Decision Making in Manufacturing and Services
Vol. 19 • 2025 • pp. 21–39

Critical Success Factors for Six Sigma Implementation – A Case Study from an Automotive Company Located in Poland

Marcin Nakielski*

Abstract. Six Sigma is a widely adopted method across many companies from different industries based in various locations in the world. As the proper implementation of Six Sigma is critical for the further success of the method in companies, researchers and practitioners are analyzing which factors play an important role in early stages of adaptation. This paper refers to Critical Success Factors (CSF) analyzed in various types of companies, industries and locations. Additionally, the paper brings the perspective of the problem from a company in the automotive sector of Poland. Survey studies on Critical Success Factors (CSF) for Six Sigma implementation were performed across engineering teams working on product development and process optimization. The summarized results show the perspective of Six Sigma practitioners on the most important factors, specific to the given sector and location. The findings offer valuable insights for managers who are defining Six Sigma implementation strategies and teams which are planning individual implementation steps. The results are important for companies in Poland but also can be generalized for any Six Sigma implementation practices.

Keywords: Six Sigma, Design for Six Sigma, DMAIC, implementation, automotive, Critical Success Factors, CSF

Mathematics Subject Classification: 62C99

JEL Classification: C44

Submitted: May 4, 2025

Revised: July 16, 2025

1. INTRODUCTION

The Six Sigma concept, introduced by Motorola in the 1980's, was developed to help companies optimize processes and therefore improve their financials. Six Sigma is

* AGH University of Krakow, AGH Doctoral School, Kraków, Poland, Nexteer Automotive Poland Sp. z o. o., Tychy, Poland, e-mail: nakielsk@agh.edu.pl.

a disciplined, project-oriented, statistically based approach for reducing variability, removing defects, and eliminating waste from products, processes, and transactions (Montgomery & Woodall, 2008). Six Sigma can be described as an improvement program aimed at reducing variability by focusing on continuous and innovative improvement. The main goal of reducing variability in a production or service process is customer satisfaction (Noronha et al., 2023). In parallel, in some cases of application where process optimization is insufficient to meet the expectations of the process and business owners, project teams decide to redesign their products, processes or services from scratch. In these circumstances, teams reach for the 'design for Six Sigma' method. Design for Six Sigma is a powerful approach to designing products, processes and services in a cost-effective and simple manner in order to meet the needs and expectations of the customer (Anbari & Kwak, 2004).

Once Six Sigma had proven to be an effective method that brought significant benefits, more and more companies started the implementation of the program. Since then, researchers and practitioners have studied the implementation strategies that ensure the effective usage of the method, in turn guaranteeing significant profits to the companies in the shortest possible time. Publications related to Six Sigma concentrate on individual tasks for management and project teams in the early stages of program adaptation but also analyze the detailed organizational aspects that affect successful implementation. As a result of this work, researchers created the set of Critical Success Factors for Six Sigma implementation. Critical Success Factors are those few things that must go well to ensure success for a manager or an organization and therefore represent those managerial or enterprise areas that must be given special and continual attention to bring about high performance. CSFs include issues vital to an organization's current operating activities and to its future success (Boynton & Zmud, 1984). Every organization's creation of a Six Sigma set-up is unique, but there are factors common to every successful implementation (Breyfogle et al., 2001).

Based on the available papers, a common practice is that researchers target their work analyzing the CSF with regards to specific economic conditions, i.e. analyzing companies within a certain location or industry. There are also cases where an individual case study of a Six Sigma project is concluded with information about CSF for project success, i.e. Noronha et al. (2023): top management support, external expert mentoring, training, effective communication, teamwork, reliable data and statistical analysis are CSFs for the effective execution of a Six Sigma project.

This paper discusses the analysis of critical success factors for Six Sigma in an automotive company located in Poland. The purpose is to understand the perspective of engineering teams who are familiar with the method and are using it in tasks related to process optimization or product development. Therefore, the research question posed by the paper can be formulated as: "which critical success factors for Six Sigma implementation have the biggest impact on the success of the method in an automotive company located in Poland". Available studies on Six Sigma and its implementation in the industries located in Poland are limited, therefore this insight brings value for the academics and practitioners who are planning Six Sigma implementation strategies in Polish companies.

In order to find answers to the research question given, the studies were designed as shown on Figure 1. First, researchers started with the detailed analysis of the available literature on CSF. Conclusions from the analysis, supplemented with the personal observations of researchers, led to the development of a set of survey questions on the importance of individual critical success factors. Following, this based on the criteria of experience with the method, a set of respondents were selected. Next, data was collected based on an anonymous survey. Then the data was summarized and crosschecked with the previous studies. Lastly, a discussion of these results followed by a conclusion section was completed.

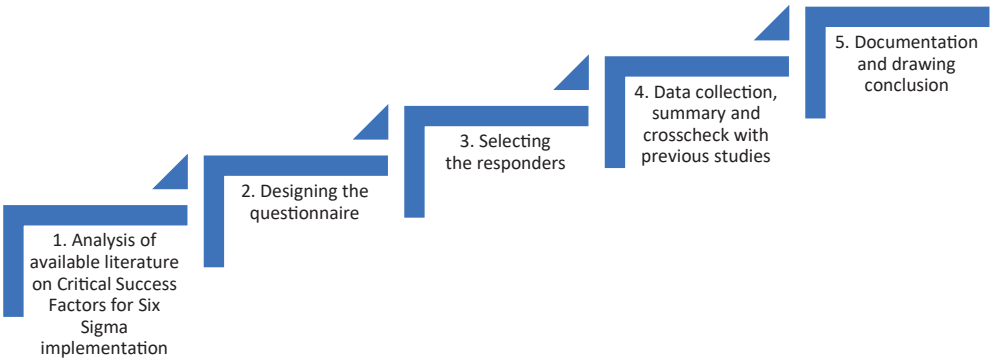

Fig. 1. *Research process*

This paper is structured in the following manner. First, the author brings the perspective of previous studies with regards to the topics raised in the Literature Review chapter. The research method adopted is described in the Methodology section. The results of the study, followed by the Discussion section, includes a summarized effect of the research crosschecked with selected results from other publications. Lastly, limitations and conclusions of the research are provided.

