

PAPER PUBLISHED IN
INTERNATIONAL JOURNAL OF OPERATIONS
AND PRODUCTION MANAGEMENT (IJOPM)

Gutierrez-Gutierrez, L.; Lloréns-Montes, F.J. and Bustinza-Sánchez, O.F. (2009): “Six Sigma: From a goal-theoretic perspective to shared-vision development” *International Journal of Operations and Production Management*, Vol. 29, Iss. 2, pp.151-169.

DOI: <http://dx.doi.org/10.1108/01443570910932039>

Six Sigma: From a goal-theoretical perspective to shared-vision development

L.J. Gutierrez-Gutierrez¹, F.J. Lloréns-Montes, O.F. Bustinza-Sánchez

Department of Business Administration, Cartuja s/n 18071,

University of Granada, Spain

Abstract

Purpose The purpose of this paper is to extend understanding of the success of Six Sigma quality management initiative by investigating the effects of Six Sigma teamwork and statistical process control (SPC) on organizational shared vision.

Design/methodology/approach The information used comes from a larger study, the data for which were collected from a random sample of 237 European firms. Of these 237 organizations, 58 are Six Sigma organizations. Structural Equation Modelling (SEM) was used to test the hypotheses.

Findings The main findings show that Six Sigma teamwork and SPC positively affect the development of organizational shared vision. A positive but not significant influence is also observed between shared vision and organizational performance.

Research limitations/implications Positive effects found in this study should be investigated further employing a larger sample of Six Sigma firms and including other variables such as organizational learning. Further, the effects of these variables on performance should be measured with real results from firms to test possible direct and indirect influence on performance.

Practical implications The findings of this study offer a justification of Six Sigma implementation in firms. This study provides us with an in-depth understanding of some structural elements that characterize the Six Sigma methodology, enabling us to provide an explanation for its success.

Originality/value There is little empirical research on the positive effects of Six Sigma implementation and even less that explains the success of Six Sigma initiatives. Our paper contributes to filling this gap. It also contributes to emerging literature on how the development of shared vision affects organizational performance.

Keywords Six Sigma, teamwork, statistical process control (SPC), shared vision, goal-theoretical perspective, organizational performance.

Paper type Research Paper.

Introduction

Six Sigma methodology has become one of the most important quality initiative in the world at the present. Motorola and General Electric provide the best-known examples of Six Sigma success. The former obtained savings of over 940 million dollars in three years (Hann et al. 1999), and the latter increased its operating margin from 14.4% to 18.4% during the first five years of program implementation (Lucier et al. 2001). Shamji (2005) studied several firm experiences, including those of Samsung Electronics, American Express, Motorola, General Electric, the National Science Foundation and DuPont, and observed companies save an average of \$100,000 to \$200,000 per implemented improvement project.

¹ Corresponding author. Email: leogg@ugr.es

The positive effects of Six Sigma implementation are well known due to experiences like Motorola's, General Electric's, and Allied Signal's, but the literature contains little empirical research that tests Six Sigma's influence on organizational performance. Lee and Choi (2006) observed Six Sigma's positive effects on quality improvement, process innovation, and corporate competitiveness. Antony et al. (2007) and Antony et al. (2005) studied Six Sigma implementation in UK service and manufacturing SMEs, respectively. The results showed benefits such as improved customer satisfaction, reduction in process variability, increased profitability and increased market share. However not all results are favourable for Six Sigma. For example, Goh et al. (2003) studied stock price performance in the Six Sigma announcement day. They could not find significant differences on stock price performance on the announcement day or in the long run. This paper contributes to the empirical literature on Six Sigma by observing its positive effects on organizational performance. Specifically, our study finds that teamwork and SPC are important Six Sigma practices and tests whether they could be a reason for the initiative's success.

An analysis of the six sigma teamwork methodology, based on concepts from the goal-theoretic perspective contributed to academic understanding and led to the development of a number of propositions by which the phenomenon could be investigated empirically (Linderman et al., 2003). Some of these propositions were subsequently tested, and the setting of goals within six sigma improvement teams was found to contribute to the achievement of higher levels of performance, provided that the six sigma tools and method were adhered to (Linderman et al., 2006). This finding is in accord with the goal-theoretic perspective which argues that the setting of specific and challenging goals is linked to motivation and performance (Linderman et al., 2003, 2006). In this paper, we use the goal-theoretic perspective and propositions developed by Linderman et al. (2003, 2006) to attempt to further explain the success of the six sigma methodology. For this purpose, we introduce a new variable – shared vision – arguing that this is related to the use of specific and challenging goals.

The importance of shared vision for the organization was indicated by Senge (1992). This author explained some of the positive effects of this capability, such as long-term commitment, easier learning and improvements and increases in workers' aspirations. These benefits help the organization to adapt quickly and flexibly to changing markets, leading it to obtain competitive advantage. The importance of shared vision is currently motivating the publication of studies that attempt to observe their positive effects on organizational performance (Cohen et al. 2006; García-Morales et al. 2006; Shum et al. 2007). This study seeks to enrich this emerging line of empirical research by observing whether we can go beyond our knowledge that teamwork and statistical control of processes of the Six Sigma methodology affect shared vision to determine whether this shared vision can have positive repercussions on organizational performance.

The main purpose of this paper is to determine whether Six Sigma teamwork and statistical process control have a positive influence on the development of shared vision. We will then determine whether this shared vision leads to higher organizational performance. The paper is structured as follows: After this introduction, we present a literature review that covers three areas: Six Sigma methodology and its teamwork and SPC; the importance of shared vision in the organization; and the goal-theoretical perspective as an explanation for linking teamwork and SPC in Six Sigma, and shared vision. After we review the literature, we describe the methodology and the analysis performed. Subsequently, we discuss the results obtained and present the main conclusions, limitations and recommended directions for future research.

Theoretical background

Six Sigma methodology

The concept of Six Sigma was originated in Motorola in the U.S. around 1985. The increase in competitiveness of Japanese products threatened the rest of the electronics industry and sparked the need for dramatic improvements in quality levels (Harry and Schroeder, 2000). Following the success of Motorola, many firms put this methodology into practice, seeking to improve their results. Some examples are General Electric, Honeywell, IBM, American Express and Citibank (Kuei and Madu, 2003).

Linderman et al. (2003, p.195) offer the following definition: “Six Sigma is an organized and systematic method for strategic process improvement and new product and service development that relies on statistical methods and the scientific method to make dramatic reductions in customer defined defect rates.”

The Six Sigma denomination, “ 6σ ”, symbolizes a specific number, 3.4 defects per million opportunities (DPMO), where “opportunity” is understood as any possible source of error in products, process or service, which refers to key issues for the customer. This philosophy proposes continuous improvement in the firm, increasing perfection of the processes to reach the level Six Sigma. Thus, firms are to decrease their defect rates in processes, products and services, obtaining improvements in customer satisfaction, cost reductions, efficiency, productivity, etc. (Breyfogle, 2003; Pande et al. 2002).

