

Exploring sustainability integration and digitalization of the company innovation work process for non-assembled products

Koteshwar Chirumalla (MDU), Thomas Lager (MDU), and Mikael Ankerfors (AFRY)

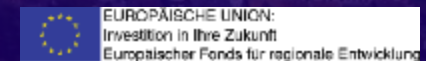
13.05.2022



**Process⁴
Sustainability**

**Cluster for climate-neutral
process industries in Hesse**

Supported by:



Exploring sustainability integration and digitalization of the company innovation work process for non-assembled products

Koteshwar Chirumalla (MDU), Thomas Lager (MDU),
and Mikael Ankerfors (AFRY)

Frankfurt 13 May 2022

List of contents

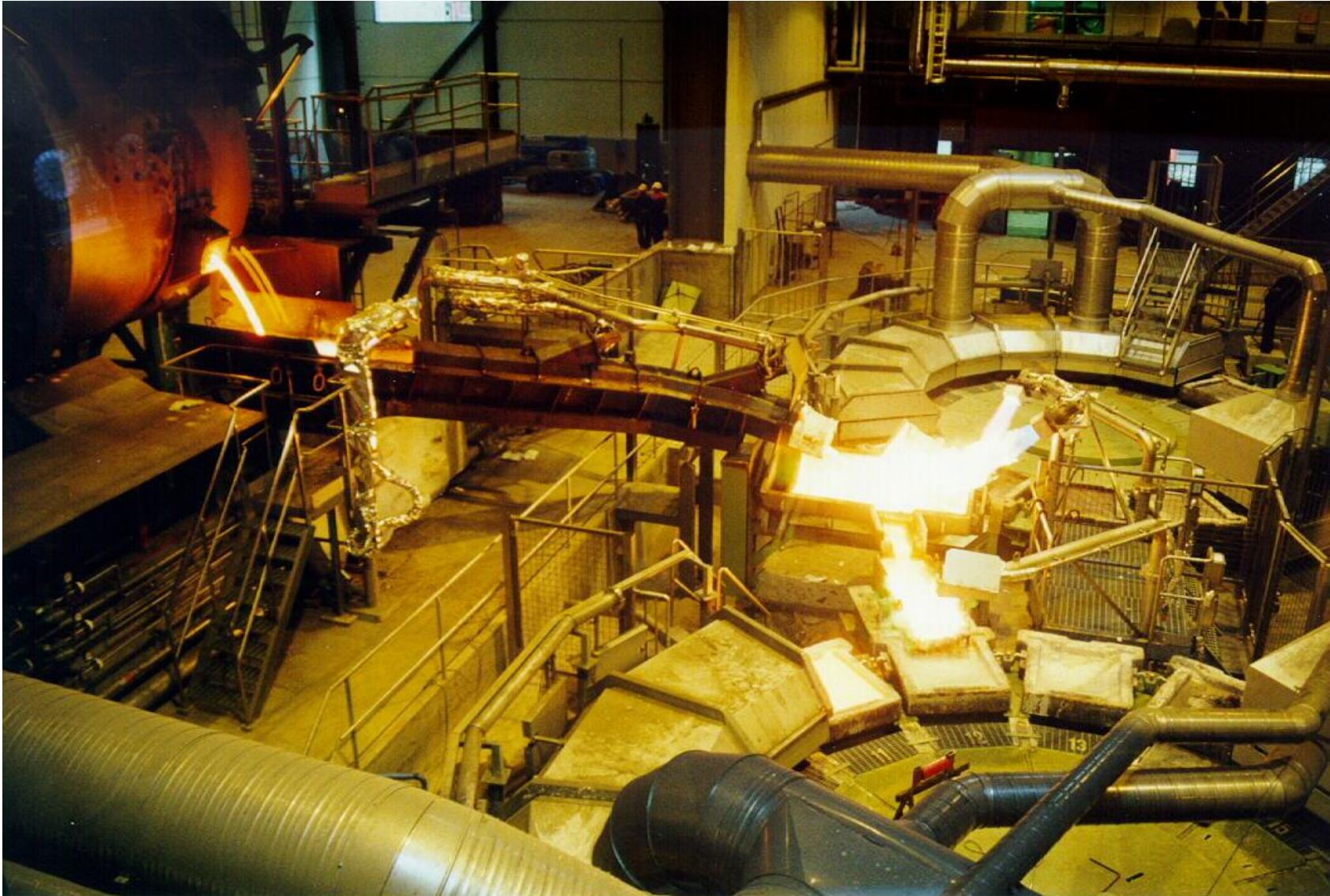
- Introduction
- Frame of reference
- Research design
- Empirical findings
- Discussion
- Conclusions

