Harnessing Cultural Competency to Implement Lean Six-Sigma (LSS): Lessons From Saudi Arabia

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Both six-sigma and Lean focuses on a company culture characterized by increased customer satisfaction through continuous improvement, however, the path they follow to achieve that is not the same. Both the approaches, i. e., Lean and six sigma via Total Quality Management (TQM), sprang from the same root; however, the approaches they follow in harnessing strategy, system, processes, and employees are different --- Lean uses a people system, while six-sigma is a technology driven system. Literature suggests that six-sigma should be a sub-set of the overall umbrella of lean practices adopted by a company. In this study the cultural aspects of LSS implementation are studied for Saudi Arabia. For successful implementation of LSS Saudi Management should assess their competencies. If LSS is adopted, management needs to form LSS teams both at the company level and at the process level, there needs to be a LSS champion who will work as the liaison between the process teams and the executive team for successful implementation.

Keywords: lean system, six-sigma, lean six-sigma (LSS), workforce culture

INTRODUCTION

With the globalization of world markets, the competitive spirit has intensified between economies, in this backdrop productivity improvement and quality has become the driving force of many companies to capture market share and increase profits. The dual objectives of productivity improvement and quality are the reason why many companies have chosen Lean Six Sigma (LSS) to achieve these two goals. LSS has been defined, for instance (Laureani and Antony, 2012) as "a business improvement methodology that aims to maximize shareholders' value by improving quality, speed, customer satisfaction, and costs: it achieves this by merging tools and principles from both Lean and Six Sigma." LSS has emerged as a combination of two distinct concepts, lean which focuses on waste reduction, continuous improvement, and cost, while six sigma is a data-driven approach to reduce process variation, defect reduction, and innovation to reduce cost and customer satisfaction. LSS identifies opportunities to eliminate waste, unwanted variation, errors in business processes, and drives higher goals of cost, quality, and customer satisfaction.

Lean & Six Sigma Two Distinct Approaches
Lean Uses less of everything compared with mass production – half the human efforts in the factory, half the manufacturing space, half the investments in tools, and half the engineering hours to develop a new product in half the time. Also, it requires keeping far less than half the needed inventory on site, results in fewer defects, and produces a greater and ever-growing variety of products (Belekoukias, Garza-Reyes, Kumar 2014, Feizabadi, Singh, Motlagh 2014). It is implemented by bringing systems, processes, and

people together such that 'muda' or waste is minimized by authorizing teams of workers to oversee an entire process. The lean system is a people system that is geared toward minimizing waste. Lean was first a human-based system where people were involved with continuous improvements, and the foundation for the system was leadership and empowerment through education and training as opposed to the six-sigma approach in which the human element is removed, and elite elements of the production staff are brought together to work on CTQ (Critical to Quality) projects using scientific methods. Both six-sigma and Lean focus on a company culture characterized by increased customer satisfaction through continuous improvement, however, the path they follow to achieve that is not the same. Both the approaches, i. e., Lean and six sigma via Total Quality Management (TQM), sprang from the same root, Japanese quality management practices; as a result, they share many common elements in their strategic and tactical implementations. Figures 1 and 2 represent the elements of lean and six-sigma approaches. As can be gleaned from these figures, both are focused on customer satisfaction, both are focused on developing distinctive capabilities, both require strong supply-chain capabilities, both require a strong commitment to system maintenance and finally, both require a burning desire to achieve efficiency and effectiveness. The Lean system is not strictly a quality system, it was developed at Toyota to create a company culture of collective enthusiasm to achieve its goals and objectives. Lean focuses on transaction reduction by emulating the efficiencies of continuous manufacturing or continuous service processes. We need to realize that Lean is an approach to the design and management of a production or service facility, the operating aspect of the approach is the system that pulls the jobs through the facility. This implies that there will be major developmental costs of innovations to cut set-up times and construct more streamlined plant configurations. In addition, the creation of a company culture of collective enthusiasm is not easy, it has its costs, too. In addition, lean has certain environmental requirements, to maximize the learning curve effect on production or service performance a facility should be dedicated to the production of a few standardized products and services, and they must have stable demand. The bill of materials (BOM) or service bills should be streamlined to include fewer levels by standardizing the parts or the service components. Products or families of products/services should have dedicated production cells. The supply chain should be streamlined through automation with fewer vendors to reduce the overhead costs of logistical transactions. The costs of engineering changes should be reduced by using a modular design. However, since both lean and six-sigma sprang from the same root, there are many common elements in both. The lean goals of zero defects, zero inventory, zero disturbance, and total standardization can be vigorously adopted in six-sigma. Both are committed to improving system performance through continuous improvement, problem-solving, continual education, and reduction of organizational slack. Except for the control mechanism of lean – which requires a repetitive production or service system – many of the lean principles can be applied to any production or service system. Concepts like transaction reduction, waste reduction, stable schedule, separation of man and machines, focused operation, and employee empowerment, can all be readily implemented across all systems. However, management must exercise prudence in selecting the features of lean that apply to their system.

As can be gathered from figures 1 and 2, both lean and six-sigma are focused on the reduction of cost and improvement of efficiency. Six-sigma achieves that by focusing entirely on quality, while lean achieves that by improving quality through process improvements. Lean emphasizes process flow, and six-sigma focuses on process defects. Lean deals mostly with visible process problems, such as inventory, bottlenecks, and safety whereas six-sigma tries to dig out quality problems that are not readily obvious. Six-sigma uses a parallel organizational structure with liaison from the executive suite while lean uses a bottom-up approach by including all process owners for improving and controlling the process. Both value involving management and the employees for improving performance, however, in six-sigma the involvement of employees is less pervasive. Process improvements in lean are achieved through several action programs, first by reducing the number of product options such that discrete production mimics the efficiencies of continuous manufacturing. Second, by redesigning the existing production facility into dedicated operations where each sub-unit produces only a particular family of products, in lean language it is called focused operation. The third action program focuses on the development of multifunctional workers and the standardization of operations. This is the back end of the lean system which also can be implemented under

the umbrella of lean six-sigma (LSS) provided the production environment allows that. Otherwise, LSS adopters can only pick from the front end of the lean system.

