5(11.11)	**21(46.66%)**	4(8.88%)	86.79%
Setup Time Reduction	51	4(7.84%)	4(7.84%)	10(19.61%)	13(25.49%)	**17(33.33%)**	3(5.88%)	96.22%
Cellular Manufacturing	26	3(11.54%)	2(7.69%)	**8(30.77%)**	6(23.08%)	5(19.23%)	2(7.96%)	49.06%
Kanban	22	0	**6(27.27%)**	5(22.73%)	3(13.64%)	4(18.18%)	4(18.18%)	41.51 %
Standard Work	50	3(6%)	1(2%)	6(12%)	10(20%)	**22(44%)**	8(16%)	94.34%
Small lot/ Batch Size	37	2(5.41%)	5(13.51%)	5(13.51%)	**11(29.73%)**	9(24.32%)	5(13.51%)	69.81%
Poka Yoke (mistake proofing)	37	3(8.11%)	2(5.41%)	7(18.92%)	6(16.22%)	**14(37.84%)**	5(13.51%)	69.81%
Total Quality Management	50	0	1(2%)	5(10%)	9(18%)	**22(44%)**	13(26%)	94.34%
Quality Circles	45	2(4.44%)	0	4(8.88%)	10(22.22%)	**22(48.88%)**	7(15.55%)	84.91%

Table 11 above represents 53 organizations that completed the full survey. The table shows how useful each of the practices used in the Qatari Manufacturing Industry were to the organizations that applied them. Most of the practices used are consider very useful with the majority ranking them with "A Fairly large extent" or better. It is also seen that the majority of organizations applying

Kanban believe that it was useful to "a very small extent" and the majority of organizations applying *Cellular Manufacturing* believe that it was useful to "a moderate extent". These leads to the conclusion that the organization that apply these practices are either not applying it correctly or effectively. The most useful practices according to the table are *Standard work*, *TQM*, *Quality Circles* with 22 organizations that apply them stating that it is useful to "A large extent" with *Total Production System* right behind them with 21 organizations that apply them stating that it is useful to "A large extent".

Table 12 – Performance measure used in the Qatari Manufacturing Industry

Performance measure	**Organizations that uses this Performance measure**	**Percentage from 53 Total Responses**
Percentage of Parts Delivered Just in Time in The Production Line	51	96.23%
Total Production Manufacturing Time	51	96.23%
Actual Cost Compared to Budget	50	94.34%
Number of Projects Delivered on Time	47	88.68%
Lead time to market	46	86.79%
Cycle Time	42	79.25%

Table 12 above represents 53 organizations that completed the full survey. The table shows the different performance measures that are used in the Qatari Manufacturing Industry and the ranks the most used performance measure to least. *Percentage of Parts Delivered Just in Time in the production line* and *Total Production Manufacturing Time* are used by most organizations as a performance measure with 96.23% for both. The least common performance measure used was *Cycle Time* with 79.25%.

Table 13– The usefulness of each performance measure used according to survey participants

Performance measure	Total number of organization that use this practice	A very small extent	A small extent	A moderate extent	A fairly large extent	A large extent	A very large extent	Percentage from 53 Total Responses
Lead time to market	46	2(4.35%)	5(10.87%)	11(23.91%)	11(23.91%)	**15(32.61%)**	2(4.35%)	86.79%
Total Production Manufacturing Time	51	3(5.88%)	3(5.88%)	7(13.73%)	8(15.69%)	**20(39.22%)**	10(19.61%)	96.23%
Cycle Time	42	1(2.38%)	3(7.14%)	8(19.05%)	**15(35.71%)**	12(28.57%)	3(7.14%)	79.25%
Number of Projects Delivered on Time	47	1(2.13%)	1(2.13%)	7(14.89%)	10(21.28%)	**25(53.19%)**	3(6.38%)	88.68%
Percentage of Parts Delivered Just in Time in The Production Line	51	3(5.88%)	4(7.84%)	9(17.65%)	15(29.41%)	**20(39.22%)**	0	96.23%
Actual Cost Compared to Budget	50	1(2%)	4(8%)	5(10%)	7(14%)	8(16%)	**25(50%)**	94.34%

Table 13 above represents 53 organizations that completed the full survey. The table shows how useful each performance measure is to the organizations that use them to evaluate their work. All of the performance measures used were considered useful with a rank of a "A fairly large extent" or better. *Actual Cost Compared to Budget* was the considered the most useful with 25 organizations

ranking it useful to "A very large extent". *Cycle Time* was ranked with the lowest usefulness with 15 organizations ranking it useful to "A fairly large extent". The table leads us to conclude that all of the organizations consider these performance measures useful in evaluating their work.

Table 14 – Challenges that the Qatari Manufacturing Industry face when implementing lean

Challenge	**Organizations that face this challenge**	**Percentage from 53 Total Responses**
Lack of employee Engagement	43	81.13%
Lack of effective Communication Across the Organization	38	71.70%
Lack of Top Management Commitment and Support	28	52.83%
Unsupportive Organization Culture	27	50.94%
Lack of Connection with Stakeholders	16	30.19%

Table 14 above represents 53 organizations that completed the full survey. The table shows the different challenges faced when implementing lean in the Qatari Manufacturing Industry and the ranks the most faced challenge from the highest to the least. The most faced challenge is *Lack of employee Engagement* with 43 organizations in Qatar facing it. The second highest challenge faced by 38 organizations in Qatar is *Lack of effective Communication Across the Organization*. The least faced challenge is *Lack of Connection with Stakeholders* with only 16 organizations in Qatar that facing it.