Six Sigma is a method for improving organizational processes that goes beyond quality assurance or quality control (Harry, 2000). In fact, Six Sigma is closer to the concept of total quality management (TQM). According to Lucas (2002), Six Sigma implementation includes most of the TQM practices. Green (2006) observed how Six Sigma is developed over five main TQM components: customer focus, employee involvement, continuous improvement, leadership and fact-based decision making. The three basic TQM principles; customer focus, continuous improvement and teamwork (Dean and Bowen, 1994; Prajogo et al. 2003), are included in the principles cited by Lloréns et al. (2006) as the basis of Six Sigma philosophy: customer focus, process improvement and/or new products development, and teamwork.

Teamwork in Six Sigma

Teamwork is one of the pillars of Six Sigma methodology (Breyfogle, 2003; Lloréns et al. 2006; Lowenthal, 2002; Pande et al. 2002). Continuous improvement proposed by this philosophy is developed through different projects assigned to teams of workers. The success of improvement projects depends on these cross-functional teams (Pande et al. 2002; Shamji, 2005). Teamwork is the key factor for Six Sigma success, due to the fact that team members are the main carriers of the new philosophy (Thawani, 2004). In one year, General Electric invested \$450 million in Six Sigma team improvement projects, obtaining benefits near \$1.2 billion (Lucas, 2002).

For Six Sigma working teams, roles such as “Champions”, “Master Black Belts”, “Black Belts” and “Green Belts” are explicitly established. According to Gitlow et al. (2005) and Pande et al. (2002), “Champions” are usually members of the Executive Committee. They facilitate the obtaining of resources and elimination of barriers for the development of improvement projects. “Champions” usually sponsor these specific projects. “Master Black Belts” play a role as Six Sigma process leaders, linking top management with the person in charge of each improvement project. They have developed important abilities and possess deep knowledge of Six Sigma methodology. “Black Belts” are full-time agents dedicated to an improvement project. They are posted to specific projects to be in charge of such activities as putting the project into action, training members, and providing leadership. “Green Belts”

are workers who belong to an improvement project or lead a team but have only part-time dedication to this task.

Statistical Process Control (SPC) in Six Sigma

On the other hand, Six Sigma teamwork members are trained intensely in abilities, group dynamics and statistical methods and tools (Gitlow et al. 2005; Lee et al. 2006; Ravichandran, 2006). In this way, Six Sigma offers very solid statistical methodologies of experimentation and research (De Mast, 2006). In fact, the very definition given by Linderman et al. (2003) indicates how this initiative is grounded in statistical methods. Thus, another distinctive aspect of the Six Sigma methodology is its strong statistical component (McAdam et al., 2004).

Starting from the DMAIC cycle (define, measure, analyze, improve and control) also present in Six Sigma, Breyfogle (2003) describes a very wide variety of statistical tools that can be used in each phase of the cycle. Examples of these tools include scorecards, Pareto diagrams, cause-effect diagrams, benchmarking, brainstorming, histograms, quality function deployment (QFD), control charts, comparison tests, regression analysis and many others. Thus, when positions and roles have been assigned and tools and abilities developed, teams begin the work that focuses on defect rate reduction in each improvement project selected. Teams design successful solutions and show that the tools and abilities learned work well (Cooper, 2003).

The importance of Shared Vision in the organization

Pearce and Ensley (2004, p.260) defined shared vision as “a common mental model of the future state of the team.” It represents the capacity of sharing the future image desired by firm members, developing common commitment to this future image, and establishing some principles for pursuing it (Senge, 1992). According to Harrington (1999), shared vision is the most important idea concerning leadership in the twentieth century. Workers’ ability to share a future image toward which to direct their efforts enables the achievement of a series of significant advantages for the organization. Through shared vision, relationships between professionals improve, learning is facilitated, and long-term commitment is stimulated (Senge, 1992). These factors have significant repercussions for organizational performance.

Analyzing the problems of information systems, Cohen et al. (2006) observed the benefits of being able to share a vision within the organization. These authors contrasted the positive effect of shared vision on commitment at work and on organizational performance, finding significant relationships in both cases. Feeny et al. (1992) had already observed that the best relationships between executive leaders arise when they share the same vision of information systems. In the context of the development of new products, Shum et al. (2007) analyze the repercussions of shared vision on financial performance. They observe that shared vision, united to organizational strategic fit, constitutes an antecedent of financial performance in organizations that act in this innovative context. The positive effects of shared vision have also been tested on innovation and organizational learning (García-Morales et al. 2006; Shump et al. 2007).

Teamwork and SPC in Six Sigma as sources of shared vision: the goal-theoretical perspective

According to Locke and Latham (1990), the goal-theoretical perspective affirms that establishing specific and challenging goals leads firms to obtain better results. Therefore, goals should fulfil both requirements. Firstly, establishing specific goals focuses workers’ attention and directs their efforts in the right direction. Further, if goals are specific and clear and not depend on the appreciation of the worker, as in the case of “do the best as you can,”

performance improves (Locke and Latham, 1990). The second requirement established by the goal-theoretical perspective is that goals must be challenging and difficult. This fact increases worker effort and the results obtained (Locke and Latham, 1990; Tubbs, 1986).

Studying both ideas in teamwork context, Katzenbach (1997) defined a team as a group of people with complementary abilities who are committed to a common purpose according to a specific working method. Teams must be committed to a specific goal and exert their efforts in a common direction. Also, goals must be specific to prevent problems of multiple goals conflict in teamwork (O'Leary-Kelly et al. 1994; Zander, 1980). As to difficulty of goals, O'Leary-Kelly et al. (1994) argue that the group context constitutes an additional stimulus, one beyond the individual, to the worker's strength and persistence. This stimulus will increase his or her contribution. In establishing difficult goals for work teams, group cohesion will lead to greater effort, improving the results (Levine and Moreland, 1990). The members of the cohesive teams will be better disposed to working on the common goals proposed to the group (O'Leary-Kelly et al. 1994).