Leadership plays a vital role in implementing lean systems, not only at the shop floor employee level but also at the executive level (Gandhi, J., 2021; Belekoukias, I. et al., 2014; Laureani, A. & Antony, J., 2012). An important element determining the effectiveness of the implementation of the lean management principles is the possession of permanent managerial and executive staff. This is an increasingly difficult goal to accomplish today, but it is the basic challenge to increase profits and reduce losses to a minimum. Currently, due to the lack of qualified executive staff, permanent employees are very often replaced by "accidental" employees, who do not help to implement the principles of lean management culture (Niewiadomski et al., 2018). Lean Management is a management methodology that creates a kind of pervasive work culture in an organization. It comes down to the fact that all people associated with a given organization are interested in a constant reduction of costs, shortening the delivery cycles, and improvement of quality. It shares some common ground with six-sigma in terms of the goals both try to achieve, however, as opposed to the pervasive culture of lean, six-sigma advocates a culture of the elite few.

Although there are factors other than social norms and cultures that influence various aspects of Six Sigma projects, such as the lack of field professionals and supporting infrastructure (Khanna and Palepu, 1999), such factors as technical difficulties, political environment, individual workload, and stress, as well as organizational commitment (Staren & Eckes, 2013) are, however, rarely defined; in fact, they are often used to study the existence of Quality Management (QM) rather than its effectiveness (Prasad and Tata, 2003).

Several studies have shown how cultures influence the effectiveness of Lean Six Sigma and other QM strategies. Kull and Wacker (2010) have concluded that cultural values in Confucian Asia (China, South Korea, and Taiwan) have a moderating impact on the effectiveness of QM. More specifically, Zou and Lee (2010) have found some Chinese Six Sigma project teams incorporating philosophies from both the West and the East in their projects. Pisani et al. (2009) have built a conceptual model using Hofstede's cultural dimensions (1980) to prove possible cultural moderation effects in each stage of the Define-Measure-Analyze-Improve-Control or the DMAIC process. They have also suggested that there is a need to further study the impact of culture on Six Sigma implementation.

The objective of employing an integrated approach combining Lean and six-sigma is to ensure that both process flow and efficiency are maximized that reduce waste in the system, and at the same time, critical quality (CTQ) issues for the business addressed. There is a difference of opinion as to how this integration should take place. According to Shah, Chandrasekaran, and Linderman (2008) and Hines, Holweg, and Rich (2004) the parent system should be Lean in which six-sigma should be applied as a sub-set of operational strategies to realize the maximum benefits of an integrated system. This has the advantage of implementing six-sigma in a company where they already have an integrated supply chain, where the roles and responsibilities of employees are clearly defined, quality and efficiency is addressed through transaction reduction, problem-solving, foolproof methods, and inventory reduction; overall, the lean system is a disciplined system where an intervention like six-sigma would be easy to apply. Lean tools can be very effective in the first stage of process improvement where the aim is to eliminate waste and simplify processes before starting to tackle the more difficult problems through optimization and process control aimed mainly at process steps (Snee, 2005). According to Rath and Strong (2003), certain organizational cultures are preferred in favor of Six Sigma applications, and lean offers such a culture. With a directive and highly hierarchical leadership style, there is only a limited decision-making authority given to the project teams. They can only make proposals and wait for obtaining approval from upper management. The engagement of the management in Six Sigma projects could also be undermined in this case if the management only acts as the authorization party in the Six Sigma projects. In an organization with a participative/collegial leadership style, i.e., a lean system, more autonomy is given to the project teams, and they would have the necessary authority when making on-the-spot decisions during recommendation and implementation. Lean is not well suited to resolving complex problems that require intensive data analysis and advanced statistical methods. When the problem solution is unknown, it is likely that extensive data collection and analysis will be required to resolve the issue. The need for careful diagnosis of the problem

emphasizes the deployment of the Six Sigma. That is the ideal environment for six sigma to flourish. In addition, the upper management in a lean organization is more likely to be involved in the progress of a project, understand the project better and make sure its direction is aligned with the designated strategy of the company. Six Sigma methodologies appreciate to a greater degree group efforts rather than individual heroism. Smooth cross-functional processes hardly require individual heroes, but rather good coordination and sharing of common goals among different departments. The empowerment employees enjoy in lean systems offers an ideal environment for injecting six-sigma concepts into it. The concept of 'Lean Six Sigma' as an integrated strategy is still in development: since its inception in 2000, several academics have developed an integrated approach, while others have focused on a framework for the successful integration of Lean and Six Sigma (Laureani & Antony, 2019).

