

Critical Success Factors for Six Sigma Implementation: Evidence from Slovenia

Dušan Gošnik

University of Primorska, Faculty of Management, Slovenia

dusan.gosnik@fm-kp.si

Abstract. The purpose of our study is to determine the most important success factors for Six Sigma implementation. A list of many different relevant influencing factors from the literature have been identified. Factors include the following main areas: strategic, organisational, culture-related, finance-related, customer-related and supplier-related, obstacles for successful Six Sigma implementation and required characteristics of leaders in organisations. An online questionnaire was launched in April 2022. An empirical case analysis includes a sample of 33 Slovenian companies. The descriptive statistic method was used to summarise and describe the main features of a dataset. Results show that the most critical success factors for Six Sigma implementation in organisations are culture-related factors such as: selection of proper leaders, followed by proper communication with employees before implementation and top management commitment to change. This research can be considered as case study and preliminary research.

The results of this study will be of great value to academics, consultants, researchers, practitioners of Six Sigma, managers and decision makers in organisations.

Keywords: management, Six Sigma, implementation, success, factor

1. Introduction

Market requirements direct organisations to optimise business processes, deliver top quality products/services and improve business performance. One of the methodologies that can be used in companies to improve business process performance is Six Sigma. For many companies, the question is not whether or not to use Six Sigma, but how to implement it in the company and improve company performance. Six Sigma implementation requires proper leadership. For that reason, it is important for managers to know which are the main success factors for Six Sigma implementation in organisations.

The positive effects of Six Sigma on company performance had been a topic of many studies (Goldstein 2001; Banuelas and Jiju 2002; Gošnik and Hohnjec 2009; McCarty and Fisher 2007; Gošnik and Vujica-Herzog 2010; Kavčič and Gošnik 2016; Raval, Ravi and Ravi 2021; Bagherian, Gershon and Kumar 2023; Bhat et al. 2023; Jovanović et al. 2023; Pereira dos Reis et al. 2024). Gošnik and Hohnjec (2009) suggest the importance of Six Sigma project selection for successful Six Sigma implementation. Additionally, Kavčič and Gošnik (2016) highlight the importance of Six Sigma education and training for successful Six Sigma implementation. Jovanović et al. (2023) also outline the importance of top management roles and employee engagement for successful Six Sigma implementation in organisations. However, there are noticeable cases in which Six Sigma failed to deliver the desired results due to unsuccessful implementation (Raval, Ravi and Ravi 2021; Bagherian, Gershon and Kumar 2023; Bhat et al. 2023; Jovanović et al. 2023; Pereira dos Reis et al. 2024). Due to the many unsuccessful attempts to implement Six Sigma in organisations (Banuelas and Jiju 2002; Raval, Ravi and Ravi 2021), special attention should be given to the factors that support successful Six Sigma implementation in organisations.

This research problem is addressed in this paper in which we determine the most critical factors for successful Six Sigma implementation in organisations. The purpose of our study is to determine the most important success factors for Six Sigma implementation. Knowing these factors can support

decision making, increase the success of Six Sigma in organisations and improve the overall long-term strategic success of organisations.

2. Theoretical background

Six Sigma was invented at Motorola, Inc., as a quality measure that seeks to identify and eliminate defects, mistakes or failures in business processes and improve customer satisfaction (Snee 2004). The Six Sigma framework includes the D-M-A-I-C steps; Define (D), Measure (M), Analyse (A), Improve (I) and Control (C). Six Sigma methodology includes the use of many tools such as: Voice of the customer, Statistical process control, Gage R&R, Failure Modes Effect Analysis, Cause and Effect Analysis and many others.

To ensure success, Six Sigma implementation in an organisation should be a well-managed project and should consider many aspects of implementation, such as; strategic, project, operational. Knowing critical success factors is essential for managers to provide better organisational success. (Raval, Ravi and Ravi 2021)

Raval, Ravi and Ravi (2021) suggest the study of many possible factors which may affect successful Six Sigma implementation in an organisation. They particularly suggest including the following clusters of potential factors; (1) strategic, (2) organisational, (3) culture-related, (4) finance-related, (5) customer-related and (6) supplier-related factors.

However, for successful Six Sigma implementation in an organisation, Banuelas and Jiju (2002) suggest considering the following:

- Six Sigma should be based on an organisation's available resources and skills base.
- Providing top management leadership, commitment and support to Six Sigma.
- The company should align Six Sigma projects to strategic business objectives.
- The company should ensure employee engagement.
- Managers should identify training needs and select the right Six Sigma training participants.
- Professional Six Sigma training should be employed.
- The company should select proper Six Sigma projects.
- The company should employ a proper Six Sigma project reporting management system.