This study seeks to determine the effect of the improvements associated with establishing specific and challenging goals for work teams on the development of shared vision. First, as we have mentioned, the specificity of the goals established for the teams leads their members to orient themselves to a shared direction (Katzenbach, 1997). Thus, Katzenbach (1997) refers to the idea of shared vision (Ensley et al. 2003). The specificity of the goals leads to the development of a shared mental model of a future state desired by the group, that is, the development of shared vision (Chan et al. 2003; Ensley et al. 2003), as we have defined it in our study. Abrams et al. (2003) and Tsai and Goshal (1998) associate shared vision directly with common goals. Strange and Mumford (2002) affirm that vision starts from the mental models of individuals, as a function of their goals. In the case of teams, these goals are shared, creating a shared mental model, which means that the group comes to share a vision (Pearce and Ensley, 2004). Further, the resulting shared vision of the specificity of the goals helps to solve the above-mentioned problem of conflicts and confusion in the work groups (O'Leary-Kelly et al. 1994; Zander, 1980). Common vision will solve problems such as incorrect interpretations of the tasks performed or the language used (Abrams et al., 2003). In conclusion, establishing specific goals for work teams affects the development of shared vision positively.

Second, the difficulty of the goals established by the teams will require cohesion, leading to the development of shared vision. Shared vision represents a first step in motivating people to trust others and work together (Kolzow, 1999), and this constitutes the basis for achieving cohesion. Shared vision increases the trust between members of the team through the clarification of goals and tasks to be performed (Abrams et al. 2003). A study by Hambrick (1997) establishes the requirements that the managerial team should have to become a truly integrated team. On facing challenging goals, such a team responds with better results. According to Hambrick, there are five requirements that lead to development of shared vision: (1) the need for a team identity, knowing exactly who belongs to the team and who does not; (2) the real existence of teamwork, performing tasks jointly, periodic meetings, etc. (3) identifying the composition and the roles assigned within the team; (4) the existence of incentives that reward teamwork; and (5) the leadership of the executive director of the organization. Finally, establishing challenging goals for cohesive work teams contributes to the development of shared vision in these teams.

Next, we see how the Six Sigma methodology, and specifically the work teams that it incorporates and the statistical control it proposes, constitute an ideal framework for

establishing specific and challenging goals for its members. As discussed above, this will have positive repercussions on the development of shared vision.

The improvement projects of the Six Sigma methodology, assigned to different work teams, focus on specific and challenging goals for improvement (Linderman et al. 2003; 2006). First, as the name itself indicates, Six Sigma establishes a specific improvement goal “ 6σ ” (3.4 DPMO) and a measurement mechanism for reaching it. Thus, one of the first steps in the improvement projects consists of observing the “sigma” level reached in the organizational process in question, as a function of the quantity of defects (DPMO) that it incurs¹. All of the improvement projects performed, using this methodology, begin by establishing specific improvement goals (Linderman et al. 2003). Second, in order to specify the points of improvement and focus the Six Sigma team members’ attention clearly, this methodology uses indicators. These may be issues critical for quality that are identified by the consumer (CTQ’s), that is, characteristics that, according to the consumer, have a high impact on the quality of the product or service (Breyfogle, 2003). They thus also establish specific goals based on the consumers’ requirements (Linderman et al. 2003). Third, this methodology is grounded in a philosophy of continuous improvement (Breyfogle, 2003; Pande et al. 2002), which seeks to make the performance of processes better every day, a challenging goal for the members of the work groups. According to Linderman et al. (2003, p.196), “Six Sigma is known for employing challenging process improvement goals”. Pande et al. (2002) state that Six Sigma establishes an extremely challenging but feasible goal, in contrast to earlier orientations to “0 defects”. Finally, as a result of the ambition associated with the goals established, the cohesion that facilitates the team members’ ability to respond better to challenging goals (O’Leary-Kelly et al. 1994) should also be guaranteed by this methodology. To demonstrate this, if we observe the above-mentioned requirements proposed by Hambrick (1997) to ensure that a team is integrated, we find first that the formal design of the Six Sigma work teams facilitates group identity. Second, the creation of specific positions dedicated to Six Sigma projects, such as “Green Belts” or “Black Belts”, helps in assigning tasks, while identifying clearly the roles performed. Third, the organization’s recognition of the workers’ achievements also forms part of this methodology (Breyfogle, 2003), in both its extrinsic and its intrinsic channels (Lloréns et al. 2006). Finally, the “Champions” perform the role of managerial leadership required in this initiative. These aspects satisfy the requirements established by Hambrick (1997) to make the teams integrated, enabling them to obtain shared vision. In accord with this, the Six Sigma methodology includes the use of very specific and challenging goals which, as mentioned above, should affect positively the development of shared vision. We can thus propose the following hypothesis:

Hypothesis 1: Teamwork implemented in Six Sigma methodology affects positively the ability to develop shared vision.

As discussed above, the functioning of Six Sigma and its teams is distinguished by its high content of statistical tools. The very measurement of “sigma” level for each process already requires mastery of some of these tools (Breyfogle, 2003; Pande et al. 2002). “The use of Six Sigma tools and methods assumes an aid mechanism for achieving the teams’ goals, especially when facing challenging goals” (Linderman et al. 2006, p.781). Thus, their use will influence the teams’ performance when they confront the specific and challenging goals that this methodology proposes (Linderman et al. 2003; 2006). In this study, we propose that one of the ways in which the statistical tools facilitate work is through their contribution to the development of shared vision.

¹ Relationship between sigma levels “ σ ” and the number of defects per million opportunities (DPMO):
1 σ =690,000DPMO, 2 σ =308,537DPMO, 3 σ =66,807DPMO, 4 σ =6,210DPMO, 5 σ =233DPMO, 6 σ =3.4DPMO.

The statistical tools in Six Sigma are oriented to very specific goals, such as detecting the causes of errors, reasons for deviations, calculation of the number of defects, etc. (Breyfogle, 2003). As in the previous case, this specificity of goals will facilitate the development of shared vision, since it leads to a mental model shared by the group of the future state desired (Chan et al. 2003; Ensley et al. 2003). Furthermore, the common use of statistical tools by the workers will facilitate communication between them and contribute to developing a shared language. The development of frequent communication increases the amount of information available, making it easier for members of the organization to develop a shared vision (Abrams et al. 2003; Farmer et al. 1998). Shared language will also help to eliminate or decrease confusion and possible conflicts between workers, which has positive repercussions on the development of shared vision (Abrams et al. 2003; O'Leary-Kelly et al. 1994; Pearce and Ensley, 2004; Zander, 1980). This idea ties in to the specificity of the goals already mentioned. Based on the foregoing, we establish the following hypothesis:

Hypothesis 2: Statistical Process Control (SPC) implemented in the Six Sigma methodology positively affects the ability to develop shared vision.

