Proceedings of the Design Society, Volume 6: DESIGN 2026
https://doi.org/10.1017/pds.2026.10390

Agile alignment in production system development processes

Julia Trolle✉ and Carin Rosio

Jönköping University, Sweden

✉ Julia.Trolle@ju.se

ABSTRACT: This study explores the alignment of production system development processes (PSDP) with agile principles in the automotive industry. A multiple case study of eight companies reveals low overall alignment, with OEMs and subcontractors constrained by sequential, stage-gate structures, while engineering consultants show higher agility in early phases. Findings suggest gradual adoption of hybrid models, culural changes and iterative planning to enhance flexibility and responsiveness.

KEYWORDS: production design, agile development, process improvement

1. Introduction

Industrial manufacturing within the automotive industry is undergoing rapid transformations, driven by increasing demands for flexibility, responsiveness and technological integration. As companies continuously seek to develop production systems, they face challenges of developing and designing modular and adaptable systems capable of accommodating evolving product requirements and emerging technologies. Traditionally, the production system development process (PSDP) has been managed using sequential models such as stage-gate or waterfall. These are often combined with ad-hoc problem solving (Koren et al., 2018; Säfsten, 2010). These models structure work into distinct phases with formal reviews and deliverables, offering clarity and traceability (Cooper, 2013). However, their rigidity often results in longer lead times, exceeding budgets, documentation overload and limited possibility for flexibility (Patil, 2019; Yazdani, 1999). These types of development processes are further complicated by high levels of uncertainty, especially in early project phases where decisions must be made with limited information and shifting conditions (Pinto & Slevin, 1987; Trolle et al., 2020). The complexity of production system development and the need for cross-functional collaboration across functions and departments, requires coordinated efforts and shared understanding, which has also been highlighted by many researchers. In this context, traditional project management approaches could possibly fall short in addressing the dynamic and iterative nature of production system development. Agile project management, which is rooted in software development, promotes e.g. iterative progress and cross functional collaboration through its 12 agile principles. Its adaptability has proven to be effective to deal with these challenges in other contexts (Fernandez & Fernandez, 2008). Although agile principles and their adaptation in software and product development have been widely examined, there is limited empirical evidence regarding their consideration or application within PSDP. Existing studies focus primarily on theoretical frameworks or hybrid models in product development, leaving a gap in understanding how agile principles or various agile methods can be operationalized in production contexts (Luna et al., 2020; Sommer et al., 2015). This paper addresses a research gap by investigating how current PSDP align with agile principles in the automotive industry.

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

2. Methodology

In this research, a multiple case study was carried out comprising eight companies within the automotive industry. The automotive industry operates in a dynamic environment with frequent technological and market changes. This makes it an ideal context for exploring agile principles in production system development. Furthermore, all companies were characterized by having high demands for customization. This research aligns with Yin's (2018) definition of a case study, which involves an in-depth investigation of a contemporary phenomenon within its real-world context, particularly when the boundaries between the phenomenon and its context are unclear.

The selection of respondents was based on two main criteria's: all respondents needed to have several years of experience in production system development to ensure relevant and high-quality insights and at least two Original Equipment Manufacturers (OEM) had to be included. OEMs manage both product and production development and the integration of these, providing a broader perspective and more comprehensive feedback. First tier subcontractors and an Engineering consultant involved in PSDP were also included to capture different viewpoints across the supply chain, which improved the generalizability of the findings. The multiple case study was carried out through a combination of questionnaires, semi-structured interviews and reviews of various internal documents. The questionnaire, distributed prior to interviews, provided initial insights into the production system development processes of each stakeholder and their familiarity to agile methodology. None of the subcontractors or engineering consultants had formally implemented Scrum, SAFe or other agile methodologies in their PSDP, but all respondents were familiar with the concept of agile methods. Although respondents varied in their level of familiarity with agile concepts: most had encountered agile in product or software development contexts, but none had received formal agile training specific to production system development. The OEM companies A, B, and C were more familiar with agile methodologies, particularly SAFe, which is used within their organizations today, but its application is focused on software and product development and has limited influence on production system development. The interview guide therefore included clarifying questions to ensure that responses, regardless of their prior agile knowledge, reflected actual practices rather than assumed knowledge. This context is important for interpreting findings, as low alignment with agile principles or methods does not necessarily imply resistance but may reflect limited exposure to agile frameworks in PSDP.

