OPPORTUNITIES FOR DRIVING CONTINUOUS IMPROVEMENT THROUGH TQM, LEAN AND SIX SIGMA WITHIN BUSINESS PROCESS MANAGEMENT

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ABSTRACT
With this research the importance of various quality practices is highlighted, while emphasising the fact that all have their fair share of advantages and disadvantages that must be weighed by any organisation seeking a structured strategy towards furthering their continuous improvement initiatives. This article promotes a theoretic model that suggests that an efficient and effective approach towards Business Process Management should not be short-sighted at capturing just elements from Total Quality Management or Re-engineering ; a holistic balanced attitude towards continuous improvement might prove to be suitable embodying for instance also elements from Lean and Six Sigma, not just with regards to tools and methodology, but also considering the level of employee engagement or leadership involvement.

KEYWORDS : *Business Process Management, Continuous Improvement, Lean, Six Sigma, Total Quality Management.*

JEL CLASSIFICATION : *L10, L15, L60, L80, M10, O30.*

1. INTRODUCTION

Quality and research within Continuous Improvement (CI) displayed a particular interest in recent years, highlighting the importance of quality in BPM (Business Process Management). Within the manufacturing environment, the study towards quality is assessed to have reached maturity, while in services, in general, and BPM, in particular, this is still deemed to be at an early stage. CI is a fundamental element of our society and the interest towards it was displayed in the last couple years through various research publications that presented a wide range of concepts and practices circulated as supreme : works of Deming and Juran, Total Quality Management (TQM), Re-Engineering, ISO, Toyota Production System (TPS), Lean, Six Sigma.
In order to present the evolution of knowledge on CI it is necessary to analyse the TQM works of thinkers like Deming and Juran, present Lean and Six Sigma, highlighting the benefits and drawbacks of these concepts in the context of developing and improving BPM.

2. BUSINESS PROCESS MANAGEMENT (BPM)

Process is defined as a series of activities leading to the transformation of inputs into outputs. Process is the means by which an organisation's resources are used in a safe, repeatable and consistent way for accomplishing organisational objectives (Zairi, 1997), while BPM is the structured approach that allows analysis and continuous improvement of the activities carried out within an organisation : production, marketing and sales. Customers, competition, intense changes in the context of a highly globalised economy, led some organisations that had acceptable performance on some markets, to find themselves as unprepared/unfitted to meet the needs arising on others. Companies developed on intense, stable and growing mass production, find it is difficult

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to change overnight in order to be successful within the global economy that requires flexibility, agility, quick turnaround to face customer and market needs. World Class organisations must operate as a team with all functions integrated effectively, providing them an understanding of the importance of cross-functional processes (O'Neill & Sohal, 1999).
BPM's role and the importance of a holistic approach for business processes, became acknowledged in the '80s, when companies like Ford/IBM felt that there are benefits that derive from a cross-functional approach to business processes ; this came in contrast to the traditional approach which was based on organisational functions such as procurement, production or sales (Reijers, 2003). The process-based management approach, views the organisation as a system of interconnected processes, involving efforts towards documentation and compliance together with process improvement. The BPM approach is based on the works of Deming, Juran and Ishikawa that developed into TQM and were popularised through various programs as ISO 9000, Six Sigma (Benner & Tushman, 2003).

3. TOTAL QUALITY MANAGEMENT (TQM)

In an empirical approach, quality was deemed as being directly proportional to costs, this view getting fought in the works of thinkers such as Deming and Juran who stressed the cost of lack of quality, the quality that can be generated through pushing down the production costs : expenses incurred in generating waste, defects, re-processing costs.
CI impacts the results of an organisation in two directions : internal cost savings, pushing down productions costs, process improvement, direct impact on performance and external – through the market, market share/revenue increase by improving products/services quality, this being an indirect impact on results (Sousa & Voss, 2002). Organisations that implemented the principles of TQM together with a process-focused approach displayed improvements (Dobrin, 2011) in various areas as improved processing times, re-processing, productivity, increased customer satisfaction, market share, competitiveness.