Finally, it remains only to determine the positive effects of shared vision on organizational performance. As discussed, Senge (1992) attributes benefits such as improvements in commitment, professional aspirations and relationships among workers to shared vision (Feeny et al. 1992). Cooper (1990) affirms that organizations that have a clear image of the current and future situation and of the paths required to reach the latter are more likely to achieve success. The few studies that have analyzed the effect of shared vision on the organization's performance do not yield conclusive results. For example, Shum et al., (2007) found a direct influence. Developing the idea of Collins and Porras (1996), these authors state that shared vision enables orientation and focusing of attention, making it possible to renew strategy appropriately and improve performance. They thus confirm the positive repercussions of shared vision on financial performance in innovative organizations. In the context of information systems, Cohen et al. (2006) demonstrate that the best relationship between managers will orient their efforts appropriately toward the organization's goals. Thus, they find a direct relationship with performance (market share, profitability, competitive position, efficiency and decision-making) and another, indirect relationship through commitment. The indirect effect was also observed by García-Morales et al. (2006), who observed shared vision indirect repercussions for performance through innovation and organizational learning. Therefore, both direct and indirect effects on performance have been found. The current study also seeks to contribute to this field by observing whether there can be a direct relationship between both variables in this context. Thus, we establish the following hypothesis:

Hypothesis 3: Shared vision in Six Sigma firms positively affects organizational performance.

Research method

Data sample

The sample used to contrast the hypotheses proposed is formed of manufacturing firms and services in Europe. Firms contacted were chosen randomly from the Amadeus database and the publication *Actualidad Económica* (2004). The procedure for data collection consisted of sending a letter by email explaining the research project to different European firms. The card was addressed to the person responsible for quality management in the firm and explained the reasons for and objectives of the research. It included a direct link to a questionnaire available

on Internet. From this link the questionnaire could be accessed, filled out online and, once finished, sent automatically.

The questionnaire was developed after an extensive review of the literature related to quality management practices and shared vision. Once designed, the questionnaire was pretested by three quality managers, which enabled the clarification of possible ambiguities, correction of errors and solution of formatting problems. This paper is part of a larger study that analyzes the current functioning of QM initiatives in Europe, but as the goal of this research was to study the shared vision development in the Six Sigma initiative, we considered only responses from firms that had implemented this methodology. The larger global study had a target sample of 2500 organizations, from which 254 responses were obtained, representing a response rate of 10.16%. Of these, 17 responses were eliminated because they were incomplete or contained an error. Thus, the final sample was composed of 237 valid responses. Of these, only the respondents who indicated that they used the six sigma methodology to a reasonable degree (as discussed later) were used in this study. These numbered 58.

Of the total of 58 Six Sigma firms, 31.03% belong to machinery and components sectors, 25.86% to different activities in the service sector, 20.68% to electricity and electronics, and the remaining 22.41% to miscellaneous sectors. As to the number of employees in each of the firms surveyed, 37.93% of the firms had from 51 to 250 employees, 36.20% from 251 to 1000, and 25.86% over 1000 workers. A breakdown of the countries of origin in the sample shows that most of the organizations analyzed are from Spain (55.17%). Italy also represents a significant part of the sample (18.96%). Finally, Austria and the United Kingdom represent 13.79% and 12.06%, respectively.

Measurement

Teamwork

Teamwork was measured using the six-item scale proposed by Flynn, Sakakibara and Schroeder (1995). This scale analyses whether the firm has structured work teams that are used for problem solving. The last three items analyse the work of the supervisors in encouraging the workers to share ideas, work as a team and provide a formal structure for the group. In Six Sigma, this work is performed, as mentioned above, by the Green Belts (GBs) or Black Belts (BBs). Both the items on this scale and those in the following scales were accompanied by a 7-point Likert-type scale (0=totally disagree; 7=totally agree). The study of the scale's internal consistency recommended eliminating the first item of the scale, which produced a scale of five items that has a Cronbach's alpha coefficient ($\alpha= 0.893$) above the recommended minimum of 0.7 (Nunally, 1978). To ensure the scale's unidimensionality, we performed an exploratory factor analysis, which showed that the five items explained a single factor. To perform this task, we used the statistical programme SPSS 15.0.

Statistical Process Control (SPC)

To measure statistical process control, we used the scale developed by Ahire, Golhar and Waller (1996). This scale is composed of four items and measures whether the organization makes intensive use of statistical methods and tools to manage processes, as well as the training required to do this. The exploratory factor analysis confirms the presence of a single factor that explains over 85% of the variance. The Cronbach's alpha ($\alpha= 0.943$) guarantees the internal consistency of the scale.

Shared vision

The scale used for measuring shared vision is composed of six items taken from work by García-Morales et al. (2006), Oswald et al. (1994) and Tsai et al. (1998). This scale includes

whether the members of the organization have goals and an image of the future in common and share ambitions. Both the scale's unidimensionality, through the explanatory factor analysis, and its internal consistency ($\alpha=0.910$) were confirmed.

Organizational performance

To measure organizational performance, we asked those surveyed to evaluate the organization's performance in terms of three items. The three indicators measured sales, market share and profits respectively as compared to the competition over the last three years. This kind of measurement and scale are being used with increasing frequency (García-Morales et al. 2006; Steensman et al. 2000). Each indicator was accompanied by a 7-point Likert scale (0=Very bad; 7=Very good). The managers surveyed judged the organization's performance relative to the competition over the last three years. An explanatory factor analysis confirmed the scale's unidimensionality. The Cronbach's alpha had a value of $\alpha=0.880$, higher than the established minimum of 0.7 (Nunally, 1978), which confirmed the scale's internal consistency.

To complete validation, all scales were subjected to a confirmatory factor analysis (CFA) using the computer programme LISREL 8.53, which guaranteed the scales' convergent and discriminant validity, all of which were higher than the established minimums (Howell, 1987; Hulland, 1999; Szulanski, 1996). Because the shared vision scale is composed of items from different studies, the validation data are included in the following table. Appendix A presents the different scales used in the study, as well as their original sources.

Table I. Shared Vision Scale: Confirmatory Factorial Analysis

Item	Standardized factor loadings (>0.4 ^a)	t-value (t>1.96, p<0.05 ^a)
1. In the organization there is a clear vision guiding the strategic goals and missions	1.00	-
2. The leadership of the company shares a common vision of the organization's future	0.97	9.24
3. The shared vision guiding change, in the organization, is appropriate	0.99	11.88
4. We agree on what is important for our organisation	0.99	10.73
5. Our unit shares the same ambitions and vision with other units at work	0.88	8.61
6. People on our unit are enthusiastic about pursuing the collective goals and missions of the whole organization	0.88	6.71

^aHulland (1999).

Implementation of quality management initiatives

Finally, to identify the implementation of the quality management initiatives, the questionnaire included a list of the different alternatives such as ISO Standards, the EFQM model, Six Sigma, the Deming model, quality control with a 7-point Likert, from 1 (minimal implementation) to 7 (maximum implementation). The firms would choose the initiatives that they had underway and the degree of implementation associated with each of these.