Introduction

In use of the theoretical lens of Dynamic Capabilities by Prof. David Teece, integration of sustainability and digitalization perspectives in the product innovation work process for non-assembled products have been explored in this study. According to Teece (2009 p. 48), such capabilities are mainly associated with managerial processes:

... there is much management can do to simultaneously design processes and structures to support innovation while unshackling the enterprise from dysfunctional processes and structures designed for an earlier period.

In reference to the above quote, incorporating both of sustainability and digitalization aspects in a company product innovation work process will most likely crave such dynamic capabilities, since their proper integration will probably require new incremental operational procedures, and possibly even more radical strategic and organizational solutions in the development of a well-functioning product innovation work process.



A copper anode
foundry at the
Boliden group
in Sweden

Frame of reference

Sustainability integration in the product innovation work process – selected references

- In a study of implementing a strategic sustainability perspective in the product innovation process, Hallstedt et al., (2013), concluded that: "currently there is a very strong focus on technical aspects and business opportunities of product concepts, but very little consideration of the sustainability implications of these concepts".
- Brockhaus et al. (2019) conclude that how companies make sustainability considerations an integral part of their new product development process still remains elusive and recommend an avoidance of the fallacy of "trickle-down" product sustainability model.
- Petersen (2021) observe that competences and attitudes have a decisive impact on product innovation, when sustainability considerations are to be integrated as an extra layer of product requirements, and hard-to-make decisions on tradeoffs.
- In sum, and in spite of the very large number of publications related to the development of sustainable products (Thomé et al., 2016), there are still a surprisingly few publications related to HOW sustainable perspectives could be integrated into formal product innovation work processes in general, and for non-assembled products in particular.

Frame of reference

Digitalization integration in the product innovation work process – selected references

- Smart Manufacturing, which is one component of Industry 4.0, consists of integrated manufacturing systems that are able to meet the demands of the plant itself, supply networks, and customer needs in real time (Kusiak, 2018).
- Marion and Fixson (2020) examined the transformation of the innovation process by using digital tools and found that digitalization not only affect output and process efficiency, but they also lead to rearrangement of the entire innovation processes, enable new configurations of people, teams, and firms.
- Chirumalla (2021) investigated how digitalization can support process innovation work processes from dynamic capabilities perspective and proposed sensing, seizing, and reconfiguring dynamic capabilities for digitally-enabled process innovation.
- Aaldering & Song (2021) indicated that not all process industries can be regarded as laggards in terms of incorporating digital capabilities, and they also confirmed that each segment of the process industries has adopted a unique pathway towards unlocking digital transformation opportunities.