Why Lean Six-Sigma Appeals to Management

First, the lean six-sigma appeals to management because it is results-oriented, the economic justification used in project selection highlights the immediate benefits to the company for implementing the project, and the lean portion of the approach will help reduce the cost of a product or a service (Gupta et al., 2020; George, M. L., 2002). This is consistent with the inherent optimism of top management that there is a quick fix to process problems that are difficult to get rid of – lean six-sigma will get rid of the process problems through its relentless analytical approach. Which is the hallmark of any data-driven management approach because it is more focused on technology, measurements, and results (Huq, 2017); and now enters the culture and people-building approach of lean systems, which will eliminate other process problems ignored by a data-driven management approach. It can be said that six-sigma also focuses on building workforce culture, but that culture is not pervasive, and it is not rooted in employee conformance, rather it is rooted in process innovation through a careful study by an elite group, and the presence of lean principles will resolve that issue. It appeals to top management because it is a top-down approach that involves only technically savvy process leaders in the company who can be given a clear charter and be held accountable to fulfill that charter and use a bottom-up approach to involve everyone in certain norms of process behavior. From management's point of view, the six-sigma aspect of it is an easier control mechanism than holding everyone responsible. As opposed to other quality approaches, i. e., TQM, etc., it does not try to improve everything simultaneously, selected projects need to target only a few key processes and a few selected employees. In case of failure, management can easily drop the project – without widespread damage – and move on to more profitable projects. In incorporating six-sigma in a lean environment, lean six-sigma does not require training for all employees in the company, it needs to train only that portion of the employees involved in the selected project. Although the training for black belts and green belts in lean six-sigma is more rigorous than training requirements for lean or other quality approaches, deployment of the six-sigma part in LSS is more rapid because only a few people need to be trained. Of course, the biggest appeal of lean six-sigma is its focus on attacking quality and cost problems – one at a time, based on customer-mandated CTQ's (critical-to-quality) that are more manageable and easier to fulfill than attempting to improve everything simultaneously.

As TQM became unattractive in the western industrial world, new terms for excellence in quality such as Business Excellence, Organizational Excellence, six-sigma, or lean six-sigma appeared on the horizon. These new approaches although appear to have common themes with TQM are structurally different in their application. Dahlgaard-Park (2011) categorizes them as more mechanistic and rational in their approach to quality as opposed to the humanization of the organization by focusing on workforce culture, values, people motivation, and education and training. Among the new approaches, the lean six-sigma appeals more to top management because the six-sigma approach only invites competent people in the organization to get involved with the initiative as a secondary approach to an existing lean framework. This is indeed a big strength of the lean six-sigma and convenience presented for participatory management. As it is a structured data-driven approach, employees have clear guidelines to follow; both lean and six-sigma training helps develop individual competence – a critical moderator variable for participatory management. Lean six-sigma focuses on coalition building with employees vis-à-vis the development of a quality culture (Sreedharan et al., 2020).

METHODOLOGY

This is a qualitative study of the cultural competencies needed, or the lack thereof, to adopt lean six-sigma in the backdrop of strategic and social strengths and weaknesses prevailing in the public sector of Saudi Arabia. The author has interviewed eight groups of CEOs, quality managers, and entrepreneurs in the Saudi private sector which includes food industries, consumer goods, energy, pharmaceuticals and health care, and small manufacturers. The paper focuses on strategic and workforce culture decisions needed for lean six-sigma implementation. The paper is a qualitative study based on discussions with CEOs, company executives, and quality professionals engaged in lean six-sigma and other quality programs in both manufacturing and service companies. The use of qualitative research techniques is appropriate for gaining information inductively in such behavioral studies. This approach allows company officials to respond openly to inquiries about their experiences in implementing six-sigma. A qualitative study can be a valid scientific inquiry if it fulfills the criteria of reliability, validity, and generalizability (Azham & Hamidah, 2011). The inquiries, posed by the researchers, came from constructs presented in the literature on six-sigma strategic competency dimensions, the content validity of these lean six-sigma constructs (table 1) is determined by published literature (Jones et al., 2010; Shah et al., 2008; Schroeder et al., 2008; Huq, 2006; Huq 2017; Motwani et al., 2004; Coronado & Antony, 2002; Antony & Banuelas, 2002; Gabor, 2001; Pande & Neuman, 2000).

TABLE 1
COMPARISON OF LEAN SIX-SIGMA (LSS) STRATEGIC DIMENSIONS WITH SAUDI LSS ENVIRONMENTAL ISSUES

Strategic Dimensions	Ideal Organizational Competency Identifiers	Saudi Organizational Competency Status
Shaping vision for LSS (the building blocks)	– LSS is selected as a strategic choice – Leadership is committed to LSS – Structured leadership with a defined hierarchy of decision making based on fact – Experience with change management – Lean practices are adopted as a strategic choice, at least one percent of our employee have the technical proficiency for six sigma	– LSS is being tried as a pilot project – Leadership is not committed to LSS, Top-down leadership structure – Limited experience with change mgt. – Evidence of Lean practices are at minimum, most LSS trained staff are expatriate workers, it is far less than one percent of total employees
Design issues (to make LSS operational)	– Company had implemented a successful lean system; six sigma is added to further improve quality and cost. – Integrated supply chains with checks and balances to guarantee quality – Executive decisions on quality are based on consensus of cross section of process leaders - Decisions are communicated to	– Some process industries with successful lean system have added six-sigma, others are trying to resurrect lean for the sake of LSS – Supply chains are not integrated, propensity to buy from ISO certified suppliers – Quality decisions are handed down to employees by top management – Internal marketing efforts are at a rudimentary level

