The TQM Journal

Emerald Article: Integrating the Balanced Scorecard with Six Sigma

Colm Heavey, Eamonn Murphy

Integrating the Balanced Scorecard with Six Sigma

Colm Heavey and Eamonn Murphy
Enterprise Research Centre, University of Limerick, Limerick, Ireland

Received 22 November 2010
Revised 4 March 2011
Accepted 11 April 2011

Abstract

Purpose – The purpose of this paper is to provide new insights in understanding the value of integrating the Balanced Scorecard (BSC) with Six Sigma.

Design/methodology/approach – The paper is based on a comprehensive literature review of the BSC and Six Sigma. The literature review provides the basis for a new integration framework that is grounded on the Plan-Do-Check-Act cycle.

Findings – The literature review for both Six Sigma and the BSC crystallise how a fusion can add further value in comparison to a standalone implementation of either the BSC or Six Sigma. This new integration framework is identified through first, leveraging the strengths of both the BSC and Six Sigma and second, by incorporating the key themes of the literature review.

Practical implications – This paper provides practitioners with a greater understanding of the value of integrating Six Sigma with the BSC. Also, the study provides a framework that can serve as a basis for the integration of Six Sigma with the BSC.

Originality/value – Little research has been carried out on the integration of the BSC with Six Sigma. This paper takes a novel approach for the integration framework by identifying the integration leverage points through the strengths and weaknesses of both the BSC and Six Sigma. The key contribution of this paper is that it provides new insights in understanding how the BSC can be integrated with Six Sigma. In addition, the paper provides direction for future research that will address weaknesses in the way organisations execute integration of the BSC with Six Sigma today.

Keywords Total quality management, Six Sigma, Balanced scorecard, Integration, Plan-Do-Check-Act

Paper type Literature review

1. Introduction and rationale for the study

To-day, organisations operate in a more challenging global environment. The business environment is becoming more turbulent with organisations across the globe facing greater challenges such as increased competition, more demanding customers and the harsh consequences of a global recession. Improving organisational performance is more important now than it has ever been before. Six Sigma is one of the organisational approaches to process improvement and operational excellence that has been in existence since the 1980s. Similarly, the balanced scorecard (BSC) has given organisations the framework to transform their organisational strategy into organisational "forward looking" performance metrics that will help an organisation compete. Despite the plethora of studies on Six Sigma and the BSC, the integration of Six Sigma with the BSC is an under researched topic to-date. A scan of the Inderscience and *Emerald* databases from 1992 to 2009 revealed that there are no research papers currently available on the integration of Six Sigma with the BSC. The journals covered in this review also included the journals that are documented in Aboelmaged's (2009) comprehensive and structured review of Six Sigma papers. This lack of research does not reflect the reality of organisational life to-day. For example, Motorola's Digital Six Sigma, introduced in 2003 to Motorola, is anchored by scorecards and accelerated or executed through training, project work and project review (Huesing, 2008). Also, in relation to the complex challenges confronting the health care industry, it is argued that the "best way to reach and sustain a new level of organizational excellence" may

The TQM Journal
Vol. 24 No. 2, 2012
pp. 108-122

1754-2731
DOI 10.1108/17542731211215062

"involve combining Six Sigma with the Balanced Scorecard" (Schultz, 2010). Schultz (2010) further adds that "a powerful management tool can be crafted through the unification of these two proven strategies".

Motorola's Digital Six Sigma (Huesing, 2008) provides credence to a number of authors' views on the integration of Six Sigma with organisational strategy. These authors (Antony *et al.*, 2005, 2006; Coronado and Antony, 2002; McAdam and Lafferty, 2004; Snee, 2010) have highlighted the importance of linking Six Sigma to the overall organisational strategy.

Also, Neely *et al.* (2004) makes reference to a BSC integration:

> Is it that the organization did not supplement the Balanced Scorecard with an appropriate improvement methodology and/or programme? (Neely *et al.*, 2004, p. 768).

Therefore, the overall aim of this paper is to deepen the understanding of the value of the integration of the BSC with Six Sigma to organisational performance improvement. Drawing from a large body of knowledge on Six Sigma and the BSC, this study answers the following questions:

(1) What are the strengths and weaknesses of the BSC and Six Sigma?

(2) How can the BSC and Six Sigma strengths and weaknesses be leveraged for the development of a framework that brings the Six Sigma and the BSC together?

(3) What are the key components of this BSC-Six Sigma framework?

The paper is structured in three sections: the first part provides a brief overview of Six Sigma and the BSC from an origin, benefits and adoption rate perspective. The second part describes and evaluates the strengths and weaknesses of both the BSC and Six Sigma inside the context of a combined integration. The third part provides a new framework that is based on the evaluation in part two and discusses the implications.

2. Overview of Six Sigma

Six Sigma is an organisational approach to operational excellence that has been in existence since its inception at Motorola in the 1980s. It has received considerable attention in the literature from a multitude of authors and practitioners (e.g. Aboelmaged, 2009; Antony, 2004; Breyfogle, 2003; George, 2003; Harry and Schroder, 2000; Henderson and Evans, 2000, Hoerl, 2004; Pande *et al.*, 2000; Pepper and Spedding, 2010; Schroeder *et al.*, 2008; Snee, 2010; Watson, 2004; Wiklund and Wiklund, 2002).

Motorola first introduced Six Sigma as a "transformational quality and business improvement initiative methodology". In 1986, the concept of Six Sigma (Barney, 2002, p. 15) was introduced by Bill Smith at Motorola. Bill Smith was strongly supported by Bob Galvin, the then CEO at Motorola, who "urged Bill to go forth and do whatever was needed to make Six Sigma the number one component in Motorola's culture" (Breyfogle, 2003, p. 5). When asked, "What do believe that you did best in leading this initiative within Motorola?" Bob Galvin replied. "I listened. Our people knew that they could say anything in front of me. […] I believe that we have created an atmosphere where people could speak up and influence the company" (Godfrey, 2002, p. 46). This culture of openness solidified the partnership between Bob Galvin and Bill Smith, and was instrumental in sowing the seeds for the inception and growth of the Six Sigma methodology throughout Motorola. The researchers contend that this support structure, exemplified by the robust partnership between Robert Galvin and

Bill Smith, is a central plank for Six Sigma success at any organisation (e.g. American Express, Boeing, Caterpillar, Fidelity Investments, Honeywell International, J.P. Morgan Chase, Johnson and Johnson, Kodak, Lockheed Martin, Maytag, Northrop Grumman, Sony, GE, and Texas Instruments; (Nakhai and Neves, 2009).

