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Measuring and Analyzing agility of an Enterprise through DMAIC Six Sigma

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Abstract

Purpose: Assessment of organizational Agility creates a problem due to inexact boundaries by which Agility is defined, and the variation depending on type of enterprise. This paper proposes how Six Sigma DMAIC approach may be utilized to address this gap. The agility assessment framework curve developed for information development systems used in this research has synergies with DMAIC phases of Six Sigma. This logic forms the basis of forming metrics to measure and analyze agility of an enterprise through DMAIC Six Sigma.

Design/Methodology/approach: Structured literature review of peer reviewed journals and content analysis is followed of articles comprising of theoretical frameworks on Agility assessment and DMAIC Six Sigma methodology. The keywords Agility assessment frameworks, DMAIC Six Sigma, Critical success factors of Six Sigma are used for literature review.

Findings: DMAIC methodology of Six Sigma can be used to measure and assess agility of an enterprise because of its synergies with agility assessment framework curve. Cycle time of DMAIC project implementing identified number of changes can be used as metrics for defining agility maturity level of an enterprise.

Research limitations/implications: The hypothesis of measuring and analyzing enterprise Agility through DMAIC Six Sigma approach proposed in this paper needs testing for validation. This model may be tested by implementing it in an enterprise and further generalizations may be made by testing it in varied enterprises.

Practical Implications: This proposed research will provide framework that will establish metrics to assess agility of an enterprise from DMAIC Six Sigma projects. This will further help managers of an enterprise to assess lack of agile practices followed and to improve upon them.

Originality: This paper proposes framework and metrics to assess agility of an enterprise through DMAIC Six Sigma approach for the first time. Also the synergies between agile practices and critical success factors for six sigma implementation are established to improve upon agility of an enterprise.

Keywords: Agility assessment frameworks, DMAIC Six Sigma, Critical success factors Six Sigma.

Introduction

Due to the variability in definition of agility in context of different enterprises there are myriad agility assessment frameworks developed (Gren, L., Torkar, R., & Feldt, R. (2015). Moreover, there is a gap identified on agility improvement metrics in the literature because of the lack of generality and quantifiable parametric definitions (Gren, L., Torkar, R., & Feldt, R. (2015). So, this gap is addressed in this paper by using two most widely used frameworks for agility assessment (Sidky, A., Arthur, J., & Bohner, S. 2007) and (Gunasekaran, A. 1998). Agility enablers identified in these frameworks are in commonality with some critical success factors for Lean Six Sigma implementation described in literature (Antony, J., Singh Bhuller, A., Kumar, M., Mendibil, K., & Montgomery, D. C. 2012). Moreover, there is an agility assessment framework curve developed for information development systems (Conboy, K., & Fitzgerald, B.2004, November) that has synergies with DMAIC methodology phases. These synergies are used to develop a generic framework that utilizes DMAIC six sigma methodology.

Cycle time of DMAIC Six Sigma project and number of changes implemented through it are some of the metrics proposed by the methodology described to measure and analyze agility of an enterprise (Conboy, K., & Fitzgerald, B. 2004, November). The synergies identified between agile practices and critical success factors of Six Sigma can help to demonstrate the improvement in agile metrics as defined in this study with improvement in critical success factors of Six Sigma implementation. The agility assessment framework proposed in this study is different from other frameworks (Erande, A. S., & Verma, A. K.2008) as it utilizes DMAIC methodology and critical success factors of Six Sigma. Validation of this proposed framework can help enterprises to measure and improve upon agile practices.

Literature Review

Agility

The study of agile development is a new domain. The term itself, “agile development” coined for software development but similar concepts preceded it in the literature on manufacturing (Gren, L., Torkar, R., & Feldt, R. 2015).The background to agile ideas was that projects in crisis took on more flexible ways of thinking and working (Cobb, C. G. 2011). Agility is more formally defined as the ability of an enterprise to operate profitably in a rapidly changing and continuously fragmenting global market environment by producing high-quality, high-performance, customer-configured goods and services (Gren, L., Torkar, R., & Feldt, R. 2015). Agility is not a concept unique to software development. Indeed, it first appeared in the mainstream business literature in 1991, when a group of researchers at the Iacocca Institute in Lehigh University introduced the term “agile manufacturing”. Agility means an organization with incredible internal capabilities (i.e. hard and soft technologies, human resources, educated management and information) to meet dynamic needs of the market place (i.e. speed, flexibility, suppliers, infrastructure, customers, competition and responsiveness). “A system that shifts quickly (speed and responsiveness) among product models or product lines (flexibility) ideally in real time responds to customer demands (Dubey, R., & Gunasekaran, A. 2015). One of the most referenced