	– employees through internal marketing – Employee incentives are team based and results oriented. – Employees are trained in lean concepts, belt training program for six-sigma is enhanced through proactive coaching that takes a process view of activities	– There is no established incentive program, depends on the pleasure of top management – Personal initiative to get trained is encouraged, expatriate professionals are encouraged to provide proactive coaching to locals
Business case for each proposed project (CTQ)	– LSS projects are selected based on CTQ, strategic fit with company goals, and economic justification – In selecting projects complexity of the change, skill set needed, its impact on other projects, and supply chain needs are evaluated – Project team also considers any potential resistance from employees with a back-up contingency plan.	– Ad Hoc LSS projects are selected based on profit potential and CTQ – Projects are selected by the quality professionals, and they must convince top management about its appropriateness. – There is no contingency plan if the project fails, that is why only projects with fail safe potential are usually selected – There is usually a contingency plan in case of project failure
Implementation issues before any project is launched	– Clear guidelines for champion/team leader roles and responsibilities mandated by the executive suite – Strict process view is used in project implementation and all related parties are involved – Planning is done to support both internal and external customers – Executive suite/champion is focused on creating passion for LSS among the workforces.	– Top management is always in control, no delegation of power, underlying lean principles suffer – Process view is not used in project implementation, cross functional coordination is minimal – Planning is not focused on internal customers, only the external customers and profits matter – Most LSS projects are initiated by the process quality professionals, management is minimally involved in propagating LSS
Sustaining Change	– Project successes are celebrated through internal marketing – Change management is taken very seriously by top management – Internal marketing is focused on disseminating the benefits of LSS across system.	– Project successes are celebrated by management by recognizing the people involved – Top management is seldom involved in internal marketing – Top management assumes changes will take place through their directives

Reliability, on the other hand, relates to measurements that can be independently verified has no relevance in qualitative research (Stenbacka, 2001; Golafshani, 2003, p. 601). Golafshani (2003) states that to ensure reliability in qualitative research, the examination of trustworthiness is crucial. The trustworthiness of this study is corroborated by other studies on quality management in Saudi Arabia (Muhareb & Graham-Jones, 2014; Asamadi et al., 2012). The word generalizability is usually defined as the degree to which the results of a study based on a sample can be applied to an entire population, and qualitative studies have generally found it difficult to satisfy this criterion. However, there are other positive

aspects of qualitative studies that can satisfy generalizability within a specific situation or case, Lewis & Ritchie (2003) calls it representational generalizability. Our study satisfies this condition based on the evidence from other studies on quality in Saudi Arabia (Muhareb & Graham-Jones,2014); and (Asamadi et al., 2012).

Table 1 represents the strategic dimensions that embody successful lean six sigma programs, it is based on published literature on the subject (Gandhi, 2021, Al-bliwi et al., 2015, Aboelmaged, 2011, Antony et al., 2007). At the strategic level, a company needs competency both at the organizational and workforce levels. Lean Six-sigma (LSS) is not a radical re-thinking approach; however, it becomes one if the company has no prior experience with lean and quality management practices. It combines best-of-breed practices of both lean and six-sigma for cost and quality improvement. The six-sigma part of LSS uses a data-driven non-intuitive approach and combines the expertise of technically proficient workers to design, produce, manage, and control products and services that meet or exceed customer expectations; while the lean part of it focuses on waste reduction, transaction reduction, and process efficiency. Deming said without statistical evidence quality cannot be improved. One needs technical expertise to apply SPC and to study process capability, six-sigma requires that. Goals should be set keeping in view the fulfillment of the company's strategic goals and customer-supplied CTQs, and teamwork is the foundation of that – a central requirement in both lean and six-sigma. Goal setting, i. e., selection of six-sigma projects through economic justification, can be centralized, decentralized, or integrated, it works best when the process is integrated. It also requires workforce competency.

Design issues are part of the strategic aspects of LSS. At the design stage, one needs to address supplier selection policies, project worthiness vis-à-vis company strategic goals, communications, employee training programs, and incentive programs for employees. Suppliers' processes should also have competency for delivering on time, the required quality, and quantity; poor supply quality means bad quality. The supplier's process capability must be certified. The complexity of the project will determine the level of engagement by LSS staff, suppliers, partners, and customers. Training is an essential part of LSS; however, it should not stop at that; successful companies go one step further, they use proactive coaching beyond the belt training. Process employees (usually green belts) are coached by a black belt about the process attributes, Key Process Input Variables (KPIV), and Key Process Output Variables (KPOV).

Making the business case for each LSS project is a prerequisite for the program. The scope of each project should be studied, projects that benefit other related processes should get priority, and each project represents a CTQ, selected based on customer preferences, company strategic objectives, and economic benefits to the company. To have a better grasp of the process linkages one needs to study the entire supply chain, a SIPOC map (supply-input-process-output-customer) or a value-stream map can be very useful at this stage. The importance of the supply chain can hardly be overemphasized because the efficiency and effectiveness of the process performance are entirely dependent on its supply chain, especially when major components of the product or service are procured externally. When employees identify company goals as their own goals, participation increases, and resistance diminishes. The company should have a contingency plan in place if an LSS project fails.

The implementation issues at the strategic level involve maintaining a process view, customer focus – it may be an internal customer, creating the passion for LSS among the involved workforce, and understanding the causal relationship between key process input variables (KPIV) and key process output variables (KPIV). In an LSS project role of process owners will change, and all project employees, suppliers, and partners must get involved. Finally, sustaining change and celebrating success is an important hallmark of both lean and six-sigma programs, they contribute to employee commitment. LSS staff must understand the relationships between KPIVs and KPOVs, how to measure them, and the creation of systems and procedures – rooted in lean principles -- that are simple, user-friendly, and foolproof. This is where LSS diverges from other quality programs, at this point, we justify the appropriateness of selecting an LSS project through economic justification and the strategic goals of the company.