Research design

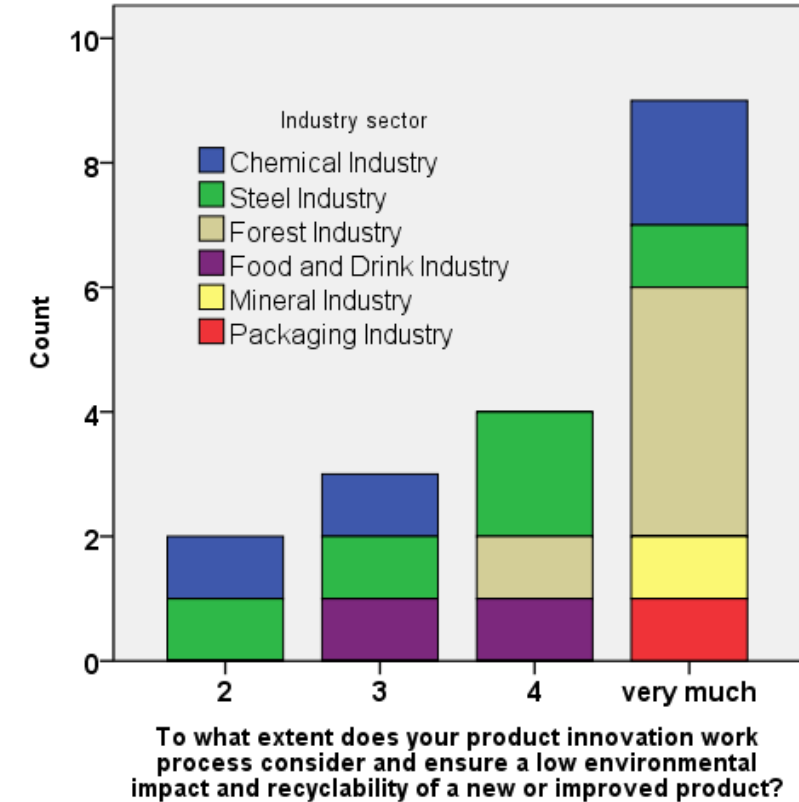
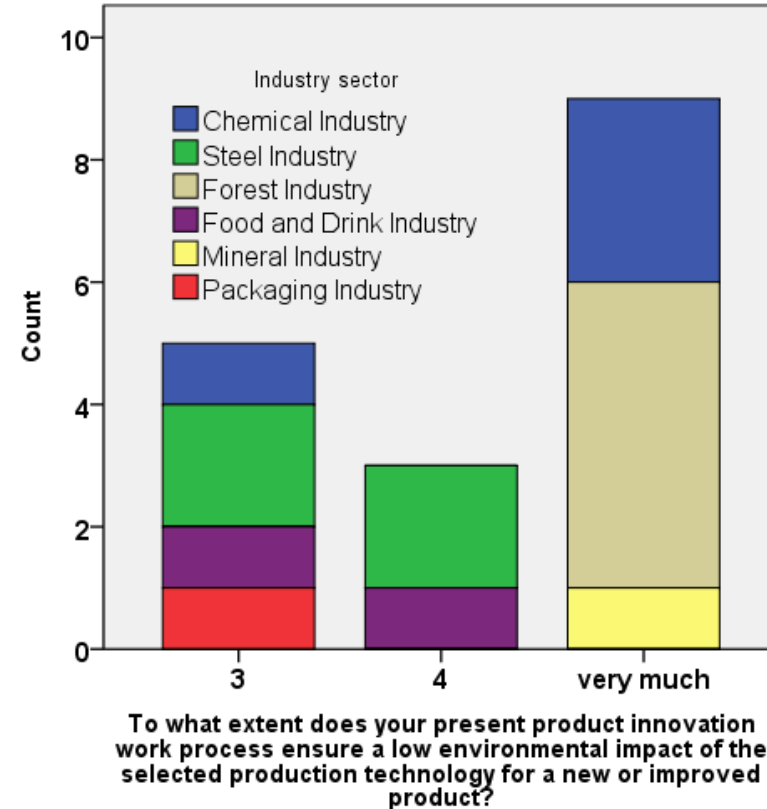
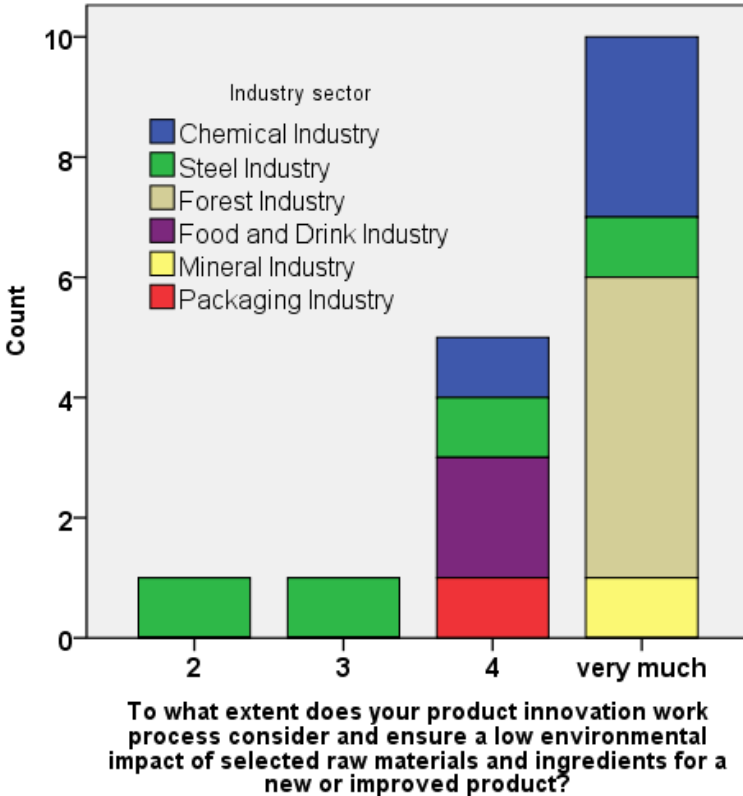
- Starting from a precursory framework related to the development of an enhanced product innovation work process for non-assembled products, integration of sustainability and digitalization has been theorized and further empirically tested in a survey mode of inquiry in an interactive dialogue with informants in nineteen global manufacturing companies in six sectors of the process industries (Alveson & Sköldbber, 2009, reflexive methodology).
- The companies belonged to the following sectors: Chemical Industries (five), Steel Industries (five), Forest Industries (five), Food & Drink Industries (two), Mineral Industries (one) and Packaging Industries (one).
- The company representatives in this study can be viewed as “multiple informants” since their answers often are grounded in their intimate knowledge also about similar sectoral conditions outside their own company (Yin. 1994; Wagner et al., 2010). The informants were asked to answer close-ended and complementary open-ended questions in a questionnaire, as “judges of the concept-in-use” (Barrett and Oborn, 2018)