definitions of agility was introduced by (Goldman et al. 1995). The authors conceptualized agility as a construct with the following strategic dimensions: enriching the customer, cooperating both internally and externally to enhance competitiveness, organizing to both adapt and thrive on change and uncertainty, and leveraging the impact of people and information. (Gunasekaran, A. 1998) viewed agile manufacturing as a capability to survive and prosper in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer-designed products and services.

Agility from manufacturing perspective is one of the operational strategies which organizations have adopted to beat uncertainties resulting from worldwide economic recession, shortening of product life cycle, supplier constraints and obsolete technologies. Manufacturing companies across many industries have gained a competitive advantage from such an agile philosophy (Yusuf, Y. Y., Sarhadi, M., & Gunasekaran, A.1999).

Frameworks for measuring and analyzing Agility

Researchers suggested qualitative approaches like interview, as a method for assessing agility in teams (Boehm & Turner, 2003; Sidky et al., 2007; Pikkarainen & Huomo, 2005), (Sidky, A., Arthur, J., & Bohner, S. 2007) defines “how agile” a company is by the amount of agile practices used. A measurement tool is possible and means that an organization that uses ten agile practices is more agile than one that uses three. The assumption that higher number of implemented practices necessarily implies more agility, is wrong since teams can use agile practices without having them aligned with the agile principles, which is also supported by research (Zieris, F., & Salinger, S. 2013, August). (Kumar, A., & Motwani, J. 1995) propose a methodology for time based competitive advantage through the self-assessed survey which is use measurement of structural properties of business (info and material flow, organizational relationships, and communication network) instead of operational properties (batch size, change over times etc.). From the manufacturing perspective core competency management, virtual enterprise, capability for reconfiguration and knowledge driven enterprise are considered some of the drivers of agile manufacturing (Gunasekaran, A. 1998). (Batra, D, Vander Meer, D., & Dutta, K. 2011). (Erande, A. S., & Verma, A. K.2008) describes an agility measurement index as an indicator the author suggests that the five dimensions: Duration, Risk, Novelty, Effort, and Interaction should be considered when selecting a development method. Their method is, however, a company-specific assessment, which makes comparisons between different organizations cumbersome. (Giachetti, R. E., Martinez, L. D, Sáenz, O. A., & Chen, C. S.2003) showed that a set of agile measurement models give different results when tested with practitioners. This bolsters the scientific validation of different agility measurement models and also the fact that quantitative models should be developed for evaluating agility and its trade-offs, while proposing a framework for the implementation of agility. Creative, proactive and reactive activities are measured in terms of their level of agility is done by comparing the number of changes identified and fulfilled by an activity to the cost of carrying out that activity. The greater the

number of changes per change cost, the more agile the activity (Conboy, K., & Fitzgerald, B.2004, November).

Six Sigma(DMAIC)