2. LITERATURE REVIEW

The topic of Critical Success Factors for Six Sigma implementation is widely described in the literature. Publications typically address specific localizations of the studied enterprises (i.e. studies completed among companies in India (Desai et al., 2012), UK (Antony et al., 2005), Turkey (Taner, 2013), or a specific industry – i.e. financial services (Chakraborty & Leyer, 2013) or manufacturing (Antony et al., 2005).

Singh & Singh (2020) present the effect of the literature research – systematic analysis of 64 different research publications and case studies from 34 different journals that are relevant in the context of Six Sigma. The authors used a Pareto diagram to present the list of most frequent CSFs found in the publications. The results of the analysis are shown in the graph below (Fig. 2).

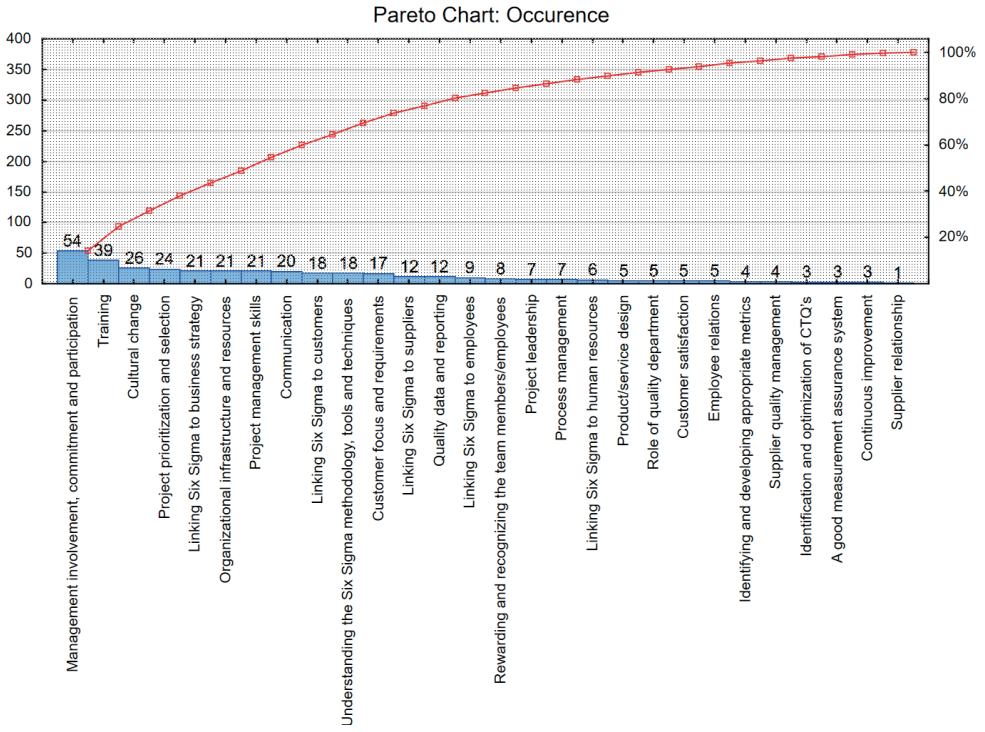

Fig. 2. *Pareto of CSFs based on research by G. Singh and D. Singh (2000) with occurrence in analyzed publications*

The most frequent critical success factors for Six Sigma implementation were described in Table 1. Next to the selected definitions based on the literature study, a list of the appropriate publications is presented.

Table 1. *Selected Critical Success Factor for Six Sigma implementation, its definitions based on the literature review supplemented with list of sources*

Most frequent Critical Success Factor based on literature review	Selected definitions of CSF based on literature study	Reviewed publications relevant to Critical Success Factor
Training	– implementation of the belt system; – identification of the key roles and responsibilities for project teams; – orientation towards statistical methods; – practical usage of the tools; – creation of the continuous improvement mindset; – training for organization leaders	Anbari & Kwak (2004), Antony et al. (2005), Bagherian et al. (2023), Banuelas Coronado & Antony (2002), Cheng (2007), Desai et al. (2012), Kumar et al. (2008), Kumar et al. (2009), Lande et al. (2016), Sandholm & Sorqvist (2002), Saraph et al. (1989)

Table 1 (cont.)

Most frequent Critical Success Factor based on literature review	Selected definitions of CSF based on literature study	Reviewed publications relevant to Critical Success Factor
Management involvement, commitment and participation	– management involvement in the implementation process; – definition of the implementation strategy; – connection of the strategic goals and Six Sigma; – understanding of the method by management; – access to resources provided by management; – monitoring the progress of the implementation and key metrics; – leadership support of Six Sigma as an improvement strategy for long term growth	Antony et al. (2005), Bagherian et al. (2023), Desai et al. (2012), Kumar et al. (2008), Lande et al. (2016), Sandholm & Sorqvist (2002), Saraph et al. (1989), Sharma & Chetiya (2012), Taner (2013)
Cultural change	– motivation of the Six Sigma teams towards project work and accomplishment of the project goals; – identifying the resistance towards Six Sigma implementation and proper reaction; – early communication of the Six Sigma implementation reasons in the company; – understanding of the Six Sigma implementation benefits for the company	Antony & Fergusson (2004), Antony et al. (2005), Bagherian et al. (2023), Banuelas Coronado & Antony (2002), Cheng (2007), Chakraborty & Leyer (2013), Desai et al. (2012), Sharma & Chetiya (2012)
Project prioritization and selection	– definition of the clear project selection criteria including; – examples of the project selection criteria: company financial profit, customer satisfaction, low performance of the processes, time to complete the project; – established connection of the project and company business strategy	Antony & Fergusson (2004), Antony et al. (2005), Chakraborty & Leyer (2013), Cheng (2007), Desai et al. (2012), Kumar et al. (2009), Sandholm & Sorqvist (2002)
Project management skills	– project goal definition and progress monitoring; – definition of roles and responsibilities in the project; – project timeline definition; – regular project reviews	Banuelas Coronado & Antony (2002), Desai et al. (2012), Laosirihongthong et al. (2006), McAdam & Evans (2004)

Table 1 (cont.)