Numerous authors have extolled the virtues of Six Sigma (Breyfogle, 2003; Gillett *et al.*, 2010; Harry, 1998; Montgomery, 2001; Pande *et al.*, 2000; Snee, 2010). Harry (1998, p. 60) contends that Six Sigma provides companies with a series of interventions and statistical tools that can lead to breakthrough profitability and quantum gains in quality. Snee (2010) goes further by arguing that it works better than other improvement methodology because it integrates "the human and process aspects of process improvements" (p. 11). Jack Welch described Six Sigma "as the most important initiative GE has ever undertaken" (Harry, 1998, p. 64). Jack Welsh's zealous commitment is a key factor in the savings that GE reported in the 1999 annual report:

> […] the six sigma initiative is in its fifth year – its fifth trip through the operating system. From a standing start in 1996, with no financial benefits to the company, it has flourished to the point where it produced more than $2 billion in benefits in 1999, with much more to come this decade (Coronado and Antony, 2002, p. 92).

Motorola report a similar success story. Between 1987 and 1997 achievements at Motorola have yielded cumulative savings of US$14 billion from Six Sigma efforts (Pande *et al.*, 2000, p. 7). Similarly, Antony and Banuelas (2000) report that Allied Signal reduced manufacturing costs by more than US$1 billion between 1992 and 1996. Hammer's (2002) figures on adoption are also worth noting:

> At least 25% of the Fortune 200 claim to have serious Six Sigma program, including Ford Motor Company, Bank of America, Eastman Kodak Company, Dupont and American Express Company (Hammer, 2002, p. 30).

In summary, showcase organisations like GE, Motorola and Allied Signal illustrate the large savings that Six Sigma is capable of bringing to organisations. Six Sigma brings savings to organisations because it is based on a structured data driven problem-solving methodology that is uniquely driven by a close understanding of customer needs (Pande *et al.*, 2000, p. xi), and is supported by a critical mass of improvement specialists and organisational managers at all levels in the organisation right up to executive level.

3. Overview of the BSC

The essence of the BSC is captured succinctly by Metri (2007): "If you can't measure it, you can't manage it and thus you can't improve upon" (p. 60).

The seeds of the BSC were sown on the premise that "an exclusive reliance on financial measures in a management system is insufficient" (Kaplan and Norton, 2001, p. 87). In 1992, a year long study of 12 companies culminated in the introduction of the BSC (Kaplan and Norton, 1992). Kaplan and Norton's (1992) BSC revolutionised the conventional thinking on performance metrics. By going beyond measures of financial performance, organisations had a better view on what needs to be achieved and how the company is performing against these metrics. Overall, the BSC "provides a balanced picture of current operating performance as well as the drivers for future performance" (Kaplan and Norton, 1996a, p. 53).

Many organisations use the BSC as the cornerstone for the strategic management system. The BSC has been adopted in many countries (Spain: Urrutia and Eriksen,

2005; Sweden: Dabhilkar and Bengtsson, 2004; India: Aravamudhan and Kamalanabhan, 2007; Greece: Anagnostopoulos and Elmasides, 2010) and also across a range of industries including health care (Noorein and Kaplan, 2002), education (Beard, 2009), chemicals (Kaplan, 1993), electronics (Gumbus and Lyons, 2002) and metal powder manufacture (Pineno and Cristini, 2003). There are contrasting statistics on the adoption rate and success rate. On the one hand, Pineno and Cristini (2003) cite a report by Bain & Co., indicating "approximately 50% of Fortune 1,000 companies in North America and about 40% in Europe use a version of the BSC" (p. 28). Similarly, Silk (1998) reports that 60 per cent of Fortune 1,000 companies has either implemented or are in the process of implementing the BSC. On the other hand, Neely *et al.* (2004) reports that commentators suggest that only between 30 and 60 per cent of large US firms have adopted the BSC. These adoption statistics, although demonstrating a high level of variation, accentuate the importance of the BSC to the business world. On the same theme, the BSC is deemed to be the most dominant framework for performance management (Marr and Schiuma, 2003; Neely *et al.*, 2004; Smith, 2005).

From a BSC benefit perspective, many authors argue that there is a paucity of empirical evidence (e.g. Bourne *et al.*, 2002; Neely *et al.*, 2004; Nørreklit, 2000). However, one statistic is worth noting. Lewy (McCunn, 1998, p. 34) claims that 70 per cent of BSC implementations have failed. In an attempt to uncover the failure reasons, Lewy (McCunn, 1998) together with Lex Du Mee of KPMG management consulting, found through case studies on seven European companies, that only those companies who had followed the majority of the "ten commandments of balanced scorecard implementation" could claim to have successfully rooted scorecards "in their reporting and control processes" (McCunn, 1998, p. 34). McCunn (1998, p. 34) adds to the work of Lewy by putting forward an 11th commandment for consideration:

> Do not start implementing the scorecard until you know what you hope to achieve.

Similar to the Ten Commandments Olve *et al.* (1999), introduce steps that will "encourage support for the BSC improvement" (Amaratunga *et al.*, 2001, p. 186). These implementation guidelines also serve to highlight the importance of having a robust change management process inside the organisation before embarking on any initiatives such as BSC implementation, Business Process Re-engineering, Lean or Agile. If it is a case that the organisation is being constantly challenged by change management, then the organisation may need to assess first where it is positioned on the organisational growth ladder using for example, Greiner's Model (Rowe and White, 2009).

To conclude, adoption of the BSC using a robust change management process, promotes a strategic focus throughout the organisation, drives forward-looking behaviours and in turn, promotes higher levels of commitment and performance.