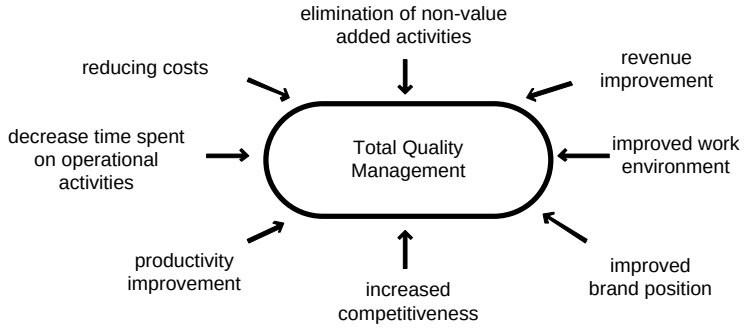

Figure 1. Benefits achieved by implementing TQM
Source : adapted from Dobrin (2011)

Although some authors call attention towards the efforts displayed since ancient times by human society towards quality assurance (Holweg, 2006), Deming and Juran are seen as initiators of the movement towards quality management (Landesberg, 1999), where quality represents customer's perception. There are some similar points in the approaches of Deming and Juran, especially regarding management's role in creating a quality organisational environment, a quality culture based on learning and training which thus determines a development of skills and competencies. Most problems within an organisation, arise from management actions/policies or lack of them. The approaches of Deming and Juran should not be seen just as programs with start and end dates, but rather as philosophies geared toward long-term improvement and customer satisfaction. Although these approaches are similar in some respect, the involvement of management, lack of effectiveness

of after the fact inspection, involvement of customers and suppliers in improvement efforts ; a number of differences are likewise visible (Suarez, 1992) :

Table 1. Overview on the approaches of Deming and Juran

	Deming	Juran
How is Quality defined	In line with current and future customer needs	Fit for purpose meets customer needs
Use of Measurements	Based on statistical methods and statistical thinking	quality and cost. statistical methods and statistical thinking
Goal Setting	Opposes the use of objectives and standards to manage work	Importance of organisational objectives and implementation
Supplier Relations	Single supplier	Reducing number of suppliers
Leadership	Defines leadership's role	Activities for management and employees to reaffirm the commitment to quality
Training and Education	Training to improve management practices. Education and training to develop knowledge and skills	Importance of training in the field of quality management and techniques to solve problems
Continuous Improvement	The organisation is a system and scientific methods are applied to optimise the system. Statistical methods for monitoring variation	In order to achieve improvement 3 steps are required (planning, control, improvement)

Source : adapted from Suarez (1992), p. 19

Targeting quality in line with customer needs and desires, is considered to be a long-term process in which the use of measurements and problem solving techniques together with suppliers involvement is critical. The implementation of quality management principles is highly dependent on management, long-term strategic plans, customers, organisation's view on quality, and typically the solutions that are selected represent eclectic approaches that integrate fragments from the works of Deming, Juran, Crosby, Ishikawa under the umbrella of TQM. In an overview on how to drive CI (Bhuiyan & Baghel, 2005), TQM is seen as a basic approach that in practice unfortunately does not provide a clear description on how to prioritise improvements.

4. TOYOTA PRODUCTION SYSTEM AND LEAN

TPS (Toyota Production System) was developed within Toyota Motor Company, as a manufacturing practice that views as waste, resources allocated for any purpose other than creating value for the end customer. In order to enable the understanding and application of Lean, concept developed from TPS, explanations are required on various terms, methodological aspects and tools that were developed within Toyota. It should be noted that Toyota developed Lean in several decades and although knowledge on the topic is quite extensive and easily available, no organisation can expect to implement Lean overnight. Ohno (1988), was viewing the TPS as being based on two pillars, Jidoka and Just-in-Time that lead to the „Toyota Production Style" – highly innovative in comparison with traditional approaches.