Empirical findings



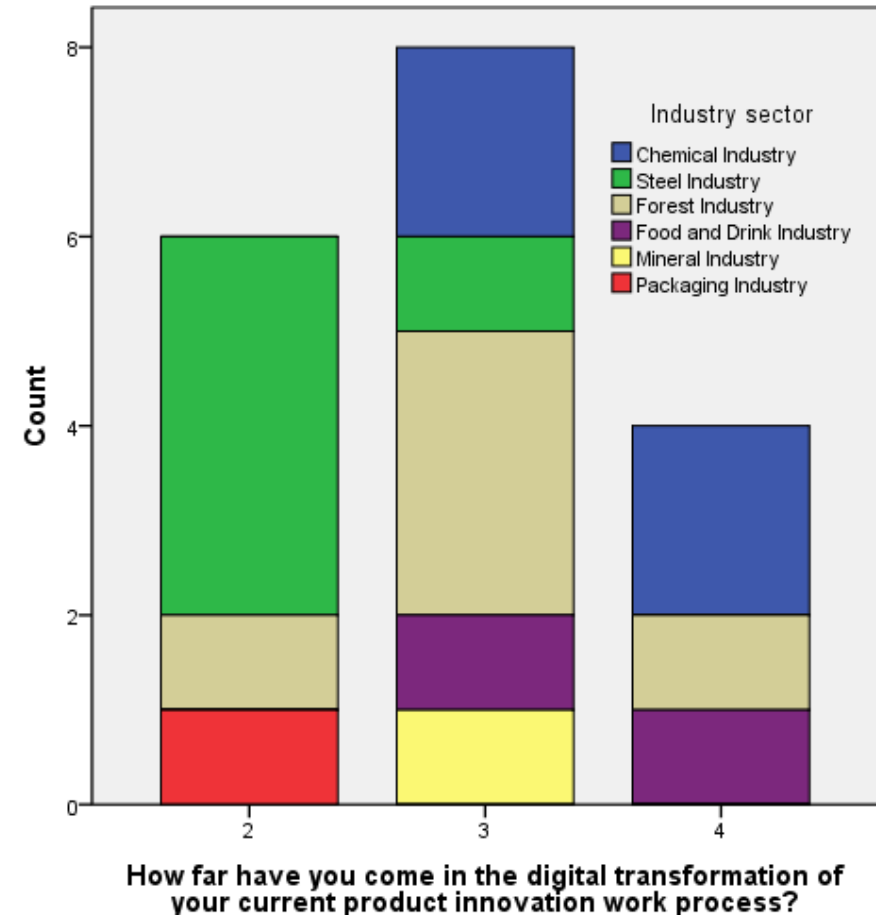
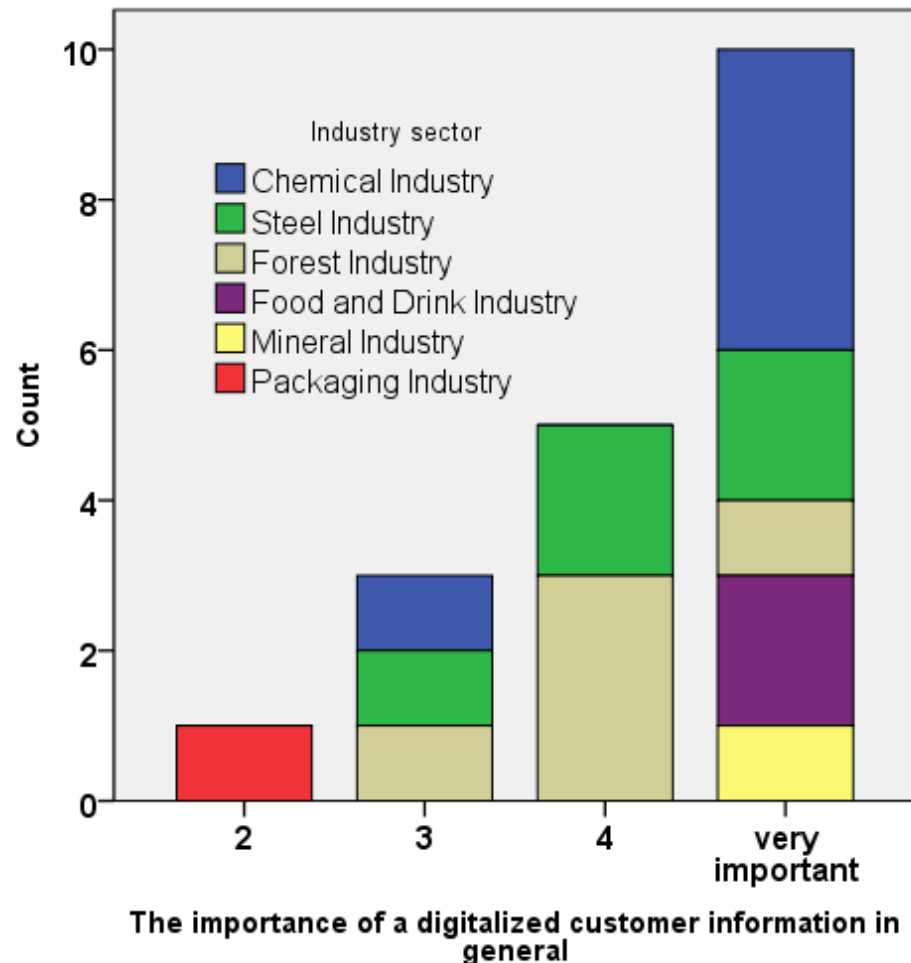
A paperboard mill
at the HOLMEN
group in Sweden