Additionally, Bagherian, Gershon and Kumar (2023) claim that the long-term success of Six Sigma depends on the leadership support and commitment to the organisation's quality policy.

However, in many organisations Six Sigma implementation has failed due to poor employee engagement, as demonstrated via employee resistance to change (Bhat et al. 2023). Additionally, Raval, Ravi and Ravi (2021) and others (Bagherian, Gershon and Kumar 2023; Bhat et al. 2023; Jovanović et al. 2023; Pereira dos Reis et al. 2024) claim that a lack of understanding of how to get started with Six Sigma, poor linkage of Six Sigma projects to strategic business goals, and a lack of measurable objectives also result in failed Six Sigma implementation.

In summary, before implementing Six Sigma in an organisation, managers and decision makers should consider many aspects to ensure success, such as; strategic, project, operational. Managers in organisations should clarify answers to the following questions: Do the managers in the organisation (top managers) know about the power of Six sigma? Will we plan and take enough time for training? Are we aware of the most frequent problems that we have now and how we are dealing with them? How will we involve the employees? How will we manage Six Sigma projects (selection, reporting, controlling)?

Because not all these aspects can be included in one research project, we studied the Six Sigma implementation factors which have, in previous research projects and literature (Goldstein 2001; Banuelas and Jiju 2002; Gošnik and Hohnjec 2009; McCarty and Fisher 2007; Gošnik and Vujica-Herzog 2010; Kavčič and Gošnik 2016; Raval, Ravi and Ravi 2021; Bagherian, Gershon and Kumar 2023; Bhat et al. 2023; Jovanović et al. 2023; Pereira dos Reis et al. 2024), been identified as potentially the most significant. Our research focuses on Slovenian organisations.

3. Methodology

The purpose of our study is to determine the most important success factors for Six Sigma implementation. The main research question in this study asks which are the most important success factors for successful Six Sigma implementation in organisations.

An online questionnaire was used for data gathering. A questionnaire was developed based on a review of the latest literature and the previous research projects of the authors in this field and others, such as Raval, Ravi and Ravi (2021). A closed type of questionnaire was employed and a Likert scale was used to assess each statement. The questionnaire consisted of many parts, such as: survey background, company and participant competences, experiences of companies with Six Sigma methodology, the use of Six Sigma tools, and critical success factors for Six Sigma implementation.

For the purpose of this study, we have used only relevant data related to our research question. The snowball sampling method was used to gather data. A sample of 33 Slovenian organisations was gathered. The descriptive statistics methodology approach was used to analyse data and present results (Figures 1-4 and Table 1).

4. Results and discussion

The participants in this study who completed our online questionnaire were engineers and Six Sigma practitioners from Slovenian manufacturing companies. (Figure 1)

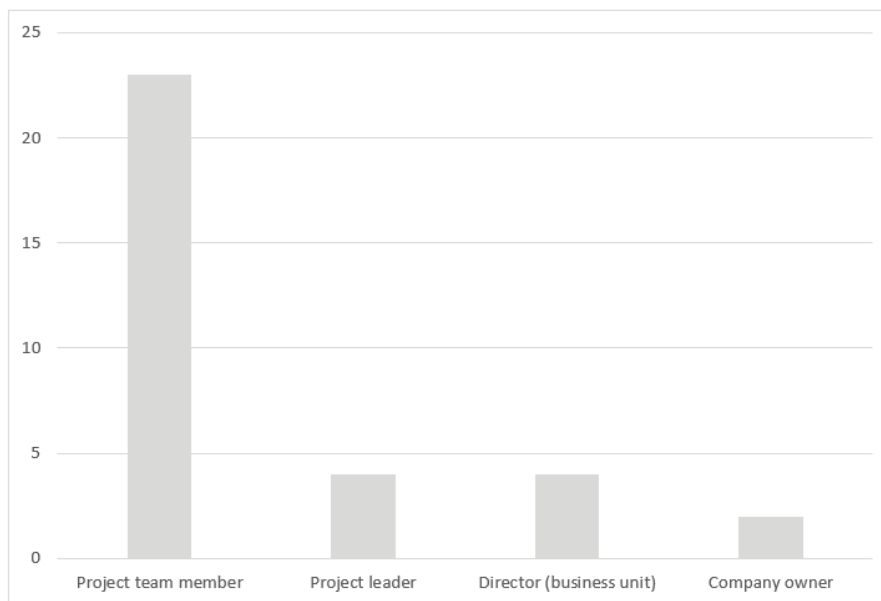


Figure 1: Participants in the study

The majority of the participants (22.5%) were project team members, 4% were project leaders, 4% were directors of business units and 2% were company owners.