Data analysis

First, we separated from the total research sample (237 responses) the organizations that indicated the implementation of the six sigma methodology (66 responses). Next, from these, we selected those firms that had assigned an implementation value of two or higher on the scale. This guaranteed that the firms used in the study had already implemented the initiative in some depth, and avoided introducing data from organizations in which the six sigma initiative had not yet had sufficient development. Thus, we eliminated eight organizations from the study who responded at level 1 on the Likert scale, indicating that they used the six

sigma initiative to only a minimum degree of implementation. The rest of the organizations (58 cases) responded at level 2 or higher on the scale. Thus, the final group of six sigma firms observed was composed of 58 organizations.

Structural Equation Modelling (SEM)

Secondly, we must determine through a structural equation modelling (SEM) whether the implementation degree of “teamwork” and “SPC” in six sigma firms implies greater development of shared vision. To perform this task, we used the programme LISREL 8.53. To ensure that there is no multicollinearity between the variables analysed we calculate the variance inflation factors and the condition index. The results obtained take values below the maximum recommended (Kleinbaum et al., 1988), eliminating the possibility of multicollinearity.

The fit indices used in this study to estimate measurement models are the ratio of χ^2 to degree of freedom, Root Mean Square Error of Approximation (RMSEA), a consistent version of the Akaike’s Information Criterion (CAIC), the Parsimony Goodness of Fit Index (PGFI), the Parsimony Normed Fit Index (PNFI), and the Comparative Fit Index (CFI). These fit indices, with the exception of RMSEA, were chosen because of their abilities to adjust for model complexity and degrees of freedom. Although RMSEA is sensitive to model complexity, it is one of the most informative criteria as to an absolute fit (Byrne, 1998). Recommended values of these fit indices for satisfactory fit of a model to data are presented in table II.

Table II. Goodness of fit statistics of the structural model

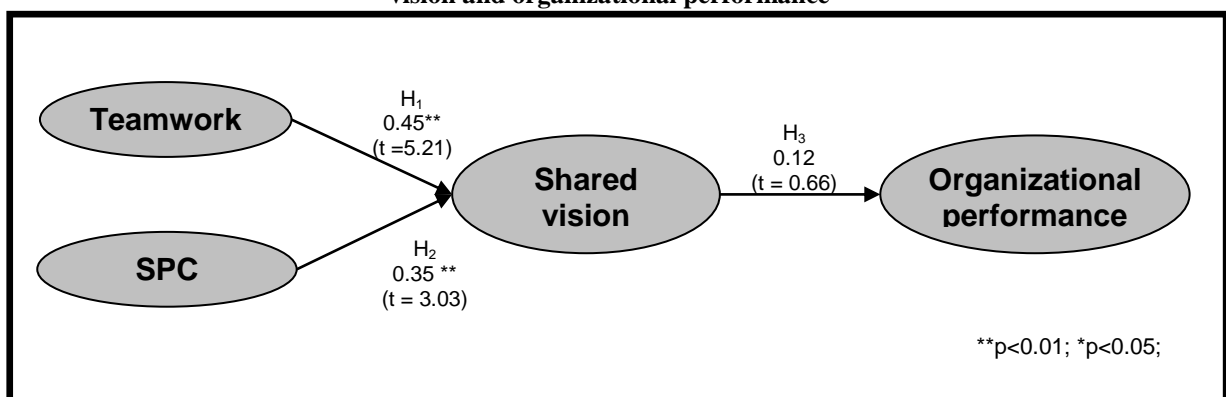
Goodness of Fit Statistics	Structural Model	Recommended values for satisfactory fit of a model to data
χ^2 (sig.)	337.08(p=0.0)	
Freedom negrees	131	
χ^2 / df	2.573	<3.0 ^a
Root Mean Square Error of Approximation (RMSEA)	0.078	<0.08 ^a
Akaike’s Information Criterion (CAIC)	379.12	< Saturated model and independence model ^a
CAIC for saturated model	865.34	
CAIC for independence model	1649.06	
Parsimony Goodness of Fit Index (PGFI)	0.73	>0.5 ^b
Parsimony Normed Fit Index (PNFI)	0.81	>0.5 ^b
Comparative Fit Index (CFI)	1.00	>0.5 ^b

^aHair et al. (2004) y Byrne (1998).

^bByrne (1998).

Figure 1 depicts the SEM results of the relationships between teamwork and SPC, shared vision, and organizational performance, in Six Sigma firms. Each path in the figure indicates the associated hypothesis as well as the estimated path coefficients and *t*-values (*t*-values for path coefficients greater than 1.96 are significant at $p < 0.05$; *t*-values for path coefficients greater than 2.58 are significant at $p < 0.01$).

Figure 1. Structural modelling of the relationship between Teamwork and SPC in Six Sigma firms, shared vision and organizational performance



We can see that teamwork has a positive and very significant effect ($p < 0.01$) on shared vision, leading us to accept Hypothesis 1. Hypothesis 2, which affirms that the use of statistical control of processes affects the organization's shared vision positively and significantly, is also accepted. We can see how it has a positive and significant influence ($t = 3.03$, $p < 0.01$). Finally, Hypothesis 3, which establishes that shared vision affects the organization's performance positively, is not supported. The results of the model show that its influence is positive but not significant, such that we cannot confirm this hypothesis.

Discussion of results and further directions for research

The main goal of this study was to observe whether teamwork and SPC within the six sigma methodology influence positively the development of a shared vision in the organization. We analyse in greater empirical depth the possible reasons for the success of a Six Sigma initiative. Further, this paper contributes to the emerging literature that analyses the effects of shared vision on organizational performance.

First, results show that the teamwork and statistical process control (SPC) of Six Sigma lead to the achievement of greater shared vision. One of the concepts on which we have grounded the reasoning of this paper is the orientation of Six Sigma to specific and challenging goals (Linderman et al., 2003; 2006). The specific goals established by Six Sigma are shared by its members, creating a common future image, that is, the shared vision (Pearce and Ensley, 2004). Further, the highly challenging goals that Six Sigma establishes (Pande et al. 2002, Linderman et al. 2003; 2006) develop more cohesive groups with better communication, trust, and cooperation. Lloréns et al. (2006) have established theoretically that Six Sigma teamwork differs from teamwork included in other quality initiatives, mainly due to the creation of specialized positions to run its projects instead of overloading the firm's managers. Further, the Black Belts and Green Belts are responsible for leading teams and improvement projects (Gitlow et al. 2005; Pande et al. 2002). To do this, they foster the participation of the workers, formalize the work that they perform and encourage the workers to work as a team. These positions help to make the goals specific by focusing attention on the improvement projects established and thus avoiding the conflicts that can arise due to multiple goals (O'Leary-Kelly et al. 1994; Zander, 1980). In this way, the positions exercise the function of team leadership, which together with their help for good functioning, appropriate development of meetings and achievement of group identity satisfy the requirements established by Hambrick (1997) for achieving an integrated team that shares a vision of the future.

