Received: 12 December 2022 | Revised: 21 November 2023 | Accepted: 25 February 2024

DOI: 10.1002/bse.3740

RESEARCH ARTICLE

Business Strategy and the Environment

WILEY

Sustainability-oriented innovation in manufacturing firms: Implementation and evaluation framework

Budi Harsanto[1] | Niraj Kumar[2] | Roula Michaelides[3]

[1]Faculty of Economics & Business, Universitas Padjadjaran, Bandung, Indonesia

[2]Essex Business School, University of Essex, Essex, UK

[3]Business School, Manchester Metropolitan University, Manchester, UK

Correspondence
Niraj Kumar, Essex Business School, University of Essex, Elmer Approach, Southend-on-Sea, Essex SS1 1LW, UK.
Email: n.kumar@essex.ac.uk

Abstract

In this paper, complementary perspectives from innovation management capabilities (IMC), the natural resource-based view (NRBV) and the social resource-based view (SRBV) are revisited in order to lay the theoretical foundation for developing evaluation framework for sustainability-oriented innovation (SOI). Six dimensions of SOI are identified, as innovation focus, sustainability focus, integration intra-organisation, integration inter-organisation, ambidexterity, and emphasis on physical life cycle — which then lead to developing the key parameters for the evaluation framework. The proposed framework is validated through analysis of 25 cases from the manufacturing sector in Indonesia. Data were primarily collected through semi-structured interviews and analysed using a polar diagram. This approach offered a comprehensive understanding of the qualitative data by assessing all six SOI dimensions simultaneously, presenting an effective visualisation of the firms' approach to SOI. The findings suggest that the majority of firms tend to adopt an operational optimisation approach when developing their SOI, while only a few opt for organisational transformational, and none choose the system building approach. This research paper makes a significant contribution to literature by introducing transition phases among SOI approaches, which were previously not explored in literature. The framework developed in this study would provide valuable support to practitioners in implementation and enhancement of their SOI practices.

KEYWORDS
natural resource-based view, social resource-based view, sustainability-oriented innovation, innovation management

Abbreviations: ASEAN, The Association of Southeast Asian Nations; BoP, Base of the Pyramid; EMS, Environmental Management System; INSEAD, Institut Européen d'Administration des Affaires; NRBV, Natural Resource-based View; OO, Operational Optimisation; OT, Organisational Transformational; R&D, Research and Development; RBV, Resource-based View; RPJMN, Rencana Pembangunan Jangka Menengah Nasional or National Medium-Term Development Plan; SMEs, Small and Medium Enterprises; SOI, Sustainability-oriented Innovation; SRBV, Social Resource-based View; TBL, Triple Bottom Line; WIPO, World Intellectual Property Organization.

1 | INTRODUCTION

In the past decade, there has been a growing focus on sustainability-oriented innovation (SOI) because of the urgent global challenges imposed by environmental degradation and climate change (Lim & Fujimoto, 2019). This rise in interest is evidenced through the increasing number of scholarly publications in this area. One influential publication by Hansen et al. (2009) introduced the term SOI, while another significant work by Nidumolu et al. (2009) argued that sustainability serves as a fundamental catalyst for innovation within firms. The dynamic shifts in market trends further indicate a growing consumer preference for purchasing products from innovative brands with well-established reputation for implementing sustainability practices (Unilever, 2017). From a policy perspective, the growing interest in SOI is evident in the implementation of stringent policies in numerous countries. These policies aim to promote innovative practices helping to achieve sustainability goals, recognising that traditional innovation policies are no longer sufficient (Kern et al., 2019; Schot & Steinmueller, 2018). This is what makes it important to harmonise both competitiveness and sustainability in business and the policy-making realm (Ghisetti et al., 2015).

Multiple streams of research in SOI are evident in past literature, such as policy-mix perspective (Kivimaa & Kern, 2016), key success/failure factors (Gee & McMeekin, 2011), opportunities for innovation (Hall & Vredenburg, 2003), financial incentives (Wesseling et al., 2015), or firms' approach towards SOI (Adams et al., 2016; Klewitz & Hansen, 2014; Varadarajan, 2017). At the firm level, studies on how to approach SOI are of particular interest as they attempt to analyse firm's position surrounding innovation by integrating elements of sustainability (Harsanto et al., 2020). Here, the term 'approach' is used in line with Behnam et al. (2018), Wu (2017), Provasnek et al. (2017a) and Adams et al. (2016) to describe firm's approach to their innovative practices. Current sparse literature substantiates a dominance of conceptual studies proposing models for firms to achieve more advanced level of SOI that lack theoretical grounding as well as empirical data (Dangelico et al., 2017). More importantly, most of these studies focus on firms from developed economies, without realising the fact that innovation development is likely to be different in developing countries. Thus their assumptions are missing the nuances of innovation novelty and economic importance in developing countries (Cirera & Muzi, 2020).

To address these research inconsistencies, this study asserts and proposes an evaluation framework to understand firm's approach to attain SOI and to provide insights into SOI dimensions to achieve greater innovation performance. This research provides a stepping-stone for complementarity and extension of various approaches to incorporate rich data on developing countries through a theoretically immersed framework. It aims to enhance our understanding of firm's transition towards SOI and offers a pathway to attain greater innovation performance.

The contributions of this paper to literature are twofold: firstly, we propose theoretical considerations and empirical evidence to effectively develop SOI in firms. The theoretical premise of this paper is based on three complementary theories in innovation and sustainability fields, namely the innovation management capabilities (IMC) (Tidd & Bessant, 2013), the extension of RBV of the firm, natural NRBV (Hart, 1995; Hart & Dowell, 2011), as well as social RBV (Tate & Bals, 2016). These theories provide a solid foundation for developing a holistic understanding of SOI and the necessary capabilities required for greater performance.

IMC has been selected as an appropriate theoretical lens to address the economic element of SOI to help firms manage their innovations to improve competitive advantage and growth (Tidd & Bessant, 2013). The concept of IMC addresses the innovation aspect of SOI, whereas the natural resource-based view (NRBV) (Hart, 1995; Hart & Dowell, 2011) address the environmental aspect and social resource-based view (SRBV) address the social aspect (Tate & Bals, 2016). NRBV provides a valuable theoretical approach to address the environmental aspect of SOI by promoting economically viable activities that are environmentally friendly. This includes strategies such as pollution prevention, product stewardship, clean technology and base of the pyramid (BoP) (Hart, 1995; Hart & Dowell, 2011). However, it was recognised that the NRBV was incomplete to explain SOI as it failed to incorporate the social aspect. To address this limitation, the NRBV was extended to include SRBV to explain both environmental and social aspects of sustainability, as proposed by Tate and Bals (2016).Additionally, our study makes a significant contribution to innovation policy and practices by emphasizing the interconnectedness of sustainability and innovation within the context of developing economies. We develop and introduce a unique evaluation framework for assessing SOI approaches and validate it through empirical data. This research is also valuable for practitioners and policy makers as it sheds light on the current antecedents for the development of SOI and provides guidance for firms to transition into responsible economic agents as sustainable innovators. By adopting these practices, Indonesia's economic growth, which has traditionally relied on its natural resources, can be enhanced, fostering a shift towards a more innovation-driven business and trade landscape (Damuri et al., 2018; Park & Kim, 2020).

2 | THEORETICAL BACKGROUND

SOI is defined in varied manner by past scholars. In literature, SOI is also known as sustainability-related innovation (e.g., Wagner & Llerena, 2008), sustainable development innovation (e.g., Hall, 2002) or sustainable innovation (e.g., Varadarajan, 2017). SOI research is consolidated from two perspectives: eco-innovation and social innovation (Hansen & Große-Dunker, 2013). Eco-innovation or ecological innovation gives attention to the environmental aspects, besides the economics aspect of innovation (Rennings, 2000). This notion is also familiar as green innovation), or environmental innovation (e.g., Truffer & Coenen, 2012). Social innovation concern on the social aspect, besides economics (Phills et al., 2008). This concept is also known as inclusive innovation (e.g., Altenburg, 2009) or jugaad innovation (Rai, 2015). Even though SOI is relatively 'young' discourse and there is no major inconsistency or contradiction between the studies,

we posit that this is due to the immaturity and lack of depth of the study field. To advance our understanding we describe below the complementarities in pathways to innovate sustainably to unpack the complex relationships among SOI approaches and dimensions.

2.1 | IMC, NRBV and SRBV

IMC reflect the ability of a firm to practice innovation, which consists of five main elements (Tidd & Bessant, 2013) such as, strategy (Dyer & Singh, 1998; Ramanujam & Mensch, 1985), process (Gregory, 1987), linkages (Chesbrough, 2003), organisation and learning (Calantone et al., 2002). A firm's innovation strategy, is manifested though its innovation objectives, allocation of resource to innovation endeavours, behaviour to innovation risks, timing of introducing new products or processes to the market, and their long term perspective (Ramanujam & Mensch, 1985). The term 'process' encompasses activities involved in searching for, developing, and commercialising ideas, to bring to the market (Chakravorti, 2004). At the searching and development stage, technical capabilities play an important role (Adams et al., 2006), while at the commercialisation stage, marketing capabilities play a vital role (Calantone & Di Benedetto, 1988). Linkages refer to establishing connections within and outside a network and accessing diverse resources to support and facilitate innovation (Harsanto et al., 2022; Tidd & Bessant, 2013). In essence 'linkages' are seen as firm's ability to combine, develop and adapt internal and external (Teece, Pisano, and Shuen, 1997). Organisation refers to the structure and culture that is conducive to innovation (Ekvall, 1996), and learning is regarding the absorption and management of knowledge by firms in the form of both explicit or implicit knowledge and learn from mistakes in the past (Luqmani et al., 2017).