4. Strengths and weaknesses of the BSC and Six Sigma

Numerous authors provide insight into the weaknesses (see Table I) of the BSC framework (e.g. De Waal, 2003; Epstein and Manzoni, 1998; Neely *et al.*, 2004, 2005; Nørreklit, 2000; Othman, 2008; Schneiderman, 1999) and the Six Sigma methodology (e.g. Coronado and Antony, 2002; Antony, 2004; Douglas *et al.*, 2009, Goh *et al.*, 2006; Hendricks and Kelbaugh, 1998; Pepper and Spedding, 2010).

According to Othman (2008), for example, the BSC (see Table I) is myopic and "ignores the activities and initiatives that goes beyond the original targets" (p. 261). Similarly, Self (2004) contends that the BSC can highlight problems, but it does not

Strengths	Weaknesses
The term "balanced scorecard" reflected the balance between short- and long-term objectives, financial and non-financial measures, lagging and leading indicators and external and internal performance perspectives (Hepworth, 1998, p. 560)	Developing and maintaining a BSC can create a workload for many people. In particular, some of the data required may not currently exist within the firm and thus needs to be collected specifically for the Scorecard (Epstein and Manzoni, 1998, p. 198)
The added value of the balanced scorecard (BSC) is in the drawing together of all the key business areas and identifying and exploiting the linkages that deliver success (Hepworth, 1998, p. 560)	The first problem that many firms encounter is the realisation that the top management team cannot articulate a clear and shared view of the firm's strategy; in some cases, the strategy is not clear, in other cases members of the top management team hold different views on what the strategy of the firm is or ought to be (Epstein and Manzoni, 1998, p. 198)
The balanced scorecard helps an organisation "maintain a holistic perspective by providing a concise display of performance metrics" (Pyzdek, 2004, p. 22)	It does not include a competitor perspective (Neely *et al.*, 2005, p. 1244)
It enables companies to track financial results while simultaneously monitoring progress in building the capabilities and acquiring the intangible assets they would need for future growth (Kaplan and Norton, 2007, p. 150).	The BSC does not provide a solution for "How to measure?" David Norton says "We are experts in what to measure, not in how to measure" (De Waal, 2003, p. 33)
The scorecard puts strategy and vision, not control, at the center (Kaplan and Norton, 1992, p. 79)	"It can point out problems, but t does not revel the solution" (Self, 2004, p. 104)
"It has made us figure what areas are important, and what constitutes success in those areas" (Self, 2004, p. 104)	The BSC is "seen as myopic and ignores the activities and initiatives that goes beyond the original targets" (Othman, 2008, p. 261)
The BSC translates an organisation's mission and strategy into a set of performance measures that provides the framework for a strategic measurement and management (Kaplan and Norton, 1996b, p. 2).	Nørreklit (2000) concludes from the analysis that "causality claimed to hold between perspectives is problematic" (p. 76)
The BSC provides a model that translates an organisation's vision and strategy into specific strategic objectives, monitored through a coherent set of performance indicators (Solano *et al.*, 2003, p. 68)	To be successful, the BSC must be viewed as the tip of the improvement iceberg (Schneiderman, 1999, p. 6)
"It is distinct from other strategic measurement systems in that it contains outcome measures and the performance drivers of outcomes, linked together in cause-and-effect relationships" (Nørreklit, 2000, p. 67)	There is no deployment system that breaks high-level goals down to the sub-process level, where actual improvements activities reside (Schneiderman, 1999, p. 7)
Scorecard balance is important because if you do not have balance you could be giving one metric more focus than another, which can lead to problems (Breyfogle, 2008, p. 22)	The BSC can be critised for not "taking a broad enough view of the stakeholders who interact with an organisation" (Neely *et al.*, 2001, p. 12)
"The scorecard has encouraged innovation" (Self, 2004, p. 104)	

Table I.
Balanced scorecard (BSC) strengths and weaknesses

provide the solution. Also, in an interview with De Waal (2003), David Norton alludes to this limitation:

> We are experts in what to measure, not in how to measure (De Waal, 2003, p. 33).

Schneiderman (1999) articulates the problem succinctly: "There is no deployment system that breaks high level goals down to the sub-process level, where actual improvements activities reside" (p. 7). The point raised by the authors (De Waal, 2003; Othman, 2008; Schneiderman, 1999) on this inability to provide a solution path, is a key theme on the BSC limitations (see Table I). The question arises: What can be done to address this limitation?

The strengths and weaknesses of the Six Sigma methodology outlined in Table II provide insight into the answer.

Six Sigma is a business problem-solving methodology that provides the capability to effect measurable process improvements (Montgomery, 2001; Goh and Xie, 2004; McAdam *et al.*, 2005; Snee and Hoerl, 2003). The capability for effective business process improvement is provided through the "structured methodology that is uniquely driven by a close understanding of customer needs, disciplined use of facts, data and statistical analysis, and diligent attention to managing, improving and reinventing business processes" (Pande *et al.*, 2000). The real power of Six Sigma lies in the closed loop problem-solving methodology that it brings to the business which will help to keep an organisation on the "often twisted path to performance and success" (Pande *et al.*, 2000, p. 200). In specific terms, Six Sigma provides the business with a structured tool for defining a business problem through the voice of the customer, measuring the performance baseline, and prioritising the root causes for solution implementation and control. All of this structured problem solving serves to improve the Six Sigma metrics or Critical to Quality metrics. So, improvements in these Six Sigma metrics can collectively influence the higher order performance metrics of the BSC. For example, if a particular customer requires a two day reduction in lead time for 100 per cent customer satisfaction, then the organisation can introduce a Six Sigma program that will directly influence the customer satisfaction perspective of the BSC. So, melding the Six Sigma with the BSC will address the "inability to provide a solution path" weakness of the BSC and provide a problem-solving capability for the high-level performance metrics in the BSC.