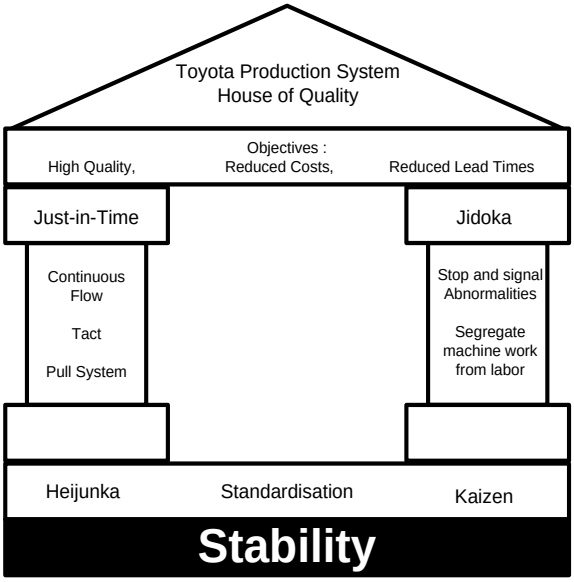

Figure 2. House of Quality – Toyota Production System
Source : adapted from Wrye (2012)

In the traditional approach, the lathes, milling and drilling machines can be found in the lathes, milling and drilling departments. This approach leads to disruptions in the flow, and for Toyota, maintaining a continuous flow was seen as being critical, thus the lathe, milling and drilling equipment was placed to meet the needs of the production process for the flow to be maintained and the worker to track multiple devices while in the traditional approach they had to do only certain operations, deal only with specific steps in the process.
This represents the segregation of the work carried out by the machines from labour ; and where the machines are equipped with a human element (stop if their function is abnormal / signal this) – Jidoka is reached.
Kanban is seen as the main instrument for achieving Just-in-Time, allowing signaling upstream the need for resources that is felt downstream, this being translated into a pull system. Just-in-Time is the system by which required inputs are available exactly when they are needed, in the necessary quantity, thereby reducing waste, inconsistency and efficiency improvement. Ohno (1988), accredits Kiichiro Toyoda, founder of Toyota, being the one who exhibited for the first time this idea, stressing that the necessary inputs should be available not only on time but exactly on time.
The principles of TPS led to Lean, where Lean thinking (Womack & Jones, 1996a) holds various underlying elements as the fact that the value is defined from customer's perspective. This can provide the organisation with visibility on the final product in terms of value and non-value, where the value chain must be indetified and waste removed ensuring a continuous flow for the remaining steps, the ones that bring value. Design must offer customers only what they want, when they want, thus the emphasis is placed on a customer initiated pull system and the elimination of waste caused by over-production. Through lean tools, the organisation can develop a environment/culture of CI and to strive toward perfection. Lean is viewed as a basic, fundamental philosophy (Drickhamer, 2004), which sets out how to make processes correctly, but cannot, sometimes, to manage to solve difficult issues. Lean wants to remove waste and its applications have found a place not only in manufacturing but also in services, BPM. (Womack & Jones, 1996b).

5. SIX SIGMA

Bill Smith, a Motorola employee, defined Six Sigma in 1986, drawing inspiration from various concepts used until then for continuous improvement : quality control, TQM, Zero Defects. Although the techniques and tools used are strikingly similar to practices found in other approaches for CI, Six Sigma is distinguished through a rigorous control on process improvement and a

innovative organisational structure (Schroeder et al, 2007). Six Sigma has evolved from scientific management and theories on CI, combining the finest elements of existing quality initiatives. (Aboelmaged, 2009) In some approaches, Six Sigma is regarded as an organised & parallel structure with the goal to reduce variation in organisational processes through a structured methodology, specialised continuous improvement employees and with performance indicators in order to ensure strategic objectives (Schroeder et al, 2007). Six Sigma is regarded as a comprehensive and flexible system for achieving, sustaining and maximizing business success. Six Sigma is based on a high degree of customer proximity and understanding towards their needs, disciplined use of data, information and statistical analysis, giving particular attention to managing, improving and remodeling business processes (Pande et al, 2000).
It is noticed that the roots of a significant part of Six Sigma's principles and tools are found in the works of Deming and Juran (Pande et al, 2000), and it is also acknowledged the fact that the Deming Cycle (PDCA - Plan, Do, Check, Act) led to the development methodology used in Six Sigma – DMAIC (Define, Measure, Analyse, Improve, Control). Six Sigma projects developed within an organisation follow a defined sequence of steps and have a number of financial objectives (eg. reduce costs and / or profit increase). The basic methodology used in Six Sigma projects that aim to improve existing performance by reducing variation is DMAIC (Define, Measure, Analyse, Improve, Control).