The concept of IMC addresses the innovation aspect of SOI, whereas the NRBV (Hart, 1995; Hart & Dowell, 2011) and SRBV address the environmental and social sustainability aspect, respectively (Tate & Bals, 2016). NRBV highlights the significance of the relationships between firms and their natural environment. It encompasses various aspects such as pollution prevention, product stewardship and sustainable development (Hart, 1995). A later update by Hart and Dowell (2011) expanded the framework to include four components: pollution prevention, product stewardship, clean technology, and the BoP. Pollution prevention strategy includes reducing emissions and effluents through better handling or process innovation. This can provide advantages to firms in terms of cost-savings through better utilisation of inputs, reducing costs for waste disposal, or reducing compliance costs so that ultimately it can increase positive cash flow and level of profitability (Hart, 1995). Product stewardship is integrating environmental aspects into the value chain, especially in the product design and development phase (Hart, 1995). This is different from pollution prevention, which focuses on the operational phase. Sustainable development is an effort to reduce the environmental impact of firms' economic activities in developing economies in the South, because most attention to environmental issues has been focused on the advanced economies in the North (Hart, 1995).

Subsequently, it was recognised that the NRBV was incomplete as it fails to incorporate the social aspect. To address this limitation, the NRBV was extended to include SRBV as proposed by Tate and Bals (2016). The SRBV encompasses two key strategies: the mission-driven approach and stakeholder management. The mission-driven approach signifies a firm's commitment and consistency in maximising social and environmental benefits, alongside profitability (Tate & Bals, 2016). It serves as a signal of the firms' dedication to creating societal positive impact. On the other hand, stakeholder management focusses on establishing connections to harnessing support from diverse stakeholders in order to achieve business value creation (Tate & Bals, 2016). Both of these strategies align with the 3C framework, which emphasizes the commitments of value, consistency of behaviour and connections within value networks (Tate & Bals, 2016). Through the adoption of SRBV, Tate and Bals (2016) argue that the social dimensions, which have previously received less attention in sustainability, can be better addressed.

In sum, IMC is more inclined to addressing the economic dimension of SOI to help firms manage their innovation so that they can increase their competitive advantage and help the survival and growth of the firm (Tidd & Bessant, 2013). NRBV is useful to address the environmental dimension of SOI through contribution to the four interconnected strategies of pollution prevention, product stewardship, clean technology, and BoP in facilitating environmentally friendly economic activities (Hart, 1995; Hart & Dowell, 2011). SRBV (Tate & Bals, 2016) is suitable for addressing the social dimension of SOI.

2.2 | SOI approach

A firm's position surrounding innovation by integrating elements of sustainability is referred as SOI. The term 'approach' is used by Behnam et al. (2018), Wu (2017), Provasnek et al. (2017b), and Adams et al. (2016) to describe firm's approach to develop innovation. Confusingly, the three most frequently cited articles in the literature SOI (according to the Web of Science database), namely Nidumolu et al. (2009), Klewitz and Hansen (2014) and Adams et al. (2016), employ distinct and interchangeable terminology when referring to SOI approaches. Nidumolu et al. (2009) propose five stages for firms to become sustainable innovators, starting from perceiving compliance as an opportunity progressing towards developing new business models. In contrast, Klewitz and Hansen (2014), discuss a spectrum of SOI approaches, ranging from 'resistant' to 'rooted sustainability', with a particular focus on small and medium-sized enterprises (SMEs). Additionally, Adams et al. (2016) strengthened the understanding of SOI approaches by presenting a comprehensive model comprising of operational optimisation, organisational transformation and systems building, derived from a systematic review.

Other studies explore various perspectives on SOI approaches. For instance, Kuokkanen et al. (2019) analyse SOI from the disruptive innovation standpoint. Hansen et al. (2009) focus on the life cycle, whereas (Wesseling et al., 2015) investigate the role of financial incentives. Provasnek et al. (2017b) explore the entrepreneurial

aspects of SOI and Varadarajan, (2017) examines SOI from a marketing perspective. Other studies are bounded by focus on specific business sizes as large (e.g., Provasnek et al., 2017) or SMEs (Klewitz & Hansen, 2014); or focus on certain sectors such as automotive (Wesseling et al., 2015) or food industry (Kuokkanen et al., 2019). Upon evaluating different approaches to SOI employed by various firms, this research adopts the fundamental SOI classification model proposed by Adams et al. (2016) as the basis for developing our conceptual framework. This model is chosen for its three key attributes: generalizability, robustness and currency. In contrast to other existing models, the framework developed by Adams et al. (2016) stands out as the most comprehensive and inclusive. It is based on a thorough synthesis of empirical literature spanning from 1992 to 2012, encompassing diverse firm sizes, sectors and regions. Importantly this study by Adams et al. (2016) is a relatively recent publication. Their categorisation of the literature is guided by a framework synthetic approach, drawing on established categories from innovation management scholarship, such as strategy, innovation process, learning, linkages, and innovative organisation. They proposed their configurational SOI approach model as a scientific model (p. 195) whilst arguing that the SOI scholarship field currently in an early stage of theoretical development - in Whetten (1989) focused on 'what',' and their model tried to move SOI field to 'how' phase.

2.3 | SOI dimensions

SOI dimensions reflect the important aspects that form the SOI approach of a firm. Although there are no contradictory theoretical assumptions between Adams et al. (2016) and other SOI scholars, we are moving towards integrating the ideas of developing firm capabilities through IMC, NRBV and SRBV theories (Table 1). In order to develop an integrated theoretical approach, we identified six complementary SOI dimensions according to the way a firm moves towards sustainable innovation, namely: innovation focus; sustainability focus; intra-organisational integration; inter-organisational integration; ambidexterity, and physical life cycle.

As sustainable innovation falls within the broader domain of innovation, it become apparent that the 'innovation focus' is an integral part of SOI (Adams et al., 2016; Watson et al., 2018). In IMC (Tidd & Bessant, 2013), '*innovation focus*' explains how innovation goals can be achieved through resource allocation, as well its behaviour and timing (Ramanujam & Mensch, 1985). *'Sustainability focus'* becomes one of the SOI dimensions as a logical consequence of the innovation focus on the first dimension. Sustainability focus is inseparable from SOI -as with innovation focus- remembering SOI is an intersection manifestation between innovation and sustainability. The incorporation of sustainability practices within manufacturing processes has gained significant traction in recent times (Centobelli et al., 2022; El-Garaihy et al., 2022).

The successful integration of sustainability into innovation and the business processes of a firm relies on the support of both the internal (Mubushar et al., 2021; Saha et al., 2020). *'Intra-organisational integration'* reflects the level of diffusion of sustainability-oriented innovation within the firm. This perspective is commonly discussed in the literature on innovation management capabilities (IMC) under the 'organisation' and 'learning' capabilities stream (Tidd & Bessant, 2013). On the other hand, the dimension of *'Extra-organisational integration'* refers to the extent to which a firms' relationships with stakeholders in a broader socio-economic system enables systemic changes. This dimension is central in the literature on IMC, NRBV and SRBV.

'Ambidexterity' refers to the innovation orientation of an organisation, specifically its ability to simultaneously pursue both exploitation and exploration stages of innovation in terms of implementing existing ideas (exploitation) and developing new ideas (exploration/

TABLE 1 SOI dimensions.

Dimension	IMC (Tidd & Bessant, 2013)	NRBV (Hart, 1995; Hart & Dowell, 2011)	SRBV (Tate & Bals, 2016)	Example of supporting references
Innovation focus	Strategy	-	-	(Kuokkanen et al., 2019); (Varadarajan, 2017); (Hall & Vredenburg, 2003); (Geels, 2005)
Sustainability focus	-	Pollution prevention BoP	Mission-driven approach	(Silvestre & Ţîrcă, 2019); (Kuokkanen et al., 2019); (Periac et al., 2018);
Intra-organisational integration	Organisation Learning	Pollution prevention	-	(Provasnek et al., 2017a); (Adams et al., 2016); (Klewitz & Hansen, 2014); (Seebode et al., 2012);
Inter-organisational integration	Linkages learning	Product stewardship	Stakeholder management	(Kuokkanen et al., 2019); (Periac et al., 2018); (Metz et al., 2016); (Ayuso et al., 2011); (Watson et al., 2018)
Ambidexterity	Learning	Clean technology	-	(Wesseling et al., 2015); (Adams et al., 2016); (Von Pechmann et al., 2015) (Coccia, 2017); (Hansen et al., 2018)
Physical life cycle	Process	Pollution prevention	-	(Varadarajan, 2017); (Hansen et al., 2009); (Kolsch et al., 2008)

Abbreviations: BoP, base of the pyramid; IMC, innovation management capabilities; NRBV, natural resource-based view; SRBV, social resource-based view.

development) for products, process is or the organisation itself. This includes exploring ideas from nature known as nature-inspired innovation (Mead et al., 2020). *'Physical life cycle'* refers to the focus of SOI on the complete physical life cycle of a product, encompassing its birth or creation through to its end or disposal ('cradle to grave'). The dimension emphasizes the consideration of environmental and social impacts at every stage of product's lifecycle, from production and use to eventual disposal or recycling. Considering the complex interdependencies between these SOI dimensions, it is essential to develop an approach that enables firms to assess their capabilities in sustainable innovation whilst considering the interplay among the identifies factors.

