Appendix A. Synthesised LSS Limitations

Limitations	Description	References
High implementation cost	High startup costs deter both small and large organisations from adopting Six Sigma.	Albliwi et al. (2014), Sony et al. (2020b)
Implementing a structured improvement method like Six Sigma may hinder organisational innovation	A prior study showed that Six Sigma, which originally focused on structured improvement, shifted towards a statistical process approach, neglecting broader business improvement.	Sony et al. (2020b)
Ineffective project management	Many Lean Six Sigma projects fail due to inadequate project management skills, often when inexperienced Master Black Belts or Black Belts are chosen.	Albliwi et al. (2014)
Lack of a performance measurement system	Organisations often miss out on the benefits of lean strategies due to a lack of performance metrics for assessing effectiveness and efficiency improvements.	Aboelmaged (2011), Albliwi et al. (2014)
Lack of an effective model or roadmap to guide the implementation/ Lack of understanding of how to get started	A lack of understanding and a lack of effective models for guiding LSS program implementation contribute to project failures.	Albliwi et al. (2014)
Lack of application of statistical theory	In many small companies, management lacks the theoretical knowledge and may even be intimidated by discussions involving statistical tools.	Aboelmaged (2011), Albliwi et al. (2014)
Lack of awareness of the benefits of Lean/Six Sigma	Lack of awareness about the benefits of quality improvement programs hinders successful deployment and leads to unclear strategies.	Albliwi et al. (2014)
Lack of awareness of the need for Lean/Six Sigma	Management commitment is crucial for LSS success, but many managers are unaware of its benefits.	Albliwi et al. (2014)
Lack of clear vision and a future plan	A lack of visionary leadership hampers the introduction and deployment of LSS initiatives, affecting culture and employee empowerment.	Albliwi et al. (2014)
Lack of consideration of the human factors	Employees often lack motivation to participate in LSS initiatives due to workload, fear of change, or lack of recognition and decision-making power.	Albliwi et al. (2014)

Appendix A. Synthesised LSS Limitations

Limitations	Description	References
Lack of data and poor data for analysis	A prevalent feature of Six Sigma projects involves a reliance on data, making issues related to missing or low-quality data a frequent challenge.	Aboelmaged (2011), Albliwi et al. (2014)
Lack of employee engagement and participation/lack of team autonomy	Overloaded employees, fear of change, lack of recognition, and limited decision-making authority can hinder motivation to participate.	Albliwi et al. (2014)
Lack of estimation of implementation cost	Uncertainty about startup costs and the expense of hiring experienced Six Sigma professionals deter organisations from adoption.	Albliwi et al. (2014)
Lack of experience in Lean/ Six Sigma project implementation	Organisations often lack the experienced Master Black Belts or Black Belts necessary to train and lead Lean Six Sigma initiatives.	Albliwi et al. (2014)
Lack of link between LSS and customer needs	LSS strategies should align with customer needs to ensure their satisfaction and the continued success of initiatives.	Albliwi et al. (2014), Sony et al. (2019)
Lack of process thinking and process ownership	Processes are often overlooked in favour of focusing on tasks and activities.	Albliwi et al. (2014)
Lack of resources	A shortage of resources, whether financial, technical, or human, is a major barrier to LSS success.	Aboelmaged (2011), Albliwi et al. (2014), Sony et al. (2019)
Lack of top management attitude, commitment and involvement	At times, top management may offer nominal support to initiatives without genuine commitment, which can harm LSS success.	Albliwi et al. (2014), Sony et al. (2019)
Lack of training and education	Comprehensive training, both in statistical tools and soft aspects like change management, is critical for LSS success.	Albliwi et al. (2014), Sony et al. (2019)

Appendix A. Synthesised LSS Limitations

Limitations	Description	References
Large toolset/Wrong selection of LSS tools	Incorrect tool usage can lead to incorrect decisions, undermining the LSS program.	Albliwi et al. (2014), Sony et al. (2019)
LSS projects are time-consuming	LSS projects take time to yield results and require significant commitment from project leaders.	Aboelmaged (2011), Albliwi et al. (2014)
Misalignment between the project aim, the main goals of the company and the customer demand	The absence of alignment between the project's goals, the organisation's strategy, and customer needs presents an issue.	Albliwi et al. (2014), Sony et al. (2019)
Misuse of statistics	Using statistical tools incorrectly can lead to flawed decision-making, potentially causing the organisation to stop its Lean Six Sigma efforts.	Sony et al. (2019)
Negative impact on customer satisfaction if not implemented properly	Improper implementation of Six Sigma can negatively impact customer satisfaction, like any other improvement initiative.	Antony and Sony (2019), Sony et al. (2020b)
Non-standardisation of the curriculum	Different countries have varying training standards tailored to industries and companies.	Antony and Sony (2019), Sony et al. (2020b)
Poor communication	Effective communication channels at all levels are crucial for team engagement in improvement projects.	Albliwi et al. (2014)
Poor execution	Poor execution of projects, including planning, communication, and tool usage, can lead to process improvement failures.	Albliwi et al. (2014)

Appendix A. Synthesised LSS Limitations

Limitations	Description	References
Poor implementation of Six Sigma can have a negative impact on employee satisfaction	Varying levels of Six Sigma implementation can affect employee job satisfaction and morale negatively.	Antony and Sony (2019)
Poor LSS project selection and prioritisation	The right project selection is critical for timely and convincing results.	Albliwi et al. (2014), Sony et al. (2019)
Poor selection of candidates for belts training	A common mistake made by many organisations is to prioritise personnel selection over aligning their plans with the specific needs of the project.	Albliwi et al. (2014)
Premature discontinuation of LSS expert	LSS experts should be retained until sustainable results are achieved, preventing discontinuation of initiatives.	Sony et al. (2019)
Resistance to cultural change	Culture change in organisations is a lengthy process, involving shifts in employee habits, attitudes, and mindset towards fostering a culture of confidence and trust. This difficulty in cultural change is a significant reason for the failure of most continuous improvement projects.	Albliwi et al. (2014)
Six Sigma lacks innovation	Six Sigma methodology incorporates traditional quality improvement tools within a new framework.	Antony and Sony (2019), Sony et al. (2020b)
Six Sigma stifles employee creativity and innovation	The structured and rigid nature of Six Sigma can hinder employee creativity and innovation.	Antony et al. (2019), Antony and Sony (2019), Sony et al. (2020b)

Appendix A. Synthesised LSS Limitations

Limitations	Description	References
The benefits of Six Sigma implementation do not outweigh the effort and costs of implementation	Implementing Six Sigma requires significant time and resources relative to the minimal benefits obtained.	Antony et al. (2019), Antony and Sony (2019), Sony et al. (2020b)
Unrealistic expectations from LSS	Unrealistic expectations from top management or external influences can hinder LSS initiatives.	Sony et al. (2019)
Unsustainable results	Neglecting behavioural aspects in LSS initiatives can lead to unsustainable results and discontinuation.	Aboelmaged (2011), Sony et al. (2019),
Weak linking to suppliers	If suppliers don't embrace lean practices, the organisation's own lean efforts can become less effective.	Albliwi et al. (2014)