



# Mapping SAP-Six Sigma Resources to Agile Management Processes

Selva Staub, Sam Khoury, Kouroush Jenab\*

Department of Business Administration, Haliç University, Büyükdere Cad. No. 101, 34394 Mecidiyekoy, Istanbul, Turkey  
College of Business, Athens State University, 300 N. Beatty Street, Athens, AL, USA  
College of Aeronautics, Embry-Riddle Aeronautical University, 600 S. Clyde Morris Blvd. Daytona Beach, FL, USA

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## ABSTRACT

Enterprise Resource Planning (ERP) has become the most strategic tool for an organization to employ. A leading ERP solution is SAP®. It has been employed by organizations to enable them to collaborate on different projects and to integrate all aspects of operations. Just as organizations have adopted ERP solutions, they employed quality initiatives that are designed to help organizations maximize efficiency. One of these quality initiatives organizations have turned to is Six Sigma. This paper explores the impact of SAP® solutions on the success of Six Sigma initiative implementation in an agile environment, where the needs of the customer changes rapidly. The literature shows that SAP® type ERP products play a critical role in the implementation process like Six Sigma, where the implementation process takes time. Also, the literature implies that in agile environments Six Sigma implementation can be ineffective.

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## 1. Introduction

Information systems technology has become one of the primary means for gaining a competitive advantage in a global business environment. This technology emerged as the need to share large quantities of data effectively and efficiently between all operations became a necessity. In this regard, ERP has become the most strategic tool for an organization to employ. The brand name SAP®, is essentially synonymous with ERP, allows organizations of all sizes to collaborate on different projects, and integrates all aspects of

operations. Software that is as sophisticated as SAP® naturally requires considerable resources on the part of the developer to ensure that the product remains reliable and relevant. In the current economic environment where certainty is lacking, continued investment in software product development arises as a central concern. This context has facilitated the adoption of agile methodologies as a means for software development. Chan et al. define agile methodologies as “new host of methodologies that claim to overcome the limitations of traditional plan-driven system development methodologies (SDMs)” (2009, pg. 807). While in

\* Corresponding author: Kouroush Jenab  
Email: Jenab@ieee.org

traditional SDMs, process is the focal point, in agile methodologies the focal point is people.

Competitive advantage in a global business environment is, in many cases, derived from customer satisfaction which is, in large part, accomplished through the development of products that are of high quality and low cost. To do so, organizations must work to maximize efficiency, which is why many organizations turn to the Six Sigma process to reach this end. Six Sigma is a management strategy that works toward excellence in operations through quick and accurate data sharing. If the premises are that Six Sigma relies on effective data sharing and that SAP<sup>®</sup> purportedly does so, then what is the impact of SAP<sup>®</sup> implementation on Six Sigma? This paper will explore the impact of SAP<sup>®</sup> solutions on the success of Six Sigma initiative implementation in an agile environment, where the needs of the customer changes rapidly.

## 2. SAP AG<sup>®</sup> as an ERP

ERP applications are standardized tools used to cut costs and improve efficiency within organizations, enabling them to gain a competitive advantage. ERP systems started as material requirement planning systems in the 1960s and, over time, developed into more complex systems that include all aspects of operations within organizations (Ngai et al., 2008). Therefore, ERP implementations became a key factor in the strategic development of organizations. Organizations believe that a wide range of functionality in ERP systems can give them a competitive advantage and benefits them in areas such as improved management and decision

making, improved financial management, cycle time reduction, and increased revenues. These advantages make ERP systems attractive to organizations.

The broad prevalence of ERP in the market place has naturally led to a body of research exploring many facets of ERP implementation. Some of these studies have concentrated on ERP maturity and models used to represent different levels of maturity in order to gain a better understanding of ERP implementations (Davenport, 2000; Fraser et al., 2002). Other studies have focused on the successes and failures of ERP implementation (Boersma & Kingma, 2005; Bondarouk & van Riemsdijk, 2007; Hasiao, et al., 2007; Ngai, et al., 2008; Noudoostbeni et al., 2009). The shortage of skilled ERP users have drawn universities to think about implementing ERP systems in their own programs; e.g. simulating business program applications for continuous improvement in curriculum via hands on assignments (Khoury et al., 2014). Numerous studies have been carried out regarding the successes and challenges experienced in academia (Khoury et al., 2012) and different sectors such as manufacturing and logistics, as well as to different processes such as supply chain, human resources, and Six Sigma (e.g. Antonucci et al., 2004; Boykin & Martz, 2004; Hawkings, 2004; Jenab et al., 2012; McCombs, 2007; Sager et al., 2006; Seethamraju, 2012).