3 | PROPOSED EVALUATION FRAMEWORK

Drawing upon the theoretical foundation presented in Section 2, an evaluation framework is proposed, adopting a polar diagram format, which incorporates all six dimensions of SOI along with three distinct SOI approaches: operational optimisation, organisational transformational, and systems building (Adams et al., 2016). Given the inclusion of multiple SOI dimensions n this study, a polar diagram is more suitable as compared with Cartesian diagrams (XY or XYZ). The polar diagram allows for the effective representation of the numerous SOI dimensions considered in the analysis. Similar approach has been used by past researchers in the innovation field (such as, Tidd & Bessant, 2009; and Carrillo-Hermosilla et al., 2010). Figure 1 shows a mix of all six SOI dimensions (innovation focus (IF), sustainability focus (SF), intra-organisational integration (IN), inter-organisational integration (OU), ambidexterity (DX), and physical life cycle (LC)) and three SOI approaches (operational optimisation, organisational transformational, and systems building). The evaluation framework analyses each dimension of SOI for the sample firms and present it in the form of the polar diagram (Figure 1).

A firm focussing on a specific SOI approach has some particular characteristics. For example, operational optimization is characterized by SOI dimensions such as: their primary focus is technical innovation (Klewitz & Hansen, 2014), the firm sustainability focus is strongly emphasised on economic aspects in terms of efficiency and compliance (Bendell, 2017); their intra-organisational integration is standalone (Tilley, 1999); inter-organisational integration is insular (Adams et al., 2016); ambidexterity is limited to exploitation of current demand (Wesseling et al., 2015); and the emphasis on physical life cycle is limited to the manufacture phase (Hansen et al., 2009).

The proposed framework advances the recent debates in SOI literature on SOI evaluation and explains the scenarios that may help a firm to innovate sustainably. Moreover, this framework can also help practitioners to understand the level of SOI approach they have adopted and explore more advanced approach that could be realistically achieved in short, medium, and long term.

4 | RESEARCH METHODOLOGY

This research consists of two primary stages. In the first stage, a literature review was conducted to identify and establish six dimensions of SOI: innovation focus, sustainability focus, intra-organisational integration, inter-organisational integration, ambidexterity, and physical life cycle. These dimensions are linked to three SOI approaches: operational optimization, organisational transformational, and systems building. This process led to the development of the SOI evaluation framework. In the subsequent stage, a rigorous approach was followed to empirically validate the proposed framework. A qualitative research design based on multiple case studies was adopted to thoroughly explore SOI practices within the manufacturing sector in Indonesia. This choice is driven by the existing research gap in the field of SOI from a capability perspective, as highlighted by Dangelico et al. (2017). The qualitative research method is the most appropriate approach for this study, as emphasised by Silverman (2013). It enables the analysis of myriad phenomena in a multitude of contexts (Köhler et al., 2022). The theory development approach used in this study is abductive, which is a combination of inductive and deductive through a process of matching and going back between literature and data (Dubois & Gadde, 2002). Timmermans and Tavory (2012) argue that abductive approach entails a recursive process of iteratively fitting data and literature together. A blend of data and literature represents a balancing effort to reach coherence that facilitates exploration without the need to duplicate well-established concepts (Gioia et al., 2012; Howard-Grenville et al., 2021). This approach is the most appropriate because on the one hand the literature regarding SOI is growing, while on the other hand the evidence from a capability perspective as well as from the emerging economies context is still limited.

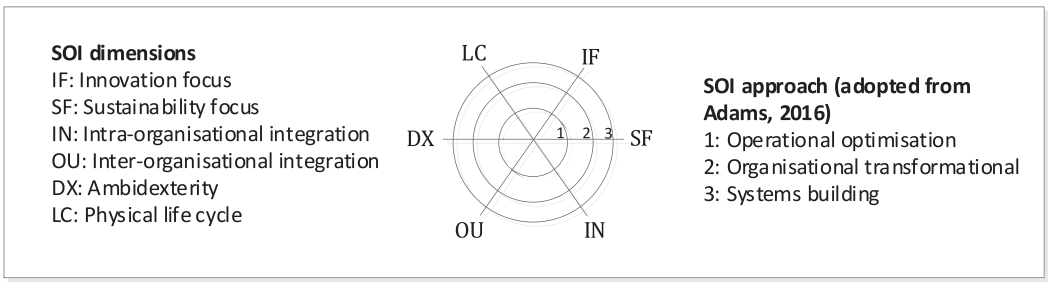


FIGURE 1 SOI evaluation framework.

4.1 | Research context

The evaluation framework is validated in context of the manufacturing sector in Indonesia. There are multiple reasons, which guide this selection. Indonesia has an interesting context considering its status as one of major developing economies in the world (Harsanto et al., 2018). It is a typical developing country, that has a large market, but that also faces challenges in terms of both innovation and sustainability (Cornell University et al., 2018; Harsanto & Permana, 2019; RobecoSAM, 2018). On global innovation index, Indonesia is ranked 85th out of 126 countries (Cornell University et al., 2018). Cornell University, INSEAD and WIPO (2018) reported that ASEAN (The Association of Southeast Asian Nations) countries made a significant innovation progress in the past years. Even though, the position of Indonesia (85th) compared with its neighbours is very poor: Singapore (5th), Malaysia (35th), Thailand (44th), Vietnam (45th), Brunei Darussalam (67th), and the Philippines (73rd). On the aspect of sustainability, Indonesia is ranked 48th out of 65 countries in the Sustainability Ranking 2018 (RobecoSAM, 2018). RobecoSAM (2018) highlighted that air pollution is now the greatest threat to public health with a welfare estimation cost – due to premature deaths – reaching USD 5.06 trillion. In addition, Indonesia is the fourth largest contributor to this cost after China, India, and Russia. Even though providing an interesting context for research, until now Indonesia is one of the countries that have been completely overlooked in past SOI literature (Adams et al., 2016; Klewitz & Hansen, 2014; Watson et al., 2018).

TABLE 2 Sample profile.

Firms	Interviewees	Industry	Size	Establishment year	Mode of interview	Site visit
A	1: CEO	I	Medium	2004	Face-to-face	Yes
B	2: CEO; VP operations	II	Small	2000	Face-to-face; face-to-face	Yes
C	1: CEO	I	Medium	1975	Face-to-face	Yes
D	1: CEO	II	Medium	2009	Face-to-face	Yes
E	1: CEO	I	Small	2010	Skype	No
F	1: VP productions	III	Medium	1950	Face-to-face	Yes
G	1: HR & legal manager	II	Large	1981	Face-to-face	Yes
H	2: CEO; PPIC manager	II	Large	2007	Face-to-face: Face-to-face	Yes
I	1: CEO	I	Small	2015	Skype	No
J	2: Marketing manager; HR & legal manager	II	Large	1995	Face-to-face; face-to-face	Yes
K	1: CEO	II	Medium	1999	Skype	No
L	3: R&D manager; operations manager	III	Large	1974	Face-to-face; face-to-face	Yes
M	1: VP marketing & administration	II	Large	2004	Face-to-face	Yes
N	1: CEO	III	Medium	2009	Skype	No
O	3: CEO; VP; marketing manager	II	Large	1997	Face-to-face; face-to-face; skype	Yes
P	1: VP	I	Small	2007	Face-to-face	Yes
Q	1: CEO	II	Small	2003	Face-to-face	Yes
R	2: CEO, marketing manager	I	Small	2013	Face-to-face	No
S	1: CEO	I	Small	2012	Face-to-face	No
T	1: CEO	II	Medium	2000	Face-to-face	No
U	1: CEO	II	Small	2011	Face-to-face	No
V	1: CEO	I	Medium	1995	Face-to-face	Yes
W	1: VP marketing	III	Large	2013	Face-to-face	Yes
X	1: HR manager	I	Large	1990	Face-to-face	Yes
Y	1: Factory manager	I	Large	1986	Skype	No
25 firms	**33 interviews**	**I = 12; II = 15; III = 6**	**S = 10; M = 8; L = 15**	**-**	**26 face-to-face; 7 skype**	**16 yes; 9 no**

Note: I = Food and beverage industry; II = Textile, leather, footwear, and multifarious industry; III = Other sectors including pharmacy, cosmetics, and medical devices industry or transportation industry or electronics and ICT industry. All are manufacturing firms.