Most frequent Critical Success Factor based on literature review	Selected definitions of CSF based on literature study	Reviewed publications relevant to Critical Success Factor
Linking Six Sigma to business strategy	– financial impact of the projects; – Six Sigma project impact on customer satisfaction; – established relation of the project and process improvements, i.e. rework, process efficiency, number of produced parts or services not meeting customer requirements	Antony & Banuelas Coronado (2002), Antony & Fergusson (2004), Banuelas Coronado & Antony (2002), Desai et al. (2012), Laosirihongthong et al. (2006), Szeto & Tsang (2005)
Organizational infrastructure and resources	– involvement of all departments of the company and active participation in the projects; – employee competency: Green Belts, Black Belts, Master Black Belts; – Six Sigma integration with existing processes; – providing resources and removing roadblocks for project teams	Antony & Banuelas Coronado (2002), Antony et al. (2005), Desai et al. (2012), Henderson & Evans (2000), Szeto & Tsang (2005), Waxer (2004)
Communication	– communication within the project team and between project teams and management; – communication strategy addressing employee's motivation towards project completion; – identification and addressing the implementation issues; – communication strategy on Six Sigma benefits	Banuelas Coronado & Antony (2002), Henderson & Evans (2000), Lande et al. (2016), Sandholm & Sorqvist (2002), Shanmugam (2007), Sharma & Chetiya (2012), Taner (2013)
Understanding the Six Sigma methodology, tools and techniques	– understanding of the DMAIC process; – theoretical and practical usage of statistical tools; – understanding of the KPI's and VOC's; – proper definition and adjustment of the training plans towards specific tasks	Desai et al. (2012), Henderson & Evans (2000), Manville et al. (2012), Yusof & Aspinwall (1999)
Linking Six Sigma to customers	– understanding of the customer requirements; – established connection between Six Sigma projects and customer satisfaction	Banuelas Coronado & Antony (2002), Laosirihongthong et al. (2006)

The available literature on Six Sigma implementation among Polish companies is limited. Individual papers describing Six Sigma usage point out critical factors for

Six Sigma success. Those are not only going to be specific to the location but also to the industry. For example, Lemke et al. (2021), while analyzing the application of Six Sigma in urban logistics, highlights potential risks for Six Sigma programs: lack of commitment of leaders and management, lack of competences, incorrect selection of projects for implementation, resistance to change or mistakes in understanding the client's needs as well as lack of data, while the concept effectiveness relies on the data quality. Similarly, Paslawski (2013), while analyzing the implementation of Six Sigma in construction SME, found that the Six Sigma concept seems to be difficult to implement in the construction industry due to the process stability required. Knop (2022), while studying the Six Sigma application for work safety related problems came to the following conclusions: Six Sigma methodology and the DMAIC cycle required the employees of the analyzed company to know the possibilities of using various types of tools, including statistical tools, which involved the need to conduct a number of training courses in this field and was time-consuming and costly, highlighting the importance of the tools and training as CSF. Efficient use of the Six Sigma DMAIC cycle and its effectiveness (analysis time, costs) also depends on the type of problem and its complexity, which underlines the need of proper project selection as CSF.

3. METHODS

A survey study was conducted to understand the impact of individual critical success factors from the perspective of the engineering personnel involved in Six Sigma projects in the company.

The study was performed in a large size company located in Poland which is responsible for the design and production of steering systems to the passenger vehicles for major European OEMs (Original Equipment Manufacturer). The company structure includes engineering specialists responsible for the design, mainly users of the Design for Six Sigma approach, as well as process optimization specialists, focusing on the DMAIC tools and methods.

Surveyed personnel were chosen based on the experience in Six Sigma related activities, starting with Six Sigma Champion and Black Belts, through Green Belts with current responsibilities of the project leaders. In total 20 participants provided answers in the study, which represents about 5% of the total engineering staff working in the company in Poland.

An anonymous survey dedicated to the Polish company was based on CSFs from the literature survey but, in the view of the author, was limited to the 20 most relevant factor. The top 13 factors of the highest occurrence from the literature review and factors presented to respondents in the Polish automotive company are common. Another 7 factors were chosen as most relevant to the characteristics of the company. The complete list of CSFs presented to the respondents is shown in Table 2. Engineers were asked to rate those factors on a scale from 1 to 5, where 1 has the lowest impact on the success of Six Sigma implementation, 5 is the highest impact. For further analyze and summary of the data arithmetic mean and median was used as well as rank position of the CSF, especially for the reference comparison with other studies known from literature.