The Cultural Background of Quality Programs in Saudi Arabia

Since joining World Trade Organization (WTO) in 2002 Saudi firms started facing international competition thus focusing on quality became imperative. Over the last two decades, manufacturing and service companies in Saudi Arabia have tried to implement Total quality management (TQM), Kaizen, ISO certification, Business Process Reengineering (BPR), Lean, etc., with limited success (Muhareb & Graham-Jones, 2014; Asamadi et al., 2012). One study (Albliwi et al., 2017) found that Saudi companies are ill-prepared for implementing Lean six sigma in terms of organizational competency and technical and cultural preparedness. Many of these implementations could not fulfill the inherent optimism of management in these companies that there is a quick fix to their quality problems even though benefits of most of these approaches are realized years after their adoption. The immediate benefits of six-sigma are well known (Pande & Neuman, 2000); if it is synergized with the benefits of an already functional lean system then the benefits magnify (Shah et al., 2008, Hines et al., 2004) even further. One of the features of Lean six-sigma (LSS) is that it is results-oriented, and the economic justification used in project selection highlights the immediate benefits to the company implementing the project. The dual benefit feature of LSS lures many to adopt it without having the cultural environment for its implementation.

Most businesses in Saudi Arabia are family-owned (Najeh & Kara-zaitri, 2007), decision making processes in such businesses are rigidly top-down, participative management or horizontal organizations -- an essential element of the lean system -- are not part of the management culture of Saudi Arabia. Although LSS also focuses on building workforce culture, only the lean part of it does that. The path for implementing LSS is that Lean is the parent system, and within the confines of Lean, the six-sigma approach should be applied for maximum benefit in terms of cost and quality (shah et al., 2008; Hines et al., 2004). Lean was introduced in Saudi Arabia in the 90s, many companies adopted some lean features without implementing the total system. Although the six-sigma part of LSS may appeal to Saudi business leaders because of its top-down approach, participative management of Lean is a big challenge for Saudi management culture. From a Saudi management point of view, six-sigma is preferable for an easier control mechanism than Lean. Another advantage of LSS over other quality management practices lies in its limited training requirements for the six-sigma part, SS does not require training for all employees in the company, it needs to train only the employees in the selected LSS project. With an established Lean system already in place making the transition to LSS can be smooth, this is where the challenge lies for Saudi companies to implement LSS. In a functioning Lean system deployment of LSS is more rapid because only a few people need to be trained. For Saudi Arabia, it is particularly important because a major part of the technocrats who work here are expatriate workers who can be given a clear charter and held accountable for project success. Companies planning LSS adoption can initially hire technically savvy and LSS-trained expatriate workers to launch the program and eventually build local expertise through the expatriate workers. With the government's focus on improving the private sector in its Vision 2030 plan, there will be a new impetus to adopt best-of-breed management practices in the private sector. As opposed to many industrialized nations labor management does not pose to be a challenging issue in Saudi Arabia as there is no union and the bargaining process is biased in favor of management because of the contractual agreement with the expatriate workers (Najeh & Kara-zaitri, 2007).

From our company interviews, it was apparent that most are familiar with the LSS toolset, and many are using them on a selective basis, however, they are not calling that adoption LSS yet. Many of the technically savvy quality people are expatriate workers, and their knowledge and expertise have just started to trickle down to their Saudi counterparts. Family-owned businesses are not generally interested in taking a long-term view of the well-being of the company, they have a myopic view of company operations outcome, and are showing interest in systems like LSS only if competition is adopting them. Many LSS-trained expatriate workers have told us that with proper reasoning based on the economic justification for the adoption of LSS, Saudi management is gradually showing interest in Lean six-sigma. Also, as the six-sigma part of LSS is based on technology, mechanization, and specialization as opposed to the humanization of the system – it is supposed to appeal to Saudi management because of their inclination for top-down decision-making processes. Of course, the biggest appeal of LSS to Saudi management would be its focus on attacking quality problems – one at a time, based on customer-mandated CTQs (critical-to-

quality) that are more manageable and easier to fulfill than attempting to improve everything simultaneously. Algoal-setting setting process of LSS will be consistent with the Saudi management approach that not only implements customer-mandated CTQs, but also verifies each proposed project (CTQ) against the corporate strategy, economic justification, and company's competitive capability.

For Saudi Arabia, Asamadi et al. (2012) report that Saudi enterprises got disillusioned with ISO certification, business process re-engineering (BPR), total quality management (TQM), and Kaizen because the benefits of some of these approaches are not quality-focused, and some require long term commitment. Special mention goes to ISO Certification and business process re-engineering; ISO Certification does not guarantee quality because it is a certification that states the certified company has a documented quality system in place and supposedly, they are using it, the key lies in their using it. BPR on the other hand is focused on streamlining operations by reducing transactions and removal of non-value-added activities for better customer service and profits. Both are pervasive operations systems that require discipline in implementing them. Given that, a company has implemented some features of lean that reduce waste, the transition to LSS will no longer be a pervasive system, it can be tailored to the extent of the company's competitive capability. Multiple LSS projects can be implemented simultaneously that may involve a small section of the company, a certain process or department, or even a nested sub-process. LSS has common themes with TQM but is structurally different. Dahlgaard-Park (2011) categorizes it as more mechanistic and rational in its approach that invites only competent people in the organization to get involved. It is a big convenience of LSS in terms of participatory management that management does not need to get involved with the entire workforce. Its deployment can be rapid because only a small section of the workforce needs to get LSS trained.