4.2 | Data collection

The Ministry of Industry in Indonesia provided the research team with a list of all registered firms across Indonesia. The sample firms considered for this study were from the manufacturing sector. The size of firms was decided based on the 'firm-size definition' from the Enterprise Survey (small: 5–19, medium: 20–99, large: >100 employees) (World Bank, 2015). Specifically, the firms in the sample were from the following industries: a) food and beverages, b) textiles, leather, footwear, and multifarious other areas, and c) other big five priority industries. This categorisation is based on the regulations regarding the priority industry in Indonesia for 2015–2035 (Government of Indonesia, 2015). Sample was selected purposively with attention to be representative especially in terms of size and sectors. Our sample is a combination of small, medium and large business sizes; also, a combination of several sub-sectors in the manufacturing industry (see Table 2). The sample for this study considered 25 case firms for in-depth exploration of SOI practices.

Semi-structured interviews were conducted with the owners and/or senior managers of these firms, predominantly in physical settings. The interviews focussed on elaborating on the six dimensions outlined in the proposed framework, namely innovation focus, sustainability focus, intra-organizational integration, inter-organizational integration, ambidexterity, and physical life cycle. Here are examples of typical questions posed during the interviews: "Do you work with external stakeholders (e.g., suppliers, customers, other firms and universities) in developing new concepts? [Follow up if yes] How do you relate to them? Can you suggest examples, please?"

Long distant interviewees were contacted through online platforms like Skype/Zoom. The study involved 33 in-depth interviews, with 26 conducted in-person and seven conducted through virtual platforms. These interviews were conducted with representatives from 25 firms in Indonesia, as shown in Table 2. Thirty-three interviewees were considered sufficient for this study from information saturation perspective, as no new themes emerged after reaching the 30th interview. This suggests an indiscernible norm in the interview based data collection approach (Saunders & Townsend, 2016). We visited most of firms to observe how innovation was approached. We also collected archival data related to firm's operational practices, including information available through firm's websites, product catalogues, and other public documents to ensure the validity and broader context of the responses collected.

4.3 | Data analysis

The data collected were analysed using thematic analysis, which was closely aligned to the proposed SOI evaluation framework (depicted in Figure 1). Insights from the participants were transcribed and then analysed, involving categorisation into six dimensions of SOI: innovation focus, sustainability focus, intra-organizational integration, extra-organizational integration, ambidexterity, and physical life cycle. This approach is closely aligned with the genre of case studies in qualitative research, which aims to identify patterns within the data (Bansal et al., 2018). Following this, the relevance of the participants insights was assessed based on the three SOI approaches: operational optimization, organizational transformational and systems building. Specific guidelines for the analysis can be found in Table 3.

To illustrate, when evaluating a firm's innovation focus within the 'innovation focus' dimension, as score of 1 was assigned if a firm primarily focussed on technical innovation. A score of 2 was given if a firm's innovation efforts encompassed both technical aspects and some degree of human resources involvement. A score of 3 was awarded if firm's innovation efforts predominantly emphasised behavioural changes among consumers, reflecting a people-centric approach. Following a systematic analysis of each firm individually, the findings were subsequently summarised based on the SOI approach and further compared considering the industry and size.

5 | FINDINGS

The key findings referring to SOI approach evaluation framework are discussed in this section, but detailed findings are presented in Appendix A, if readers want to refer that for further consultation. Sample firms were found to be following two SOI approaches: operational optimisation and organisational transformational. No firm has followed the systems building approach.

TABLE 3 Assessment matrix guidelines.

SOI approach SOI dimensions	Operational optimisation (1)	Organisational Transformational (2)	Systems Building (3)
Innovation focus	Technical	Technical and some degree of people	People dominant
Sustainability focus	Economic	Economic and environmental or social	Economic, environmental, and social
Intra-organisational integration	Stand-alone	Stand-alone and some degree of integration	Integrated
Extra-organisational integration	Insular	Insular and some degree external value sharing	Systemic
Ambidexterity	Exploitation	Exploitation and some degree of exploration	Exploitation and exploration equally
Physical life cycle	Manufacture	Manufacture and use or end-of-life	Manufacture, use and end-of-life

Abbreviation: SOI, sustainability-oriented innovation.

5.1 | Operational optimisation approach

As expected, majority of firms were approaching SOI with an operational optimisation approach (20 out of 25 firms). Among these 20 firms, 12 were approaching SOI with operational optimisation, while eight were in transition to the organisational transformation approach.

5.1.1 | Fully operational optimisation

Firms that are completely approaching SOI with operational optimisation are Firm B, D, H, J, K, M, Q, R, S, T, U, and V. These firms approached SOI at a minimal scale in all six dimensions. Efficiency and compliance were the main characteristics of firms at this level. In terms of innovation focus, full attention was given to technological aspects, especially to improving production efficiency in these firms (for example Firm B through the use of electric heaters, Firm K by means of electric wood planers and jointers, or Firm Q by using a machine with a certain number of needles), and for compliance (for example Firm J to meet stricter regulations regarding industrial waste, or Firm M through the use of an air blower to reduce excessive dust in the production process). These findings are supported by the comments made by the CEO of firm B as follows:

> "We are naming it embossed. Long ago, to make embossed, it began with sponge sheets, cutting the pattern, putting it in the oven, then pressing it, it took a long time. Along with the growth, we think we need to make the process easier, so I am improving it with the same results, cheaper costs, and it's faster, I am using the electrical heater device that's widely used for Screen Printing, faster."
>
> (CEO, Firm B)

In terms of sustainability focus, various initiatives had been carried out, almost entirely for economic reasons, such as the use of some portions of eco-friendly materials (Firm B) as expressed by the VP operations of Firm B *"For the bags production, we have used a lot of materials such as yarns that are eco-friendly"*; partnering with surrounding communities (Firm V) as explained by CEO of Firm V, *"Yes, buying (from local) fishermen"*; local sourcing (Firm U) as revealed by CEO Firm U, *"… (local) duck farms … the beginning there were 3 farms"*; or waste handling (Firm H, Firm K) as for example explained by CEO of Firm K, "*We can sell the wood sawdust … The unused wood scarps we can use as firewood* …". In terms of intra-organisational integration, it was stand-alone in nature where SOI practices were an add-on and not embedded in the organisation (for example the use of some eco-friendly materials or a minor process change); while the inter-organisational integration was insular, especially to solve firm's internal problems (for example health and safety or regulation compliance issues).

For the ambidexterity dimension, the firms' focuses were on the exploitation of current demand. For instance, Firm M continues to exploit the production of mountain sandals from large buyers that has been going on for many years, as revealed by VP marketing and administration of Firm M, "*… as time goes by, precisely at the end of 2004 the owner entered into a partnership with a larger firm to supply mountain slippers … until now the manufacture of mountain sandals is still running"*. While the physical life cycle dimension was emphasised in the manufacturing phase. For example, Firm H have done it through a water cleaning process to improve efficiency during manufacturing as explained by their CEO, "*… it circulated to be cleaned, filtered, recycled and then returned to the water tank, then reused*".

5.1.2 | Transition of operational optimisation to organisational transformational

The transition between operational optimisation and organisational transformational (transition OO-OT) was visible in eight firms (F, G, W, P, I, A, N, and E). These firms approached SOI at a lower level of one or more dimensions and at a higher level in one or more other dimensions. Two types of patterns were emerged in this transition approach. Type 1 firms predominantly followed operational optimisation approach but beginning to adopt more advanced level in one to three (out of six) SOI dimensions. Type 2 firms were in transition that had almost reached the organisational transformational level, indicated by more than three (out of six) SOI dimensions with higher than the minimal value.

Type 1 firms are the dominant type in transition OO-OT (eight out of nine firms). It has some unique patterns. The first pattern shows minimal value in all dimensions except for 'intra-organisational integration'. Firms that had this unique pattern were Firms F, G, and W. They had similarities in implementing certain management system that helped them approach SOI in a more integrated way (e.g., ISO, certification from a larger manufacturer). The second specific pattern shows lower value in all dimensions except for the emphasis on the 'product life cycle'. This specific pattern is observed in firm P, which offers a more hygienic process in production (manufacturing) as well healthier products for consumption (use). The third specific pattern shows lower value in all dimensions except on 'integration outside' and an emphasis on the 'physical life cycle'. It is observed in firm I, which has been aggressive in cooperating with outside firms since the beginning of operations and offers product that are hygienic in production (manufacturing) and healthier to consume (use). This is evident from the statement made by the CEO of Firm I:

> "… in September the permit was issued, because previously there was a request from several stores that we must have a license from health office, finally after September I immediately collaborated with modern markets … since early January 2016 we have been working with some big retailers, and well, from there at the beginning of the development I immediately pursued cooperation with larger parties …"
>
> (CEO, Firm I)

The fourth specific pattern shows minimal value in all dimensions except in intra-organisational integration, inter-organisational integration, and putting more emphasis on the physical life cycle. This pattern is observed in case of Firm N, which avoids the use of hazardous materials commonly found in similar products on the market, engages with suppliers of natural ingredients from the seas of Indonesia, and implemented SOI both in manufacturing and use phases. The CEO of Firm N highlighted that,

> "… we now focus on producing organic skin care products from the Indonesian oceans treasury… We already have organic certificates so the raw material we use are derived from seas treasury in Indonesia which already has organic certificates."
>
> (CEO, Firm N)

Type 2 pattern is observed in only one firm, namely Firm E. This firm has adopted more advanced approach than operational optimisation in five (out of six) SOI dimensions. Among those that stand out are the 'sustainability focus' and 'inter-organisational integration' as implied in the CEO's expression,

> "I collaborated with mushroom farmers in this city … because geographically the elevation is quite good to grow mushrooms … I have experience of around 8 years to develop this business, I can share it with college students … they are my partners to educate the society."
>
> (CEO, Firm E)

On social parameters, this firm innovates by providing added value to the environment through the transmission of an entrepreneurial spirit to college students, as well as research with their institution. Inter-organisational integration is performed through the partnership with mushroom farmers in their city for long-term and sustainable sourcing.