Table 2. *List of Critical Success Factors in the order presented in the survey*

Number	Critical Success Factor for Six Sigma implementation
1	Quality data and reporting
2	Rewarding and recognizing the team members/employees
3	Project leadership
4	A good measurement assurance system
5	Communication
6	Linking Six Sigma to customers
7	Continuous improvement
8	Identifying and developing appropriate metrics
9	Project prioritization and selection
10	Management involvement, commitment and participation
11	Organizational infrastructure and resources
12	Customer focus and requirements
13	Linking Six Sigma to suppliers
14	Training
15	Project management skills
16	Process management
17	Role of quality department
18	Cultural change
19	Linking Six Sigma to business strategy
20	Understanding the Six Sigma methodology, tools and techniques

Respondents participating in the survey have extensive work experience as engineers (Fig. 3). 45% of the group questioned had more than 12 years of experience working as engineers. Another 45% represents the group that have from 8 to 12 years of experience. 10% of the respondents have between 4 and 8 years of experience.

Similarly, Six Sigma experience within the surveyed group is significant (Fig. 4). 35% of respondents have known about Six Sigma for 12 years or more. 5% represents 8 to 12 years of experience. Another 35% know Six Sigma for 4 to 8 years. The group of respondents that have known about Six Sigma for less than 4 years represent 25% of the questioned staff.

Besides years of experience, the group of respondents was asked about their subjective assessment of Six Sigma knowledge (Fig. 5). Engineers were asked to provide their assessment on the scale form 1–5, where 1 is the lowest level of knowledge of Six Sigma methods. 25% of respondents rated their knowledge level as 5, meaning the highest possible. 30% of respondents rated their knowledge level as 4. 35% of respondents rated their knowledge level as 3. Only 10% of respondents subjectively rated their knowledge of Six Sigma at the level of 2. Overall subjective perception of the knowledge of Six Sigma in the group is high.

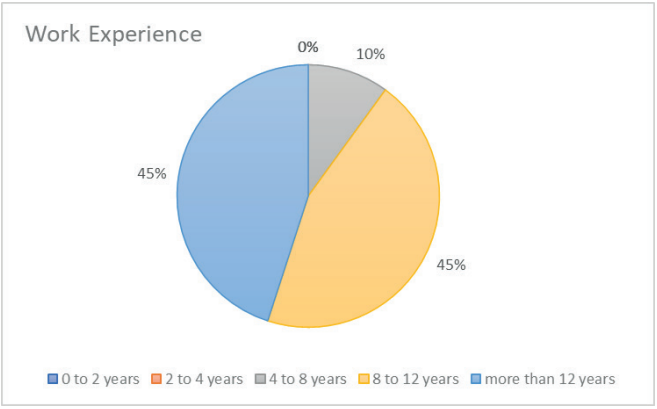

Fig. 3. *Work experience of the respondents*

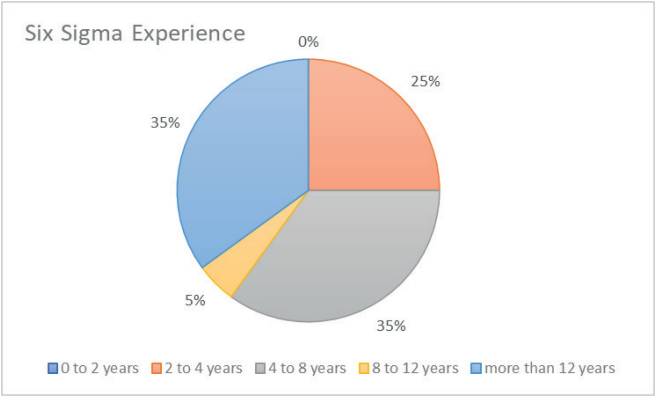

Fig. 4. *Six Sigma experience of respondents*

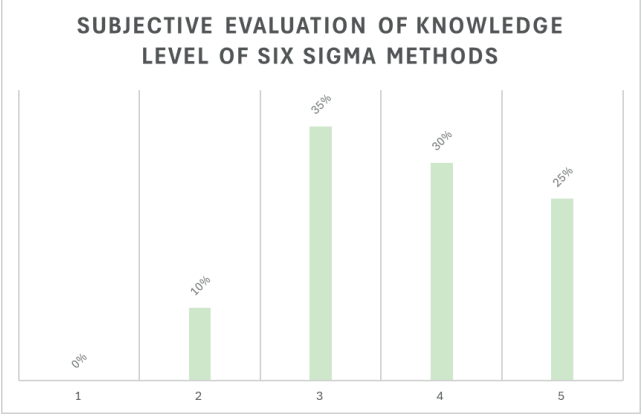

Fig. 5. *Subjective evaluation of the Six Sigma knowledge*

4. RESULTS

The survey results indicated the highest average result and median of the rating for understanding of the Six Sigma methodology, tools and techniques with the average results of 4.7 and median of 5.0. Nearly equally important, in the opinion of the respondents, is management involvement, commitment and participation and project management skills, both with an average of 4.6 and median of 5.0. The top results are completed by several CSF of an equal rating – an average of 4.4: quality and data reporting (median 5.0), continuous improvement (median 5.0), project selection and prioritization (median 4.5) and organizational infrastructure and resources (median 4.0). On the opposite end of the ranking, respondents placed linking Six Sigma to suppliers, with the average of 2.9 and median of 3.0, linking Six Sigma to customers, with the average of 3.15 and median of 3.0 and role of quality department with the average result of 3.45 and median of 3.0. Summarized results of the survey are shown in Table 3 followed by the graphical analysis (Figs. 6–8).