DMAIC is applied in practice as a standardized problem solving and improvement approach (McAdam, R., & Lafferty, B.2004). DMAIC is instrumental in the implementation of Six Sigma as a process improvement methodology (Chakrabarty, A., & Chuan Tan, K. (2007). Six Sigma as an operational philosophy of management, can be shared beneficially by customers, shareholders, employees and suppliers (Chakrabarty and Tan, 2007). Thanks to its flexibility, Six Sigma application is not limited only to manufacturing but can be extended to the whole supply chain, which includes the provision of services. Six Sigma is also defined as a multifaceted, customer-oriented, structured, systematic, proactive and quantitative philosophical approach for business improvement to increase quality, speed up the deliveries and reduce costs (Mahanti, R., & Antony, J. 2005). DMAIC methodology could enhance product development cycles and process design, shorting product lead times by reducing the cycle time of the overall manufacturing process. The adoption of Six Sigma has improved both the efficiency of product line and production capability, including minimizing waste such as reduced need for inspection, removed useless components and excessive movements and decreased time for repair (Oke, S. A. 2007). However, (Van Iwaarden, J., van der Wiele, T., Dale, B., Williams, R., & Bertsch, B. 2008) state that the approach to Six Sigma varies among organizations because they integrate different techniques according to their needs, so there might be disagreement regarding the benefits as these benefits depend on the industry and even the country where Six Sigma is applied. Six Sigma also keeps the main principles of TQM such as customer focus (identified as CTQ in the “define” phase within DMAIC), employee involvement (green belts and black belts team leaders who lead self-directed work teams and are empowered to make changes), continuous improvement (the “control” phase within DMAIC), enlightened leadership (represented by the champion in Six Sigma team) and fact-based decision making (Six Sigma is visibly data oriented) (Green, 2006; Black and Revere, 2006).

Methodology

The frameworks used for this study and critical success factors for lean, Six Sigma are matched below for finding synergizes.