5.2 | Organisational transformational approach

Organisational transformational approach to SOI focusses on more advanced level in all dimensions than in operational optimisation. There are five firms adopting organisational transformational approach. Among these, one was limited to adopting organisational transformational approach, while other four were in a transition to the systems building approach.

5.2.1 | Fully organisational transformational

Fully organisational transformational was observed in one firm (that is Firm O). The focus of firm adopting fully organisational transformation approach is, both on innovation and sustainability beyond the minimal level. Firm O innovated the production of designer leather bags and hand-made shoes using with elegant and authentic designs, by the means of a specific tanning process. Interestingly, most of their products are sold in foreign markets, which is something that is still a rarity amongst similar by local firms with similar products having of similar business scale. On sustainability parameters, this firm mainly makes social impact by empowering tanners in their specific tanning processes, empowering smaller businesses in the surrounding areas to supply accessories for their products, and by placing showrooms in non-mainstream places. Instead of at the mall, they put the showroom (as well as the production site) in the middle of a village, which later proved to be successful. This is reflected in the statement made by the CEO of Firm O as,

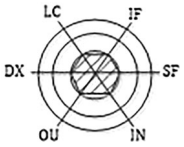
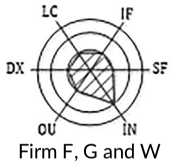
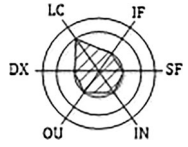
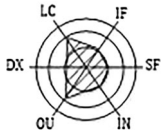
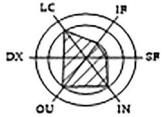
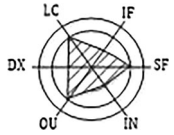
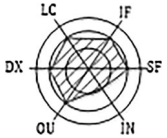
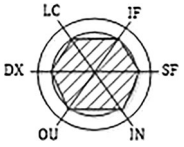
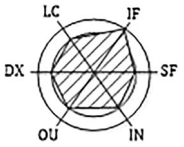
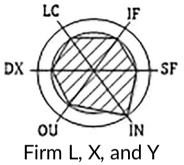
> "At first, we didn't have a showroom, then we make a small showroom, the more consumers who come here, finally we make bigger ones … The important thing is 'low cost, high profit'. And now location is not a problem, right? And accidentally, this location is also quite strategic because it is close to airport. — I fixed the road, people came here comfortably. The parking lot is spacious can fit 2 or 3 large buses. Not jammed, not crowded and then people can view rice fields … As I mentioned earlier, changing and shortages becomes an advantage. That's the point. From the very beginning I was an anti-mainstream. I want to be different, so it is more visible."
>
> (CEO, Firm O)

5.3 | Transition of organisational transformational to systems building approach

Transition between organisational transformational and systems building (Transition OT and SB) was observed in four firms: C, L, X and Y. These firms generally approached SOI at organisational transformational levels but in one or more dimensions took a more advanced approach. Two specific patterns were observed here. The first one was observed in Firm C where five dimensions were at the organisational transformational level and one dimension, that is innovation focus, was at the system building level. Firm C was orienting their innovations, not only from a technological aspect, but also from the wider systems perspective by raising the prestige of local material as well the economic level of local farmers (indeed they had also innovated technologically with the development of their own machines for processing rice with a high level of cleanliness for greater shelf life). This is also reflected in the statement made by the CEO of firm C,

> "The machine. Actually, I got the knowledge for this product when I was trained in Japan. I was there for marketing training actually. But since I am a production person … when I returned here, I tried this … I also returned to my campus when I built the machine,

TABLE 4 Summary of SOI approach patterns.

SOI approach	Operational optimisation		Organisational transformational		Systems building
Firms and pattern	 Firm B, D, H, J, K, M, Q, R, S, T, U, and V	Transition Type 1 (OO dominant):  Firm F, G and W  Firm P  Firm I  Firm A  Firm N Type 2 (OT dominant):  Firm E	 Firm O	Transition Type 1 (OT dominant):  Firm C  Firm L, X, and Y	-
Total	12 firms	8 firms	1 firm	4 firms	-

Abbreviation: SOI, sustainability-oriented innovation.

> asked my lecturer … In the beginning, this product was sent to the stores, shops, but they were rejected. We've explained, too, but they said the shelf is full, etc."
>
> (CEO, Firm C)

Firms L, X, and Y had distinctive value in the intra-organisational integration dimension, as indicated by the various advanced formal certifications they had implemented. For example, Firm Y, which is engaged in milk processing, had a degree of standardisation that allowed them to be recognised by the Indonesia Standardisation Agency as one of the role models in the application of standards in the industry.

5.4 | Systems building approach

There was no firm in the sample that had adopted systems building approach to achieve SOI. Adopting this approach is proving most challenging because as firms are expected to follow the highest level in all six SOI dimensions. A summary of firms' patterns following different approaches to SOI is presented in Table 4.

6 | DISCUSSION

Findings of the empirical study show that the evaluation framework developed in this paper – combining six SOI dimensions and three SOI approaches – reveals interesting lessons for firms' approach to SOI. Insights from these findings are interpreted and linked to the existing theories and literature, especially around the most adopted SOI approach, the transitions between approaches, and the nature of transformation in this section.

6.1 | Operational optimisation as the most widely adopted SOI approach

Operational optimisation is the SOI approach that was most widely adopted by the firms in the sample (20 firms out of 25). It is the more basic approach in SOI compared with other two approaches, namely organisational transformational (five firms) and systems building (no firm). Firms using the operational optimisation approach comply with environmental and social regulations when innovating their products and processes, but the focus is still on traditional benefits in terms of achieving financial efficiencies (Bendell, 2017).

This finding corroborates with the systematic review study of Adams et al. (2016) who concluded that operational optimisation was the most prevalent approach in SOI literature (70 scholar publications out of 100). In contrast to this finding, Metz et al. (2016) and Pace (2016), concluded that most of the firms they studied were at an advanced level of SOI approach. However when we looked in detail into the findings of Metz et al. (2016) and Pace (2016) there could be biased towards firms that were leaders in SOI, considering the selection of the sample of firms in their studies.

There are several possible explanations why most firms in our sample adopted an operational optimisation approach. The innovation strategies, as fundamental elements of IMC, in the firms with an operational optimisation approach, were based on compliance with the regulations or were looking to gain internal efficiency (Adams et al., 2016; Tidd & Bessant, 2009). Most of the initiatives in these firms were SOI processes in the form of better waste management, pollution control or recycling (Alston et al., 1999; Dangelico & Pujari, 2010). Prior literature indicates that SOI practices can provide tangible returns through cost reduction or sales increase (Paul & Zhou, 2017). The competitive advantage aspired by firms with an operational optimisation approach was mainly to achieve lower costs, which suggested an NRBV drive by societal forces for minimising emissions (gas), effluents (water), and waste (Hart, 1995). The key resources used to achieve this competitive advantage based on NRBV was continuous improvement (Hart & Dowell, 2011). The basic level of innovation strategy at the firm level resonates with the policy in Indonesia in the past that did not give emphasis on science and innovation. Instead, it primarily an emphasis on the exploitation of natural resources to drive economic growth (CIPG and Nesta, 2019; Park & Kim, 2020).

Most of the firms operating with an operational optimisation approach could also be constrained by their resource limitations. The evidence suggested that financial resource was the primary constraint, followed by human resources (Eccles & Serafeim, 2013; Metz et al., 2016). Developing SOI to a more advance level requires significant financial resources, besides involving significant risks (Evans et al., 2017). Beside financial requirements, Eccles and Serafeim (2013)(Eccles & Serafeim, 2013) argued that new skills are also needed when developing SOI, especially if the development is significant. This human resource challenge is reflected, for example, by the very small number of researchers in Indonesia. Indonesia only has around 89 researchers per one million people; far behind developed economies in the range of 4,000 to 5,000 researchers per one million population (World Bank, 2013). Recent effort from policy side to improve this condition among others through the mechanism such as greater funding for research commercialization and capacity building via international collaboration (CIPG and Nesta, 2019).

The type of the industry could also explain why most of the firms are using an operational optimisation approach. Around half of the firms using operational optimisation (nine out of 20) operated in industry II (textile, leather, footwear, and multifarious). The evidence suggested that industry II is that which most struggles to achieve a more advanced level of approach to SOI. This can be due to the nature of Industry II, especially textiles, which have unique characteristics in terms of absorption of a large workforce as well as complex environmental and social impacts (Boston Consulting Group, Global Fashion Agenda, 2018; Boström & Micheletti, 2016). Issues on environmental degradation and human health have placed textiles, especially those involving the use of chemicals, as an industry that is supervised by various regulators worldwide (Boston Consulting

Group, Global Fashion Agenda, 2018). Textile industry in Indonesia is global value chain (GVC) oriented and requires stimulation to be able to innovate, including to be more sustainable (Damuri et al., 2018).