Table 3. *Results of the survey*

No.	Critical success factors for Six Sigma implementation	Mean	Median	Rank
1	Quality data and reporting	4.40	5.00	4
2	Rewarding and recognizing the team members/employees	3.65	4.00	16
3	Project leadership	4.30	4.00	8
4	A good measurement assurance system	4.00	4.00	12
5	Communication	3.85	4.00	13
6	Linking Six Sigma to customers	3.15	3.00	19
7	Continuous improvement	4.40	5.00	4
8	Identifying and developing appropriate metrics	3.65	3.50	16
9	Project prioritization and selection	4.40	4.50	4
10	Management involvement, commitment and participation	4.60	5.00	2
11	Organizational infrastructure and resources	4.40	4.00	4
12	Customer focus and requirements	3.70	4.00	15
13	Linking Six Sigma to suppliers	2.90	3.00	20
14	Training	4.20	4.00	9
15	Project management skills	4.60	5.00	2
16	Process management	3.85	4.00	13
17	Role of quality department	3.45	3.00	18
18	Cultural change	4.10	4.00	11
19	Linking Six Sigma to business strategy	4.15	4.00	10
20	Understanding the Six Sigma methodology, tools and techniques	4.70	5.00	1

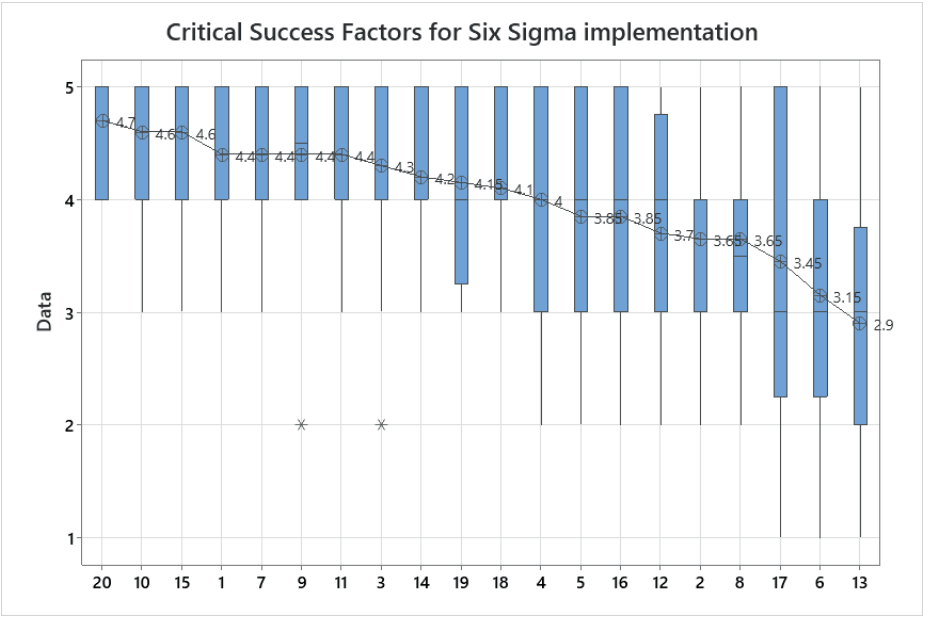

Fig. 6. *Results of the survey*

On top of the summarized data representing answers for all surveyed respondents, data were analyzed upon categorizing into groups of medium and high Six Sigma experience levels. Answers from respondents with more than 8 years of experience using the method were classified as high experience, while answers from respondents with less than 8 years of experience in Six Sigma were classified as medium. Since there were no respondents with experience levels below 2 years authors decided not to use low level of experience in data categorization. The results are presented in the graphs below (Figs. 7 and 8).

Noticeable differences between ratings from highly experienced users and users with medium experience are related to several CFSs. Firstly, management involvement, commitment and participation is the most important factor for experienced users, with an average rating of 4.8. For less experienced users, understanding the Six Sigma methodology, tools and techniques is more important, with an average rating of 4.8.

Another difference occurs with the rating of communication (high experience respondents rating average: 4.4, mid experience respondents rating average: 3.3), customer focus and requirements (high experience respondents rating average: 4.0, mid experience respondents rating average: 3.4), rewarding and recognizing the team members/employees (high experience respondents rating average: 3.9, mid experience respondents rating average: 3.4), identifying and developing appropriate metrics (high experience respondents rating average: 4.1, mid experience respondents rating average: 3.2), linking Six Sigma to customers (high experience respondents rating average: 3.6, mid experience respondents rating average: 2.7), linking Six Sigma to

suppliers (high experience respondents rating average: 3.5, mid experience respondents rating average: 2.3).