Table 15 – The extent of each challenge faced according to survey participants

Challenge	Total number of organization that face this challenge	A very small extent	A small extent	A moderate extent	A fairly large extent	A large extent	A very large extent	Percentage from 53 Total Responses
Lack of Top Management Commitment and Support	28	**13(46.43%)**	11(39.29%)	2(7.14%)	0	2(7.14%)	0	52.83%
Lack of effective Communication Across The Organization	38	**16(42.11%)**	11(28.95%)	8(21.05%)	2(5.26%)	1(2.63%)	0	71.70%
Lack of employee Engagement	43	**19(44.19%)**	8(18.60%)	7(16.28%)	7(16.28%)	1(2.33%)	1(2.33%)	81.13%
Unsupportive Organization Culture	27	7(25.93%)	**12(44.44%)**	4(14.81%)	2(7.41%)	2(7.41%)	0	50.94%
Lack of Connection With Stakeholders	16	**8(50%)**	4(25%)	2(12.5%)	0	2(12.5%)	0	30.19%

Table 15 above represents 53 organizations that completed the full survey. The table shows how much each challenge faced is affecting the organizations and preventing the success of lean implementation. Most organizations consider the challenges facing them to be not a major challenge since most rankings are "A very small extent". The only challenge faced that was ranked higher by the majority of organizations facing it was *Unsupportive Organization Culture* with a rank of "A small extent". The highest number of organization face *a Lack of employee Engagement* with 19 organizations in Qatar facing it with an effect on lean implementation

considered to be "A very small extent" effect. This leads to the conclusion that there is a good chance of overcoming these challenges with the right strategy combined with lean education and training.

The hypothesis test conducted were:

- H1: There is a significant difference in the success of lean implementation and the quality management practices used by ISO certified organizations compared to non-ISO certified organizations in Qatar.

- H2: Organizations in different sectors in Qatar differ significantly in terms of their lean implementation and quality management practices.

Before conducting the different statistical tests, it was assumed that the data is drawn from a normally distributed population. A Chi-square and a sample t-test were used to test H1 while a one-way ANOVA test was used for H2.

<u>4.3.2.1 Hypothesis Test 1</u>

Table 16 – ISO certified Vs Non-ISO certified
Group Statistics

	ISO-certified	N	Mean	Std. Deviation	Std. Error Mean
Are you aware about Lean Systems, Lean concepts / tools/ practices	No	8	.63	.518	.183
	Yes	45	.71	.458	.068
most people have an awareness of Lean concepts / tools/ practices in the organization	No	8	.13	1.642	.581
	Yes	45	.22	1.744	.260
My organization has had success in implementing some lean concepts / tools / practices	No	8	.75	.463	.164
	Yes	45	.62	.490	.073

Table 17 – Chi-square results of ISO certified Vs Non-ISO certified

Variable	Category	ISO9000 Certified		Chi-square	df	P-value
		No N (%)	Yes N (%)			
Aware of Lean system	No	3 (37.5%)	13 (28.9%)	0.24	1	0.60
	Yes	5 (62.5%)	32 (71.1%)			
Employee having awareness of lean	Strongly disagree	0 (0%)	3 (6.7%)	2.83	6	0.83
	Disagree	2 (25%)	5 (11.1%)			
	Somewhat disagree	1 (12.5%)	10 (22.2%)			
	Neither of both	1 (12.5%)	4 (8.9%)			
	Somewhat agree	2 (25%)	11 (24.4%)			
	Agree	2 (25%)	8 (17.8%)			
	Strongly agree	0 (0%)	4 (8.9%)			
Success in implementing lean concepts	No	2 (25%)	17 (37.8%)	0.48	1	0.49
	Yes	6 (75%)	28 (62.2%)			

Table 18 – Levene's test of equality of variances & sample t-test

Independent Samples t-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Aware of Lean system	Equal variances assumed	.658	.421	-.481	51	.633	-.086	.179	-.446	.274
	Equal variances not assumed			-.441	9.060	.670	-.086	.195	-.528	.355
Employee having awareness of lean	Equal variances assumed	.168	.683	-.146	51	.884	-.097	.664	-1.430	1.235
	Equal variances not assumed			-.153	10.024	.882	-.097	.636	-1.514	1.320
Success in implementing lean concepts	Equal variances assumed	3.113	.084	.684	51	.497	.128	.187	-.247	.503
	Equal variances not assumed			.713	10.007	.492	.128	.179	-.272	.527

The first hypothesis is testing the difference between ISO certified organizations vs Non-ISO certified organizations concerning lean awareness and success of lean implementation. Using the results obtained from the survey and as shown in Table 17 and setting up the confidence level to be $\alpha=0.05$, the p value is 0.001 at 95 % confidence interval. Table 18 shows the Levene's test of equality of variances results on a p value of 0.42, 0.68 and 0.08 which is greater than 0.05. Thus, we assume equal variances. The results indicate

that 2-tailed p value is greater than 0.05, so with 95 % confidence interval the result is failure to reject the null hypothesis. The results lead to the conclusion that there is no significant difference in the success of lean implementation and the quality management practices used by ISO certified organizations compared to non-ISO certified organizations in Qatar.