6.2 | Transitions between SOI approaches

By employing the polar diagram, we are able to obtain extra granular insights to our data, which uncovered that different transition levels exist between three SOI approaches (operational optimisation, organisational transformational, and systems building). Firms in transition are basically those who started with a certain SOI approach but have succeeded in further developing themselves on one or several dimensions of SOI (Figure 2).

The transition between SOI approaches is based on the concept of transition in the World Economic Situation and Prospect (United Nations, 2019), which divides countries into three broad categories of developed, transitional, and developing economies, based on their particular characteristics. The transition in the SOI approach shows the approach between two adjacent but different approaches states in the SOI journey of a firm that have certain similar characteristics based on SOI dimensions. In a broader context, this is also in line with the socio-technical transition found in the process of changing sustainability in innovation and technological changes (Ramos-Mejía et al., 2018).

This in-depth insight emerged as two types of patterns are identified in the transition between operational optimisation and organisational transformation. Type 1 signifies firms that is are at the early stages of transition, meaning that they phase, which is still at an early stage of transition. Firms in this type are beginning to approach SOI in a more advanced way than operational optimisation in one to three of the SOI dimensions (out of six dimensions). There were seven of eight firms in this transition phase that were categorised as type1. Type 2 is the transition phase, which is at an advanced stage. Firms in this type have nearly reached the organisational optimisation approach. Only one firm (out of eight) in this transition phase was categorised as type 2.

The next transition approach is the transition between organisational transformation and systems building (four out of 25 firms). Unlike the transition of operational optimisation to organisational transformation which consists of two types, this transition approach only consists of one type, where all four of the firms have basically adopted an organisational transformational approach but have been able to develop one to three SOI dimensions (out of six). One firm stood out in terms of innovation focus, whereas the other three firms stood out on intra-organisational integration. The one firm that stood out in the innovation focus dimension, is a medium-sized firm, which has paid attention to aspects of people (not only technical) when innovating. By being people-oriented, the firm has been able to manage their resources in a different way than just from being technically oriented (Hansen et al., 2009; Nidumolu et al., 2009).

6.3 | SOI approach development: sequential or configurable/non-sequential?

It is not yet known whether the process of development from one SOI approach has to be sequential from one approach to another (for example, from operational optimisation to organisational transformational) or can it be non-sequential and configurable (for example from operational optimisation to systems building). This is because this study is cross-sectional, in which the observations were made at one particular point in time so that a pattern of change was not observed. Theoretically, the development process of SOI is possible to be done

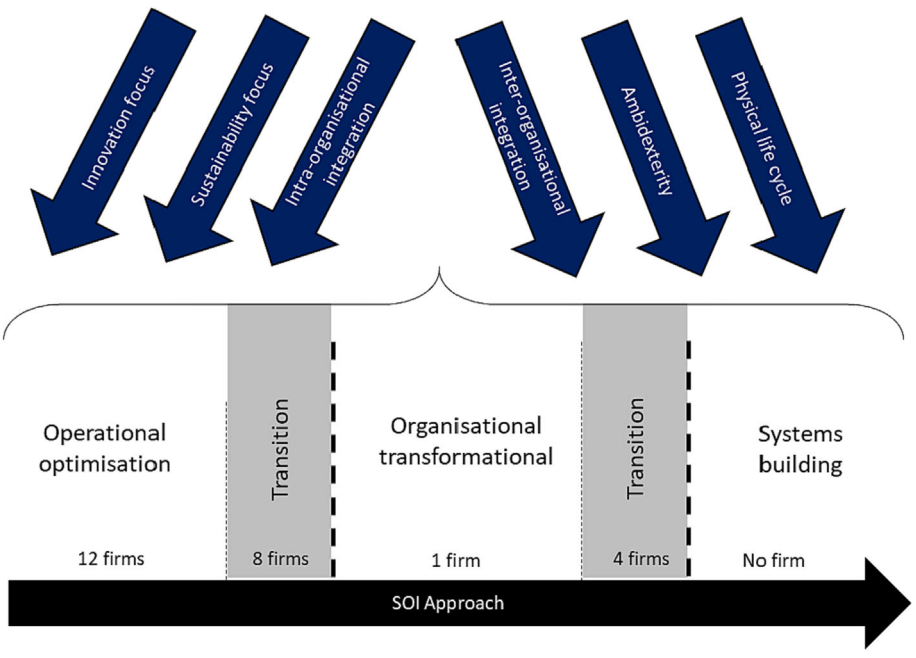


FIGURE 2 SOI dimensions and SOI approaches.

both sequentially and non-sequentially. Although this study cannot conclusively determine the SOI development process, based on the findings, sequential development is the logical way forward, considering different phases involve in advancing through different SOI dimensions. The IMC also suggests that successful innovation depends on the firms' routines in managing their innovation (Tidd & Bessant, 2013). Routines and habits are things that are learned and trained over time and through a long process (Tidd & Bessant, 2013).

Based on the findings, the paper could argue that in majority of cases non-sequential development of SOI is less likely to occur. Unless there are radical transformations taken by the firms. In NRBV of the firm, radical transformation in product stewardship strategy is based on strong pollution prevention, which has been revealed to have a real impact on increasing sales (Hart, 1995). To achieve systems building, radical transformation is also needed of the philosophy of thinking and the purpose of the firms' business (Adams et al., 2016). Changes in the philosophy of thinking, as explained in SRBV, require commitment, consistency, and connections in the value network (Tate & Bals, 2016). Changes such as these can be supported by collaboration with external partners to find, build, and run the new innovation systems (Seebode et al., 2012; Shashi et al., 2018). An empirical study with a longitudinal time horizon is required to know exactly how this SOI developmental process takes place in an organisation.

6.4 | Incorporating natural and social strategic capability into innovation practices

The NRBV theory focuses on the strategic importance of a firm's environmentally sustainable activity through three strategic capabilities: pollution prevention, product stewardship, and sustainable development, for gaining a competitive advantage (Hart, 1995). The findings of the study do not directly contradict the NRBV theory but rather complement it by discussing the concept of SOI. The study identifies six dimensions of SOI, including sustainability focus, inter-organizational integration, and emphasis on the physical life cycle. These dimensions suggest that firms need to consider their natural strategic capabilities in the context of sustainability and integrate them into their innovation practices to build a stronger advantage. It is also important to emphasize the integration of connections with other organizations in developing SOI. This extends the NRBV theory by emphasizing the importance of incorporating innovation and inter-organizational considerations into resource-based strategies to progress a more solid competitive advantage.

The SRBV theory emphasizes the strategic importance of a firm's social resources, such as relationships, networks, and social capital, which are encompassed by two strategic capabilities in SRBV: the mission-based approach and stakeholder management (Tate & Bals, 2016). The findings of the study extend the SRBV theory by introducing the dimensions of intra-organizational integration and inter-organizational integration as part of SOI. These dimensions highlight the significance of social resources in driving SOI. By integrating sustainability concerns within and across organizations, firms can leverage their social resources to promote collaboration, knowledge sharing, and collective action towards sustainability goals. Therefore, the findings of the study support and extend the SRBV theory by emphasizing the role of social resources in the context of SOI.

7 | CONCLUSION

In this study, a SOI evaluation framework is proposed to help academics, businesses, and policymakers in assessing a firm's SOI approach. The framework is then validated via a series of firm-level empirical cases in Indonesian manufacturing sector. The most adopted approach by firms is operational optimisation (can refereed as the basic SOI approach), with the main objective towards compliance and short-term benefits due to improved internal efficiency. Our finding further identified the transition phases among different approaches that have certain characteristics based on their SOI dimensions. No firms were found following the most advanced SOI approach, the systems building approach, indicating how difficult it is to reach at this level, even for large firms with their greater resources. From the industry perspective, industry II (textile, leather, footwear, and multifarious) struggles the most to achieve more advanced level of SOI approach. This is due to the nature of this industry with its complex environmental and social impacts.

7.1 | Academic contribution

This study contributes to SOI literature in several ways. First, this study extends NRBV theory by emphasizing significance of integrating innovation and inter-organizational factors into resource-based strategies for advancing sustainable competitive advantage. It goes beyond three strategic capabilities on NRBV: pollution prevention, product stewardship, and sustainable development, in order to attain competitive advantage (Hart, 1995). This study also extends SRBV theory by incorporating sustainability considerations both within individual organizations and across multiple organizations, firms can utilize their social resources to foster collaboration, facilitate knowledge exchange, and encourage collective efforts in pursuit of sustainability goals. It goes beyond the two strategic capabilities discussed in SRBV, namely the mission-based approach and stakeholder management (Tate & Bals, 2016).

Second, this study has been able to synthesise SOI dimensions and explain the evolution of literature in this field, which will open new avenues for more holistic studies in future. Although in past researchers have proposed some SOI dimensions (Adams et al., 2016; Ayuso et al., 2011; Hansen et al., 2009), they put more emphasis on certain aspects, rather than providing a comprehensive understanding over the development process. Juxtaposed to the systematic review of Adams et al. (2016), this study incorporates three new SOI dimensions: sustainability focus, ambidexterity, and the physical life cycle. More specifically, this study has introduced ambidexterity as one of

SOI dimensions that was never used before in the SOI study. Ambidexterity has been widely discussed in the innovation literature but overlooked in the SOI literature.