Saudi Readiness for LSS and Suggestions

A summary of comparison of strategic LSS requirements and state-of-affairs in Saudi Arabia is presented in Table 1. The following discussion enlarges some of the findings that are deemed critical for the success of LSS in Saudi Arabia:

- Leadership support (Table 1) for strategy and sustainable promotion of LSS implementation in Saudi Arabia is lacking, rigid top-down management in most Saudi family-owned businesses precludes participative management -- an essential element of lean systems. After Saudi Arabia became a member of the World trade organization in 2002, there was an impetus to take quality issues more seriously and many companies adopted TQM principles. Among them, the food industry was more successful in implementing TQM (Asamadi, 2012). The top management has very limited experience with change management and is very cautious in adopting an advanced quality management approach like LSS. In companies where they have LSS-trained professionals – whether expatriate or local – it is being tried as a pilot project. It is our opinion many companies, especially in food, drug, and industrial manufacturing Saudi Arabia has good potential for implementing LSS because they can hire expatriate LSS professionals from abroad to implement it. As these professionals are given decent salaries, they will have the motivation and the drive to live up to their contracts. In our investigations, we did not see any concerted effort on the part of management to adopt LSS as a strategic choice for long-term quality development. Although goal setting is based on CTQ issues, projects are selected only if they promise immediate benefits to the company or if there are other compulsive reasons such as fulfilling a regulatory requirement or countering a move by a competitor.
- As regards the design issues to make LSS operational (Table 1), one of the most important design issues is the integration of the supply chain, but the good thing in favor of Saudi Arabia is that there is a plan to improve IT infrastructure nationwide and it is supposed to trickle down to organization levels. Also, transportation infrastructure in Saudi Arabia has improved significantly making just-in-time delivery a reality. Quality decisions should be consensus decisions of the LSS teams, not the way it is handed down to employees in Saudi Arabia on an ad-hoc basis. There must be internal marketing of LSS principles, there is no concerted effort to popularize LSS in most companies where LSS is being tried as a pilot project. In most

companies, there are awards for employees, but no incentive program for LSS, companies should institute team-based, results-oriented incentive programs. There is no organized company-sponsored Lean/six-sigma training programs, but the personal initiative to get trained at Institutes and universities is encouraged, and expatriate six-sigma professionals are encouraged to provide proactive coaching to the locals.

- The business case for each project (Table 1) is made based on profit potential and CTQ. In the majority of cases, the initiative to launch an LSS project is taken by top management because fear of failure deters process leaders to initiate an undertaking; if the project is selected by quality professionals, then they need to convince top management about its appropriateness. In the absence of any contingency plans, if the project fails to deliver, only projects with fail-safe potential are selected. In many of these companies, expatriate quality professionals are well-trained and have the expertise to lead major LSS projects, if they are empowered to do so.

- Saudi LSS adopters need to take implementation issues (Table 1) more seriously. Adoption of process view, determination of process boundaries, and cross-functional coordination are essential for LSS success; most trained LSS professionals that we interviewed understand this, however, the *laissez-faire* approach used by top management discourages process people to pledge their full commitment. Management needs to get involved, take the helm, create a passion for LSS in the company, and monitor progress every step of the way.

- Sustaining change (Table 1) through change management is important for LSS's success and future projects. Although top management celebrates success by recognizing, and rewarding people involved with monetary incentives, it is done on a case-by-case basis; such incentives depend on the pleasure of top management, there is no established incentive program in most of the LSS companies in Saudi Arabia. To popularize LSS management must focus on change management to inculcate a lean and six-sigma culture, establish a formal reward system to celebrate success, and most importantly use internal marketing to achieve employee buy-in; also, motivate expatriate trained professionals to engage in proactive coaching to train the local employees.

CONCLUSION

As the adoption of the LSS quality program continues to gain momentum globally, being a member of the World Trade Organization (WTO) Saudi Arabia also needs to take quality seriously to remain competitive. Evidence from our qualitative study suggests that many companies in the food, consumer goods, health care, and energy industries have either adopted LSS or are considering its adoption. However, the adoption of LSS is contingent upon having a proper strategic environment within the company, and most adopters in Saudi Arabia need to create that environment for LSS success. Discussion of our finding in the previous section highlight that leadership in most companies where LSS is being implemented have not taken control of the initiative, it is being implemented by LSS professionals who are obliged to initiate only fail-safe projects. The majority of these LSS professionals are expatriate workers who are risk averse, and they carry the burden of convincing top management for any LSS initiative. Most companies in Saudi Arabia are family owned and have a rigid hierarchical administrative structure, move towards shared governance has been slow but there is evidence that it is happening in some companies.

Although LSS has not become a pervasive quality management approach in Saudi Arabia, most Saudi companies are well-versed in quality management techniques (Muhareb & Graham-Jones, 2014; Asamadi et al., 2012). Given the Saudi Government's Vision, 2030 – an initiative for economic development thru the improvement of the private sector; availability of well-trained expatriate quality professionals; Saudi management's proclivity for immediate results; LSS has the potential for widespread adoption in Saudi Arabia. Another advantage Saudi Companies have is the availability of strong IT and transportation infrastructure within the country and the government's effort to improve it continuously.

However, for successful implementation, Saudi Management should assess their competencies. If LSS is adopted, management needs to form LSS teams both at the company level and at the process level, there

needs to be an LSS champion who will work as the liaison between the process teams and the executive team. The current ad-hoc rewards system based on individual performance should be replaced with a reward system based on team performance. The executive suite needs to get involved in the design, management, and control of LSS projects; create a passion for LSS by using internal marketing within the company. Management needs to recognize comprehensive ongoing training as an essential part of LSS; in addition, proactive coaching should become a part of the continuous improvement culture. From the design for LSS perspective management needs to look at the SIPOC map (supply-input-process-output-customer) or a value-stream map for each LSS project.

We recognize the limitations of this study, there is a need for a more expanded study that can validate the findings of this study with quantitative estimates. However, this study has recognized the strategic competency dimensions for launching Lean six-sigma (LSS) in Saudi Arabia.