<u>4.3.2.2 Hypothesis Test 2</u>

Table 19 – One-way ANOVA test for different industrial sectors

Variable	**Chemical/ Petroleum/ Coal/ Rubber/ Plastic**	**Metal/ Machinery/ Equipment**	**Food/ Beverage/ Tobacco**	**Paper/ Printing/ Publishing**	**Wood/ Furniture**	**Others**	**F - ratio**	**P- Value**
	N, Mean ± SD	**N, Mean ± SD**	**N, Mean ± SD**	**N, Mean ± SD**	**N, Mean ± SD**	**N, Mean ± SD**		
Performance measures used index	12, 66.90 ± 13.58	11, 61.87 ± 18.18	16, 62.5 ± 13.22	2, 76.39 ± 5.89	2, 58.33 ± 7.86	9, 55.55 ± 24.81	0.77	0.57
Lean Practice index	11, 51.59 ± 15.97	11, 41.74 ± 15.21	16, 49.17 ± 7.63	2, 67.5 ± 12.96	2, 46.67 ± 2.36	8, 56.04 ± 18.92	1.79	0.13
Challenge faced when implementing lean index	12, 27.64 ± 23.03	11, 12.58 ± 7.50	17, 18.72 ± 11.39	2, 21.67 ± 16.50	2, 33.33 ± 28.28	9, 18.52 ± 13.96	1.45	0.22

The second hypothesis is testing the difference between each industrial sector when it comes to lean implementation and lean application. Using the data obtained from the survey and setting up the confidence level to be α=0.05 we see the results of the One-way ANOVA test in Table 19. The table compares each sector with respect to practices used, performance measures used, and challenges faced. The mean and standard deviation along with p value are shown. All the p-values are greater than 0.05. Thus, the result is failure to reject the null hypothesis. This means that there is no significant difference between the different industrial sectors in Qatar in terms of their lean implementation and quality management practices.

CHAPTER FIVE: CONCLUSION

Lean implementation in the manufacturing industry has made a significant improvement to the industrial community. The success of lean across global manufacturing is driving academics, researchers, and organizations of all sizes and nature to study and apply lean in their organizations. Current lean research is largely focused on the developed economies in Europe, the Americas, and in Southeast Asia (Mady, 2009). However, the subject of lean implementation, lean awareness, and challenges faced when implementing lean have not been studied much within the Qatari Manufacturing Industry context. According to Pay in 2007, 70% of all United States based manufacturing plants attempted to implement lean system concepts. Of those companies, only 2% achieved a full successful lean implementation and 24% achieved a partial success (Pay, 2008). According to Bhasin and Burcher (2006), less than 10 % of the organizations in the United Kingdom accomplished a successful lean manufacturing implementation. This study attempts to shed light on the external and internal factors that may impede the success of lean systems within the Qatari Manufacturing Industry.

In order to do so, this study focused on learning the state of applications of lean in Qatar and assess the awareness of the lean practices/tools/concepts in the manufacturing industry and SME. Secondly, the study seeks to understand the current practices in the Qatari Manufacturing Industry and if the implementation of lean is successful. Finally, the study addresses the reasons that impact of the success or failure of lean by explaining the challenges facing the organizations in the Qatari Manufacturing Industry and SME. To study the current state of the Qatari Manufacturing Industry and SME, an online survey was designed using the SurveyMonkey tool. Since the objectives of this study arento access the current state of lean implementation in Qatar, the survey developed the questions that included a list of practices, performance measures, and

challenges faced based on the literature which outlined the most common used practices and tools along with similar surveys (Al-khalifa & Aspinwall, 2000; Fricke & Buehlmann, 2012; Al-Najem, 2014; Choothian, 2014; Mirdad & Eseonu, 2015; Salem, Musharavati, Hamouda, & Al-Khalifa, 2015).

5.1 Major Findings

From all of the organization that were contacted to participate, a total of 82 respondents agreed to participate with 53 completing all sections of the survey. Most of the participants are in high positions in their organizations and most participants have a high educational level. This means that they were capable of accurately assessing the state of their organization's implementation of lean. The most represented sectors in the survey were Food/Beverages organizations and Chemicals/ Petroleum organizations, with most of them being medium sized enterprises. Based on the survey data, it is understood that most of the organizations in Qatar have some level of awareness of lean concepts, tools, and practices. However, there are some indication that it is not implemented well in all aspects of the organization. Some organizations have communication issues and language barriers and some organizations workers don't have the desire to participate and provide suggestions for improvements. These signs lead to the conclusion that the idea is not fully formulated and imbedded across the organizational structure.

Most organizations in the study are ISO certified which might be the reason for applying many of the quality management tools that are affiliated with lean. The most used lean practices in the Qatari Manufacturing Industry are *Setup Time Reduction*, *Standard Work* and *TQM* among most of the organizations evaluating. These are considered to be the most effective tools in improving the organization implementing lean. The least common practice used were *5S* and *Kanban*. The most common performance measures used by the Qatari Manufacturing

Organizations are *Total Production Manufacturing Time* and *Percentage of Parts Delivered Just in Time in the production line*. The least used performance measure used was *Cycle Time*. All of performance measures organizations used were considered effective and useful to evaluate the organization's performance. However, these tools, methods, and performance measures may have been applied in the most manufacturing organizations in Qatar as part of a different quality model. The results suggest that organizations are implementing some kind of LS but most of them are applying it without a deeper understanding of the use or purpose of lean across all levels of the organizations. In fact, the survey suggests that most organizations in Qatar face a *Lack of employee Engagement* challenge that prevents them from successfully implementing lean. However, most organizations consider having an *Unsupportive Organization Culture* challenge a major hindrance to lean implementation efforts. This is further supported by the fact that most of respondents thought that their workers are just working for pay without actual care if the organization is growing, succeeding, or failing. In addition, workers don't have the desire to participate or provide suggestions. This means that there is an organizational cultural issue, even if most organizations consider it to have a small effect on lean implementation. It still plays a factor in preventing the establishment of a healthy lean system.