Also, this fusion can counteract the Six Sigma weakness that Antony *et al.* (2006) describes. Antony *et al.* (2006) reports "that senior management in many organisations view Six Sigma as another quality improvement initiative or flavour of the month in their list" (p. xxi). This can result in Six Sigma being operated as a standalone improvement initiative without any link to the organisational strategy. This disconnect may help to explain David Fitzgerald reporting " that fewer than 10% of the companies are doing it to the point where it is going to significantly affect the balance sheet and the share price in any meaningful period in time" (Coronado and Antony, 2002, p. 92). On the same theme, Coronado and Antony (2002, p. 95) further adds that Six Sigma cannot be treated as another standalone strategy and that linking Six Sigma to the business strategy is one of the critical success factors for successful deployment of Six Sigma. Coronado and Antony's (2002) view on the disconnect between strategy and Six Sigma is also consistent with Asif *et al.*'s (2009) view on why quality management programs (QMP) fail. Asif *et al.*'s (2009) concludes that there is potential for competitive advantage when QMP are "effectively aligned with organisational strategy and institutionalised in an organisational setting" (Asif *et al.*, 2009, p. 788). For this strategic

Strengths	Weaknesses
Six Sigma continues to-day as the best approach to process improvement (Snee and Hoerl, 2003)	Fewer than 10 per cent of the companies are doing it to the point where it is going to significantly affect the balance sheet and the share price in any meaningful period in time (Coronado and Antony, 2002, p. 92)
No approach integrates the human and process elements as well as Six Sigma (Snee, 2004, p. 9)	Douglas *et al.*'s paper (2009) provides evidence that Six Sigma is a reductionist approach. Douglas *et al.* (2009) contend that a reductionist approach "works well for simple, well defined 'hard' problems but fails to perform well on complex, ill defined 'soft' problems and when the parts of a more complex problem are independently optimised" (p. 144)
Six Sigma is uniquely driven by close understanding of customer needs, disciplined use of facts, data and statistical analysis, and diligent attention to managing, improving and reinventing business processes (Pande *et al.*, 2000, p. xi)	"A large amount of investment is required to train employeees to be green belts, black belts, master black belts and so on" (Goh *et al.*, 2006, p. 238)
The strength of Six Sigma lies largely from the customer focus coupled with measureable improvements in the Critical to Quality (CTQ) (Goh *et al.*, 2006, p. 236)	"I personally have experienced that senior management in many organisations view six sigma as another quality improvement initiative or flavour of the month" (Antony, 2004, p. 303)
The effectiveness of Six Sigma is rooted in its judicious application of statistical techniques for information gathering, analysis and interpretation (Goh and Xie, 2004, p. 236)	"The prioritization of projects in many organisations is still based on pure subjective judgement. Very few powerful tools are available for prioritising projects and this should be a major thrust for research in the future" (Antony, 2004, p. 304)
In a typical Six Sigma program, the aim is to build what the customers want as reflected by what is known as CTQ (Goh *et al.*, 2006, p. 236).	The shift of 1.5 Sigma especially for services has not been validated (Goh *et al.*, 2006)
Six Sigma has a strategic role to play in organisations (Goh and Xie, 2004; Antony and Banuelas, 2000,, Pande *et al.*, 2000)	There are no uniformly accepted standards for certification of Six Sigma personnel (Goh *et al.*, 2006)
Six Sigma is usually carried out on a project-by project basis. With a project-based approach a Six Sigma program can be better defined and managed (Goh *et al.*, 2006, p. 236)	Frustration can occur due to expensive data driven solutions and this may result in only a small portion of the solution been implemented (Antony, 2004)
"Six Sigma is seen as having a significant impact on operational efficiency" (McAdam *et al.*, 2005, p. 168)	

Table II.
Strengths and weaknesses of Six Sigma

disconnect (Coronado and Antony, 2002; Asif *et al.*, 2009), the researchers contend that the panacea does not reside inside the Six Sigma methodology. Six Sigma does not provide a systematic means to translate the organisational strategy into a set of metrics for measuring, improving and controlling. For this problem, the researchers posit that deployment of the BSC, will provide this capability to translate the operational strategy into high-level metrics that can be impacted by the introduction of Six Sigma initiatives. Thus, the integration of the BSC with Six Sigma will bring Six

Sigma into the boardroom and address Antony *et al.*'s (2006) call for linking Six Sigma to business strategy.

Also, the limitation, around whether Kaplan and Norton's (1992) perspectives are sufficient for an organisation, can be eradicated by the design and adoption of a customised scorecard. So a car manufacturer for example, may add a supplier perspective to the BSC. For another organisation that is very much dependant on how the employees engage with their customers, an employee perspective may be added to the BSC.

In summary, this lack of solution capability, a central theme in the literature on the BSC limitations, can be overcome through leveraging the closed loop problem-solving strength of the Six Sigma methodology. Also, this integration will eradicate the Six Sigma strategic disconnect that Antony *et al.* (2006) reports on. In addition, the BSC and Six Sigma compliment each other and serve to create a "burning platform" for melding the BSC inside the Six Sigma methodology. Finally, melding the BSC with Six Sigma has the potential to bring additional value to the organisation through the strengths and weaknesses levers and allow the BSC and the Six Sigma methodology to realise their full potential inside the organisation.

5. Integration of Six Sigma with the BSC framework

In addition to the value that can be gained through leveraging the strengths and weaknesses of the BSC and Six Sigma, the integration of the BSC with Six Sigma is closely linked to Cocks's (2010) research findings on winning organisations. Cocks's (2010) research of 1,000 Australian organisations is centred around the theme that balancing strategy formulation with effective strategy execution, plays a pivotal role in becoming a winning organisation and is more important than charismatic leaders, breakthrough ideas and activity that is linked to creating the perfect organisational structure. The integration of the BSC with Six Sigma will allow an organisation to translate the strategy into high-level metrics and will also provide the capability to improve the high-level metrics through Six Sigma initiatives.