A sample of 33 Slovenian companies is included in this research (Figure 2).

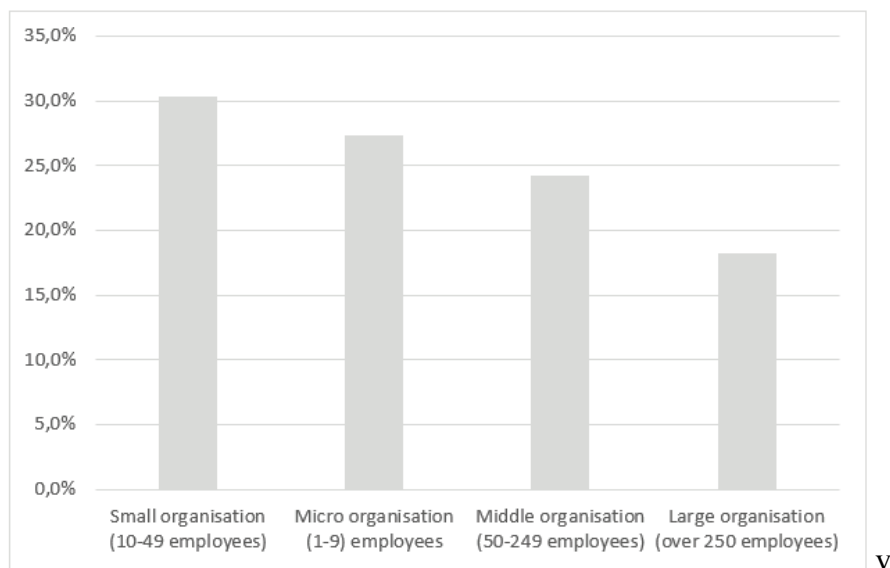


Figure 2: Sample - company size

The data shows that 10 organisations, 30.3% of our sample (N=33), were small organisations employing 10-49 people, followed by 9 micro-organisations, which represents 27.3% of our sample, followed by 8 middle-size organisations (24.2%) and 6 large organisations, which represents 18.2% of our sample. Figure 3 shows company profile data such as the industry in which the organisations operate (Figure 3).

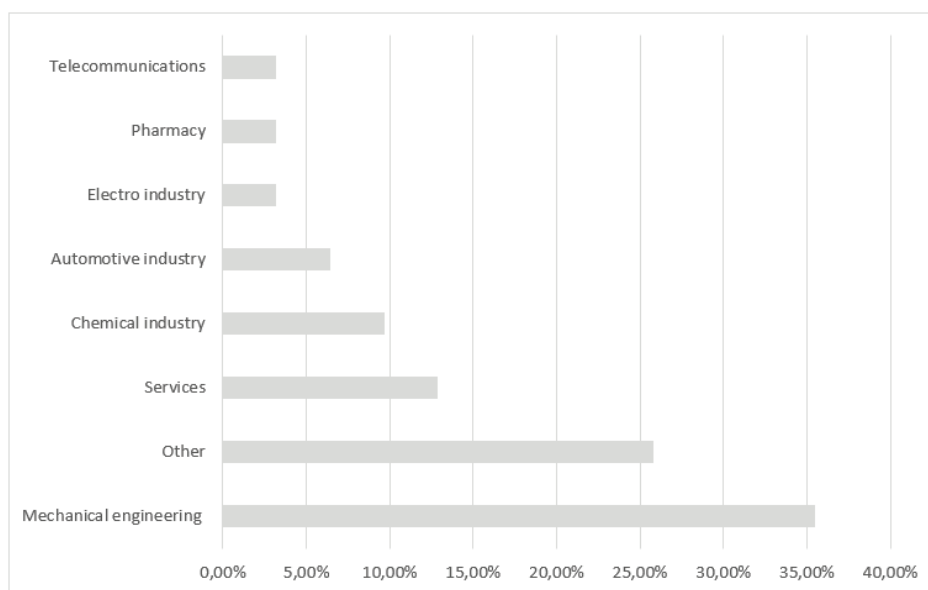


Figure 3: Sample - company profile

The data shows that the majority of the companies in our sample operate in the mechanical engineering industry (35%), followed by services (13%), chemical industry (9%), automotive industry (6%), pharmacy (3%) and telecommunication industry (3%).