A hypothesis test was developed to see if there is a significant difference between organizations that are ISO-certified vs organizations that are not. A second hypothesis test was developed to see if there a difference between industrial sectors when it comes to lean implementation. The results of both test were the failure to reject of the null hypothesis. This means that based on the data from the survey there is no difference between ISO-certified and Non-ISO certified organizations and no difference between the different industrial sectors. These results might not accurately represent the reality because only 15% of respondents were Not ISO certified.

In addition, the different industrial sectors were not evenly represented due to some limitations; thus, the results can be considered inaccurate.

All of that leads to the conclusion that there is evidence that suggests that the Qatari Manufacturing Organizations are not implementing lean concepts and are not using quality management practices effectively. There seems to be a lack of commitment by workers to improve the organization combined with a lack of education about the benefits of applying lean. This results in an organizational culture that is not supportive and eager to implement lean. However, it is also interpreted from the survey data that the building block for implementing lean are there in most organizations but they are not being utilized. Based on the data, most organizations do not have a communication issue, are applying continuous improvement programs, are aware of the value that their customers are willing to pay for, and are open to hearing their customer's suggestions and complaints. On the other hand, the data suggests that most organizations have issues with their workers; as they tend to lack motivation and desire to participate. This is supported also by the fact that the highest number of challenge faced by organizations in Qatar is *Unsupportive Organization Culture*. This is a trust issue at its core and it needs to be addressed. Through the empowerment of employees and by allowing them to be part of the future vision of the organization and participate in the decision-making process trust can be built. Treating employees as partners in the organizations can create a positive atmosphere that is motivated to succeed in their lean efforts. The issues should be addressed internally to find root causes of the problem and the fixed if the organizations objective is to successfully adopt LS. With the right strategy combined with lean education, training and establishment of trust, organizations can move from failing to successfully implementing all or parts of the lean process.

5.2 Limitations of Research

Several limitations were faced during the design of this study. First, not all questions in the survey were answered. Only 65% of the respondents completed all sections of the survey, which resulted in some difference in sample sizes of data in each question. This may result in inconsistency in the analysis of the data. Another limitation was time, as most organizations were not willing to give time to do the survey and due to the nature of thesis and deadlines, there could have been a bigger sample if there was more time. Finally, not all manufacturing sectors were evenly represented in the study. The majority of organizations that responded were from the Food/ Beverage industrial sector and Chemicals/Petroleum industrial sector. This is due to the fact that these sectors represent the majority of the Qatari Manufacturing Industry and that they were the most willing sectors to participate in this study. Furthermore, due to time constraints, there wasn't huge opportunities to represent the other sectors. This can mean that insight into the extent of lean application in the whole industry was not accurately represented in this study.

5.3 Future Research Opportunities

This study aims to access the level of lean awareness and implementation and sheds a light on the challenges that face the Qatari Manufacturing Industry. Due to many circumstances and the limitations, like lack of time, and by using the data in this study there are many avenues that can be explored in future research.

First, as explained above, this study was not able to effectively cover all the different industrial sectors. Exploring these other sectors like textiles, clothing, wood and wood products, furniture, paper/ paper products and printing/ publishing and getting a greater sample sizes would give a deeper insight to the state of lean adoption in the Qatari Manufacturing Industry.

Secondly, there needs to be a deeper study for the drivers that can further imbed lean thinking in the Qatari Manufacturing Industry. As interpreted from this study most of the organizations in Qatar have general awareness of lean concepts/tools and practices. However, they are not applied in every area with enough consistency to be effective. The research found that many of the applied practices are applied as part of ISO certification or other QM training rather than applying them as part of a lean initiative. Therefore, in order to advance lean manufacturing in Qatar, a future research opportunity can focus on how to imbed these core principles and practices in the organizations and what strategies are needed to ensure that all workers truly understand lean.

Finally, this study address the challenges and barriers that organizations face internally when implementing lean. The survey defines five challenges and ranks them from most effective for the success of lean implementation to the least effective for the success of lean implementation. There are two avenues that can be adopted for future research in that area. A future research that covers other internal factors that prevent successful implementing of lean, like lack of good education in lower level workers, and how to build trust within the organizational culture to encourage participation. Studying specific internal challenges effects can help new organizations trying to implement lean in overcoming these barriers. The other avenue for future research is looking at the external factors that organizations face when implementing lean. Do the rules and regulations need adjustments to help organizations succeed? Are there strategies that should be put in place by the government to better implement lean and prevent failures? These external factors are not covered in this study and can provide needed information about how external factors play a role in lean implementation in Qatar

APPENDIX A: IRB LETTER

UNIVERSITY OF CENTRAL FLORIDA

<u>NOT HUMAN RESEARCH DETERMINATION</u>

July 1, 2019

Dear Abdulwahab Alyousef:

On 7/1/2019, the IRB reviewed the following protocol:

Type of Review:	Initial Study
Title of Study:	Lean awareness and challenges in Qatar SME
Investigator:	Abdulwahab Alyousef
IRB ID:	STUDY00000540
Funding:	None
Grant ID:	None
IND, IDE, or HDE:	None
Documents Reviewed:	• HRP-250 - FORM - Request for NHSR (2).pdf, Category: IRB Protocol;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving human in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study.