The literature review clearly outlines the benefits of both Six Sigma and the BSC to organisations. In parallel, the strengths and weaknesses literature for both Six Sigma and the BSC crystallise how a fusion can add further value in comparison to a standalone implementation of either the BSC or Six Sigma. Also, Ahn (2005) makes reference to Kaplan and Norton's (1996b, p. 10) recommendation with respect to the incorporation of the mission and strategy into the BSC. Together, Cocks's (2010) research and the literature review on the BSC and Six Sigma provide a compelling reason for melding the BSC with Six Sigma. The BSC will provide the capability to translate the strategy into relevant organisational metrics and Six Sigma will provide the vehicle for influencing the metrics.

In addition, for a particular case of a BSC failure, Neely *et al.* (2004) pose a key question:

> Is it that the organization did not supplement the Balanced Scorecard with an appropriate improvement methodology and/or programme? (Neely *et al.*, 2004, p. 768).

Fedotowsky (2010) addresses Neely *et al.*'s (2004) concern partially by accentuating the importance of linking the BSC to Six Sigma using a series of cascading metrics. However, the paper does not take into account the importance of linking the metric to an appropriate improvement methodology (Neely *et al.*, 2004, p. 768). The term "appropriate improvement methodology" (Neely *et al.*, 2004, p. 768) is a key point because not all organisational metrics exist are suitable to the Six Sigma methodology. All of these points form the basis for the framework that is shown in Figure 1.

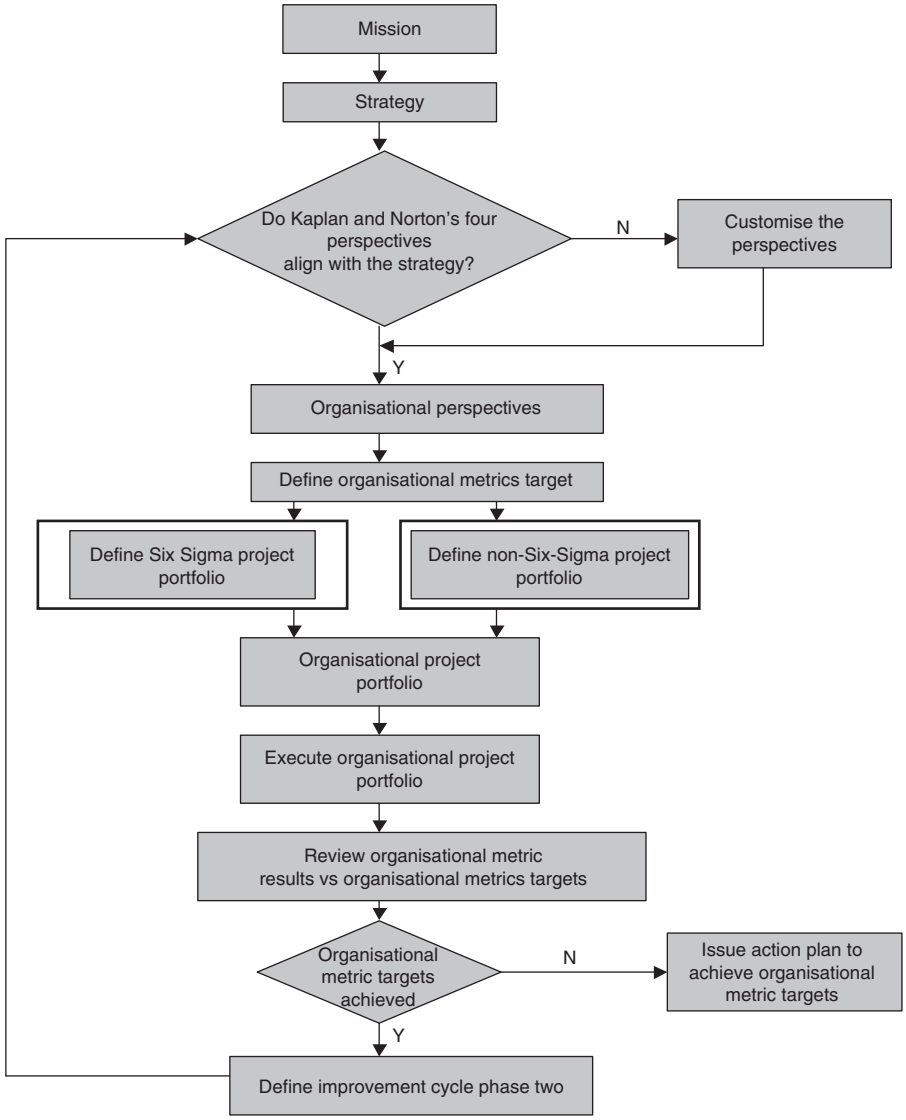

Figure 1.
Framework for balanced scorecard-Six Sigma integration

The framework depicted in Figure 1 is based on the four stage Plan-Do-Check-Action cycle (PDCA), "a flow chart for learning and process improvement" (Pyzdek, 2001, p. 8), that was made popular by Deming. Similar to the PDCA, the fundamental principle of the framework in Figure 1 is iteration (Pyzdek, 2001). For example, once the organisational metric targets have been met a second improvement cycle can begin and the rate of improvement can be tracked for each cycle as outlined by Schneidermans' half-life papers (Schneiderman, 1986, 1988). Alternatively, if the organisational metric targets have not been achieved an action plan is put in place to close the gap between the metric targets and the actual results.

Also, the framework in Figure 1 allows the organisation to customise the perspectives and then based on these perspectives, to define a Six Sigma portfolio and a Non-Six-Sigma portfolio that will influence the high-level metrics in the BSC. For example, the total organisational portfolio may consist of Define-Measure-Analyse-Improve-Control (DMAIC) and Define for Six Sigma initiatives coupled with other initiatives such as Project Management initiatives. Thus, this has the overall effect of aligning the various elements of the strategy to a correct methodology for effective and efficient execution. In this way, resources are correctly aligned with no inefficient allocation of resources taking place. For each organisational metric, the organisation will need to carry out a deep dive to the various sub process levels in the organisation and then decide on the mix of projects that will be executed as part of the organisational project portfolio (PMI, 2004, p. 16). Finally, in light of this discussion, the researchers argue that this integration framework in Figure 1 is a flexible, robust and efficient framework that is applicable to all organisations involved in performance improvement and has the potential to bring considerable strategic benefits to any organisation.