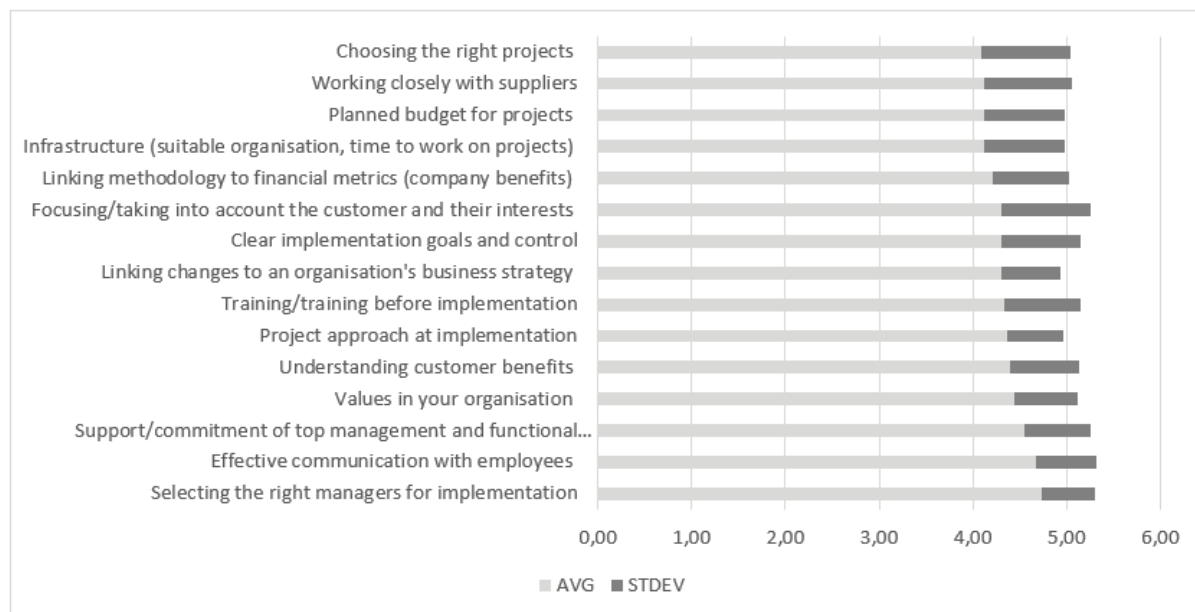
The results regarding the most important success factors for Six Sigma implementation are shown in Table 1 and Figure 4.

The results show that the most critical success factors for Six Sigma implementation in organisations are culture-related factors such as: (1) selecting the right managers for implementation, which scored 4.73 on a Likert scale of 1-5 in which 5 shows the highest importance, followed by (2) effective communications with employees, which scored 4.67 out of 5, while support and commitment of top management scored 4.55 out of 5 and support of values in organisations scored 4.45 out of 5.

The lowest score, but still an important success factor, was identified as proper project budget planning for Six Sigma implementation, which scored 4.12 out of 5, followed by close work with suppliers, which scored 4.12 out of 5, and choosing the right Six Sigma projects, which scored 4.09 out of 5 (Table 1, Figure 4).

Table 1: The most important success factors for Six Sigma implementation

Success factor	AVG	STDEV
Selecting the right managers for implementation	4.73	0.57
Effective communication with employees	4.67	0.65
Support/commitment of top management and functional managers	4.55	0.71
Values in your organisation	4.45	0.67
Understanding customer benefits	4.39	0.75
Project approach at implementation	4.36	0.60
Training/training before implementation	4.33	0.82
Linking changes to an organisation's business strategy	4.30	0.64
Clear implementation goals and control	4.30	0.85
Focusing/taking into account the customer and their interests	4.30	0.95
Linking methodology to financial metrics (company benefits)	4.21	0.82
Infrastructure (suitable organisation, time to work on projects)	4.12	0.86
Planned budget for projects	4.12	0.86
Working closely with suppliers	4.12	0.93
Choosing the right projects	4.09	0.95



Likert scale: 1-is not important, 2...,3...,4...5-is the most important
AVG - average, STDEV- standard deviation

Figure 4: The most important success factors for Six Sigma implementation

The starting point of Six Sigma implementation and its use in Slovenia was manufacturing organisations. Our sample of companies included in this research also reflects that structure. The majority of Slovenian manufacturing companies are still strongly related to the automotive industry and are usually a part of the European automotive industry supply chain. Slovenian manufacturing companies are export oriented. Clients (other companies), especially in the automotive industry, exert great pressure on cost efficiency, business efficiency and high product quality, so it is not surprising that Six Sigma methodology use prevails in Slovenian manufacturing companies. Market pressure in manufacturing organisations to achieve better productivity and operational excellence is constantly high. An analysis of the data regarding our sample also confirms this.