However, failure of ERP products has driven attention to cultural studies in ERP implementation. ERP process and systems developed with western culture implications on eastern cultural change (Srivastava & Gips, 2009)

and national cultural impact on ERP project management and their effect on employees and the ultimate outcome of ERP (Livermore, 2011) are the primary focus areas of culture and ERP implementation studies. For example, Krumbholz and Maiden (2001) synthesized social science theories of culture to manage the impact of culture in ERP implementation.

One of the most well-known ERP firms, SAP AG<sup>®</sup>, was founded in Germany in 1972 as an integrated software developer. According to the SAP<sup>®</sup> website, there are over 250,000 customers in 188 countries that rely on their software solutions and services from back office to boardroom, warehouse to storefront, on premise to cloud, and desktop to mobile device. SAP<sup>®</sup> empowers people and organizations to work together more efficiently in an integrated set of modules to support all aspects of organizations. SAP<sup>®</sup> applications and services enable organizations to operate profitably, adapt continuously, and grow sustainably in fast changing environments (SAP<sup>®</sup>, “SAP<sup>®</sup> customer showcase” 2011). SAP<sup>®</sup> has many products that help organizations align their operations by synchronizing manufacturing processes with business processes and by achieving continuous improvement.

### 3. SAP<sup>®</sup> and Six Sigma

Friedman in his famous book *The World is Flat* (2005), talked about the perceptual shift required for countries, companies, and individuals to remain competitive in a global market where historical and geographical divisions are becoming increasingly irrelevant. Expansion

from a local geographical landscape to a global landscape increases the pressure on business. On the other hand, the “flat world” helps organizations to reach distant places and expand their businesses. This also allows distant competitors to enter in their places. This rapid development demands that organizations increase their business performance and drives organizations to adopt continuous improvement methodologies, which results in an increase and greater reach in operational performance. In time, the incremental changes compound and provide a competitive advantage.

A methodology behind defect reduction that emphasizes business process improvement is called Six Sigma, where pursuing continuous improvement in customer satisfaction is the central aim. Utilizing statistical tools to measure improved customer satisfaction, reducing cycle times and reducing errors are the main focus areas in design for Six Sigma (DFSS). It is implemented at the management level “to deal with complex organizational problems that need extensive analysis of data, confirmation of results, and validation of long-term actual benefits” (Moosa & Sajid, 2010, pg. 746). An organization that links the three key elements of customer, process, and employee to DFSS process achieves the greatest advantage. Therefore, Six Sigma is a management strategy that attempts to achieve excellence in operations and the implementation of Six Sigma has become more about organizational culture than a statistical standard. For example, a recent study explored the connection between Six Sigma implementation

and logistics managers' perception of workers (Khoury et al., 2013).

Design for Six Sigma (DFSS) is meant for process management, which follows five phases: define, measure, analyze, improve, and control which is also known as DMAIC (Chung et al., 2008). A structured DMAIC problem-solving road map comprising these five steps is commonly regarded as the core of every Six Sigma project. The common language of DMAIC makes sharing knowledge learned in different projects much easier (Zhang & Xu, 2008). Knowledge sharing helps reduce the complexity of operations and helps share data in different areas. The key shareholders in Six Sigma range from the executive team to laymen, where each has their own roles and where the knowledge shared improves the process.

The key roles for each stakeholder are as follows (Jenab & Staub, 2011):

Executive Leadership (CEO and members of top management).

- Empower the other role holders.
- Give freedom and resources to explore new ideas.
- Create an environment for breakthrough improvements.

Champions (Executive Leadership draws them from upper management).

- Take responsibility for Six Sigma implementation across the organization in an integrated manner.
- Focus on identifying projects/functions for Six Sigma.
- Act as mentors to Black Belts.

Master Black Belts (identified by Champions and act as in-house coaches on Six Sigma).

- Dedicate 100% of their time to Six Sigma.
- Assist champions and guide Black Belts and Green Belts.
- Ensuring consistent application of Six Sigma across various functions and departments.
- Focus on identifying projects/functions for Six Sigma.

Black Belts (operate under Master Black Belts).

- Apply Six Sigma methodology to specific projects.
- Dedicate 100% of their time to Six Sigma.
- Responsible for Project execution.

Green Belts (employees that operate under Black Belts).

- Take up Six Sigma implementation along with their other job responsibilities.
- Operate under the guidance of Black Belts.

Yellow Belts (employees who have basic training in Six Sigma tools).

- Locally trained in the concepts, but do not participate in the project team.
- They have limited participation in projects.

White Belts (other employees).

- Locally trained in the concepts, but do not participate in the project team.

We formulate the Six Sigma methodology as:

*Six Sigma = F(Customer Quality Assurance, Statistical Tools, Cost Benefit Analysis, Total Quality Management, Project Management)*

Therefore, it requires a complex ERP system to manage all the parts and to give quick snapshots to each stakeholder. A significant benefit an ERP system provides is the ability to share data in real-time. The ability to use real-time data to manage

all the parts and to produce quick snapshots is beneficial to any quality initiative.

