| Authors (Year) | Framework / Model/ Roadmap / Method / Guideline | Limitations | Category | Applied in practice |
| --- | --- | --- | --- | --- |
| Arcidiacono and Pieroni (2018) | Lean Six Sigma 4.0 approach | No framework, just an approach that is very specific to hospital processes. A mapping between LSS tools and I4.0 tools would be beneficial. CTQ monitoring through usage of sensors and smart devices is allocated to the Improve phase, but it is not clear which LSS tool is enhanced here that would belong to Improve. | Specialised | YES (single-case) |
| Azadeh-Fard et al. (2019) | Framework based on CRISP-DM | Specific for hospitals. No enhancement of LSS tools by digital tools. Only control charts designed for hospital usage and length-of-stay anomaly detection purposes.The analysis is after the fact, not predictive. | Specialised | YES (single-case) |
| Belhadi et al. (2021) | Framework integrating BDA with Green tools and LSS tools | Define phase is not covered by BDA solutions and depends on traditional LSS tools such as SIPOC. Specific for chemical industry and green LSS. | Well-balanced | YES (single-case) |
| Chiarini and Kumar (2021) | Framework to integrate LSS methods and DMAIC with Industry 4.0 technologies | A comprehensive framework, but mapping of I4.0 technologies to DMAIC phases, is too high level. The focus is on how LSS can make I4.0 implementations more successful. | Mutual support | YES (single-case) |
| Fahey et al. (2020) | Hybrid Business Analytics framework based on Six Sigma and CRISP-DM  | Only some DMAIC phases are covered by innovative techniques. Although the authors refer to Big Data, the Data set used was quite small so model accuracy is not maximised. Still depending on traditional statistical tools for the Control phase. | Partial | YES (single-case) |
| Ghosh and Maiti (2014) | Framework based on DMAIC that integrates Data Mining techniques | The framework covers all DMAIC phases, but the DM solution only enhances the Analyse phase. Other phases still depend on traditional Six Sigma techniques. | Partial | YES (single-case) |
| Graafmans et al. (2021) | Framework and guide to integrate PM with Six Sigma DMAIC | The framework presented was developed from PM perspective and not all DMAIC activities are supported. It would be beneficial to start from DMAIC point of view an integrate PM techniques into Six Sigma tools. The case study was not performed in real-world settings. | Well-balanced | YES (single-case) |
| Gupta et al. (2020) | Framework integrating BDA techniques and DMAIC | The framework proposes 18 BDA techniques for DMAIC phases but is very high-level and the applicability of the proposed framework is not tested. | High-level | NO |
| Hsiao et al. (2016) | Framework based on DMAIC that integrates Data Mining techniques | Framework presented only integrates DM in Analyse phase. | Partial | YES (single-case) |
| Koppel and Chang (2021) | MDAIC as renovated DMAIC framework integrating Big Data strategies | The framework does not provide solutions for a typical DMAIC project. Instead, it focuses on enhancing the Measure phase through Big Data technology and the Control phase with the Big Data framework MapReduce to enhance SPC. The analysis is based on control charts and new CI projects are defined and prioritized based on those findings. Define, Analyse and Improve phases are only sparsely covered. | Well-balanced | YES (single-case) |
| Kregel et al. (2021) | Method for Integrating Process Mining into Six Sigma’s DMAIC | PM implementation in such a short time frame is only realistic for a very limited scope or for an experiment. A full-scale PM implementation requires many more system integrations and extensive design concepts. The implementation must have therefore been rather experimental than a production deployment. | Well-balanced | YES (single-case) |
| Laux et al. (2017) | Conceptual framework for integrating Six Sigma DMAIC and Big Data techniques | The innovations proposed are solely based on Big Data and the framework remains rather high-level. It does not exploit other opportunities offered by I4.0 era and is tailored for higher education. The framework has not been tested in real world. | Specialised | NO |
| Morlock and Boßlau (2021) | Approach for integration of LSS DMAIC methods with CRISP-DM | The idea of integrating process knowledge into data science projects serves the purpose to make data science projects more successful. But it also works the other way around. Only integration with data mining. | Mutual support | YES (single-case) |
| Park et al. (2020) | 3S LSS paradigm/framework5 steps DMAIC roadmap | The framework is very high-level; Big Data, AI and IOT are enablers for speedy and smart LSS, but specific tools or techniques are mentioned. | High-level | YES (single-case) |
| Schäfer et al. (2019) | Model for integrating DMAIC and CRISP-DM phases | This is an integration from CRISP-DM perspective with the aim to provide a guide for data mining starters. It only considers data mining. | Mutual support | YES (single-case) |
| Shivajee et al. (2019) | Frameworks combining quality control tools with digital tools along DMAIC | The Improve phase relies on traditional tools and was not enhanced by digital technologies. Only Measure and Analyse are enhanced by digital tools. | Partial | YES (single-case) |
| Sordan et al. (2021) | Conceptual framework for the implementation of contact points between LSS practices and I4.0 technologies | The framework is specifically designed for the manufacturing sector. No roadmap, no mapping to DMAIC phases. Literature review was mainly based on conference papers and proceedings. Framework has not been empirically tested. | High-level | NO |
| Tay and Loh (2021) | Framework integrating DMAIC and digital technologies and CRISP-DM | The framework is very high-level. Focus on Lean tools but no details on how were enhanced by digital technologies have been provided. Also, it is specifically designed for supply chain management. | High-level | YES (single-case) |
| Vinodh et al. (2021) | Framework for integrating CI strategies with I4.0 | There is no reference to DMAIC phases and no roadmap. The framework lacks practical validation and for a real-world application. | High-level | NO |
| Zgodavova et al. (2020) | Lean Six Sigma Small Mixed Batch production system method | The method is specific for manufacturing companies with small and medium sized batches. The prediction model is based on historical instead of real-time data and a very small sample size (<30) | Specialised | YES (single-case) |
| Zwetsloot et al. (2018) | Integrated CRISP-DM and DMAIC roadmap and selection matrix of solution methods | Quite high-level, i.e., more focused on organisational aspects and project approach rather than the application of certain tools and techniques. | Mutual support | YES (multi-case) |