Although SPC usage in Six Sigma methodology, may not contribute any new content (Gijo et al. 2005) it does differentiate this initiative from others by granting quality management greater structure and formality (Breyfogle, 2003; Pande et al. 2002). The greater formality and structuring of the statistical techniques used offer another possible explanation for the success of Six Sigma. The great importance attributed to SPC in Six Sigma makes it the strongest technique for quality improvement from the statistical perspective (Lloréns et al. 2006). This differentiates it from other initiatives that are weaker from the perspective of, for example, the ISO standards. As teamwork, Six Sigma SPC is also supported by challenging and specific goals that each statistical tool and method must fulfil, such that the goal-theoretical perspective assumes support for this relationship. Further, the common use of all of these tools contributes to facilitating communication between workers, to developing a shared language, to eliminating possible conflicts and misunderstandings, and to increasing the cohesion of groups.

This study thus adds to the small number of empirical studies that observe the positive effects of Six Sigma on organizations (Antony et al. 2005; 2007; Lee et al. 2006). Our results allow

us to explain Six Sigma's success from a perspective of teamwork and the tools used. We do not see the direct relation of the Six Sigma practices to variables of performance such as improvement in competitiveness (Lee et al. 2006), profitability or market share (Antony et al. 2005; 2007). However, the results show a positive effect on an intermediate variable, *shared vision*, which, as we will discuss next, could affect organizational performance. This study thus provides a possible reason for Six Sigma's positive results, one that follows the lines of Choo et al. (2004), who observe that the structuring of projects and psychological security in a Six Sigma firm affect knowledge creation positively. Nevertheless, future research should use the same process to study the effect of Six Sigma practices on other variables such as organizational learning (Wiklund et al. 2002) to provide an increasingly precise explanation of the real functioning of Six Sigma. Further, other structural aspects of this methodology, such as supplier management (Bañuelas et al. 2003; Breyfogle, 2003) and design of products, processes and services (DFSS¹) (Breyfogle, 2003; Pande et al. 2002) could also serve as an orientation for continuing in-depth analysis of the real reasons for the success of Six Sigma.

In spite of the fact that results obtained in this study support Hypotheses 1 and 2, the literature does not clarify completely the direction of the causal relationship of teamwork and SPC to shared vision. The main difference could be found in the interpretation of teamwork and SPC. If both elements are understood as a result, the fact that the employees who practice them possess a shared vision would probably have positive repercussions for the team's performance and for the results obtained when using SPC. In this sense, for example, Hong et al., (2004) confirmed that clarity of objectives improves teamwork. Pearce and Ensley (2004) observed that shared vision affects the power and behaviour of the team positively, due to the fact that it generates better understanding, greater consensus and better communication and coordination. Shared vision facilitates orientation of workers' behaviour in the right direction, contributing to the success of the innovation or learning required (García-Morales et al. 2006). However, if we understand teamwork and SPC as on-going activities or processes in the organization, then the dynamic of team functioning, the use of shared statistical tools, the possession of common objectives, and the cohesion developed over time would enable the development of shared vision in the team members and employees who share the tools and statistical methods. Kirkpatrick and Locke (1996) presented shared vision as a component of team performance. Hootegeem et al., (2004) differentiate different stages in the evolution of a team. As these stages unfold, the team's direction becomes more defined and more clearly identified by its members. In our case, this corresponds to shared vision. For example, the use of specific objectives leads to the development of shared vision (Chan et al. 2003; Ensley et al. 2003), as occurs with teams and with SPC in Six Sigma. The cohesion and unity among the employees is a result of teamwork and tool sharing. The employees are not bonded at the beginning of their work; nor do they share a common vision. Rather, it will be the development of the activity that enables them to achieve this objective. Starting from the increasingly recognized importance of the need to develop a shared vision among the organization's members, we have in the current study chosen to work in this second line of research, seeking antecedents that facilitate this development.

Secondly, the relationships established by Linderman et al. (2003; 2006) enabled us to justify theoretically the empirical relations contrasted. Our study represents a very significant contribution to this field, as it introduces new relationships based on the goal-theoretical perspective. Thus, this study explains how Six Sigma improvement teams, as well as the tools and methodology that they use and by means of the specific and challenging objectives that they establish, as shown by Linderman et al. (2006), lead to the development of shared vision.

¹ DFSS="Design for Six Sigma".

A new line of research opened could be observing empirically the relation between the assumptions of the goal-theoretical perspective and the development of shared vision.

Third, the results show a positive but not significant effect of shared vision on organizational performance, measured in terms of sales, market share and profits as compared to the competition over the last three years. The analysis shows that the direct effect of shared vision on the performance measured is not significant ($\alpha=0.12$, $t=0.66$). In the literature review, there are papers that have found a direct influence (Cohen et al., 2006; Shump et al., 2007) and an indirect influence (Cohen et al., 2006; García-Morales et al., 2006) of shared vision on the organization's performance. Our results seem to follow the line of work which observes that the indirect effect of shared vision on performance through other variables can be more important than its direct effect. One possible justification for our results may be that the studies that have found a direct influence of shared vision on performance were conducted in contexts that demand innovation or knowledge, in which the effects of shared vision on performance are more significant (Shum et al. 2007; Senge 1992). Future research could contribute empirically to the study of this indirect relationship between shared vision and organizational performance.

Finally, among the limitations of our study, we must include the fact that Six Sigma implementation is observed using a single item testing its development degree, instead of a compound construct. The sample of Six Sigma firms is not distributed uniformly between the observed countries. Together with the cross-sectional character of the research, this factor somewhat limits generalization from these results. Further, organizational performance is measured through the evaluations of those surveyed in relation to the competition over the last three years, which introduces some subjectivity. Thus, longitudinal research that analyses a greater number of cases and that observes effects on real results of organizations could enrich the literature on the Six Sigma quality management initiative and the success it brings.

In conclusion, we can affirm that this study contributes to developing empirical knowledge of the benefits of the implementation of quality management initiatives in the firm. Specifically, it studied the effects of implementing the Six Sigma quality management initiative to provide a possible explanation of the initiative's good results. Teamwork and statistical process control (SPC) in Six Sigma differentiate it from the rest of the initiatives and lead to the development of a greater shared vision.