This study focuses on Scrum because it is the most widely recognized and clearly defined agile framework, and it is also the method most directly aligned with the Agile Manifesto and its twelve principles, making it a suitable basis for structured comparison with current PSDP practices. Concentrating on one framework avoids conceptual overlapping with other agile methods, such as Kanban or SAFe.

Twelve interviews were conducted with respondents from eight companies via both face-to-face and digital interview meetings. Internal documents, such as process charts, were reviewed to validate and enrich the findings.

The empirical data was analysed through a structured comparative approach. The Likert scoring followed a structured analytic procedure. Evidence for each agile principle was first categorized and sorted from questionnaires, interviews and documents using directed content analysis. Scores were then assigned by triangulating whether at least two data sources supported the same pattern. To ensure consistency and reliability, codes and scores were revisited in a second review cycle and cross-checked across cases to maintain correct interpretations. The results were organized into matrices, while interview transcripts and notes were synthesized into summaries for each respondent. These summaries were systematically reviewed to identify patterns, similarities and deviations across cases. A 5-point Likert scale was later used to quantify the level of alignment to each agile principle for the three stakeholder groups. Likert scales are widely used in organizational and maturity assessments due to their simplicity, interpretability, and ability to convert qualitative judgments into ordinal numerical data (Joshi et al., 2015). Each Agile principle was evaluated based on evidence from interviews and documentation. The scale was anchored in observable behaviours: a score of 1 indicates explicit non-alignment, while a score of 5 indicates consistent, systematic practice of the principle.

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

The coding was performed through directed qualitative content analysis, ensuring that each score was grounded in empirical evidence. In addition to examining alignment with the twelve agile principles, the interview protocol also explored the use of agile mechanisms such as daily stand-ups, time-boxed iterations, sprint retrospectives and review activities and the presence of agile roles (e.g., product owner, scrum master).

Table 1. Multiple case study overview

Company Type	Number of Companies: (No. of interviews)	Company Characteristics	Company X: Respondent role
OEM	4: A (2), B (1), C (1), D (1)	Company A, B, C: Large international companies with extensive supply networks and production and development facilities worldwide. Company D: In-house product development and production on the same site.	A: Senior Development Engineer (2 interviews with same respondent) B: Manufacturing Manager C: Automation Manager D: Head of Manufacturing
Sub-contractor	3: E (1), F (2), G (1)	Company E, F, G: Contract Manufacturers. Component and material suppliers to OEM and all have experience in developing their own production systems (owning their own production system projects). 1st tier supplier, Company G, also develops some products by themselves which they produce and sell.	E: Strategic Sales - Advanced Manufacturing F: Head of Product & Process Development G: Director of Technology
Engineering consultants	1: H (4)	Company H: Collaborates with all other companies, mainly active in early phases (initiation, conceptual design).	H: Industrial Developer (2 respondents), CEO, Head of Business Development

3. Theoretical background

3.1. Production system development process

Increasing market dynamics, customer demands for customization and shorter product life cycles are driving companies toward more flexible and sustainable production solutions. Reconfigurable production systems (RMS), built on modularity, are essential for enabling production systems to adapt to changing requirements while minimizing resource waste (ElMaraghy, 2008; Koren et al., 2018; Rösiö, 2012). The main goal is to combine efficiency of dedicated systems with flexibility of flexible manufacturing systems, making it ideal for industries facing e.g. frequent product changes (Skärin et al., 2023). To achieve this, the process and approach for production system development need to be updated (Trolle et al., 2021). Traditionally, production development projects in the automotive industry have relied on sequential models such as stage-gate and waterfall with elements of ad-hoc problem solving. These models divide projects into distinct phases such as initiation, preparatory design, conceptual design, detailed design and implementation as shown in Figure 1, that is including formal gates for decision-making and validation (Rösiö, 2012; Bruch & Bellgran, 2013; Cooper, 2013). While these approaches provide structure and traceability, they are criticized for rigidity, long lead times and limited adaptability for changes particularly as these new demands for flexibility and reconfigurability in production systems emerge. (Ciric et al., 2019; Patil, 2019)