If you have any questions, please contact the UCF IRB at 407-823-2901 or irb@ucf.edu. Please include your project title and IRB number in all correspondence with this office.

Sincerely,

Racine Jacques, Ph.D.
Designated Reviewer

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APPENDIX B: SURVEY

Introduction:

Dear Participant,

This study is being conducted for the University of Central Florida as part of a thesis that covers lean implementation. This survey will help us assess the level of awareness of lean concepts/practices and tools used and identify the barriers/challenges of successful implementation of lean.

The following questionnaire will require approximately 12 - 15 minutes to complete. There is no compensation for responding nor is there any known risks. ***This study will not require you to name or specify your organization so there is no worry about confidentiality.*** Please answer all questions as honestly as possible to help us understand the problems we face in Qatar and try to find solution to do it better. Participation is voluntary and the data collected will provide useful information about the level of awareness of lean concepts/practices and tools in Qatar.

By completing and returning the questionnaire, you are indicating your willingness to participate in this study. If you have questions, please contact the research team though the contact information below.

Thank you for taking the time to assist us in our study.

Sincerely,

Abdulwahab Alyousef

Email:

Phone:

The Survey

About you:

1. What is your job position or title:
   - CEO / Managing Director
   - Project Manger
   - Supervisor
   - Quality Control Manager
   - Inventory Manager

- o Training Officer
- o HR Manger
- o Other (please specify) _____

2. Education Level
   - o Master's / PhD
   - o Bachelor's Degree
   - o High School
   - o Others (please specify)_____

3. Are you aware about Lean Systems, Lean concepts / tools/ practices?
   - o Yes
   - o No

Organization information:

4. What year did you start your organization?

   - o Drop menu starting at 1960 - 2019

5. Which industrial sector most closely describes your organization?
   - o Food, Beverages, & Tobacco
   - o Textiles, Clothing & leather Products Activity
   - o Wood & Wood Products and Furniture
   - o Paper, Paper Products, Printing & Publishing Activity
   - o Chemicals, Petroleum Products, Coal, Rubber & Plastic Activity
   - o Nin-Metallic Minerals Except Petrol Activity
   - o Metal Products, Machinery & Equipment Activity
   - o Other Manufacturing Activities (please specify) _____

6. Approximately how many employee work at your organization?

   - ○ Micro (1-5)
   - ○ Small (6-30)
   - ○ Medium (31-250)
   - ○ Large (251 and above)

Lean awareness:

7. My organization has an employee whose main responsibility is overseeing lean implementation?

   - ○ Yes
   - ○ No

8. In my organization, most people have an awareness of Lean concepts / tools/ practices?

   - ○ Strongly Disagree
   - ○ Disagree
   - ○ Somewhat Disagree
   - ○ Neither Agree or Disagree
   - ○ Somewhat Agree
   - ○ Agree
   - ○ Strongly Agree

9. My organization has implemented some lean concepts / tools / practices in the past?

   - ○ Yes
   - ○ No

10. My organization has had success in implementing some lean concepts / tools / practices?

   - ○ Yes
   - ○ No

ISO 9000/9001

11. Are you ISO 9000 / 9001 Certified Organization?

   o   Yes

   o   No

12. What was the driver for adopting or choosing ISO 9000 / 9001 for future implementation?

   Choose all options that apply

   o   Customer satisfaction

   o   Market need

   o   Required by Government

   o   Mandated customer requirement

   o   Self-declared conformance

   o   other(please specify) _____

13. How does adopting ISO 9000 / 9001 affect your internal processes? *(Optional)*

   Choose all options that apply

   o   Improved customer satisfaction

   o   Standardized business processes

   o   Increased management commitment

   o   Effective use of data as business management tool

   o   More effective management reviews

   o   Improved customer communication

   o   Increases supplier performance

   o   It is a customer requirement

   o   Improved supplier communication

   o   Improved financial performance

   o   No benefit at all

   o   Other (please specify) _____

14. Please rate the extent to which each practice has been useful in improving (product manufacturing and/or distribution/ services/ processes)								
	This practice is not used by our organization	Used but was not useful	A very small extent	A small extent	A moderate extent	A fairly large extent	A large extent	A very large extent
5S	○	○	○	○	○	○	○	○
Total productive System	○	○	○	○	○	○	○	○
Setup Time Reduction	○	○	○	○	○	○	○	○
Cellular Manufacturing	○	○	○	○	○	○	○	○
Kanban	○	○	○	○	○	○	○	○
Standard Work	○	○	○	○	○	○	○	○
Small lot/ Batch size	○	○	○	○	○	○	○	○
Poka yoke (mistake proofing)	○	○	○	○	○	○	○	○
Total Quality management	○	○	○	○	○	○	○	○
Quality circles	○	○	○	○	○	○	○	○

	This performance measure is not used by our organization	Used but was not useful	A very small extent	A small extent	A moderate extent	A fairly large extent	A large extent	A very large extent
15. Please rate to which extent the performance improved after applying lean for each performance measure your organization uses *(if any)*								
Lead time to market	○	○	○	○	○	○	○	○
Total Product manufacturing time	○	○	○	○	○	○	○	○
Cycle time	○	○	○	○	○	○	○	○
Number of projects delivered on time	○	○	○	○	○	○	○	○
Percentage of parts delivered just in time in the production line	○	○	○	○	○	○	○	○
Actual cost compared to budget	○	○	○	○	○	○	○	○