Third, this study fills two gaps in the literature in the form of lack of evaluation framework to help to assess firms' approach to SOI. A polar (or polar or spider) chart has been developed as an evaluation tool for understanding different SOI approach. This technique was chosen as the most appropriate way to help analysis and visualisation because the SOI dimensions used in this study were more than three so visualisation such as Cartesian diagrams cannot be used. The use of such techniques has been used by previous researchers in the fields of innovation and SOI, for example Tidd and Bessant (2009) and Carrillo-Hermosilla et al. (2010). The chart shows the mix of all six SOI dimensions and three SOI approaches. In each firm, their approach was analysed in each dimension and finally drawn using the polar chart.

Fourth, the results of the analysis found a transition phase between SOI approaches that did not exist in the previous model (Adams et al., 2016). Firms in transition are basically those who started with a certain SOI approach but have succeeded in further developing themselves on one or several of SOI dimensions. As an intermediate phase, this transition provides interesting insight to help firms move more smoothly through from one SOI approach to a more advanced SOI approach. As a result, the inclusion of new SOI dimensions and identification of the additional transition phase in the SOI approach should enhance our understanding of SOI developments in firms.

7.2 | Limitations and future work

We are aware that this paper has a few limitations; however, this does not limit the novelty of the paper considering the contributions to literature and practice it makes. Firstly, the study focused on the context of manufacturing firms, more specifically, priority industries in Indonesia (Government of Indonesia, 2015), so the results cannot be considered to apply to other sectors such as services or agriculture. Secondly, the study was conducted within the context of a single country, and the results cannot be directly extrapolated to other countries. However, emerging economies facing similar challenges may also find this study interesting, and the results could be applicable to contexts that share similar characteristics. Thirdly, in this study we did not focus on the size of firms and their type of SOI. Considering the limitations, further research could be directed at other sectors besides manufacturing.

8 | MANAGERIAL AND POLICY IMPLICATIONS

Practically, this study is expected to be useful for firms to analyse their position in attaining certain level of SOI approaches. Especially firms in Indonesia, or more broadly for firms in developing economies that have similar economic and environmental conditions. The six dimensions in the evaluation framework can be considered for SOI development within the firms. For practitioners, this study will enable them to understand the dimensions of SOI in a holistic way and guide how these could be applicable to their businesses. Development of a polar diagram to assess firms' SOI approaches can help practitioners understand how a higher level could be achieved in short, medium, and long term and accordingly can develop their SOI strategies.

By utilizing the framework, managers can gain insights into the strengths and weaknesses of their firm in different dimensions. This understanding can guide firms towards surpassing the operational optimization approach, which primarily focuses on compliance and short-term benefits. Moreover, this study sheds light on the challenges involved in advancing towards more sophisticated SOI approaches, such as systems building, even for large firms with ample resources. This highlights the need for managers to be aware and prepare the best strategies to address this difficulty. The findings particularly highlight the textile, leather, footwear, and multifarious industry (Industry II) as facing specific challenges in achieving a higher level of SOI approach. Given the complex environmental and social impacts inherent to this industry, careful consideration and tailored strategies are required. Managers in this industry need to recognize the unique hurdles they face and develop targeted approaches to overcome them. Overall, this study provides managers with valuable insights to enhance their firm's SOI approach and navigate the specific challenges of their industry.

The policy implications of this study are mainly assisting policy makers in evaluating the existing SOI conditions at firm-level, and helping to identify and create conducive atmosphere for firms to develop SOI. This study can help policymakers in evaluating firms' existing level in the development process of SOI. Understanding of existing conditions is an important step for policymakers because Indonesia's desire to become an innovation and sustainable driven economy requires a clear picture of the existing status of firms to decide the future direction for relevant policy development. Without clarity of the existing conditions, any policy change is very likely to be ineffective and, in some cases, even counterproductive. For instance, the Master Plan for Acceleration and Expansion of Indonesia Economic Development 2011 to 2025 emphasises Indonesia's vision to be an innovation-driven economy whilst minimising the adverse impacts on the environment and reducing the economic gap between the western and eastern parts of Indonesia (Indonesia Ministry for Economic Affairs, 2011). It requires a clear picture of the existing SOI conditions at firm-level in order to realise such a vision. In the same vein, better clarity is needed to achieve the National Medium-Term Development Plan (RPJMN)2020–2024, which put a strong emphasis on sustainable industrial transformation in Indonesia (Bappenas, 2019; Kementerian PPN/Bappenas, 2014).

ORCID

Budi Harsanto https://orcid.org/0000-0002-0732-0993

Niraj Kumar https://orcid.org/0000-0002-7918-5188

REFERENCES

Adams, R., Bessant, J., & Phelps, R. (2006). Innovation management measurement: A review. *International Journal of Management Reviews*, *8*, 21–47. https://doi.org/10.1111/j.1468-2370.2006.00119.x

Adams, R., Jeanrenaud, S., Bessant, J., Denyer, D., & Overy, P. (2016). Sustainability-oriented innovation: A systematic review. *International Journal of Management Reviews*, *18*, 180–205. https://doi.org/10.1111/ijmr.12068

Alston, B. K., Roberts, J. P., Alston, K., & Prince Roberts, J. (1999). Partners in new product development: SC Johnson and the alliance for environmental innovation. *Corporate Environmental Strategy*, *6*, 110–128. https://doi.org/10.1016/S1066-7938(00)80022-6

Altenburg, T. (2009). Building inclusive innovation systems in developing countries: Challenges for IS research. In *Handb. Innov. Syst. Dev. Countries. Building Domest. Capab. A glob* (pp. 33–56). https://doi.org/10.4337/9781849803427.00008

Ayuso, S., Rodriguez, M. A., Garcia-Castro, R., & Arino, M. A. (2011). Does stakeholder engagement promote sustainable innovation orientation? *Industrial Management & Data Systems*, *111*, 1399–1417. https://doi.org/10.1108/02635571111182764

Bansal, P. T., Smith, W. K., & Vaara, E. (2018). From the editors new ways of seeing through qualitative research. *The Academy of Management Journal*, *61*, 1189–1195. https://doi.org/10.5465/amj.2018.4004

Bappenas. (2019). Rancangan Teknokratik Rencana Pembangunan Jangka Menengah Nasional 2020-2024. In *Indonesia Berpenghasilan Menengah - Tinggi Yang Sejahtera, Adil, dan Berkesinambungan* (Vol. 313). PPN/Bappenas. https://doi.org/10.1017/CBO9781107415324.004

Behnam, S., Cagliano, R., & Grijalvo, M. (2018). How should firms reconcile their open innovation capabilities for incorporating external actors in innovations aimed at sustainable development? *Journal of Cleaner Production*, *170*, 950–965. https://doi.org/10.1016/j.jclepro.2017.09.168

Bendell, B. L. (2017). I don't want to be green: Prosocial motivation effects on firm environmental innovation rejection decisions. *Journal of Business Ethics*, *143*, 277–288. https://doi.org/10.1007/s10551-015-2588-2

Boston Consulting Group, Global Fashion Agenda. (2018). *Pulse of the fashion industry* (Vol. 2018) (p. 91).

Boström, M., & Micheletti, M. (2016). Introducing the sustainability challenge of textiles and clothing. *Journal of Consumer Policy*, *39*, 367–375. https://doi.org/10.1007/s10603-016-9336-6

Calantone, R. J., Cavusgil, S. T., & Zhao, Y. (2002). Learning orientation, firm innovation capability, and firm performance. *Industrial Marketing Management*, *31*, 515–524. https://doi.org/10.1016/S0019-8501(01)00203-6

Calantone, R. J., & Di Benedetto, C. A. (1988). An integrative model of the new product development process: An empirical validation. *Journal of Product Innovation Management*, *5*, 201–215. https://doi.org/10.1111/1540-5885.530201

Carrillo-Hermosilla, J., Del Río, P., & Könnölä, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*, *18*, 1073–1083. https://doi.org/10.1016/j.jclepro.2010.02.014

Centobelli, P., Cerchione, R., Oropallo, E., El-Garaihy, W. H., Farag, T., & Al Shehri, K. H. (2022). Towards a sustainable development assessment framework to bridge supply chain practices and technologies. *Sustainable Development*, *30*, 647–663. https://doi.org/10.1002/sd.2262

Chakravorti, B. (2004). *The new rules for bringing innovations to market* (p. 82). Harv. Bus.

Chesbrough, H. (2003). Open innovation: How companies actually do it. *Harvard Business Review*, *81*, 12–14.

CIPG, Nesta, 2018. *Understanding Indonesia's innovation system*.

Cirera, X., & Muzi, S. (2020). Measuring innovation using firm-level surveys: Evidence from developing countries☆. *Research Policy*, *49*, 103912. https://doi.org/10.1016/j.respol.2019.103912

Coccia, M. (2017). Sources of technological innovation: Radical and incremental innovation problem-driven to support competitive advantage of firms. *Technology Analysis & Strategic Management*, *29*, 1048–1061. https://doi.org/10.1080/09537325.2016.1268682

Cornell University, INSEAD, WIPO, 2018. *Global innovation index 2018: Energizing the world with innovation*.