Case-company inclusion of sustainability perspectives in the product innovation work process for non-assembled products



Expected outcome from a digitalized product innovation work process (1=not important; 5=very important)	Mean (SD); (Skew)
<i>Digitalized customer information in general</i>	4.3 (0.9); (-1.0)
<i>A possibility to analyze outcomes of each product innovation project versus work process execution</i>	4.1 (1.0); (-0.6)
<i>A digitalized platform of knowledge for “next generation” product development projects</i>	4.2 (1.0); (-1.2)
<i>An instrument for organizational learning about company best practice product innovation</i>	4.2 (0.9); (-1.0)
<i>A possibility to compare and learn in-between all company product innovation projects</i>	4.0 (1.1); (-1.4)
<i>An instrument for adapting the product innovation work process to project complexity</i>	4.1 (0.8); (-0.2)

Case-company importance ratings of *digitalized customer information* and the inclusion of digitalization perspectives in the product innovation work process for non-assembled products

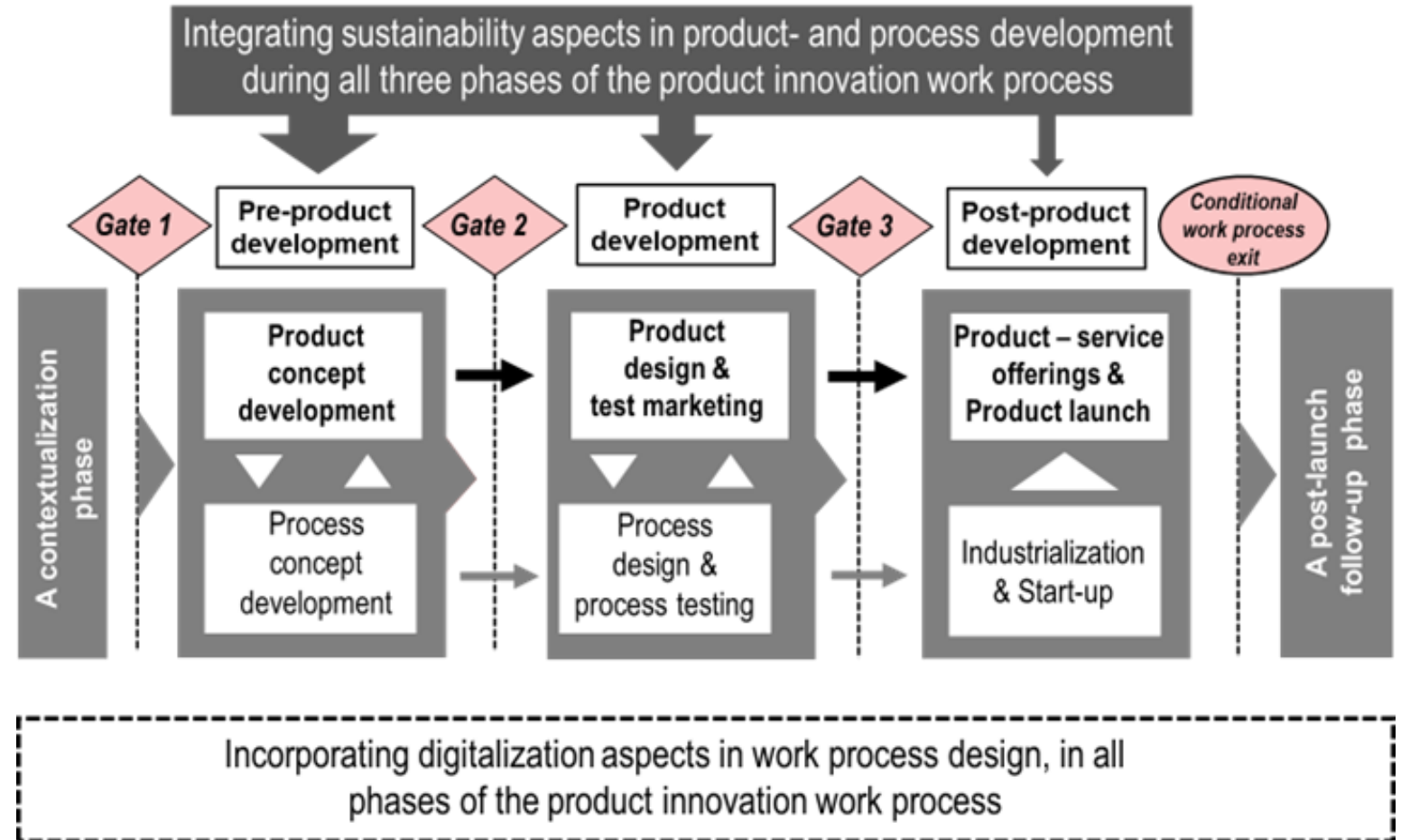


Discussion

- The preliminary findings indicate that the case-companies already have come far in institutionalizing sustainability perspectives in raw material selection, process technology development and product design. However, the study further discloses a need for a more in-depth inquiry and understanding on HOW alternative operational best practices and tools in a more systematic approach can make sustainability an integral part of this work process.
- The empirical results further demonstrate that the case-companies not yet have come far on their journeys with respect to product innovation work process digitalization. However, since the case companies rated six potential expected outcomes high from such digitalization, and *in particular digitalization of customer and product information*, this fact should incentivize companies in the process industries to put this topical area higher on their digitalization agendas.

Discussion cont.

- A proposed conceptual model for sustainability integration and digitalization of the product innovation work process for non-assembled products, resting on a previously developed generic "structural process model" (Lager & Simms, 2020).



Conclusions

- Manufacturing industries are considering sustainability and digitalization a top strategic priority, but they have often difficulties to embrace these approaches in an operational mode. The product innovation work process can *provide one central arena* for companies in the process industry to anchor and integrate sustainability and digitalization aspects within their organizations.
- The paper contributes to the growing interest to integrate the two mega trends of sustainability and digitalization, such as concepts like “*digitainability*” and “*smart circular economy*”, in a product innovation work process context for non-assembled products.
- The preliminary findings and proposed simplified conceptual model can provide a good foundational step for further discussion on sustainability integration and digitalization of the product innovation work process for non-assembled products.

**Thank you for
your attention!**

An iron ore pelletizing plant in
Sweden at the LKAB group