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

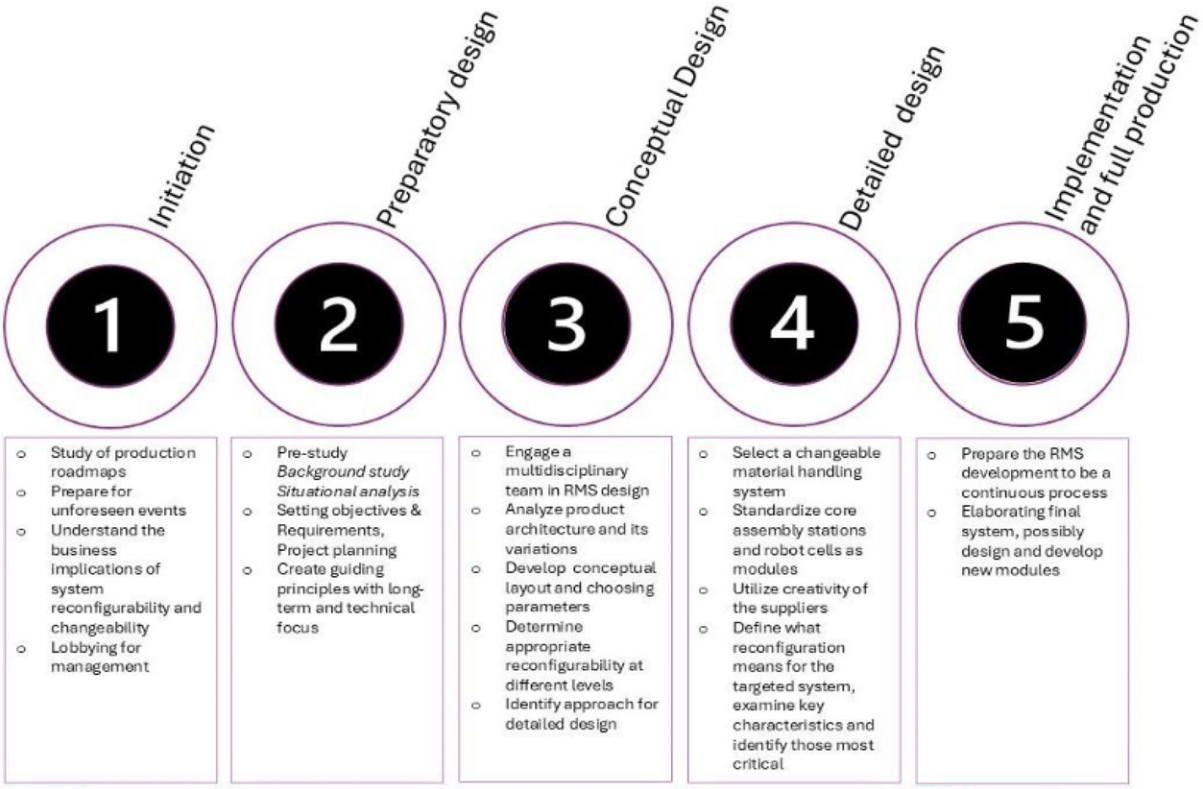


Figure 1. Production development process (Rösiö, 2012)

A key challenge in many PSDP is the reliance on push-based planning and rigid scheduling which limits adaptability and delays performance improvements (Koskela et al., 2006). Similarly, the concept of an operational performance-driven PSDP emphasizes embedding performance targets such as time-to-volume and OEE early in the design process rather than addressing them when the system is up and running. Combining these creates an approach that integrates agile principles with operational performance goals which in turn could enable faster ramp-up, higher efficiency and alignment with sustainability and reconfigurability requirements. Moving production development from static processes toward dynamic, performance-oriented strategies that support long-term competitiveness is essential (Islam et al., 2022).