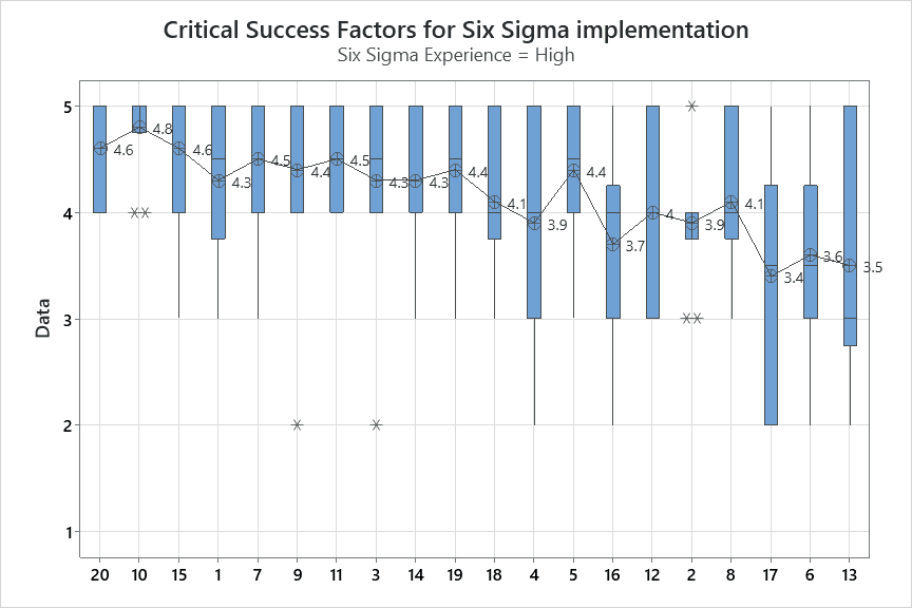

Fig. 7. *Critical Success Factor for Six Sigma users with high experience*

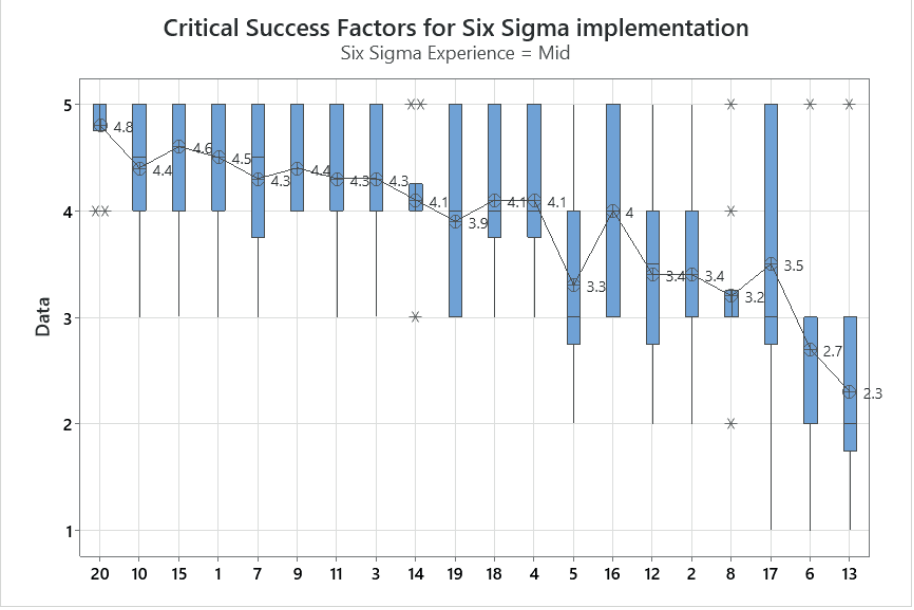

Fig. 8. *Critical Success Factor for Six Sigma users with medium experience*

On top of the results addressing specific CSF selected by the author of the survey, respondents had the opportunity to provide their opinion on important factors affecting the implementation of the method. The list below shows some of the answers to this open question:

- Available examples of the Six Sigma successful implementation with achieved benefits in the other enterprises,
- Cross department cooperation,
- Monitoring and control of implementation progress, including proper quality of the projects,
- Access to statistical software supporting Six Sigma, i.e. Minitab,
- Understanding the Six Sigma method by managers and their active participation in the projects.

5. DISCUSSION

Understanding Six Sigma methodology, tools and techniques was found as the most important Critical Success factor for Six Sigma implementation based on the survey conducted in an automotive company located in Poland. The result represents the voice of Six Sigma practitioners who are solving problems, optimizing processes and using the method for product development purposes. This Critical Success Factor is related to project leader competencies, familiarity with the tools and techniques and their application in the projects. Moreover, it is connected to the training and practice that Six Sigma teams gain with time and projects completed. As the main outcome of the study with regards to this CSF, a recommendation is to focus on the aspects of properly designed and conducted training, followed by properly coached projects to allow teams to gain experience and confidence with the tools. Answers to the open survey question about factors that are important for Six Sigma implementations seem to confirm this fact – respondents underlined the aspect of practical examples and benefits from the application of Six Sigma method, as well as access to statistical software that would help with the usage of complex tools.

The second important Critical Success Factor highlighted by the respondents is management involvement, commitment and participation. There are several management related tasks when it comes to Six Sigma success, starting with strategic aspects: the definition of the process KPI's, continuous improvement goal setting, establishing a connection between projects and strategic company goals or establishing guidance for project selection. Once projects are ongoing, management involvement should focus on the aspects of removing the roadblocks, decision making and monitor of the project progress. From the project leader point of view, which seems to be the dominant one in the survey, those are the most important areas of management involvement. Open question answers support this – respondents noted that control and monitoring of the Six Sigma progress and understanding the Six Sigma method by managers and their active participation in the projects are important factors from their perspective.

Comparing the results between employees with high and medium experience with Six Sigma it was observed that management involvement and understanding of the method, tools and techniques factors have different levels of importance for both groups. Once teams have more practice with them, understanding of the tools represents less importance, while management involvement gains in importance. This brings the following conclusion: Six Sigma teams are more confident with methods and tools once they gain more project experience and this aspect is no longer a roadblock for the project completion. Instead, management involvement, including decision making aspects and providing proper resource, gains importance towards successful project completion.

Project management skills are equally important as management involvement based on the survey results. The Six Sigma method is based on the stepwise project approach, with specific phases and tasks in each phase. To be an effective Six Sigma project leader, which is also universal to project leadership outside of Six Sigma activity, employees must have a certain skillset. This skillset contains, among others, the following competencies: leadership skills, communication, team working, management, problem solving skills, accountability and ethics.

Specific tasks and the organization of the company explain the lower results of linking Six Sigma success to suppliers and customers. The organization specific application of Six Sigma in the company is mainly related to process issues on production line in the plant or design process for new development. The voices of customers in both cases are taken into consideration, however the customer is not directly involved in project work. Similarly, suppliers can be affected by project results but are typically not directly involved.

Another aspect to take into consideration regarding conclusions from the study is a comparison of the results with the literature review and global perspective on the problem. Table 4 shows selected main Critical Success Factors and their ranking – firstly as rank based on occurrence in the literature, based on Singh & Singh's (2000) work, secondly the rank based on the case study survey conducted in a company from the automotive sector located in Poland.