	Our organization does not face this challenge	No impact on lean implementation	A very small extent	A small extent	A moderate extent	A fairly large extent	A large extent	A very large extent
16. Please rate the extent to which each challenge impacts lean implementation								
Lack of top management commitment and support	○	○	○	○	○	○	○	○
Lack of effective communication across the organization	○	○	○	○	○	○	○	○
Lack of employee engagement	○	○	○	○	○	○	○	○
Unsupportive organization culture	○	○	○	○	○	○	○	○
Lack of connection with stakeholders	○	○	○	○	○	○	○	○

Suppliers:

17. What is the current number of suppliers in your organization?

    o   Less than 3

    o   3 to 5

    o   5 to 10

    o   More than 10

18. My organization uses local suppliers?

    o   Yes

    o   No

If yes please answer this question

19. My organization uses local suppliers to avoid shipment delays? *(Optional)*

    o   Strongly Disagree

    o   Disagree

    o   Somewhat Disagree

    o   Neither Agree or Disagree

    o   Somewhat Agree

    o   Agree

    o   Strongly Agree

20. My organization uses local suppliers to support local market? *(Optional)*

    o   Strongly Disagree

    o   Disagree

    o   Somewhat Disagree

    o   Neither Agree or Disagree

    o   Somewhat Agree

    o   Agree

    o   Strongly Agree

21. In your organization, Raw materials and purchased parts are not subject to incoming inspection as they come from qualified suppliers.

    o Never

    o Very Rarely

    o Sometimes

    o Frequently

    o Always

22. In your organization, Active steps are taken to reduce the number of suppliers

    o Never

    o Very Rarely

    o Sometimes

    o Frequently

    o Always

23. In your organization, Suppliers are provided with feedback regarding quality and delivery performance. *(Optional)*

    o Never

    o Very Rarely

    o Sometimes

    o Frequently

    o Always

Work process:

24. Is your departmental relations affected by lack of communication?

    o Yes, my organization has lack of communication between departments

    o No, my organization has good communication between departments

25. Is your team work affected by language barriers?

    o Yes

- No

If yes how do you deal with language barriers?