3.2. Agile principles and their transferability

Agile project management emerged in the software industry as a response to the limitations of sequential models and their inadaptability to the dynamic nature of software projects. The Agile Manifesto was introduced in 2001 and advocates four core values: (1) individuals and interactions over processes and tools, (2) working solutions over comprehensive documentation, (3) customer collaboration over contract negotiation and (4) responding to change over following a plan (Manifesto, 2001). Out of these four core values 12 agile principles derived:

1. Focus on customer satisfaction through early involvement and continuous delivery. Deliver usable value often so customers see progress early.
2. Welcome changing requirements. Adapt even late in the project to maximize customer value.
3. Deliver working solutions frequently. Provide small, functional increments regularly.
4. Prioritize daily collaboration between business partners and developers.
5. Build projects around motivated individuals and inspire trust. Give teams autonomy, support and trust them to do the work well.
6. Encourage face-to-face conversations. Direct communication reduces misunderstandings and could help speed up processes.
7. Work with scaled solution as primary measure of progress. Real functionality matters more than documents or plans.

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

8. Promote a sustainable work pace. Teams should work at a rhythm they can maintain long-term.
9. Pay continuous attention to technical excellence. High-quality engineering enables adaptability and reduces rework.
10. Strive for simplicity and maximize work not done. Focus on what truly adds value and avoid unnecessary tasks.
11. Believe in that self-organizing teams produce the best results. Teams decide how they should work, improving ability for creativity and ownership.
12. Incorporate continuous reflections and adjustments. Teams frequently inspect their process and make improvements.

Agile methods, such as Scrum, operationalize these principles through iterative cycles, frequent feedback loops and self-organizing teams (Cervone, 2011; Darrin & Devereux, 2017; Fowler & Highsmith, 2001). This absence of established agile structures further contextualizes the findings, as the organizations operate primarily within traditional stage–gate systems rather than hybrid or scaled-agile environments. Agile practices have demonstrated success in reducing cycle times and improving adaptability in software and various product development contexts (Conforto & Amaral, 2016). However, investigating their transfer to production development remains limited (Trolle et al., 2020). Physical production environments introduce constraints such as equipment lead times, compliance requirements, and complex supply chains which may hinder direct adoption of agile methods. Literature suggests that hybrid models, combining agile principles with stage-gate governance, can offer a balanced approach for technology-based projects (Conforto & Amaral, 2016; Edwards et al., 2019). Organizational culture and top management support are critical determinants of agile adoption. Resistance often stems from entrenched hierarchical structures, rigid performance metrics and fear of losing control. Transitioning to agile requires changes at multiple levels, including governance, resource allocation and team dynamics. Without executive sponsorship and cultural alignment agile initiatives risk failure or superficial implementation (Mishra et al., 2021; Tonnquist, 2009).

4. Results

4.1. Use of agile methods in PSDP

While the results provide an overall view of agile principles, the cases also show to some extent how agile methods and its mechanisms are, or are not, used in current PSDP. None of the OEM or subcontractors applied formal agile roles or time-boxed sprints. Planning was constructed according to fixed phases with predefined deliverables. Daily and recurring stand-ups were not established, apart from informal morning meetings in engineering or maintenance functions, which were not part of PSDP or any cross-functional teams. Sprint mechanisms such as reviews or retrospectives were absent. Engineering consultants, however, facilitated iterative workshops in the fuzzy front-end that resembled early sprint practices but did not continue throughout the project. No product or system backlogs were used and the work was governed by checklists and gate documents. Some OEM teams did break down gate deliverables into smaller tasks, suggesting early signs of sprint-like iteration within sequential constraints.

4.2. Alignment of agile principles to production system development

Building on the theoretical insights, the following section presents empirical findings from the multiple case study, illustrating how these principles align with current practices in PSDP. Table 2 presents the results from the multiple case study. Each agile principle is summarized with descriptive insights derived from the case study. The table highlights differences in organizational practices, collaboration patterns and process adaptability across stakeholder types. OEMs generally exhibit structured, stage-gate-driven approaches. Subcontractors show reactive participation governed by OEM constraints while Engineering Consultants demonstrate more flexibility and early-phase involvement, although with limited engagement during later development stages.