One possible application of SAP<sup>®</sup> is in lean manufacturing, where the software enables project management to support all Six Sigma phases. The stakeholders in Six Sigma projects via SAP<sup>®</sup> solutions can manage product quality, monitor and improve quality standards, document quality compliance, and perform audits. SAP<sup>®</sup>-Six Sigma analytics helps employees make quick and informed decisions to improve the quality of the process and to reduce variability. SAP's<sup>®</sup> Six Sigma analytics supports Six Sigma's DMAIC cycle, helps shareholders understand the root causes of variability, and enables the management of exceptions by integrating the planning processes (SAP<sup>®</sup>, "Lean Six Sigma", 2013). SAP's<sup>®</sup> collaborative projects software, helps stakeholders define the five DMAIC phases of their Six Sigma project and the related tasks for every phase. According to "SAP<sup>®</sup> Functions in Detail SAP<sup>®</sup> ERP" (2008), it helps the stakeholder define criteria and checklists for passing the quality gates between the phases, manages resources such as employees, supports black belts who are needed for executing the tasks, and also uses graphical tools to schedule and visualize the relations between the project tasks and finding critical paths.

#### **4. SAP<sup>®</sup>-Six Sigma Mapping in the Agile Management Process**

The term "Agile" appears in different forms in the literature such as "Agile Manufacturing", "Agile Project Management", "Agile Enterprises", and "Agile software Development". The term has

applied to virtually any organization, including manufacturing systems in general. Hormozi (2001) indicated that in the fast changing environment for businesses with more traditional manufacturing operations, organizations were unable to adapt quickly, which prevented them from taking advantage of viable opportunities to sustain their existence.

According to Webster's dictionary, the term agile is "able to move quickly and easily; quick, smart, and clever". Therefore, in order to adjust to a competitive, fast changing world, businesses need to think quickly, make smart choices and respond intelligently to customer needs. Goldman et al. (1995) point out that in the business world "to be agile is to be capable of contributing to the bottom line of the company" (pg. 37). That is, organizations must be able to perceive the need for human and technological resources in order to effectively and efficiently respond to environmental unpredictability and shifting customer opportunities. As noted above, it is commonly accepted that new agile methodologies focus on "people over process, software over documentation, customer collaboration over contract negotiation and responding to change over following a plan" (Bonner, 2010, pg. 85)

Technology has a locomotive effect in the fast changing environment. From networks to software applications, it is forcing businesses to be informed and adapt quickly to customer needs. Therefore, methods for agile are becoming popular in the software industry. In this case, continuous integration and automatic compiling, deploying and testing in some cases multiple times a day have become very important steps to

adapting to changes (Ablett et al., 2008).

Rubinstein (2006) interviewed Richard Leavitt, CTO of Rally, where Leavitt emphasized the need for things to remain easy to modify and change. He also pointed out that with large CRM applications such as SAP<sup>®</sup>, businesses have had to adapt to how the software works. However, this is not enough. According to Leavitt “Organizations have spent years and millions of dollars creating huge, monolithic applications built and managed in siloed departments under a development process that often takes too long and is very high-risk” (pg. 38). Also interviewed was Jim MacKay, chief marketing officer at iTKO. MacKay argued that the problem is not technological; it is about people and processes involved in producing and using these component services. Therefore agile being the “people over process” (Bonner, 2010, pg. 85) supports the agile development ideas in Six Sigma/SAP<sup>®</sup> applications.

Agile development processes are an important first step in creating applications for businesses. Agile focuses on the end user, therefore, we can say that agile is about prioritizing the development effort around end-user requirements. It is about the business’ need – the highest priorities get met first (Carvalho, 2011).

Table 1 shows the mapping framework for SAP<sup>®</sup> and Six Sigma into Agile Management Processes (AMP). First, the key components of AMP are organized around the Deming cycle of continual improvement. Second, the key components of Six Sigma are organized around the DMAIC (Define, Measure, Analysis, Improve and Control) approach to process improvement. Finally, the

third area presents a representative illustration of the potential areas for integration of Six Sigma and Agile Management Processes. In the third section, four elements are described, which, considered together, form the basis for a distinctive integration method. These elements are: 1) initiation of the process, 2) development of the integrated system, 3) implementation of the integrated system, and 4) maintaining the integrated system. These are consistent with the AMPPDCA cycle and in line with the Six Sigma DMAIC methodology. Several opportunities for integration of these phases are immediately apparent, particularly with respect to the development of policies, objectives, and targets: 1) The use of relatively simple quality tools in a structured process to improve the targeted company’s processes without having to recreate what may have already done; 2) implementing measurements and applying Six Sigma tracking tools to monitor the AMP performance; 3) cross-training; 4) integrated management review meetings; and, 5) the development of cross-functional teams.

