

# Call for a Special Issue of Journal of Business Chemistry (JoBC)

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## Corporate process innovation management capabilities: Digitalization and sustainability perspectives

### Setting the scene

#### Introducing the “family” of process industries

The “family” of process industries spans multiple industrial sectors—Mineral and Materials Industries, Mining and Metals Industries, Steel Industries, Petrochemical and Chemical Industries, Pulp and Paper Industries, Generic Pharmaceuticals, Food and Beverages Industries and Utilities (Lager, 2017b). One fundamental difference between companies in the process industries and those in assembly-based industries is that supplied and delivered products in the process industries are materials rather than components (Frishammar et al., 2012, Simms et al., 2021), a fact which affects not only the upstream supply chain of incoming materials but also the downstream supply chain of outgoing products (Lager and Blanco, 2010). Moreover, in assembly-based industries, a new product is usually produced in a new production setup, whereas a new production system or technology in the process industries usually must be integrated within an existing plant structure (Samuelsson et al., 2016). If a company relies on captive (company-owned) raw materials, the characteristics of incoming materials not only will predispose the selection of unit processes and production system design (Lager et al., 2017) but also may influence certain finished product properties (Linton and Walsh, 2008). Raw material variability will also sometimes influence the production system’s receiving capability (Soman et al., 2004), especially in the food industries where raw materials are perishable (Van Donk, 2001, Van Donk and Fransoo, 2006).

The production yield in the process industries is dependent on both raw material characteristics (Finch and Cox, 1988) and production system capabilities (Lager, 2017a, Taylor et al., 1981). Meanwhile, products manufactured in the process industries are often next to homogeneous substances (Chronéer, 2003), and their inner structural characteristics largely determine their functionalities in B2B customers’ production systems (Motta et al., 2015). The product innovation time cycles in many sectors of the process industries are often extended to protect customers from unforeseen difficulties (Pisano, 1997), requiring time-consuming pilot-planting or full-scale production trials (Frishammar et al., 2014, Tottie et al., 2016). In an early study of the 2,000 top worldwide investors in research and development (R&D), about 30% of those companies belonged to the process-industrial cluster (Lager, 2010).

#### Managing innovation in the “family” of process industries

In the adoption of Woodward’s (1965) perspective on company behaviour, Barnett and Clark (1996) suggested that innovation in the process industries is primarily enabled by “process innovation” as the difficult and constraining aspect of product development. The importance of process

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innovation in the development of a corporate strategy was recognized by Skinner (1974, 1978), and his position was underscored in an article titled "The shareholder's delight: companies that achieve competitive advantage from process innovation" (Skinner, 1992, Skinner, 1996). The vital importance of a profound understanding of the production process for innovation in a process-industrial context has since been confirmed in many studies (Floyd, 2010, Frishammar et al., 2013, King, 2009, Lager et al., 2017).

Brown et al. (2005) proposed that "there is a need to view operations management as part of a fluid, interactive, mutually beneficial series of relationships between raw materials and the end customer". Conceptualizing operations management for the process industries in such a broad manner pinpoints the significant importance of the complex process and value chains in this cluster of industries (Tottie and Lager, 1995). Whilst early integrative development of product and production technology is desirable in other manufacturing industries (Bruch and Bellgran, 2014), the integrative perspective on raw materials, process technology, and products needs to be given much stronger consideration in process-industrial product and process innovation (Hullova et al., 2016, Lager, 2017b). The intimate coupling between products and related production process technology (Frishammar et al., 2013) thus makes the development of non-assembled products, in reality, the development of new or improved process technology (Hullova et al., 2019); "the process is the product" (Rousselle, 2012). Whilst product innovation must always start and finish with the customers, process development is a more in-house affair. According to the Oslo Manual (OECD, 2005), process development can be defined as follows:

*Process development (process innovation) is the implementation of new or significantly improved production or delivery methods. This includes significant changes in techniques, equipment and/or software.*

The Oslo Manual further states that, "with respect to goods, the distinction is clear". The customer for process innovation is thus primarily an internal customer, and the following slightly modified extended complementary definition underline these ideas:

*Process development could be defined as development mainly driven by internal production objectives. Such objectives may be reduction of production costs, higher*

*production yields, improvement of production intensities, environment-friendly production, etc. (Lager, 2002). In many sectors of the Process Industries, process development is mainly prompted by the needs of production (internal customer). Another internal customer to process development is the company's own product development (Lager, 2010).*

In a study of process innovation in the process industries (Lager, 2010), 40 percent of total company R&D expenditure, as an arithmetical average for all companies, was spent on process development.

## Corporate process innovation management capabilities: Digitalization and sustainability perspectives

There are a number of process-industrial characteristics that will influence digitalization, sustainability and sectoral convergencies. In reference to the previous sections, one strategic capability of utmost importance in the process industries is thus related to company management of process innovation.

### Managing process innovation in the perspective of digitalization and sustainability

Companies in manufacturing industries today generally consider digitalization and sustainability as top strategic priorities, but they sometimes face difficulties in embracing these approaches in an operational mode. However, Industry 4.0 offers the potential for increased automation and flexibility of company production processes, and digitalization is thus driving new process innovations (Blackburn et al., 2017, Iansiti and Lakhani, 2014). There is a need for process innovation to consider an integration between individual equipment, connected smart devices, dynamic software systems, smart logistics systems and suppliers (Horváth and Szabó, 2019). Aaldering and Song (2021) concluded that not all sectors of the process industries can be regarded as laggards in terms of incorporating digital capabilities and that the Biotechnology,

Pharmaceutical, Food and Beverage, Energy and Oil and Gas sectors have demonstrated a higher IT affinity. In a study of building digitally-enabled process innovation in the process industries, Chirumalla (2021) concluded that the transition to digitalization and sustainability will most likely require new strategies, work processes, organizational structures, operation modes, and capabilities.