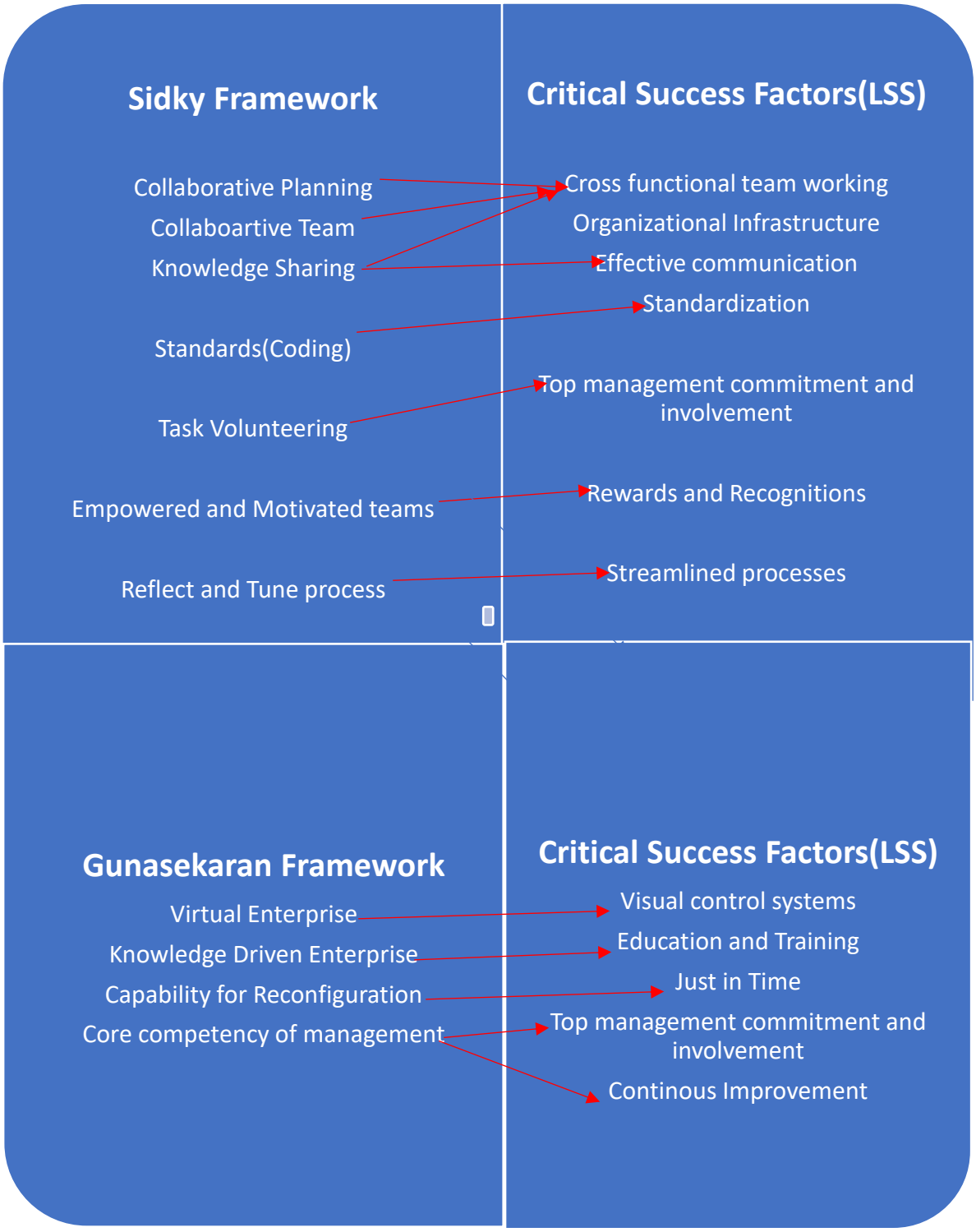


Fig 1. Synergies b/w Agility Enablers and Critical Success Factors of Lean Six Sigma

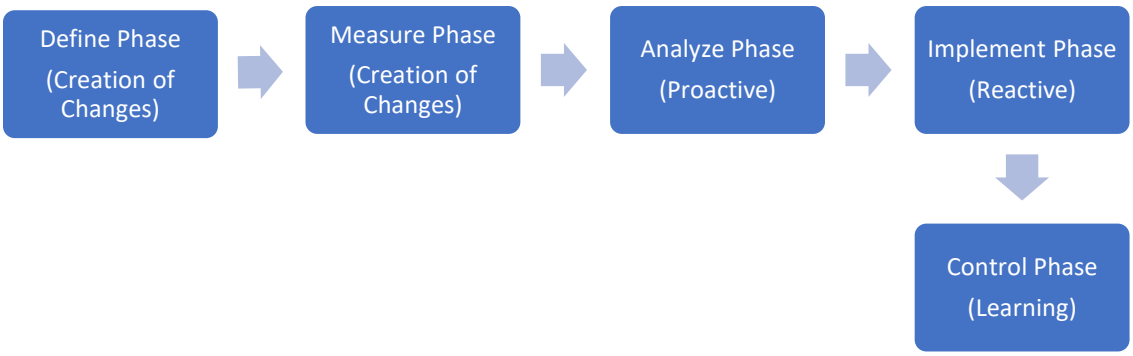
(Sidky, A., Arthur, J., & Bohner, S. 2007), (Gunasekaran, A.1998), (Abu Bakar, F. A., Subari, K., & Mohd Daril, M. A. 2015), Antony, J., Singh Bhuller, A., Kumar, M., Mendibil, K., & Montgomery, D. C. (2012).

We can observe from these agility assessment frameworks (Sidky, A., Arthur, J., & Bohner, S. 2007), (Gunasekaran, A.1998) that agility enablers for implementing and sustaining quick changes like knowledge driven enterprise, collaborative planning,

knowledge sharing, standardizing, virtual enterprise and core management competence are also some of the critical success factors for successful Lean Six Sigma implementation in an enterprise as depicted in the literature (Antony, J., Singh Bhuller, A., Kumar, M., Mendibil, K., & Montgomery, D. C.2012).

So, combining the (Sidky, A., Arthur, J., & Bohner, S. 2007) agility enablers, (Gunasekaran, A.1998) agile manufacturing enablers and agility assessment framework for IS development may be based on the generic definition of agility "more the number of changes identified and implemented in brief period at low cost per change more agile the enterprise is" (Conboy, K., & Fitzgerald, B. 2004, November). In other words, if we compare two organizations of similar type in terms of structure and utility then organization identifying and implementing more changes in less time at less cost as compared to another organization is more agile (Conboy, K., & Fitzgerald, B. 2004, November). The agility enablers described in (Sidky, A., Arthur, J., & Bohner, S. 2007) and (Gunasekaran, A.1998) frameworks are critical success factors that help enterprises to adapt quickly to more changes in less time at less cost. This is in resonance with Six Sigma methodologies where there are critical success factors for successful implementation of DMAIC project.