REFERENCES

Aboelmaged, M.G. (2011). Reconstructing Six Sigma barriers in manufacturing and service organizations: The effects of organizational parameters. *International Journal of Quality & Reliability Management*, *28*(5), 519–541.

Al-bliwi, S.A., Antony, J., & Lim, S.A.H. (2015). A systematic review of Lean Six Sigma for the manufacturing industry. *Business Process Management Journal*, *21*(3), 665–91.

Albliwi, S.A., Antony, J., Arshed, N., & Ghadge, A. (2017). Implementation of lean six sigma in Saudi Arabian organisations: Findings from a survey. *The International Journal of Quality & Reliability Management; Bradford*, *34*(4), 508–529.

Antony, J., & Banuelas, R. (2002). Key ingredients for the effective implementation of six sigma program. *Measuring Business Excellence*, *6*(4), 20–27.

Antony, J., Antony, F., Kumar, M., & Cho, B. (2007). Six Sigma in service organizations: Benefits, challenges and difficulties, common myths, empirical observations and success factors. *International Journal of Quality & Reliability Management*, *24*(3), 294–311.

Asamadi, M., Lehaney, B., & Khan, Z. (2012). Implementing six-sigma in Saudi Arabia: An empirical study on the Fortune 100 firms. *Total Quality Management*, *23*(3), 263–276.

Azham, M.A., & Hamidah, Y. (2011). Quality in qualitative studies: The case of validity, reliability and generalizability. *Issues in Social and Environmental Accounting*, *5*(1–2), 25–64.

Belekoukias, I., Garza-Reyes, J.A., & Kumar, V. (2014). The impact of lean methods and tools on the operational performance of manufacturing organisations. *International Journal of Production Research*, *52*(18), 5346–5366.

Coronado, R.B., & Antony, J. (2002). Critical success factors for the successful implementation of six-sigma projects in organizations. *The TQM Magazine*, *14*(2), 92–99.

Dhalgaard-Park, S.M. (2011). The quality movement: Where are you going? *Total Quality Management*, *22*(5), 493–516.

Feizabadi, J., Singh, M., & Motlagh, S.A. (2014). Contribution of supply chain to corporate strategy: A case study in agriculture machinery industry. *International Journal of Logistics Systems and Management*, *18*, 4.

Gabor, A. (2001). Management: Ford embraces six-sigma. *The New York Times*.

Gandhi, J. (2021). An Investigation and Implementation framework of lean green and six-sigma strategies for the manufacturing industry in India. *TQM Journal*, *33*(8), 1705.

George, M.L. (2002). *Lean six sigma: Combining six sigma quality with lean speed*. McGaw-Hill, New York.

Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The Qualitative Report*, *8*(4), 597–607.

Gupta S., Modgil S., & Gunasekaran, A. (2020). Big data in Lean six sigma: A review and further research direction. *International Journal of Production Research*, *58*(3), 947–969.
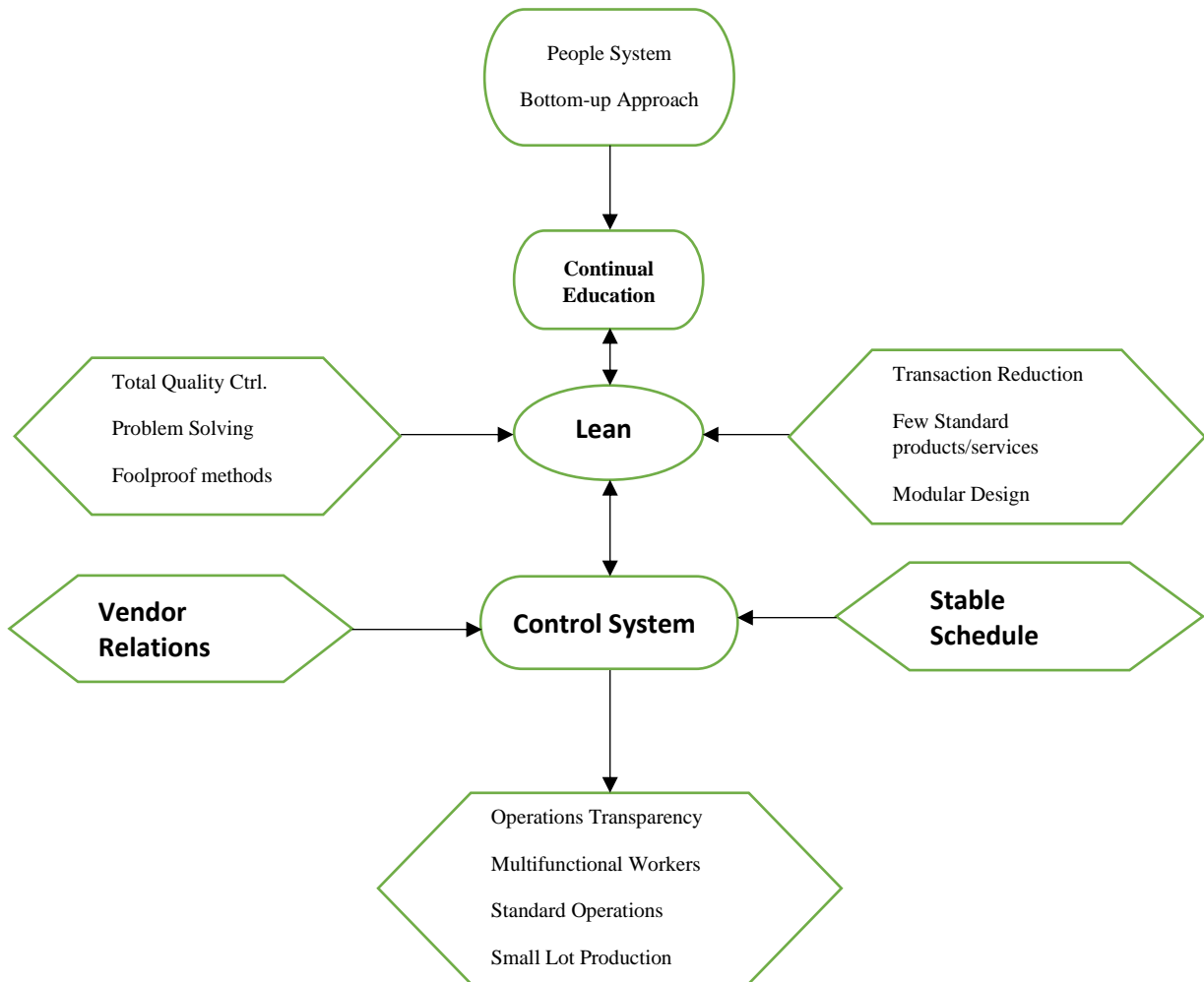
Hines, P., Holweg, M., & Rich, N. (2004). Learning to evolve: A review of contemporary lean thinking. *International Journal of Operations & Production Management*, *24*(10), 994–1011.