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

Table 2. Agile principles and their alignment with stakeholders in PSDP within the automotive industry

Stakeholder	Description
AP 1. Customer satisfaction through early involvement & continuous delivery	
OEM	The customer is mainly the internal production organization, while end-users influence requirements indirectly. Early customer involvement is prioritized for defining specifications and priorities. OEMs use a traditional stage-gate process, avoiding incremental delivery due to suboptimization risks. Hardware can't iterate as fast as software. Functions are handed over at phase gates (e.g. Preparatory design to Conceptual Design). No continuous deliveries.
Subcontractor	Subcontractors (F and G) want early involvement to share expertise and improve manufacturability, but this rarely happens because of the restrictions set by the OEM. Subcontractors usually join after design freeze. Reactive function rather than iterative which is limiting their influence. No findings show that they deliver scaled solutions continuously.
Engineering Consultants	Contribute to customer satisfaction mainly through early involvement in pre-study phases, offering analysis and recommendations iteratively. The case study shows that the engineering consultants do not engage in continuous delivery during the actual latter part of the development process.
AP 2. Welcome changing requirements, even late in the development process	
OEM	Late changes are seen as critical and problematic due to design freeze. OEMs use stage-gate which freeze requirements after phases. Several respondents mentioned that one reason for frequent project failure is because of management trying to incorporate changes in system design.
Subcontractor	Changes are rarely applied. Subcontractors are governed by contract. Subcontractors receive frozen drawings and develop solutions accordingly.
Engineering Consultants	Do not actively welcome changes during development but adapts to it if necessary, as their involvement is limited to early phases.
AP 3. Frequent delivery of scaled, working solutions	
OEM	Focus on gate checklists and project outputs. The way of working and deliveries is not conducted in sprints. One respondent explains the process as complex multi-disciplinary integration between mechanical, electrical, software and tools that is creating systems which is hard to iterate.
Subcontractor	Subcontractors do not practice frequent delivery of scaled solutions, they deliver prototypes or solutions after final specifications are set, with minimal iterative output.
Engineering Consultants	Insufficient data.
AP 4. Daily collaboration between business partners and developers.	
OEM	Not daily, only in gates or at RFQ after design freeze.
Subcontractor	Communication with OEM is mostly through RFQs and periodic updates, not daily.
Engineering Consultants	Facilitate for early and continuous workshops. Weekly involvement of business partners. Not daily.
AP 5. Build projects around motivated individuals and inspire trust	
OEM	OEMs follow a hierarchical, top-down project structure with limited autonomy for project teams. Project managers act mainly as coordinators and employees often juggle multiple projects, reducing empowerment and trust.
Subcontractor	Subcontractors follow a hierarchical structure like OEMs, with occasional flexibility in smaller firms. Resource shortages and multitasking are common. There is no sign of self-organizing teams or trust-based empowerment.
Engineering Consultants	Engineering Consultants work independently, emphasize high trust and autonomy and collaborates directly with management and operators during early phases, though their involvement is short-term.

(*Continued*)

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

Table 2. Continued

Stakeholder	Description
AP 6. Encourage face-to-face conversations	
OEM	High occurrence for internal meetings. Moderate level for external meetings.
Subcontractor	External: Mostly through RFQs and email/phone, not daily F2F. Internal: High occurrence for internal meetings
Engineering Consultants	External: High occurrence in early phases for both external and internal.
AP 7. Working scaled solution as primary measure of progress	
OEM	OEMs focus for measuring progress is by gate checklists, documentation and KPIs (cost, time, resources) not by delivering working scaled solutions.
Subcontractor	Similar to OEMs: Focus on delivering according to specifications, budget and deadlines set by the OEM.
Engineering Consultants	Engineering Consultants provide analysis and recommendations and not physical solutions.
AP 8. Promote a sustainable work pace	
OEM	Working pace peaks near gates. Large shifts in workload during the process.
Subcontractor	Resource overload & multitasking. Large shifts in workload during the process.
Engineering Consultants	No mention of overload or multitasking. Their involvement is short-term but focused.
AP 9. Continuous attention to technical excellence	
OEM	OEMs emphasize quality and compliance (e.g., PPAP, CE-marking) and have rigorous gate checklists. However, technical excellence is pursued through documentation and rigid processes, not continuous iterative improvement.
Subcontractor	Subcontractors aim for manufacturability and sometimes build flexibility into their systems. They want early involvement to improve design but usually join late, limiting their ability to influence technical excellence.
Engineering Consultants	Strong early-phase technical input but no ongoing involvement.
AP 10. Strive for simplicity: maximize work not done	
OEM	Excessive documentation and approvals. Safety, compliance and requirement documentation. Processes are described as rigid and time-consuming, with many mandatory steps before moving forward.
Subcontractor	Strong similarity to that of the OEMs.
Engineering Consultants	Advisory role avoids unnecessary tasks but limited to early phases.
AP 11. Self-organizing teams produce best results	
OEM	Decision making within the projects are made Top-down where the project manager or steering committee are the decision makers, while the team provides information and conducts the activities.
Subcontractor	Similar hierarchical approach, though smaller organizations sometimes allow more flexibility.
Engineering Consultants	Autonomy exists, but not in the form of self-organizing teams within development projects.
AP 12. Regular reflection & adjustment	
OEM	Partial. Reflection exists but is mostly tied to gates or post-project reviews. Adjustments during the project are limited, especially in later phases.
Subcontractor	Reflection is scarce. Adjustment is minimal.
Engineering Consultants	Use early-phase retrospectives/feedback loops.