Sustainability is of growing urgency to companies in the process industries (Kaplinsky and Morris, 2018), and environmental innovations give opportunities to respond to concerns over not only the depletion of natural resources but also the use of raw materials with negative environmental impacts (Yu et al., 2016). In a process-industrial context, sustainability aspects must be included not only in the development of new product concepts but also in the development of a related process concept (including a raw material concept). In a similar vein, and in the consecutive product development phase, further sustainability perspectives on product design are to a large extent dependent on an integration of sustainability aspects in the preliminary design of the related production process (Lager et al., 2022). However, companies in the Forest Industries and Mineral Industries, generally with captive raw material supplies of sustainable raw materials, face different challenges compared with companies in the Chemical Industries and some in the Food and Drinks Industries, depending on their position in the supply/value chains.

In conclusion, in perusing corporate process innovation management capabilities through the lens of digitalization and sustainability, it is evident that an enhanced management of process innovation stands out as a vital management capability in order to pursue successful corporate digitalization and sustainability agendas. In the following section, a number of areas of Process Innovation Management have been listed in the form of potential topics for further research. These include, for example, process innovation strategies (Chesbrough and Appleyard, 2007, Chiaroni et al., 2010, Larsson and Bergfors, 2006, Leker et al., 2018), structural organizational and cultural aspects on process innovation (Bergfors and Lager, 2011, Hofstede, 1993, Schein, 2009), the process innovation work process (Lager, 2000, Lim et al., 2006, Pisano, 1997), collaboration with equipment and raw material suppliers (Aylen, 2013, Lager et al., 2015, Rönnerberg Sjödin et al., 2011), inter- and intra- technology transfer (Lager and Frishammar, 2012, Lager and Hassan-Beck, 2020, Lessing and Leker, 2006,

Malik, 2002), application development (Storm and Lager, 2014), and measuring process innovation performance (Chiesa et al., 2009, Lager and Hörte, 2005, Schumann et al., 1995). Fostering such corporate process innovation management capabilities will most likely be of importance and possibly a prerequisite for successful digitalization, industrial symbiosis and future sectoral convergencies in the cluster of process industries.

## Suggested research topics of interest

The overall theme for this Special Issue is management of process Innovation within the broad family of process industries in the perspective of digitalization and sustainability. Interesting empirical insights or theoretical and conceptual contributions are invited. Possible research topics include, but are certainly not limited to, the following lines of inquiry:

- Process Innovation strategy design and portfolio balancing of process innovation projects of different degrees of newness in a process-industrial context.
- Designing structural organizational frameworks for product and process innovation from the viewpoint of digitalization, sustainability, and sectoral convergencies.
- Reconfiguring a company process innovation work process for non-assembled products from the perspective of digitalization and sustainability.
- Methodologies and best practices as supportive instruments for an enhanced process innovation work process.
- Success factors and key performance indicators for enhanced future process innovation performance.
- Revisiting the “S-curve” concept and process innovation road-mapping methodology for strategic process innovation.
- Project management and project compression mechanisms for complex collaborative strategic long-term process innovation projects.
- Exploring new or improved innovation management capabilities and knowledge areas in response to process-industrial digitalization and sustainability challenges.
- Fostering a sustainable company innovation culture in “production-oriented” process-industrial operational environments.

- Open production as “wall-to-wall” raw material supplier integration and equipment supplier integration in company production process systems.
- The search for effective coordination mechanisms and collaborative models for customer and end-user interactions in complex process-industrial supply/value chains in view of future sectoral convergencies.
- Managing process innovation in the perspective of physical exchange of raw materials, by-products, energy, and water; industry symbiosis.
- Managing intra- and inter-firm collaboration and technology transfer as supporting mechanisms in digitalization and sectoral convergencies.
- Application development in the adaptation of B2B customers’ production processes to supplied new or improved products.

## Submission process & important dates

### Direct manuscript submission to the Journal of Business Chemistry

Prospective authors are welcome to contact the guest editors to discuss initial ideas for papers for this Special Issue (SI) and related questions about submissions. Full papers must be submitted to the Journal of Business Chemistry no later than September 30, 2023. Papers will be subject to the JoBC double-blind peer-review process. A guide for authors, sample copies and other relevant information for submitting papers are available at <http://www.businesschemistry.org>. The timeline for the SI is as follows:

- Deadline for full paper submission: September 30, 2023.
- Deadline for resubmission of all revised papers after guest editors’ comments: December 31, 2023.
- Notification to authors of papers selected for the SI and start of the peer review process: January 31, 2024.
- Expected time of publication: Fall 2024.

## Manuscript submissions, also intended for workshop presentations

The 5th advanced (invitational) “International Workshop on Innovation and Production Management in the Process Industries” will be hosted at KTH, Royal Institute of Technology, Stockholm, Sweden, 11–12 October 2023. As part of the paper development process for this Special Issue in the Journal of Business Chemistry, prospective authors are also welcomed to attend this workshop and to develop an early abstract of their paper.

Please see <https://www.kth.se/ipm2023> for further information. Workshop participation is not a prerequisite for SI authors and will not influence the selection of SI papers for full peer review. The timeline for such submissions is as follows:

- Deadline for submission of abstracts for workshop participation: April 30, 2023.
- Notification of acceptance for workshop participation: May 15, 2023.
- Workshop registration: May 31, 2023.
- Full paper or working paper submission: September 30, 2023.
- Workshop: 11-12 October 2023.

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