REFERENCES

- Abrams, L.C., Cross, R.C., Lesser, E. and Levin, D.Z. (2003), "Nurturing interpersonal trust in knowledge-sharing networks", *Academy of Management Executive*, Vol. 17 No 4, pp. 64-79.
- Actualidad Económica (2004), "Cuáles son, cuánto venden y quién manda en las 5.000 mayores empresas", Octubre 2004 No 2419.
- Ahire, S.L., Golhar, D.Y. and Waller, M.A. (1996), "Development and Validation of TQM Implementation Constructs", *Decision Sciences*, Vol. 27 No 1, pp. 23-56.
- Antony, F., Kumar, M. and Cho, B. (2007), "[Six sigma in service organisations: Benefits, challenges and difficulties, common myths, empirical observations and success factors](#)", *International Journal of Quality & Reliability Management*, Vol. 24 No 3, pp. 294-311.
- Antony, F., Kumar, M. and Madu C. (2005), "[Six sigma in small- and medium-sized UK manufacturing enterprises: Some empirical observations](#)", *International Journal of Quality & Reliability Management*, Vol. 22 No 8, pp. 860-874.
- Bañuelas R. and Antony, F. (2003), "Going from six sigma to design for six sigma: an exploratory study using analytic hierarchy process", *The TQM Magazine*, Vol. 15 No 5, pp. 334-344.
- Breyfogle, F.W. (2003), "Implementing Six Sigma: Smarter Solutions Using Statistical Methods", New Jersey: Ed. Wiley.
- Byrne, B.M. (1998), "Structural Equation Modelling with Lisrel, Prelis and Simplis: Basic concepts, Application, and Programming", *Lawrence Erlbaum*, Mahwah, NJ.
- Chan, C., Lim, L. and Keasberry, S. (2003), "Examining the linkages between team learning behaviours and team performance", *The Learning Organization*, Vol. 10 No 4, pp. 228-236.

- Choo, A., Linderman, K. and Schroeder, R. (2004), "Social and method effects on learning behaviours and knowledge creation in six sigma projects", *Academy of Management Proceedings*, 2004, pC1-C6.
- Cohen, J.F. and Toleman, M. (2006), "The IS-business relationship and its implications for performance: An empirical study of South African and Australian organizations", *International Journal of Information Management*, Vol. 26, pp. 457-468.
- Collins, J. C. and Porras, J. I. (1996), "Building your company's vision", *Harvard Business Review*, Vol.74, No 5, pp.65-77.
- Cooper, N. (2003), "Do Teams and Six Sigma go together?", *Quality Progress*, Vol. 36 No 6, pp. 25-29.
- Dean, J.W. Jr. and Bowen, D.E. (1994), "Management Theory and Total Quality: Improving research and practice through theory development", *Academy of Management Review*, Vol. 19 No 3, pp. 392-418.
- De Mast, J., (2006), "Six Sigma and Competitive Advantage", *Total Quality Management*. Vol.17, No 4, pp.455-464.
- Ensley, M.D., Pearson, A. and Pearce, C.L. (2003), "Top management team process, sharer leadership, and new adventure performance: a theoretical model and research agenda", *Human Resource Management Review*, Vol. 13, pp. 329-346.
- Farmer, B.A., Slater, J.W. and Wright, K.S. (1998), "The role of communication in achieving shared vision under new organizational leadership", *Journal of Public Relations Research*, Vol.10, No 4, pp.219-235.
- Feeny, D.F., Edwards, B.R. and Simpson K.M. (1992), "Understanding the CEO/CIO relationship", *MIS Quarterly*, Vol.16, No 4, pp.435-451.
- Flynn, B.B., Sakakibara, S. and Schroeder, R.G. (1995), "Relationship between JIT and Total Quality Management: practices and performance", *Academy of Management Journal*, Vol. 38 No 5, pp. 1325-1360.
- García-Morales, V., Lloréns-Montes, F.J. and Verdú-Jover, A. (2006), "Antecedents and consequences of organizational innovation and organizational learning in entrepreneurship", *Industrial Management & Data Systems*, Vol. 106 No 1, pp. 21-42.
- Gijo, E.V. and Rao, T.S. (2005), "Six Sigma implementation – Hurdles and more hurdles", *Total Quality Management & Business Excellence*, Vol. 16 No 6, pp. 721-725.
- Gitlow, H. (2005), "Six Sigma for green belts and champions: foundations, DMAIC, tools, cases, and certification", US Prentice Hall Ed.2005.
- Goh, T.N., Low, P.C., Tsui, K.L. and Xie, M. (2003), "[Impact of Six Sigma implementation on stock price performance](#)", *Total Quality Management & Business Excellence*, Vol. 14 Issue 7, pp. 753.
- Green, F. (2006), "Six Sigma and the revival of TQM", *Total Quality Management & Business Excellence*, Vol. 17 No 10, pp. 1281-1286.
- Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, W.C. (2004), "Análisis multivariante". 5ª Ed. Madrid: Prentice Hall.
- Hambrick, D.C. (1997), "Corporate coherence and the top management team", *Strategy and Leadership*, Vol. 25, pp. 24-30.
- Hann, G.J., Hill, W.L., Hoerl, R.W. and Zinkgraf, S.A. (1999), "The impact of Six Sigma improvement-a glimpse in the future of statistics", *The American Statistician*, Vol. 53 No 3, pp. 208-215.
- Harrington, A. (1999), "The best management ideas", *Fortune*, Vol.104, pp.152-154.
- Harry, M.J. (2000), "Six Sigma", New York: Currency.
- Harry, M.J. and Schroeder, R. (2000), "Six Sigma: The Breakthrough Management Strategy Revolutionizing the World's Top Corporations", Doubleday, New York.
- Hong, P. , Nahm, A.Y. and Doll, W.L. (2004): "The role of project target clarity in an uncertain project environment", *International Journal of Operations and Production Management*, Vol.24, No 11/12, pp.1269-1291.
- Hootegem, G.V., Huys, R. and Delarue, A. (2004): "The sustainability of teamwork under changing circumstances", *International Journal of Operations and Production Management*, Vol.24, No 8, pp.773-786.
- Howell, R. (1987), "Covariance Structure modeling on the personal computer", *Journal of Marketing Research*, Vol. 24 No 4, pp. 456-459.
- Hulland, J. (1999), "Use of partial least squares (PLS), in strategic management research: A review of four recent studies", *Strategic Management Journal*, Vol. 20 No 2, pp. 195.
- Katzenbach, J.R. (1997), "The myth of the top management team", *Harvard Business Review*, Vol. 75, pp. 83-93.
- Kirkpatrick, S.A. and Locke, E.A. (1996), "Direct and indirect effects of three core charismatic leadership components on performance and attitudes", *Journal of Applied Psychology*, Vol.81, No 1, pp.36-52.
- Kleinbaum, D.G.; Kupper, L.L. and Muller, K.E. (1988), "Applied Regression Analysis and Other Multivariables Methods", PWS-KENT Publishing Company.
- Kolzow, D. (1999), "A Perspective on Strategic Planning: What's your vision?" *Economic Development Review*, Vol. 16 No 2, pp. 5-10.
- Kuei, C.H. and Madu, C.N. (2003), ""Customer-centric six sigma quality and reliability management", *The International Journal of Quality and Reliability Management*, Vol. 20 No 8, pp. 954-964.
- Lee, K. and Choi, B. (2006), "Six sigma management activities and their influence on corporate competitiveness", *Total Quality Management & Business Excellence*, Vol. 17 No 7, pp. 893-911.