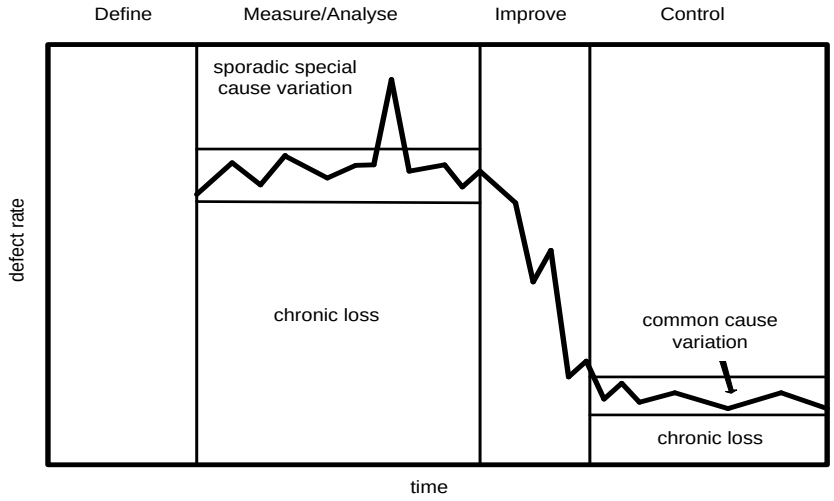

Figure 3. DMAIC phases and variation.
Source : adapted from Gotro (2003, p. 10)

During the define phase, the customers are determined together with their needs, project reasons, project team, delegation of tasks and process to be improved. The characteristics that are critical to quality (CTQ's), are identified initially, these being measurable elements that must be achieved to generate customer satisfaction. The Project Charter is developed, this being the document within which the purpose is defined together with the project plan, financial gains, project team. Within the last phase of Define a graphical representation of the process is targeted together with a COPIS look (Customer – Output – Process – Input – Supplier). In Measure, key aspects of the current process are tracked together with relevant data. The Critical to Quality characteristics are explored together with their causes in order to define some standards, measurable process, measurement method, to what extent will the variation be considered tolerable. Data analysis takes place to investigate and identify cause-effect relations, the capacity to produce outputs that are free of defects is analysed, to what extent the targeted performance levels are met and what is the predicted defect improvement ratio, what are the sources of variation that might hamper the project from reaching it's goals. Within Improve, the sources of variation with a higher impact are being checked and once the operational tolerances are established, the improvement solution is drafter and implemented, first in a pilot, in order to allow testing. In Control, the new process is tracked and monitored in order to

maintain the performance at a high level, so as to ensure a better customer satisfaction and the ability to achieve CI.

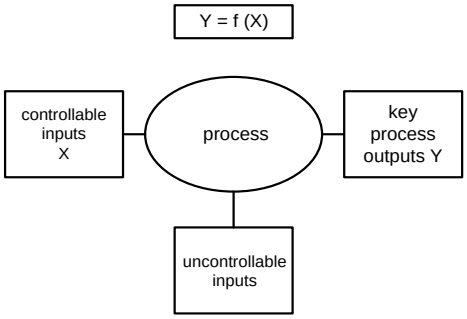

Figure 4. Six Sigma's f(x) = Y.
Source : adapted from Gotro (2003, p. 14)

DMAIC's objective is to identify which and how the process inputs are affecting the desired outputs ; looking a solution for the function f (x) = Y, where x is the inputs and Y is the desired out – Voice of the Customer. DMAIC viewed as the methodology for solving f(x) = Y, implies that in Define, Y is being understanded together with the measurement methods. During Measure the x's are being prioritised and the measurement on x vs Y takes place. Analyse has the role of validating the relevant x's based on testing the relationship between these and Y. The relevant x's are being actioned upon in Improve and thus the implementation of the solution takes place followed by the Control phase where Y and the relevant x's are monitored.