In this strategy, Six Sigma methodology emphasizes the need for utilizing quality tools and techniques for fixing process problems, helping the AMP to define objectives and opportunities for improvement, and to implement corrective actions and monitor improvements. The Six Sigma methodology provides a sequential and disciplined process for applying the tools of quality management and control in this fashion. Each tool and technique within the Six Sigma methodology has a potential role to play, though it is important to note that different organizations

may employ different tools at different times. The DMAIC methodology provides a clear indication of when, where, why, and how tools or techniques should be applied. Choosing the right tool is one of the keys to success of Six Sigma and the integration of these tools with Agile Management Processes. It is also important to emphasize that

different levels of integration are possible. The spectrum of integration ranges from two independent programs and ends with a single, integrated approach to quality and environmental management.

**Tab. 1: Mapping Framework**

	AMP		Six Sigma		Potential areas of integration		
<b>Activity</b>	Plan	Assessment	Define	Identify the improvement activity & project objectives	Initiate the process	Policy & Objectives	Incorporate policies into Six Sigma projects
		Define policies		Define customer needs and translate them to technical language			
		Define objectives	Measure	Information & data collection Sigma level calculation			
	Do	Training	Analyze	Identify root causes	Develop the integrated system	Planning & Implementation	Cross-training Involvement of AMP personnel in Six Sigma projects Involvement of Six Sigma team leader in management review meetings
		Implementation		Confirm root causes			
		Documentation		Creative solutions & corrective action Sigma level recalculation			
	Check	Monitoring Feedback Comparison	Improve	Monitoring	Implement the integrated system	Documentation	Use shared resources (human, financial and material) Tracking the AMP performance of Six Sigma projects Improvement of record management by Six Sigma systematic methodology
		Corrective action		Integrate documentation, creating a single comprehensive procedure, work instruction and records for quality and processes			
		Management review		Control			
	Act	Revision		Modification	Maintain the integrated system	Monitor business performance of Six Sigma project	Create a master system

## 5. Conclusion and Recommendation

As evident in the literature, SAP<sup>®</sup> type ERP products play a critical role in the implementation process of quality initiatives like Six Sigma, where the implementation process takes time. At the same time, the literature also implies that in agile environments, Six Sigma implementation can be ineffective. In order to reach the full benefit of Six Sigma in a short time, integration of SAP<sup>®</sup> within the quality initiative would be beneficial. Furthermore, the potential integration of Six Sigma and AMP provides organizations with several benefits. As discussed above, SAP<sup>®</sup> provides many tools that can facilitate Six Sigma implementation. SAP<sup>®</sup> allows organizations to manage product quality, monitor and improve quality standards, and document quality compliance through its available analytical tools. Therefore, employees can make quick and informed decisions to improve the quality of the process and most importantly, reduce variability, which is a critical factor in Six Sigma Implementation. The mapping of SAP and Six Sigma into the AMP framework presented above shows the dynamic relationship between the key components of AMP and how they are organized around the cycle of continuous improvement, how the key components of Six Sigma are organized around the DMAIC approach to process improvement, and presents an illustration of the potential areas for integration of Six Sigma and AMP. Furthermore, the four elements (initiation of the process, development of the integrated system, implementation of the integrated system, and maintaining the integrated system) defined and depicted in Table 1 above form the basis for a

distinctive integration method that is well suited for the Six Sigma DMAIC methodology. Also, since the opportunities for integration, especially the four noted above are readily apparent, it appears that SAP<sup>®</sup> and Six Sigma integration in AMP can be considered ideal in a variety of agile environments. Therefore, organizations that attempt to take advantage of such an integration of proven Six Sigma processes and robust SAP<sup>®</sup> analytical tools are more likely to improve processes and reduce variances than those that decide not to. It is important to emphasize that organizations need to choose the right tools and the appropriate level of integration in order to ensure success of Six Sigma within AMP. Six Sigma is known as a management tool rather than a total quality tool where the people are the key component. Also in AMP the people and especially the satisfaction of end user needs are the focal point. When we look at the process of Six Sigma, it requires time to implement. On the other hand AMP's main point is to act quickly to the needs of the end user. In order to match the two factors for improving processes at the organization, a technological tool can help. Therefore, SAP<sup>®</sup>-Six Sigma analytics helps employees make quick and informed decisions to improve the quality of the process and to reduce variability. Future research should test the effectiveness of the integrated framework presented here in various industries, where AMP is an integral part of the organization. Further research can also explore which SAP<sup>®</sup> tools are better suited for such Agile Management Process environments. Also, the effectiveness of the different levels of integration, impact on strategic



planning process, suitability to different organizational management systems and/or organizational cultures can be studied.

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