6. Future research

Given all the merits of the integration between the BSC and Six Sigma, the researchers acknowledge that integration challenges exist to-day for organisations. One key weakness for the integration of the BSC with Six Sigma is the difficulty in identifying Six Sigma project portfolios year-on-year that will impact the BSC and allow continuous improvement to be sustained inside the organisation. So, similar to Antony's (2004) view on project identification, the researchers contend that this is an opportunity for future research. For example, for process improvement we have the DMAIC methodology. It may be possible also to develop a similar methodology for project identification. In addition, another challenge to-day is centred on how organiastions make explicit connections between Six Sigma projects at lower levels in the organisation and the high-level BSC metrics. The researchers pose the question: can we devise a methodology that will allow organisations to assess the impact of Six Sigma projects at various elevations in the organisation on the high-level BSC? The researchers contend that this is another area for future research.

7. Conclusions

The key contribution of this paper is that it provides new insights in understanding the value of integrating the BSC with Six Sigma and second, the paper proposes a new framework that brings the BSC and Six Sigma together. The paper demonstrates that the BSC is an effective tool for translating strategy into high-level performance measures. Adding Six Sigma to this framework will give organisations the capability to influence and control these "element of discovery" metrics in a systematic and structured manner. The strengths and weaknesses literature for both Six Sigma and the BSC crystallise how a fusion can add further value in comparison to a standalone implementation of either the BSC or Six Sigma.

Faced with an increasingly complex and turbulent business environment, organisations need a robust link between strategy and effective strategy execution. The researchers contend that the integration of BSC with Six Sigma is central to this need and will drive efficiencies and innovation into the business, which in turn act as a platform for sustained competitive advantage. Six Sigma is not the panacea for all organisation's ills. However, an effective integration of Six Sigma with the BSC will

provide a robust bond between organisational strategy and strategy execution and allow an organisation to realise the full potential of both the BSC and Six Sigma.

In summary, properly designed and deployed using a robust change management process, the BSC in combination with Six Sigma, will articulate and execute the strategy of the business, and will act as a platform for business excellence and improvement.

References

Aboelmaged, M.G. (2009), "Six Sigma quality: a structured review and implications for future research", *International Journal of Quality and Reliability Management*, Vol. 27 No. 3, pp. 268-317.

Ahn, H. (2005), "How to individualise your balanced scorecard", *Measuring Business Excellence*, Vol. 9 No. 1, pp. 5-12.

Amaratunga, D., Baldry, D. and Sarshar, M. (2001), "Process improvement through performance measurement: the balanced scorecard methodology", *Work Study*, Vol. 50 No. 5, pp. 179-88.

Anagnostopoulos, K.P. and Elmasides, G. (2010), "Strategic plan in a Greek manufacturing company: a balanced scorecard and strategy map implementation", *Journal of Business & Management*, Vol. 5 No. 2, pp. 12-25.

Antony, J. and Banuelas, R. (2000), "Key ingredients for the effective implementation of Six Sigma program", *Measuring Business Excellence*, Vol. 6 No. 4, pp. 20-7.

Antony, J. (2004), "Some pros and cons of Six Sigma: an academic perspective", *TQM Magazine*, Vol. 6 No. 4, pp. 303-6.

Antony, J., Kumar, M. and Madu, C.N. (2005), "Six Sigma in small- and medium-sized UK manufacturing enterprises: some empirical observations", *International Journal of Quality and Reliability Management*, Vol. 22 No. 8, pp. 860-74.

Antony, J., Banuelas, R. and Kumar, A. (2006), *World Class Applications of Six Sigma*, Butterworth-Heinemann Ltd, Oxford.

Aravamudhan, S. and Kamalanabhan, T.J. (2007), "An AHP study on the critical factors for balanced scorecard implementation in Indian organisations", *International Journal of Business Innovation and Research*, Vol. 1 No. 3, pp. 387-403.

Asif, M., Bruijn, E.J., Douglas, A. and Fisscher, O.A.M. (2009), "Why quality management programs fail: a strategic and operations management perspective", *International Journal of Quality and Reliability Management*, Vol. 26 No. 8, pp. 778-94.

Barney, M. (2002), "Motorola's second generation", *Six Sigma Forum Magazine*, Vol. 1 No. 2, pp. 13-17.

Beard, D. (2009), "Successful application of the balanced scorecard in higher education", *Journal of Education for Business*, Vol. 84 No. 5, pp. 275-82.

Bourne, M., Neely, A., Mills, J. and Platts, K. (2002), "The success and failure of performance measurement initiatives", *International Journal of Operations & Production Management*, Vol. 22 No. 11, pp. 1288-310.

Breyfogle, F.W. III (2003), *Implementing Six Sigma: Smarter Solutions Using Statistical Methods*, 2nd ed., John Wiley & Sons, Hoboken, NJ.

Breyfogle, F.W. III (2008), *The Integrated Enterprise Excellence System: An Enhanced, Unified Approach to Balanced Scorecards, Strategic Planning and Business Improvement*, Citius Publishing, Austin TX.

Cocks, G. (2010), "Emerging concepts for implementing strategy", *Total Quality Management Journal*, Vol. 22 No. 3, pp. 260-6.

Coronado, R.B. and Antony, J. (2002), "Critical success factors for the successful implementation of Six Sigma projects in organisations", *Total Quality Management Magazine*, Vol. 14 No. 2, pp. 92-9.

Dabhilkar, M. and Bengtsson, L. (2004), "Balanced scorecards for strategic and sustainable continuous improvement capability", *Journal of Manufacturing Technology Management*, Vol. 15 No. 4, pp. 350-9.

De Waal, A.A. (2003), "The future of the balanced scorecard: an interview with professor Dr Robert S Kaplan", *Measuring Business Excellence*, Vol. 7 No. 1, pp. 30-5.

Douglas, A., Middleton, S., Antony, J. and Coleman, S. (2009), "Enhancing the Six Sigma problem-solving methodology using the systems thinking methodologies", *International Journal of Six Sigma and Competitive Advantage*, Vol. 5 No. 2, pp. 144-55.