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[                                                                    ]
```

Please choose the best option that represents your organization.

26. In your organization, the processes used within similar operations are placed close to each other in order to eliminate unnecessary steps
    - Never
    - Very Rarely
    - Sometimes
    - Frequently
    - Always
    - Is not applicable in my organization

27. In your organization, Each working zone/work place is controlled and operated by qualified and well-trained workers *(Optional)*
    - Never
    - Very Rarely
    - Sometimes
    - Frequently
    - Always

28. How often are improvement suggestions received from shop-floor workers?

    Choose all that apply
    - Our workers don't have the desire to participate and provide us with suggestions
    - Our workers rarely participate and provide us with suggestions
    - In Daily meets with mangers
    - In monthly meeting with top management
    - In the annual meeting
    - Suggestions can be submitted any time to the manager who moves it up in the chain of command
    - Suggestions are rarely heard/received from workers

- o   Anonymous suggestion box
- o   Other please specify _____

29. In your organization, Pull production is used as a production strategy (production at each station is pulled by demand from the next station) *(Optional)*
    - o   Never
    - o   Very Rarely
    - o   Sometimes
    - o   Frequently
    - o   Always
    - o   Is not applicable in my organization

30. In your organization, the workplace is clean and all tools/pieces of equipment are put back in their appropriate places.
    - o   Never
    - o   Very Rarely
    - o   Sometimes
    - o   Frequently
    - o   Always

31. In your organization, an employee's is always assigned (as a main responsibility) the job of insuring the workplace is clean and all tools/pieces of equipment are put back in their appropriate places. *(Optional)*
    - o   Yes
    - o   No

32. In your organization, Products are not produced unless order are requested from customers
    - o   Never
    - o   Very Rarely
    - o   Sometimes
    - o   Frequently
    - o   Always

33. In your organization, Problem-solving techniques such as fishbone diagrams are used to identify the causes of quality problems.

- o Never
- o Very Rarely
- o Sometimes
- o Frequently
- o Always

34. What is your recruitment strategy? *(Optional)*

- o No specific recruitment strategy
- o Freshly graduates through online application/ carrier fair
- o Connecting with alumni for rehire
- o Recommendation of current employee
- o Hiring free lancers not full timers when appropriate
- o Hiring candidates for long term employment online
- o Other please specify _____

Customer's relations:

Your responses in this section will help us identify customers influence on production. Please choose the best option that represents your organization

35. How do you specify customer needs?

- o Interviewing stakeholders
- o Interviewing customers
- o Conducting voice of customer surveys
- o Analysing your competition
- o Analysing cause-and-effect relationship
- o Integration workflows and satisfaction surveys
- o Other (please specify) _____

36. My organization is aware of product features that our customer's value and are willing to pay for.

   o Never

   o Very Rarely

   o Sometimes

   o Frequently

   o Always

37. Feedback from customers is sought regularly, and surveys/meetings are often held with customers to improve product design and quality, and service. *(Optional)*

   o Never

   o Very Rarely

   o Sometimes

   o Frequently

   o Always

38. In my organization, Customers participate in the initial design process. *(Optional)*

   o Never

   o Very Rarely

   o Sometimes

   o Frequently

   o Always

39. In my organization, Valued customers are brought in to visit the plant / work site in order to give them some ideas about quality control that the organization can follow. *(Optional)*

   o Never

   o Very Rarely

   o Sometimes

   o Frequently

   o Always

40. In my organization, there is a system in place for collecting customer complaints so that problems can be avoided in the future.

    o Never

    o Very Rarely

    o Sometimes

    o Frequently

    o Always

41. How do you deal with customer complaints? *(Optional)*

    Choose all that apply

    o Addressing the complaints internally and finding a solution

    o Following up with the customer to hear their suggestions

    o Reestablishing the needs and requirements of the customers and conforming to their demands

    o Ignoring customers complaints

    o Slow response rate to customer's complaints

Reward criteria:

42. Does your organization have rewards for the workers (e.g. monthly, annual, employee of the month)?

    o Yes

    o No

43. Does your organizations works know how to qualify for the rewards? (e.g. the worker with the most productivity or least mistakes or errors in the assembly line gets employee of the month reward)

    o Yes

    o No

44. Does the winner of the reward receive benefits other than recognition (e.g. financial reward , extra days off, etc.) ? *(Optional)*

   o   Yes

   o   No

45. Please provide an example of your reward criteria *(Optional)*

46. Are your workers empowered to take action when needed?

   o   Yes

   o   No

   If yes Please provide an example of this. (Optional)

47. Do you have an employee training program?

   o   Yes

   o   No

48. Does your organization send employees for outside training courses? *(Optional)*

   o   Yes

   o   No

49. How do you drive continuous improvement programs?

   Choose all that apply

   o   Identifying non-value adding actives and eliminating them

   o   Purse improvements in in term of quality/design/cost and delivery

   o   Eliminating delays in change/over times

   o   Reducing waiting/ transport / processing time

   o   Process mapping to eliminate unnecessary steps

- o Reducing the number of suppliers
- o Specifying the value that the customer will pay for and eliminating wastes
- o Developing multifunctional teams
- o Other please specify _____

REFERENCES

A. Gunasekaran, C. Patel, and R. McGaughey, "Performance measures and metrics in supply chain environment", International Journal of Operations & Production Management, Vol. 21, pp. 71-87, 2001.

Al Kuwari, N. M. (2018). *QATAR POST MARKET ANALYSIS.* Retrieved from

http://hdl.handle.net/10576/11414

Al-khalifa, K. and Aspinwall, E. (2000). "The development of total quality management in Qatar", The TQM Magazine, Vol. 12 No. 3, pp. 194-204.

Al-Najem, M. (2014). *Investigating the factors affecting readiness for lean system adoption within kuwaiti small and medium-sized manufacturing industries* Retrieved from https://login.ezproxy.net.ucf.edu/login?auth=shibb&url=https://search.ebscohost.com/login.aspx?direct=true&db=edsair&AN=edsair.od......2267..7a3babfafd33916f1e4673deadd58c72&site=eds-live&scope=site

Anand, G., & Kodali, R. (2008). Performance measurement system for lean manufacturing: a perspective from SMEs. International Journal of Globalisation and Small Business, 2(4), 371–410.

Anand, G., & Kodali, R. (2009). Development of a framework for lean manufacturing systems. International Journal of Services and Operations Management, 5(5), 687–716.

Atkinson, P. (2010). Lean is a cultural issue. Management Services, 54, 35-44.