5. Conclusions

This study gives us an insight into the most critical success factors for successful Six Sigma implementation in organisations. An understanding of these factors and the findings of our research can improve decision making in organisations by setting the right priorities and consequently increase the probability of successful Six Sigma implementation in organisations.

The results show that the most critical success factors for Six Sigma implementation in organisations are culture-related factors such as: (1) selection of proper leaders, followed by (2) proper communication with employees before implementation and (3) top management commitment to change. The results of this study are supported by the results of the previous research projects and findings of Banuelas and Jiju 2002; Gošnik and Hohnjec 2009; Gošnik and Vujica-Herzog 2010; Kavčič and Gošnik 2016; Raval, Ravi and Ravi 2021; Jovanović et al. 2023.

The results of this study are relevant for researchers, Six Sigma practitioners, Six Sigma project managers, general managers and decision makers in organisations. The research is limited to a sample of 33 Slovenian organisations that were included in this research. The research results are heavily dependent on the sample and the participants' opinions. Moreover, this research is limited by the number

of companies which are using Six Sigma methodology in Slovenia. Another limitation is the data gathering method, as only one method, an online questionnaire, was used.

Future studies about this topic could include a larger sample, and comparison studies in time, as well comparisons with other countries could be made and a more varied research methodology could be employed. Additionally, comparison studies between success factors in manufacturing and service organisations could be performed in the future, as there are currently not enough services companies in Slovenia that have implemented Six Sigma.

We evaluate that, in the near future, service organisations in Slovenia will start implementation Six Sigma or similar methods (i.e. Lean) for business process optimisation. So, experiences from the manufacturing sector and lessons learned from our research can also be useful in ensuring the optimal implementation of Six Sigma in the service sector.

References

- Bagherian, Anthony, Mark Gershon, Sunil Kumar. 2023. Leadership style as an antecedent to effective Six Sigma implementation. *Journal of Advances in Management Research*. 20 (5): 821-854.
- Banuelas, Ricardo and Antony Jiju. 2002. Critical success factors for the successful implementation of six sigma projects in organisations. *The TQM Magazine*. 14 (2): 92-9.
- Goldstein, M.D. 2001. Six sigma program success factors. *ASQ Six Sigma Forum Magazine*, 1 (1): 36-45.
- Bhat, Shreeranga, Antony Jiju, Maher, Maalouf Gijo and E.V., Souraj Salah. 2023. Applications of six sigma for service quality enhancement in the UAE: a multiple case study analysis and lessons learned. *International Journal of Lean Six Sigma*. 14 (7): 1492-1517.
- Gošnik, Dušan and Matej Hohnjec. 2009. Selection criteria for six sigma projects in Slovenian manufacturing companies. *Organizacija: Journal of Management, Information Systems and Human Resources* 42 (4): 137-143.
- Gošnik, Dušan and Nataša Vujica-Herzog. 2010. Success factors for Six sigma implementation in Slovenian manufacturing companies. *Advances in production engineering & management* 5 (4): 205-216.
- Jovanović, Ivona, Milena Gatić, Dragana Stojanović and Dušan Gošnik. 2023. Lean transformation success: the role of management and employee engagement. *Management: Journal of sustainable business and management solutions in emerging economies*. (Forthcoming): 1-9.
- Kavčič, Klemen and Dušan Gošnik. 2016. Lean Six Sigma education in manufacturing companies: the case of transitioning markets. *Kybernetes* 45 (9): 1421-1436.
- McCarty, D. Thomas and Sally A. Fisher. 2007. Six sigma: it is not what you think. *Journal of Corporate Real Estate* 9 (3): 187-196.
- Pereira dos Reis, Daniele Maia, Lizarelli Fabiane Letícia and Lillian Do Nascimento Gambi. 2024. Industry 4.0 and Six Sigma: a systematic review of the literature and research agenda proposal. *Benchmarking: An International Journal* 31 (3): 1009-1037.
- Raval, Shuti J., Kant Ravi and Shankar Ravi. 2021. Analyzing the critical success factors influencing Lean Six Sigma implementation: fuzzy DEMATEL approach. *Journal of Modelling in Management* 16 (2): 728-764.
- Snee, Ronald. D. 2004. Six sigma: the evolution of 100 years of business improvement methodology. *International Journal of Six Sigma and Competitive Advantage* 1(1): 4-20.