Based on articles published in the last two decades (Brady & Allen, 2006 ; Aboelmaged, 2009), there is a noticeable research interest towards Six Sigma mainly in practitioner publications, while there might be also a couple instances where this topic was approached by academic researchers. Six Sigma can be evaluated as a management system and unlike other programs that preceded Six Sigma, it shows a high degree of management involvement in monitoring the improvement results/accomplishments (Pande & Holpp, 2002). There is partial consensus (Brady & Allen, 2006) with regard to the factors that enable the success of Six Sigma improvement initiatives : leadership commitment and support together with multidisciplinary teams ; these together with the structured approach towards the project should lead to reaching goals.

The option chosen by some organisations in order to ensure Six Sigma's benefits are captured, bringing dramatic improvements while also rationalising the invested capital, is represented by the integration of Lean Six Sigma in a symbiotic approach, perhaps best known hybrid methodology (Bhuiyan & Baghel, 2005).

Unlike other approaches directed to process like TQM and Re-Engineering, that promoted CI as critical to achieving long term goals, Six Sigma has also a strong monetary accent targetting profitability, and together with BPM is viewed as a synergetic approach which results in the generation of the best solutions to improve processes (Breyfogle, 2004).

The fundamental cornerstones of Six Sigma are represented by the focus on generating monetary benefits in any project, importance of management, special belts infrastructure, decisions based on data rather than assumptions. Lean is a practice used mainly in instances where we search optimisation / efficiency, eliminating steps that that are not adding value ; while Six Sigma improvements rather seek to meet the „Voice of the Customer", improved effectiveness. Lean Six Sigma has been considered in recent years a stand-alone concept that takes its individual elements multiplying them. Opinions vary with regards to the proper use of Six Sigma (Soare, 2011), as it might be seen both as a solution for generating critical improvements and also as a problem that generates difficulties for organisations that try to implement it or is causing vital improvements to not be implemented because they do not fall well under a DMAIC methodology.

6. SYNERGETIC APPROACH TARGETING CONTINUOUS IMPROVEMENT

Continuous Improvement in an organisation is determined by a series of aspects as Customer, Leadership, Strategy, Organisational Culture, together with the methodology and tools used for capturing and following improvements. Most research in CI is detailing one-sided approaches towards various quality practices ; while in opposition to this, below, a synergetic approach is being outlined, that considers the finest elements of TQM, Lean and Six Sigma.

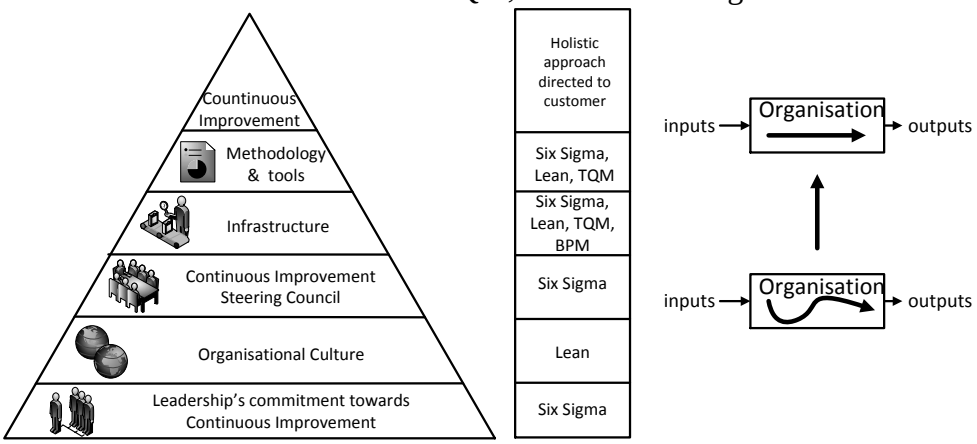

Figure 5. Synergetic approach targeting continuous improvement
Source : made by author

6.1. Leadership

The success or failure of an organisation and likewise of its CI initiatives is mainly determined by Management (Deming, 1993). Perhaps the most important feature of Six Sigma is related to the leadership involvement. Although Motorola is the organization that gave birth to Six Sigma, General Electric is the one that sparked the interest towards this concept (Park, 2003), and this is due to the fact that GE was the first organization that introduced Six Sigma as a constant element on CEO's agenda. GE's merits towards promoting Six Sigma are acknowledged by Pande & Holpp (2002) that bring special thanks to Jack Welch for moving against the current and underlying the importance of quality within GE. Jack Welch's approach towards promoting Six Sigma is highly regarded and given as an example for all organisations seeking to implement Six Sigma. This was a great example of change management enabled intensively and strongly dependent on leadership support. Leadership should follow such an approach irrespective if the change is represented by Six Sigma, BPM or other symbiotic concepts.