Epstein, M. and Manzoni, J.F. (1998), "Implementing corporate strategy: from tableaux de bord to balanced scorecards", *European Management Journal*, Vol. 16 No. 2, pp. 190-203.

Fedotowsky, A. (2010), "Added traction", *Quality Progress*, Vol. 44 No. 6, pp. 45-51.

George, M.L. (2003), *Lean Six Sigma for Services*, McGraw-Hill, New York, NY.

Gillett, J., Fink, R. and Bevington, N. (2010), "How catterpillar uses 6 sigma to execute strategy", *Strategic Finance*, Vol. 91 No. 10, pp. 25-8.

Godfrey, A.B. (2002), "In the beginning – Robert W. Galvin talks about how Motorola started Six Sigma and helped spread its success", *Six Sigma Forum Magazine*, Vol. 1 No. 2, pp. 46-9.

Goh, T.N. and Xie, M. (2004), "Improving on the Six Sigma paradigm", *TQM Magazine*, Vol. 16 No. 4, pp. 235-40.

Goh, T.N., Tang, C.L., Lam, S.W. and Gao, Y.F. (2006), "Six Sigma: a SWOT Analysis", *International Journal of Six Sigma and Competitive Advantage*, Vol. 2 No. 3, pp. 233-42.

Gumbus, A. and Lyons, B. (2002), "The balanced scorecard at Philips electronics", *Strategic Finance*, Vol. 4 No. 11, pp. 46-8.

Hammer, M. (2002), "Process management and the future of Six Sigma", *MIT Sloan Management Review*, Vol. 43 No. 2, pp. 26-32.

Harry, M.J. (1998), "Six-Sigma: a breakthrough strategy for profitability", *Quality Progress*, Vol. 31 No. 5, pp. 60-4.

Harry, M.J. and Schroder, R. (2000), *Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations*, Currency/Doubleday, New York, NY.

Henderson, K.M. and Evans, J.R. (2000), "Successful implementation of Six Sigma: benchmarking general electric company", *Benchmarking: An International*, Vol. 7 No. 4, pp. 260-81.

Hendricks, C.A. and Kelbaugh, R.L. (1998), "Implementing Six Sigma at GE", *The Journal for Quality & Participation*, Vol. 21 No. 4, pp. 48-53.

Hepworth, P. (1998), "Weighing it up – a literature review for the balanced scorecard", *Journal of Management Development*, Vol. 17 No. 8, pp. 559-63.

Hoerl, R. (2004), "One perspective on the future of Six Sigma", *International Journal of Six Sigma and Competitive Advantage*, Vol. 1 No. 1, pp. 112-9.

Huesing, T. (2008), "Six Sigma through the years", available at: http://6sigmaexperts.com/presentations/Six_Sigma_Through_the_Years.pdf (accessed 14 January 2011).

Kaplan, R.S. (1993), "Implementing the balanced scorecard at FMC corporation: an interview with Larry Brady", *Harvard Business Review*, Vol. 71 No. 5, pp. 143-7.

Kaplan, R.S. and Norton, D.P. (1992), "The balanced scorecard-measures that drive performance", *Harvard Business Review*, Vol. 70 No. 1, pp. 71-9.

Kaplan, R.S. and Norton, D.P. (1996a), "Linking the balanced scorecard to strategy", *California Management Review*, Vol. 39 No. 1, pp. 53-79.

Kaplan, R.S. and Norton, D.P. (1996b), *The Balanced Scorecard – Translating Strategy into Action*, Harvard Business School Press, Boston, MA.

Kaplan, R.S. and Norton, D.P. (2001), "Transforming the balanced scorecard from performance measurement to strategic management: part 1", *Accounting Horizons*, Vol. 15 No. 1, pp. 87-104.

Kaplan, R.S. and Norton, D.P. (2007), "Using the balanced scorecard as a strategic management system", *Harvard Business Review*, Vol. 85 Nos 7/8, pp. 150-61.

Marr, B. and Schiuma, G. (2003), "Business performance – past, present and future", *Management Decision*, Vol. 41 No. 8, pp. 680-7.

McAdam, R. and Lafferty, B. (2004), "A multilevel case study critique of Six Sigma: statistical control or strategic change?", *International Journal of Operations & Production Management*, Vol. 24 No. 5, pp. 530-49.

McAdam, R., Hazlett, S.A. and Henderson, J. (2005), "A critical review of Six Sigma: exploring the dichotomies", *International Journal of Organisational Analysis*, Vol. 13 No. 2, pp. 151-74.

McCunn, P. (1998), "The balanced scorecard: the eleventh commandment", *Management Accounting*, Vol. 76 No. 11, pp. 34-6.

Metri, B.A. (2007), "Measuring corporate performance with the Six Sigma business scorecard", *Journal of Business Perspective*, Vol. 11 No. 3, pp. 59-65.

Montgomery, D. (2001), "Editorial, beyond Six Sigma", *Quality and Reliability. Engineering International*, Vol. 17 No. 4, pp. iii-iv.

Nakhai, B. and Neves, J.S. (2009), "The challenges of Six Sigma in improving service quality", *International Journal of Quality and Reliability Management*, Vol. 26 No. 7, pp. 663-84.

Neely, A., Adams, C. and Kinnerley, M. (2001), *The Performance Prism: The Scorecard for Measuring and Managing Stakeholder Relationships*, Pearson Education Ltd, London.

Neely, A., Kennerley, M. and Martinez, V. (2004), "Does the balanced scorecard work? An empirical investigation", in Neely, A., Kennerley, M. and Walters, A. (Eds), *Performance Measurement and Management – Public and Private*, Centre for Business Performance, Cranfield, pp. 763-70.

Neely, A.D., Gregory, M.J. and Platts, K.W. (2005), "Performance measurement system design: a literature review and research agenda", *International Journal of Operations & Production Management*, Vol. 25 No. 12, pp. 1228-63.