Hofstede, G. (1980). *Culture's Consequences: International Differences in Work Related Values*. Sage, Beverly Hills, CA.

Huq, Z. (2006). Six-Sigma Implementation through Competency Based Perspective (CBP). *Journal of Change Management*, *6*(3), 277–289.

Huq, Z. (2017). Competency Model for Assessing Six-Sigma Implementation Readiness. *American Journal of Management*, *17*(5).

Jones, E.C., Parast, M.M., & Adams, S.G. (2010). A framework for Effective Six Sigma Implementation. *Total Quality Management*, *21*(4), 415–424

Khanna, T., & Palepu, K. (1999). The right way to restructure conglomerates in emerging markets. *Harvard Business Review*, *77*(4), 125–133.

Kull, T.J., & Wacker, J.G. (2010). Quality Management effectiveness in Asia: The influence of culture. *Journal of Operations Management*, *28*, 223–239.

Laureani, A., & Antony, J. (2012). Critical success factors for the effective implementation of Lean Sigma: Results from an empirical study and agenda for future research. *International Journal of Lean Six Sigma*, *3*(4), 274–283 .

Laureani, A., & Antony, J. (2019). Leadership and Lean Six Sigma: A systematic literature review. *Total Quality Management & Business Excellence*, *30*(1/2).

Lewis, J., & Ritchie, J. (Eds.). (2003). *Qualitative research practice – A guide for social science students and researchers*. London: Sage Publication.

Motwani, J., Kumar, A., & Antony, J. (2004). A business process change framework for examining the implementation of six-sigma: A case study of Dow Chemicals. *The TQM Magazine*, *16*(4), 273–285.

Muhareb, T.M., & Graham-Jones, J. (2014). Using lean six-sigma in the improvement of service quality at aviation industry: Case study at the departure area in KKIA (King Khaled International Airport). *International Journal of Social, Management, Economics and Business Engineering*, *8*(1), 145–151.

Najeh, R.I., & Kara-Zaitri, C. (2007). A comparative study of critical quality factors in Malaysia, Palestine, Saudi Arabia, Kuwait and Libya. *Total Quality Management*, *18*(1–2), 189–199.

Niewiadomski, P., Pawlak, N., & Tsimayeu, A. (2018). Barriers to effective implementation of Lean management principles – empirical exemplification in the industry of agricultural machinery. *Log Forum*, *14*(4), 563–576.

Pande, P.S., & Neuman, R.P. (2000). *The Six Sigma Way: How GE, Motorola, and Other Top Companies are Honing Their Performance*. McGraw Hill, New York.

Pisani, M.J., Hayes, R., Kumar, A., & Lepisto, L. (2009). Is Six Sigma culture bound? A conceptual model and propositions for further inquiry. *Total Quality Management*, *20*(10), 112–1137.

Rath & Strong. (2003, February). *Rath & Strong's Six Sigma Leadership handbook* (1st ed.). Wiley, New York.

Schroeder, R.G., Linderman, K., Liedtke, C., & Choo, A.S. (2008). Six Sigma: Definition and Underlying Theory. *Journal of Operations Management*, *26*(4), 536–554.

Shah, R., Chandrasekaran, A., & Linderman, K. (2008). In pursuit of implementation patterns: The context of Lean and Six Sigma. *International Journal of Production Research*, *46*(23), 6679–6699.

Snee, R.D. (2005). When Worlds Collide: Lean and Six Sigma. *Quality Progress*, pp. 63–65.

Sreedharan, V.R., Balagopalan, A., Murale, V., & Arunprasad, P. (2020). Synergising Lean six sigma with human resource practices: Evidence from literature arena. *Total Quality Management*, *31*(6), 636–653.

Staren, E.D., & Eckes, C.A. (2013). Optimizing Organizational Change. *Physician Executive*, *39*(3), 58–63.

Stenbacka, C. (2001). Qualitative research requires quality concepts of its own. *Management Decision*, *39*(7), 551–555.

Zou, X.T., & Lee, W. (2010). A study of knowledge flow in Six Sigma teams in a Chinese manufacturing enterprise. *The Journal of Information and Knowledge Management Systems*, *40*(3–4), 390–403.

APPENDIX

FIGURE 1
LEAN APPROACH

FIGURE 2
SIX SIGMA APPROACH