6.2. Organisational culture

The Organisational Culture plays a vital role in an organisation and especially in an organisation that follows a strategy based on CI, as without employee involvement and engagement, leadership can't expect improvements to take place. Lean workpractices enable such an Organisational Culture targeted towards CI as emphasised by Krafcik (1986). General Motors factory in Fremont, California, was known for poor quality, low productivity and labor conflicts that made it to get closed in 1982. Toyota entered into a partnership with General Motors and took over the factory in 1984, hiring former employees and getting them to work in TPS which resulted in productivity to double and absenteeism to decrease tenfold.

6.3. Steering council

Organisations might often find themselves to be required to make difficult choices with regards to what improvements should be followed. In most cases, the organisations follow the Pareto principle

of the „vital few and trivial many" which was extensively promoted by Juran (1975), so that it might likewise be called the Juran principle.
Within TQM and Lean the emphasis is placed on efficiency, while in Six Sigma the focus is on effectiveness ; and to ensure this effectiveness Six Sigma has a strong monetary accent and all potential improvements must be quantified in monetary terms so that improvements can be prioritised depending on the effort vs gain (Pande et al., 2000). The task of assessing potential projects and also monitoring development of the continuous improvement programs falls under the scope of the Steering Council.
The Steering Council can be a suitable element that can be considered by organisations that wish to follow CI ; thus ensuring that the link between the internal/external environment, strategic objectives and the improvement infrastructure is effectively made.

6.4. Infrastructure

With regards to the improvement infrastructure the focus is placed on the systems that are used for tracking CI programs and also on the human element that are carrying these. Training and education is required in order to improve management practices, knowledge, skills in continuous improvement and techniques for solving problems. Six Sigma's Belt System is viewed as holding most interest (Brady & Allen, 2006) and represents the most well refined Continuous Improvement Infrastructure, being far beyond the low level of detail captured within Lean and TQM. The quality circles in TQM were viewed as having reduced decision authority, improvement proposals having to go down-up within the organisation. Within Six Sigma, the belt infrastructure is represented by improvement specialists who carry out projects that were previously selected by leadership in line to their strategic importance.

6.5. Methodology and tools

A CI program is expects to make use of a set of tools : Cause-Effect Diagram (Ishikawa diagram) ; control chart, cost-benefit analysis, CTQ diagram, histograms, Pareto Analysis, QFD (Quality Function Deployment), SIPOC analysis, Taguchi methods. These are being used and extensively in various methodologies as TQM, Lean, Six Sigma. These specialised tools could bring benefits especially if they are used in a robust and powerful framework methodology as DMAIC, which is viewed as a change management process that describes ways for analyzing and implementing changes (Schroeder et al, 2007). Although DMAIC's origins can be found in Deming's Cycle (Pande et al, 2000), it is viewed as possibly the most well established methodology for improvement (Park, 2003) and is more than what TQM or Lean can offer.

7. CONCLUSIONS

It is necessary for organisations to align their Business Process Management with their goals and in order to attain results, proven elements can be borrowed from proven approaches (TQM, Lean, Six Sigma) that have predominantly a positive impact in creating an environment and culture of CI focused on monetary benefits. CI initiatives in BPM can give better results based on the elements of TQM, Lean and a solid methodology as Six Sigma's DMAIC, thus improving processes by eliminating opportunities for errors that cause major costs for the organisation.
Research in the implementation of elements from TQM, Lean and Six Sigma within BPM is at an early stage and opportunities for future exploration are available. The opportunity for mixing BPM with TQM, Lean and Six Sigma is conferred by their common goals (CI) and the complementary aspects between these concepts. TQM/Lean/Six Sigma may help improve BPM through the specialized tools, a clear methodology, strong and powerful data-driven approaches. The DMAIC methodology together with a specialised improvement infrastructure may easily be employed in relevant activities of design, modeling, execution, monitoring and optimization of business processes.

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