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

Table 3 uses the Likert scoring method for level of stakeholder alignment with the twelve agile principles. Every score is grounded directly on the case study findings and Table 2. The Likert scores are based on the following analysis:
1 = No alignment: The stakeholder's practices contradict the agile principle. The process structure blocks alignment, and the practice is completely absent.
2 = Weak alignment: The practice occurs rarely or only under special conditions. Stakeholders may want to align but lack the means.
3 = Partial alignment: The principle is applied in some areas or phases but is not consistent or embedded in the organization.
4 = Good alignment: The principle is largely followed with structural support, though not fully continuous or integrated across all phases.
5 = Strong alignment: The principle is consistently present in both behaviour and processes, fully reflecting agile theory.

Table 3. Likert scoring table: agile principles and their alignment with PSDP for different stakeholders

Agile Principle	OEM	Subcontractor	Engineering Consultants
AP1. Customer satisfaction via early involvement & continuous delivery	2	1	3
AP2. Welcome changing requirements, even late	1	1	2
AP3. Frequent delivery of scaled, working solutions	1	1	N/A
AP4. Daily collaboration between business partners	1	1	1
AP5. Motivated individuals & trust	1	1	4
AP6. Face-to-face conversation	4	3	5
AP7. Working scaled solution as primary measure	1	1	N/A
AP8. Sustainable pace	1	1	3
AP9. Continuous attention to technical excellence	3	2	2
AP10. Simplicity: maximize work not done	1	1	3
AP11. Self-organizing teams produce best designs	2	2	2
AP12. Regular reflection & adjustment	2	1	3
Mean score (AP1-AP12) * High level of alignment: 4-5 Medium level of alignment: 2-3 Low level of alignment: 1-2	1.66	1.33	2.8 (N/A)

The findings present an indication of Subcontractors showing the lowest alignment with agile principles, heavily constrained by OEMs and Engineering consultants with the highest alignment. OEMs are rigid and stage-gate-driven, preventing agile alignment.

5. Discussion

PSDP within the automotive industry remain highly sequential with rigid gates and focus on heavy documentation. All eight case companies maintain and follow documented process phases for production system development which are typically integrated with product development workflows. These phases outline steps such as investigation, planning, preliminary design, detailed design, implementation and follow-up and follows a sequential approach. Each phase is associated with checklists and deliverables that must be completed before passing through a gate. These findings correspond with previous research (Bruch & Bellgran, 2013; Säfsten, 2010; Trolle et al., 2020). Some respondents described these processes as "straightforward" and "mature" emphasizing their clarity and suitability for large-scale projects. However, several respondents noted that the rigidity of these models often results in project delays and cost increases when unexpected changes occur, particularly after design freeze. While these models provide structure, they struggle with flexibility and responsiveness. Agile principles could offer solutions to some challenges but should not be applied directly due to physical constraints: like equipment lead