The proposed methodology described in this paper is to measure and analyze agility of an enterprise through DMAIC Six Sigma projects and to set agility metrics. The hypothesis that improvement in agile practices results in significantly less cycle time to implement DMAIC Six Sigma project can be tested to validate agile metrics. The rationale behind using (Sidky, A., Arthur, J., & Bohner, S. 2007) and (Gunasekaran, A.1998) frameworks for agility enablers is that they are holistically framed and used by myriad enterprises to assess agility (Gren, L., Torkar, R., & Feldt, R. 2015). The logic behind using DMAIC is that it is a structured methodology and if the changes identified and implemented through it has less cycle time than the difference can be identified clearly and the need for improvement on agility enablers can be pursued. The synergies between phases of DMAIC methodology and agility assessment curve is represented below, this is also one of the factor of using DMAIC for the proposed methodology.



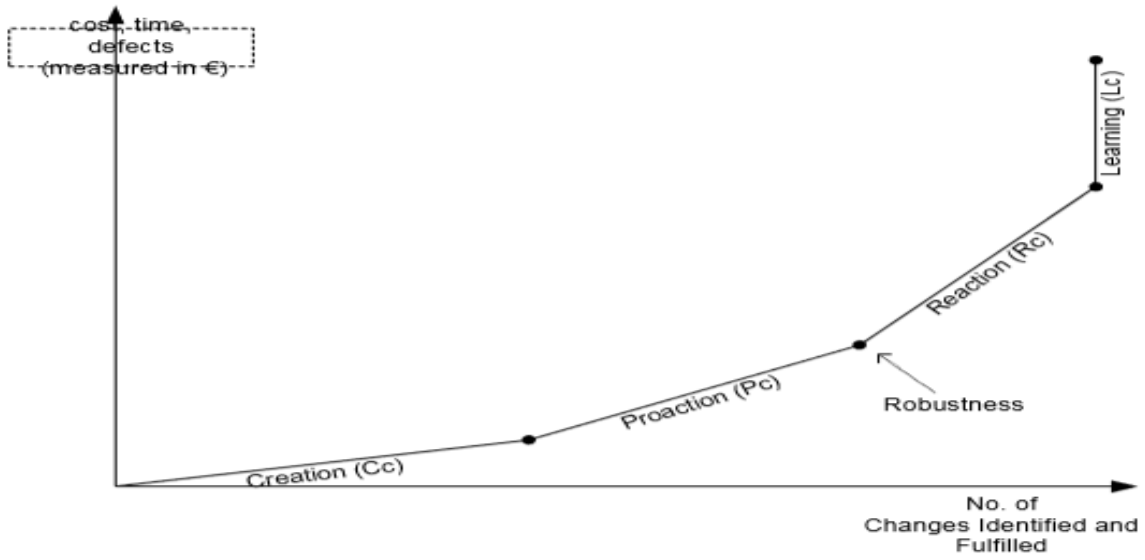


Fig 2. Agility assessment curve (Conboy, K., & Fitzgerald, B. 2004, November).

As shown in Fig 2. There are synergies between phases of agility assessment framework curve and DMAIC Six Sigma project phases. These synergies substantiate the rationale for using metrics that are cycle time and number of changes implemented through DMAIC Six Sigma projects to measure and assess agility of an enterprise.

Limitations and Future work

The hypothesis constructed in this study needs validation to establish the metric defined for agility measurement in an enterprise. There are some lurking variables like type of changes implemented and type of an enterprise which can be controlled during statistical significance testing. The parametric definition of agility used for quantifying metrics in this study is chosen from a single framework which needs further verification with other frameworks mentioned in literature. An action research can be carried out in future to test the claims. The DMAIC Six Sigma projects that are delayed or having large cycle time and implementing less changes can be followed up to investigate the level of agile practices. The practical implication of this study will be to improve the agility of an enterprise by reducing the cycle time of projects and increasing the number of changes that an enterprise can adapt.

Conclusion

The DMAIC Six Sigma projects implemented by an enterprise can be used as a source to establish metrics for agility measurement. The synergies between agile practices and critical success factors of Six Sigma implementation are identified in this study. Moreover, the similarities between DMAIC methodology phases and agility assessment framework curve are also highlighted. These finding substantiate the use of DMAIC Six Sigma projects for agility measurement. Cycle time and number of changes implemented through DMAIC projects are agility metrics that needs statistical validation but considered as critical finding of this study.

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