Table 4. *Critical Success Factors ranking based on literature review and based on survey study*

Critical Success Factor for Six Sigma implementation	Rank based on occurence in literature review	Rank based on the case study survey results
Management involvement, commitment and participation	1	2
Training	2	9
Cultural change	3	11
Project prioritization and selection	4	4
Project management skills	6	2
Linking Six Sigma to business strategy	6	10

Table 4 (cont.)

Critical Success Factor for Six Sigma implementation	Rank based on occurence in literature review	Rank based on the case study survey results
Organizational infrastructure and resources	6	4
Communication	8	13
Understanding the Six Sigma methodology, tools and techniques	9.5	1
Linking Six Sigma to customers	9.5	19
Customer focus and requirements	11	15
Quality data and reporting	12.5	4

Management involvement, commitment and participation is a highly rated factor in both cases, both based on literature review occurrence and on the survey results from the automotive company located in Poland. Training and cultural change, one of the most important factors from the literature review, are ranked lower in the opinion of survey participants. Survey participants are Six Sigma practitioners, frequently project leaders with less exposure to strategic factors of implementation. This aspect could also be the reason for their highly rated understanding of the method, tools and techniques by survey participants, factor of high importance for the project team members. Similarly, the point of view of practitioners can be observed with a high rank of quality of data and reporting, whereas for strategic implementation the rank is lower.

6. LIMITATIONS

Limitations to the study and the data interpretation above are mainly related its scale being limited to a single company from the automotive market located in Poland. Although it brings valuable insights from the perspective of Six Sigma implementation, further studies are necessary to understand the perspective of the automotive market specific factors or to draw conclusions about a wider range of companies located in Poland. Such studies, designed to collect a broader perspective of the market with regards to critical factors for Six Sigma implementation, could offer the potential of valuable inputs for implementation teams or researchers seeking to obtain a better understanding of the Critical Success Factors in different countries or markets.

7. CONCLUSIONS

As Six Sigma, after nearly 40 years of its foundation, continues to prove its value in different markets and countries, researchers and practitioners can benefit from the understanding of the Critical Success Factors for the method's implementation in an

organization. The case study presented in the article supplies the perspective of an automotive company located in Poland on the topic. The survey study was conducted among employees with an engineering background who are practitioners in the method. The results of the study revealed that:

- The most important factor for the successful implementation of Six Sigma in the studied company is an understanding of the method, tools and techniques.
- The second important factor confirmed by the survey, as well as the literature review, is management involvement.
- Comparing more experienced responder answers with those who have a medium level of knowledge of the method, it was observed that management involvement is rated higher for the first group. This suggests that with more experience of the Six Sigma team tools and techniques, the roadblocks for project completion are more oriented towards management decisions and involvement.
- Project management skills complete the list of the highest ranked skills in the survey conducted.
- The least important factors for Six Sigma implementation are links between Six Sigma and suppliers or customer. This could be affected by the specific company organization and its tasks for Six Sigma teams, as the main goals for Six Sigma teams are related to problem solving, process optimization and product development.
- Both the literature review and the conducted study are aligned in terms of the importance rating of the following CSFs: management involvement commitment and participation; project selection and prioritization and organizational infrastructure and resource.
- The literature review and the conducted study are misaligned with the importance rating for the following CFSs: understanding of the method, tools and techniques; quality data and reporting; linking Six Sigma to customer and cultural change.

Despite the limitation of the conducted study to a single company, findings can be highly valuable for practitioners and researchers who are studying CSF for successful Six Sigma implementation. The most important factors analyzed can direct implementations for teams towards certain actions and priorities. The comparison between findings from the literature review and the survey reveals many similarities as well as important differences in Six Sigma implementation represented by Six Sigma practitioners from an automotive company located in Poland. For a broader understanding of the topic, further research among Polish companies is recommended.

REFERENCES

Anbari F.T. & Kwak Y.H. (2004). Critical success factors in managing six sigma projects. In: *Proceedings of PMI Research Conference*, London: Newtown Square, PA: Project Management Institute, July 11–14.

Antony J. & Banuelas Coronado R. (2002). Key ingredients for the effective implementation of a Six Sigma program. *Measuring Business Excellence*, **6**(4), pp. 20–27. **DOI:** https://doi.org/10.1108/13683040210451679.

Antony J. & Fergusson C. (2004). Six-Sigma in the software industry: results from a pilot study. *Managerial Auditing Journal*, **19**(8), pp. 1025–1032. **DOI:** https://doi.org/10.1108/02686900410557926.

Antony J., Kumar M. & Madu C.N. (2005). Six sigma in small and medium-sized UK manufacturing enterprises: some empirical observations. *International Journal of Quality & Reliability Management*, **22**(8), pp. 860–874. **DOI:** https://doi.org/10.1108/02656710510617265.

Bagherian A., Gershon M. & Kumar S. (2023). Leadership style as an antecedent to effective Six Sigma implementation. *Journal of Advances in Management Research*, **20**(5), pp. 821–854. **DOI:** https://doi.org/10.1108/JAMR-03-2023-0078.

Banuelas Coronado R. & Antony J. (2002). Critical success factors for the successful implementation of six sigma projects in organizations. *The TQM Magazine*, **14**(2), pp. 92–99. **DOI:** https://doi.org/10.1108/09544780210416702.

Boynton A. & Zmud R. (1984). An assessment of Critical Success Factors. *Sloan Management Review*, **25**(4), pp. 17–27.

Breyfogle F.W. III., Cupello J.M. & Meadows B. (2001). *Managing Six Sigma: A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success*. New York: Wiley and Sons.

Chakraborty A. & Leyer M. (2013). Developing a Six Sigma framework: perspectives from financial service companies. *International Journal of Quality & Reliability Management*, **30**(3), pp. 256–279. **DOI:** https://doi.org/10.1108/02656711311299836.