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

times and system requirements. A direct transition to a fully agile model may pose significant risks. Adopting a gradual transition is advisable, starting with small changes and slow adaptations and alignments with some agile principles and progressing toward full agility as the organization matures. PSDP have phases with varying levels of uncertainty. Early phases are more uncertain and could benefit from agile flexibility while later phases require stability due to equipment lead times and quality requirements (Säfsten, 2010). This is also proven by the case study results covering the engineering consultants, mainly involved in early stages of the project. A stage-gate hybrid model addresses this by combining iterative and sequential approaches. The limited use of agile methods suggests that PSDP teams do not reject agile thinking but lack method-level adaptations suited to physical system development. Some OEM respondents noted that gate reviews could act as high-level iteration boundaries, like sprint milestones, if broken into smaller planning cycles. Although formal backlogs are absent, early-phase workshops run by engineering consultants demonstrate iterative refinement and short feedback loops within stage–gate constraints. These findings indicate opportunities for hybrid approaches were selected agile ceremonies, such as brief daily coordination meetings, structured retrospectives or backlog-like prioritization, could be integrated without disrupting regulatory or hardware-dependent requirements. Implementing agile methods or even its principles, is not just about tools, it requires cultural change, top-management support and possibly new roles, like product owners. These changes take time (Gustavsson, 2011). An initial step toward agility is to prioritize cultural aspects and soft values, such as team collaboration and reducing unnecessary documentation. The next step involves introducing structural changes, including iterative planning and the use of product backlogs in the early phases of PSDP. Once these foundations are in place and the organization has gained sufficient experience and confidence, it may be ready for full agile adoption. Education and training are critical to overcome misconceptions and resistance. A phased approach mitigates risk, supports learning and ensures operational performance goals are maintained. To improve the validity and reliability of this study, the data population should be expanded to include more companies and consultants, as well as system suppliers. System suppliers contribute distinct perspectives on design, integration and delivery processes, making their inclusion valuable for achieving broader coverage and stronger triangulation. This expanded and more diverse sample would enhance the robustness and generalizability of the study's conclusions.

6. Conclusion

This study shows that production system development in the automotive industry remains largely sequential and rigid, limiting adaptability. Agile principles offer potential benefits, but direct adoption is impractical due to physical and regulatory constraints. Case findings indicate low overall alignment with agile principles but there is a need to adopt and align with them. OEMs and subcontractors remain constrained by stage-gate structures while engineering consultants show the highest agility in early phases. Transitioning requires cultural change, leadership support and gradual implementation through collaboration, reduced documentation and iterative planning. This study examines alignment with agile principles without evaluating whether such alignment improves project performance in a production system development context. Future research should explore hybrid models in practice and their impact on performance in PSDP.

Acknowledgement

The authors would like to thank the researchers and industry representatives who supported and contributed to this study. We are especially grateful for the time, insights and practical experiences generously shared during the case studies.

References

Bruch, J., & Bellgran, M. (2013). Characteristics affecting management of design information in the production system design process. *International Journal of Production Research*, 51(11), 3241–3251. DOI: 10.1080/00207543.2012.755273

Cervone, H. F. (2011). Understanding agile project management methods using Scrum. *OCLC Systems & Services: International digital library perspectives*, 27(1), 18–22. DOI: 10.1108/10650751111106528

Ciric, D., Lalic, B., Gracanin, D., Tasic, N., Delic, M., & Medic, N. (2019). Agile vs. Traditional approach in project management: Strategies, challenges and reasons to introduce agile. *Procedia Manufacturing*, 39, 1407–1414. DOI: 10.1016/j.promfg.2020.01.314