Noorein, I. and Kaplan, R.S. (2002), "Applying the balanced scorecard in health care provider organisations", *Journal of Healthcare Management*, Vol. 47 No. 3, pp. 179-95.

Nørreklit, H. (2000), "The balance on the balanced scorecard: a critical analysis of its assumptions", *Management Accounting Research*, Vol. 11 No. 1, pp. 65-88.

Olve, N., Roy, J. and Wetter, M. (1999), *Performance Drivers: A Practical Guide to Using the Balanced Scorecard*, John Wiley & Sons, Chichester.

Othman, R. (2008), "Enhancing the effectiveness of the balanced scorecard with scenario planning", *International Journal of Productivity and Performance Management*, Vol. 57 No. 3, pp. 259-66.

Pande, P.S., Neuman, R.P. and Cavanagh, R.R (2000), *The Six Sigma Way – How GE, Motorola and other Top Companies are Honing Their Performance*, McGraw-Hill, New York, NY.

Pepper, M.P.J. and Spedding, T.A. (2010), "The evolution of Six Sigma", *International Journal of Quality and Reliability Management*, Vol. 27 No. 2, pp. 138-55.

Pineno, C. and Christini, C. (2003), "The balanced scorecard: a vision report card", *Management Accounting Quarterly*, Vol. 4 No. 4, pp. 28-40.

PMI (2004), *A Guide to the Project Management Body of Knowledge*, 3rd ed., PMI Publishing, Pennsylvania, PA.

Pyzdek, T. (2001), *The Six Sigma Handbook: A Complete Guide for Greenbelts, Blackbelts, Managers at all Levels*, McGraw-Hill, New York, NY.

Pyzdek, T. (2004), "Strategy deployment using balanced scorecards", *International Journal of Six Sigma and Competitive Advantage*, Vol. 1 No. 1, pp. 21-8.

Rowe, M. and White, B. (2009), "Cover your bases: double up your approach to guarantee successful improvement", *Quality Progress*, Vol. 43 No. 12, pp. 54-9.

Schneiderman, A.M. (1986), "Optimum quality costs and zero defects: are they contradictory concepts?", *Quality Progress*, Vol. 19 No. 11, pp. 1-4.

Schneiderman, A.M. (1988), "Setting quality goals", *Quality Progress*, Vol. 21 No. 4, pp. 51-7.

Schneiderman, A.M. (1999), "Why balanced scorecards fail", *Journal of Strategic Performance Measurement*, Vol. 3 No. 1, pp. 6-11.

Schroeder, R.G., Linderman, K., Liedtke, C. and Choo, A. (2008), "Six Sigma: definition and underlying theory", *Journal of Operations Management*, Vol. 25 No. 4, pp. 536-54.

Schultz, B. (2010), "Merging Six Sigma and the balanced scorecard", available at: www.isixsigma.com/index.php?option=com_k2&view=item&id=1406:merging-six-sigma-and-the-balanced-scorecard&Itemid=165 (accessed 14 January 2011).

Self, J. (2004), "Metrics and management: applying the results of the balanced scorecard", *Performance Management and Metrics*, Vol. 5 No. 3, pp. 101-5.

Silk, S. (1998), "Automating the balanced scorecard", *Management Accounting*, Vol. 79 No. 11, pp. 38-42.

Smith, M. (2005), "The balanced scorecard", *Financial Management*, Vol. 13 No. 1, pp. 27-8.

Snee, R.D. and Hoerl, R.W. (2003), *Leading Six Sigma: A Step by Step Guide Based on Experience at GE and Other Six-Sigma Companies*, Financial Times Prentice Hall, Upper Saddle River, NJ.

Snee, R.D. (2004), "Six Sigma: the evolution of 100 years of business improvement", *International Journal of Six Sigma and Competitive Advantage*, Vol. 1 No. 1, pp. 4-20.

Snee, R.D. (2010), "Lean Six Sigma- getting better all the time", *International Journal of Lean Six Sigma*, Vol. 1 No. 1, pp. 9-29.

Solano, J., DeOvalles, M.P., Rojas, T., Padua, A.G. and Morales, M.L. (2003), "Integration of Systemic Quality and the Balanced Scorecard", *Information Systems Management*, Vol. 20 No. 1, pp. 66-81.

Urrutia, I. and Eriksen, S.D. (2005), "Application of the balanced scorecard in Spanish private health-care management", *Measuring Business Excellence*, Vol. 9 No. 4, pp. 16-26.

Watson, G.H. (2004), *Six Sigma for Business Leaders*, 5th ed., GOAL/QPC, Salem.

Wiklund, H. and Wiklund, P.S. (2002), "Widening the Six Sigma concept: an approach to improve organizational learning", *Total Quality Management*, Vol. 13 No. 2, pp. 233-9.

About the authors

Colm Heavey is a Lean Sigma Business Transformation Consultant and a PhD candidate at the University of Limerick, Ireland. He has over 15 years multi-national experience in various disciplines including Continuous Improvement Project Management, Business Transformation and Lean Six Sigma. He is a Chartered Industrial Engineer, holds a First Class MBA from University of Surrey Guildford and is CIPD-Certified in Personnel Practise. Also, he is a certified

trainer, executive coach and is a PMI PMP and an ASQ Six Sigma Black Belt. Colm Heavey is the corresponding author and can be contacted at: colmheavey@gmail.com

Eamonn Murphy is the Boart Longyear Professor of Quality and Applied Statistics in the Department of Mathematics and Statistics at the University of Limerick and is Associate Dean, College of Engineering and Science. He received the Excellence in Research Award from the University of Limerick in 1999 and has published several articles, reports and papers in a range of journals and books. He has consulted on over 60 manufacturing design projects in 40 companies in Ireland, the UK and Hungary. He is Director of the Advanced Manufacturing Technology Centre (AMT) and is a co-founder of both the National Centre for Quality Management, an interdisciplinary group formed to strengthen industry-university linkages and the Small Firms Research Unit (SFRU) at University of Limerick. His current research interests include quality, productivity, innovation, next generation employability, integration of continuous professional development with postgraduate qualifications, statistical process control, experimental design and reliability techniques to optimise products and processes.