Cheng J.-L. (2007). Comparative study of local and transnational enterprises in Taiwan and their implementation of Six Sigma. *Total Quality Management & Business Excellence*, **18**(7), pp. 793–806. **DOI:** https://doi.org/10.1080/14783360701349864.

Desai D.A., Antony J. & Patel M.B. (2012). An assessment of the critical success factors for six sigma implementation in Indian industries. *International Journal of Productivity and Performance Management*, **61**(4), pp. 426–444. **DOI:** https://doi.org/10.1108/17410401211212670.

Henderson K.M. & Evans J.R. (2000). Successful implementation of Six Sigma: Benchmarking General Electric Company. *Benchmarking: An International Journal*, **7**(4), pp. 260–281. **DOI:** https://doi.org/10.1108/14635770010378909.

Knop K. (2022). Using Six Sigma DMAIC Cycle to improve workplace safety in the company from automotive branch: A case study. *Manufacturing Technology*, **22**(3), pp. 297–306. **DOI:** https://doi.org/10.21062/mft.2022.040.

Kumar M., Antony J., Madu C.N., Montgomery D.C. & Park S.H. (2008). Common myths of Six Sigma demystified. *International Journal of Quality & Reliability Management*, **25**(8), pp. 878–895. **DOI:** https://doi.org/10.1108/02656710810898658.

Kumar R., Garg D. & Garg T.K. (2009). Total quality management in Indian industries: relevance, analysis and directions. *The TQM Journal*, **21**(6), pp. 607–622. **DOI:** https://doi.org/10.1108/17542730910995873.

Lande M., Shrivastava R.L. & Seth D. (2016). Critical success factors for lean six sigma in SMEs (small and medium enterprises). *The TQM Journal*, **28**(4), pp. 613–635. **DOI:** https://doi.org/10.1108/TQM-12-2014-0107.

Laosirihongthong T., Rahman S. & Saykhun K. (2006). Critical success factors of Six-Sigma implementation. *International Journal of Innovation and Technology Management*, **3**(3), pp. 303–319. **DOI:** https://doi.org/10.1142/S0219877006000818.

Lemke J., Kijewska K., Iwan S. & Dudek T. (2021). Six Sigma in urban logistics management – A case study. *Sustainability*, **13**(8), 4302. **DOI:** https://doi.org/10.3390/su13084302.

Manville G., Greatbanks R., Krishnasamy R. & Parker D.W. (2012). Critical success factors for lean six sigma programmes: A view from middle management. *International Journal of Quality & Reliability Management*, **29**(1), pp. 7–20. **DOI:** https://doi.org/10.1108/02656711211190846.

McAdam R. & Evans A. (2004). The organisational contextual factors affecting the implementation of Six-Sigma in a high technology mass-manufacturing environment. *International Journal of Six Sigma and Competitive Advantage*, **1**(1), pp. 29–43. **DOI:** https://doi.org/10.1504/IJSSCA.2004.005276.

Montgomery D.C. & Woodall W.H. (2008). An overview of Six Sigma. *International Statistical Review / Revue Internationale de Statistique*, **76**(3), pp. 329–346. **DOI:** https://doi.org/10.1111/j.1751-5823.2008.00061.x.

Noronha A., Bhat S., Gijo E.V., Antony J., Laureani A. & Laux C. (2023). Performance and service quality enhancement in a healthcare setting through lean six sigma strategy. *International Journal of Quality & Reliability Management*, **40**(2), pp. 365–390. **DOI:** https://doi.org/10.1108/IJQRM-07-2021-0226.

Paslawski J. (2013). Hybrid flexible approach for Six Sigma implementation in constructional SME. *Journal of Civil Engineering and Management*, **19**(5), pp. 718–727. **DOI:** https://doi.org/10.3846/13923730.2013.804433.

Sandholm L. & Sorqvist L. (2002). 12 Requirements for six sigma success. *Six Sigma Forum Magazine, ASQ*, **2**(1), pp. 17–24.

Saraph J.V., Benson P.G. & Schroeder R.G. (1989). An instrument for measuring the critical factors of quality management. *Decision Sciences*, **20**(4), pp. 810–829. **DOI:** https://doi.org/10.1111/j.1540-5915.1989.tb01421.x.

Shanmugam V. (2007). Six sigma cup: Establishing ground rules for successful six sigma deployment. *Total Quality Management & Business Excellence*, **18**(1/2), pp. 77–82. **DOI:** https://doi.org/10.1080/14783360601043245.

Sharma S. & Chetiya A.R. (2012). An analysis of critical success factors for six sigma implementation. *Asian Journal on Quality*, **13**(3), pp. 294–308. **DOI:** https://doi.org/10.1108/15982681211287810.

Singh G. & Singh D. (2020). CSFs for Six Sigma implementation: A systematic literature review. *Journal of Asia Business Studies*, **14**(5), pp. 795–818. **DOI:** https://doi.org/10.1108/JABS-03-2020-0119.

Szeto A.Y.T. & Tsang A.H.C. (2005). Antecedents to successful implementation of Six Sigma. *International Journal of Six Sigma and Competitive Advantage*, **1**(3), pp. 307–322. **DOI:** https://doi.org/10.1504/IJSSCA.2005.008094.

Taner M.T. (2013). Critical success factors for six sigma implementation in large-scale Turkish construction companies. *International Review of Management and Marketing*, **3**(4), pp. 212–225.

Waxer C. (2004). Is Six Sigma just for large companies? What about small companies? **URL:** https://www.isixsigma.com/getting-started/six-sigma-just-largee-companies-what-about-small-companies/ [24.04.2024].

Yusof S.M. & Aspinwall E. (1999). Critical success factors for successful implementation of TQM in SMEs. *Total Quality Management*, **10**(4/5), pp. 803–809. **DOI:** https://doi.org/10.1080/0954412997839.