- Levine, J.L. and Moreland, R.L. (1990), "Progress in small group's research", in R.M. Rosenzweig and L.W. Porter (Eds.), *Annual Review of Psychology*, Vol. 41, pp. 585-634. Palo Alto, CA: Annual Reviews.
- Linderman, K., Schroeder, R.G., Zaheer, S. and Choo, A.S. (2003), "Six Sigma: a goal-theoretic perspective", *Journal of Operations Management*, Vol. 21 No 2, pp. 193-203.
- Linderman, K., Schroeder, R.G., and Choo, A.S. (2006), "Six Sigma: the role of goal in improvement teams", *Journal of Operations Management*, Vol. 24, pp. 779-790.
- Lloréns, F.J. and Molina, L.M. (2006), "Six Sigma and management theory: processes, content and competitiveness", *Total Quality Management & Business Excellence*, Vol. 17 No 4, pp. 485-506.
- Locke, E.A. and Latham, G.P. (1990), "A theory of goal setting and task performance", Prentice Hall, Englewood Cliffs, NJ.
- Lowenthal, J.N. (2002), "Guía para la aplicación de un proyecto Seis Sigma", Madrid: Ed. FC Editorial.
- Lucas, M.L. (2002), "The essential Six Sigma: how successful six sigma implementation can improve the bottom line", *Quality Progress*, Vol. 35 No 1, p.2-32.
- Lucier, G.T. and Seshadri, S. (2001), "GE takes Six Sigma beyond the bottom line", *Strategic Finance*, Vol. 82 No 11, pp. 40-46.
- McAdam, R. and Lafferty, B. (2004), "A multilevel case study critique of six sigma: statistical control o strategic change?", *International Journal of Operations and Production Management*, Vol.24, No 5/6, pp.530-549.
- Nunnally, J. (1978), "Psychometric Theory", McGraw Hill. New York.
- O'leary-kelly, A.M.; Martocchio, J.J. and Frink, D.D. (1994), "A review of the influence of group goals on group performance", *Academy of Management Journal*, Vol. 37 No 5, pp. 1285-1301.
- Oswald, S.L., Mossholder, K.W. and Harris, S.G. (1994), "Vision salience and strategic involvement: implications for psychological attachment to organization and job", *Strategic Management Journal*, Vol. 15, pp. 477-489.
- Pande, P.S., Neuman, R.P. and Cavanagh, R.R. (2002), "Las claves de Seis Sigma: La implantación con éxito de una cultura que revoluciona el mundo empresarial", Madrid: Ed. McGraw Hill.
- Pearce, C.L. and Ensley, M.D. (2004), "A reciprocal and longitudinal investigation of the innovation process: the central role of shared vision in product and process innovation teams (PPITs)", *Journal of Organizational Behaviour*, Vol. 25, pp. 259-278.
- Prajogo, D.I. and Sohal, A.S. (2003), "The relationship between TQM practices, quality performance, and innovation performance: An empirical examination", *International Journal of Quality and Reliability Management*, Vol. 20 No 8, pp. 901-918.
- Ravichandran, J. (2006), "Six Sigma milestone: an overall sigma level of an organization", *Total Quality Management & Business Excellence*, Vol. 17 No 8, pp. 973-980.
- Senge, P. (1992), "La Quinta Disciplina", Granica, Barcelona. España.
- Shamji, N. (2005), "Six Sigma Basics", *Total Quality Management*, Vol. 16 No 5, pp. 567-574.
- Shum, P. (2007), "A world class new product development best practice model", *International Journal of Production Research*, Vol. 45 No 7, pp. 1609-1629.
- Steensman, H.K. and Corley, K.G. (2000), "On the performance of technology-sourcing partnerships: the interaction between partner interdependence and technology", *Academy of Management Journal*, Vol. 43, pp. 1045-1067.
- Strange, J.M. and Mumford, M.D. (2002), "The origins of vision: Charismatic versus ideological leadership". *Leadership Quarterly*, Vol.13, No 4, pp.343.
- Szulanski, G. (1996), "Exploring internal stickiness: Impediments to the transfer of best practice within the firm", *Strategic Management Journal*, Vol. 17, Winter Special Issue, pp. 27-43.
- Thawani, S. (2004), "Six Sigma-strategy for organizational excellence", *Total Quality Management*, Vol. 15 No 5/6, pp. 655-664.
- Tsai, W. and Ghoshal, S. (1998), "Social capital and value creation: the role of intrafirms networks", *Academy of Management Journal*, Vol. 15, pp. 1-20.
- Tubbs, M.E. (1996), "Goal-setting: A meta-analytical examination of the empirical evidence", *Journal of Applied Psychology*, Vol.71, pp.474-483.
- 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. 233-239.
- Zander, A. (1980), "The origins and consequences of the group goals", *Retrospections on social psychology*, pp. 205-235.

APPENDIX A. SCALES AND ORIGINAL SOURCES

Teamwork (Flynn et al., 1995)

1. Our plant is organized into permanent production teams.
2. Our plant forms teams to solve problems (1.00).
3. In the past three years, many problems have been solved through small group sessions.
4. Supervisors encourage the persons who work for them to exchange opinions and ideas.
5. Supervisors encourage the people who work for them to work as a team.

6. Supervisors frequently hold groups meetings where the people who work for them can really discuss things together.

Statistical Process Control (Ahire et al., 1996)

1. SPC is used extensively in our plant.
2. SPC has been effective in improving the quality of our primary product.
3. We will continue to use SPC in the manufacture of our primary product.
4. Production workers are well-trained in SPC.

Shared Vision (García-Morales et al. 2006; Oswald et al. 1994; and Tsai et al. 1998)

1. In the organization there is a clear vision guiding the strategic goals and missions.
2. The leadership of the company shares a common vision of the organization's future.
3. The shared vision guiding change, in the organization, is appropriate.
4. We agree on what is important for our organisation.
5. Our unit shares the same ambitions and vision with other units at work.
6. People on our unit are enthusiastic about pursuing the collective goals and missions of the whole organization.

Organizational performance (García-Morales et al. 2006)

Please evaluate the performance of your firm with respect to the competition, considering only in the past three years.

1. Average annual growth of sales in the past three years.
2. Growth of market share in the past three years.
3. Growth of profits in the past three years.