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press

Conforto, E. C., & Amaral, D. C. (2016). Agile project management and stage-gate model—A hybrid framework for technology-based companies. *Journal of engineering and technology management*, 40, 1–14. DOI: 10.1016/j.jengtecman.2016.02.003
Cooper, R. G. (2013). New products: What separates the winners from the losers and what drives success. *PDMA handbook of new product development*, 3, 34. DOI: 10.1016/0737-6782(87)90002-6
Darrin, M. A. G., & Devereux, W. S. (2017). The Agile Manifesto, design thinking and systems engineering. *2017 Annual IEEE International Systems Conference (SysCon)*, DOI: 10.1109/SYSCON.2017.7934765
Edwards, K., Cooper, R. G., Vedsmand, T., & Nardelli, G. (2019). Evaluating the agile-stage-gate hybrid model: Experiences from three SME manufacturing firms. *International Journal of Innovation and Technology Management*, 16(08), 1950048. DOI: 10.1142/9789811247729_0010
El Maraghy, H. A. (2008). *Changeable and reconfigurable manufacturing systems*. Springer Science & Business Media. DOI: 10.1007/978-1-84882-067-8
Fernandez, D. J., & Fernandez, J. D. (2008). Agile project management—agilism versus traditional approaches. *Journal of computer information systems*, 49(2), 10–17. DOI: 10.1080/08874417.2009.11646044
Fowler, M., & Highsmith, J. (2001). The agile manifesto. *Software development*, 9(8), 28–35.
Gustavsson, T. (2011). Agil projektledning, First edition, Sweden: Stockholm.
Islam, M. H., Chavez, Z., Birkie, S. E., & Bellgran, M. (2022). Enablers in the production system design process impacting operational performance. *Production & Manufacturing Research*, 10(1), 257–280. DOI: 10.1080/21693277.2022.2076753
Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert scale: Explored and explained. *British journal of applied science & technology*, 7(4), 396. DOI: 10.9734/BJAST/2015/14975
Koren, Y., Gu, X., & Guo, W. (2018). Reconfigurable manufacturing systems: Principles, design, and future trends. *Frontiers of Mechanical Engineering*, 13, 121–136. DOI: 10.1007/s11465-018-0483-0
Koskela, L., Henrich, G., Owen, R. B., & Vrijhoef, R. (2006). Theory based production and project management. *Proceedings of the 3rd International Salford Centre for Research and Innovation (SCRI) Research Symposium*.
Luna, A. J. d. O., Marinho, M. L., & de Moura, H. P. (2020). Agile governance theory: operationalization. *Innovations in Systems and Software Engineering*, 16(1), 3–44. DOI: 10.1007/s11334-019-00345-3
Manifesto, A. (2001). Manifesto for agile software development. In.
Mishra, A., Abdalhamid, S., Mishra, D., & Ostrovska, S. (2021). Organizational issues in embracing Agile methods: an empirical assessment. *International Journal of System Assurance Engineering and Management*, 12(6), 1420–1433. DOI: 10.1007/s13198-021-01350-1
Patil, A. V. (2019). Comparative analysis between sequential and iterative project management approaches. *Interfaces*, 6(07), 3035–3040.
Pinto, J. K., & Slevin, D. P. (1987). Critical factors in successful project implementation. *IEEE transactions on engineering management(1)*, 22–27. DOI: 10.1109/TEM.1987.6498856
Rösiö, C. (2012). Supporting the design of reconfigurable production systems Mälardalen University]. ISBN 978-91-7485-079-6
Skärin, F., Rösiö, C., & Andersen, A.-L. (2023). Sustainability and circularity in reconfigurable manufacturing-literature review and future research directions. *International Journal of Manufacturing Research*, 18(4), 366–391. DOI: 10.1504/IJMR.2024.10058562
Sommer, A. F., Hedegaard, C., Dukovska-Popovska, I., & Steger-Jensen, K. (2015). Improved product development performance through agile/stage-gate hybrids: The next-generation stage-gate process? *Research-Technology Management*, 58(1), 34–45. DOI: 10.5437/08956308X5801236
Säfsten, K., Bellgran, M (2010). *Production Development, Design and Operation of Production Systems*. Springer. ISBN: 9781848824942
Tonnquist, B. (2009). *Project management*. Academica.
Trolle, J., Fagerström, B., & Rösiö, C. (2020). Challenges in the fuzzy front end of the production development process. In *SPS2020* (pp. 311–322). IOS Press. DOI: 10.3233/ATDE200169
Trolle, J., Raudberget, D., & Rösiö, C. (2021). Exploring Barriers for Software Development in Agile and Integrated Development of Production Systems. *2021 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)*, DOI: 10.1109/IEEM50564.2021.9672963
Yazdani, B. (1999). Four models of design definition: sequential, design centered, concurrent and dynamic. *Journal of Engineering Design*, 10(1), 25–37. DOI: 10.1080/095448299261407
Yin, R. K. (2018). *Case study research and applications* (Vol. 6). Sage Thousand Oaks, CA. ISBN: 9781506336169

https://doi.org/10.1017/pds.2026.10390 Published online by Cambridge University Press