Balle, M. (2005). Lean attitude [considering attitude in lean production]. Manufacturing

Engineer, 84(2), 14-19.

Bamber, L., & Dale, B. G. (2000). Lean production: A study of application in a traditional manufacturing environment. *Production Planning & Control, 11*(3), 291-298.

Bhasin, S. (2012). Prominent obstacles to Lean. International Journal of Productivity and Performance Management, 61(4), 403-425.

Bhasin, S. & Burcher, P. (2006). Lean Viewed as a Philosophy. International Journal of Manufacturing Technology Management, 17(1):56 -72

Boughton, N. J., and Arokiam, I. C. (2000). The application of cellular manufacturing: A regional small to medium enterprise perspective. In the proceedings of the Institution of the Mechanical Engineers, 214 (Part B), pp. 751-754.

Boyer, M. & Sovilla, L. (2003). How to identify and remove the barriers for a successful lean implementation. Journal of Ship Production, 19(2): 116–120.

Boyer, M. and Sovilla, L. (2003), "How to identify and remove the barriers for a successful lean implementation", Journal of Ship Production, Vol. 19 No. 2, pp. 116-20.

Brophy, A. (2012). *FT Guide to Lean: How to Streamline Your Organization, Engage Employees and Create a Competitive Edge.* Harlow: Pearson Education Limited.

Choothian *A study of the application of lean practices to new product development processes.*, W. (2014).

Emiliani, B. (2008). *Real Lean: The Keys to Sustaining Lean Management (Vol. 3).* Wethersfield, CT. USA: CLBM, LLC.

Ezzamel, M., Willmott, H., & Worthington, F. (2008). Manufacturing shareholder value: The

    role of accounting in organizational transformation. Accounting, Organizations and

    Society, 33, 107–140.

Farzad Behrouzi, Kuan Yew Wong, A study on lean supply chain performance measures of

    SMEs in the automotive industry. (2011). *2011 IEEE International Conference on*

    Industrial Engineering and Engineering Management, Industrial Engineering and

    Engineering Management (IEEM), 2011 IEEE International Conference on, , 237.

Fricke CF, Buehlmann U. (2012). Lean and Virginia's wood industry: lean awareness and

    implementation. BioResources 7(4): 5094–5108.

Fullerton, R. R., & Wempe, W. F. (2009). Lean manufacturing, non-financial performance

    measures, and financial performance. International Journal of Operations & Production

    Management, 29(3), 214–240

Haddadi, F., & Yaghoobi, T. (2014). Key indicators for organizational performance

    measurement. Management Science Letters, 4(9), 2021–2030.

Karlsson, C., & Åhlström, P. (1996). Assessing changes towards lean production. International

    Journal of Operations & Production Management, 16(2), 24–41.

Liker, J. K. (2004). The Toyota Way: 14 Management Principles from the World's Greatest

    Manufacturer. New York: McGraw-Hill.

Mady, T. M. (2009). Quality management practices: An empirical investigation of associated

    constructs in two Kuwaiti industries. International Journal of Quality and Reliability

Management, 26(3), 214 -233.

Martínez Sánchez, A., & Pérez Pérez, M. (2001). Lean indicators and manufacturing strategies. International Journal of Operations & Production Management, 21(11), 1433–1452.

Melton, T. (2005). The benefits of lean manufacturing: what lean thinking has to offer the process industries. Chemical engineering research and design, 83(6), 662-673.

Meybodi, M. Z. (2013). Alignment of strategic benchmarking performance measures: a lean manufacturing perspective. Journal of Competitiveness Studies, 21(1/2), 14.

Mirdad, W., & Eseonu, C. I. (2015). A Conceptual Map of the Lean Nomenclature : Comparing Expert Classification to the Lean Literature. Engineering Management Journal, 27(4), 188–202.

Nordin, N., Md Deros, B., and Abd Wahab, D. (2010). A Survey on Lean Manufacturing Implementation in Malaysian Automotive Industry. International Journal of Innovation, Management and Technology, 1(4), 374-380.

Papadopoulou, T. C., and Ozbayrak, M. (2005). Leanness: experiences from the journey to date. Journal of Manufacturing Technology Management, 16(7), 784-807.

Parks, C.M. (2002), "Instill lean thinking", Industrial Management, Vol. 44 No. 5, pp. 14-18.

Pavnaskar, S. J., Gershenson, J. K., & Jambekar, A. B. (2003). Classification scheme for lean manufacturing tools. International Journal of Production Research, 41(13), 3075–3090.

Pay, R. 2008. Everybody's Jumping on the Lean Bandwagon, but Many Are Being Taken for a Ride. Industry Week, March 1, 2008.

Puvanasvaran, P., Megat, H., Tang, S. H., & Muhamad Mohd.Razali. (2009). The roles of communication process for an effective lean manufacturing implementation. *Journal of Industrial Engineering and Management,* (1), 128.

Qatar Development Bank (2016). *" THE STATE OF SMALL AND MEDIUM ENTERPRISES (SMEs) IN QATAR – 2016"* Retrieved from https://wlabdemo.com/qdb_sliced3/The%20Satate%20of%20SMEs%20in%20Qatar-2016_EN-Web%20-%20P.pdf

Rother, M., & Harris, R. (2001). Creating continuous flow: an action guide for managers, engineers & production associates. Lean Enterprise Institute.

Rotter, T., Plishka, C., Lawal, A., Harrison, L., Sari, N., Goodridge, D., et al. (2018). What is lean management in health care? development of an operational definition for a cochrane systematic review. *Evaluation & the Health Professions, .*

Salem, R., Musharavati, F., Hamouda, A. M., & Al-Khalifa, K. N. (2015). An empirical study on lean awareness and potential for lean implementations in Qatar industries. The International Journal of Advanced Manufacturing Technology, 82(9–12), 1607–1625.

Salem, R., Musharavati, F., Hamouda, A.M. et al. Int J Adv Manuf Technol (2016) 82: 1607.

Shah, R., & Ward, P. T. (2007). Defining and developing measures of lean production. *Journal of Operations Management, 25*, 785-805.

Stone, K. B. (2012b). Lean Transformation: Organizational Performance Factors that Influence Firms' Leannes. Journal of Enterprise Transformation, 2(4), 229- 249.

Tannock, J., and Ahmed, K. S. (2008). *Quality Management in the Arabic-Speaking Countries.*
    Journal of Transnational Management, 13(2), 174-194.

Vermaak, T. D. (2010). Critical success factors for the implementation of lean thinking in South
    African manufacturing organizations (Doctoral thesis). Department of Business
    Management. Johannesburg: University of Johannesburg.

White, R. E., Pearson, J. N., & Wilson, J. R. (1999). JIT Manufacturing: A Survey of
    Implementations in Small and Large U.S. Manufacturers. Management Science, 45(1), 1–
    15.

Womack, J. P., and Jones, D. T. (1996). *Lean Thinking*. New York, NY: Simon and Schuster.

Womack, J. P., Womack, J. P., Jones, D. T., & Roos, D. (1990). *The machine that changed the
    world: Massachusetts institute of technology.* Rawson Associates.

Womack, J., and Jones, D. (2003). *Lean thinking: Banish waste and create wealth in your
    corporation (2nd ed.).* New York: Free Press.

Wong, M. (2007). The role of culture in implementing lean production. In Intemational
    Federation for Information Processing (IFIP). 246, pp. 413- 422. Boston: Olhager and F.
    Persson, Eds.

Worley, J. and Doolen, T. (2006), "The role of communication and management support in a
    lean manufacturing implementation", *Management Decision*, Vol. 44 No. 2, pp. 228-245.

Yusup, M. Z., Mahmood, W. H. W., & Salleh, M. R. (2015). Basic formation in streamlining

    lean practices in manufacturing operations-a review. International Journal of Advanced

    Operations Management, 7(4), 255–273.