Damuri, Y. R., Aswicahyono, H., & Christian, D. (2018). Innovation Policy in Indonesia. In M. Ambashi (Ed.), *Innovation policy in Asean* (pp. 98–127).

Dangelico, R. M., & Pujari, D. (2010). Mainstreaming green product innovation: Why and how companies integrate environmental sustainability. *Journal of Business Ethics*, *95*, 471–486. https://doi.org/10.1007/s10551-010-0434-0

Dangelico, R. M., Pujari, D., & Pontrandolfo, P. (2017). Green product innovation in manufacturing firms: A sustainability-oriented dynamic capability perspective. *Business Strategy and the Environment*, *26*, 490–506. https://doi.org/10.1002/bse.1932

Dubois, A., & Gadde, L. E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, *55*, 553–560. https://doi.org/10.1016/S0148-2963(00)00195-8

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *The Academy of Management Review*, *23*, 660–679. https://doi.org/10.2307/259056

Eccles, R. G., & Serafeim, G. (2013). The performance frontier: Innovating for a sustainable strategy. *Harvard Business Review*, *1*, 50–60.

Ekvall, G. (1996). Organizational climate for creativity and innovation. *European Journal of Work and Organizational Psychology*, *5*, 105–123. https://doi.org/10.1080/13594329608414845

El-Garaihy, W. H., Farag, T., Al Shehri, K., Centobelli, P., & Cerchione, R. (2022). Driving sustainability in supply chain management for a more inclusive and responsible future. *International Journal of Productivity and Performance Management*, *73*, 43–84. https://doi.org/10.1108/IJPPM-01-2022-0028

Evans, S., Vladimirova, D., Holgado, M., Van Fossen, K., Yang, M., Silva, E. A., & Barlow, C. Y. (2017). Business model innovation for sustainability: Towards a unified perspective for creation of sustainable business models. *Business Strategy and the Environment*, *26*, 597–608. https://doi.org/10.1002/bse.1939

Gee, S., & McMeekin, A. (2011). Eco-innovation systems and problem sequences: The contrasting cases of US and Brazilian biofuels. *Industry and Innovation*, *18*, 301–315. https://doi.org/10.1080/13662716.2011.561029

Geels, F. W. (2005). Processes and patterns in transitions and system innovations: Refining the co-evolutionary multi-level perspective. *Technological Forecasting and Social Change*, *72*, 681–696. https://doi.org/10.1016/j.techfore.2004.08.014

Ghisetti, C., Marzucchi, A., & Montresor, S. (2015). The open eco-innovation mode. An empirical investigation of eleven European countries. *Research Policy*, *44*, 1080–1093. https://doi.org/10.1016/j.respol.2014.12.001

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2012). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, *16*, 15–31.

Government of Indonesia, 2015. *PP No 14 Tahun 2015 Tentang Rencana Induk Pembangunan Industri Nasional 2015-2035*.

Gregory, G. (1987). A handbook of management techniques. *European Journal of Operational Research*, *29*, 211–212. https://doi.org/10.1016/0377-2217(87)90112-3

Hall, J., & Vredenburg, H. (2003). The challenges of innovating for sustainable development. *MIT Sloan Management Review*, *45*(1), 61–68.

Hall, J. K. (2002). Sustainable development innovation; a research agenda for the next 10 years. Editorial for the 10 anniversary of the journal of cleaner production. *Journal of Cleaner Production*, *10*, 195–196. https://doi.org/10.1016/S0959-6526(01)00065-8

Hansen, E. G., & Große-Dunker, F. (2013). *Encyclopedia of corporate social responsibility*. Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-28036-8

Hansen, E. G., Grosse-Dunker, F., & Reichwald, R. (2009). Sustainability innovation cube — A framework to evaluate sustainability-oriented innovations. *International Journal of Innovation Management*, *13*, 683–713. https://doi.org/10.1142/S1363919609002479

Hansen, E. G., Wicki, S., & Schaltegger, S. (2018). Structural ambidexterity, transition processes, and integration trade-offs: A longitudinal study of failed exploration. *R and D Management*, *49*, 484–508. https://doi.org/10.1111/radm.12339

Harsanto, B., Kumar, N., Zhan, Y., & Michaelides, R. (2020). Exploring sustainability-oriented innovation capabilities in the Indonesian manufacturing firms. *Academy of Management Proceedings*, *2020*, 14242. https://doi.org/10.5465/AMBPP.2020.14242abstract

Harsanto, B., Michaelides, R., & Drummond, H. (2018). Sustainability-oriented Innovation (SOI) in Emerging Economies: A Preliminary Investigation from Indonesia. In *In: 2018 IEEE international conference on industrial engineering and engineering management (IEEM)* (pp. 1553–1557). IEEE. https://doi.org/10.1109/IEEM.2018.8607473

Harsanto, B., Mulyana, A., Faisal, Y. A., & Shandy, V. M. (2022). Open innovation for sustainability in the social enterprises: An empirical evidence. *Journal of Open Innovation: Technology, Market, and Complexity*, *8*, 160. https://doi.org/10.3390/joitmc8030160

Harsanto, B., & Permana, C. T. (2019). Understanding sustainability-oriented innovation (SOI) using network perspective in Asia Pacific and ASEAN: A systematic review. *Journal of Asean Studies*, *7*, 1–17. https://doi.org/10.21512/jas.v7i1.5756

Hart, S. L. (1995). A natural-resource-based view of the firm. *The Academy of Management Review*, *20*, 986–1014. https://doi.org/10.2307/258963

Hart, S. L., & Dowell, G. (2011). A natural-resource-based view of the firm: Fifteen years after. *Journal of Management*, *37*, 1464–1479.

Howard-Grenville, J., Nelson, A., Vough, H., & Zilber, T. B. (2021). From the editors—Achieving fit and avoiding misfit in qualitative research. *The Academy of Management Journal*, *64*(5), 1313–1323.

Indonesia Ministry for Economic Affairs, 2011. *Acceleration and expansion of Indonesia economic development 2011-2025*.

Kern, F., Rogge, K. S., & Howlett, M. (2019). Policy mixes for sustainability transitions: New approaches and insights through bridging innovation and policy studies. *Research Policy*, (10), (10), 103832.

Kivimaa, P., & Kern, F. (2016). Creative destruction or mere niche support? Innovation policy mixes for sustainability transitions. *Research Policy*, *45*, 205–217. https://doi.org/10.1016/j.respol.2015.09.008

Klewitz, J., & Hansen, E. G. (2014). Sustainability-oriented innovation of SMEs: A systematic review. *Journal of Cleaner Production*, *65*, 57–75. https://doi.org/10.1016/j.jclepro.2013.07.017

Köhler, T., Smith, A., & Bhakoo, V. (2022). Templates in qualitative research methods: Origins, limitations, and new directions. *Organizational Research Methods*, *25*, 183–210. https://doi.org/10.1177/10944281211060710

Kolsch, D., Saling, P., Kicherer, A., Grosse-Sommer, A., & Schmidt, I. (2008). How to measure social impacts? A socio-eco-efficiency analysis by the SEEBALANCE® method. *International Journal of Sustainable Development*, *11*, 1–23. https://doi.org/10.1504/IJSD.2008.020380

Kuokkanen, A., Uusitalo, V., & Koistinen, K. (2019). A framework of disruptive sustainable innovation: An example of the Finnish food system. *Technology Analysis & Strategic Management*, *31*, 749–764. https://doi.org/10.1080/09537325.2018.1550254

Lim, C., & Fujimoto, T. (2019). Frugal innovation and design changes expanding the cost-performance frontier: A Schumpeterian approach. *Research Policy*, *48*, 1016–1029. https://doi.org/10.1016/j.respol.2018.10.014

Luqmani, A., Leach, M., & Jesson, D. (2017). Factors behind sustainable business innovation: The case of a global carpet manufacturing company. *Environmental Innovation and Societal Transitions*, *24*, 94–105. https://doi.org/10.1016/j.eist.2016.10.007

Mead, T., Jeanrenaud, S., & Bessant, J. (2020). Factors influencing the application of nature as inspiration for sustainability-oriented innovation in multinational corporations. *Business Strategy and the Environment*, *29*, 3162–3173. https://doi.org/10.1002/bse.2564

Metz, P., Burek, S., Hultgren, T. R., Kogan, S., & Schwartz, L. (2016). The path to sustainability-driven innovation. *Research-Technology Management*, *59*, 50–61. https://doi.org/10.1080/08956308.2016.1161409

Mubushar, M., Rasool, S., Haider, M. I., & Cerchione, R. (2021). The impact of corporate social responsibility activities on stakeholders' value co-creation behaviour. *Corporate Social Responsibility and Environmental Management*, *28*, 1906–1920. https://doi.org/10.1002/csr.2168

Nidumolu, R., Prahalad, C. K., & Rangaswami, M. R. (2009). Why sustainability is now the key driver of innovation. *Harvard Business Review*, *87*(9), 57–64.

Pace, L. A. (2016). How do tourism firms innovate for sustainable energy consumption? A capabilities perspective on the adoption of energy efficiency in tourism accommodation establishments. *Journal of Cleaner Production*, *111*, 409–420. https://doi.org/10.1016/j.jclepro.2015.01.095

Park, T., Kim, J. (2020). *Innovation policy in Asia*.

Paul, J., & Zhou, Y. (2017). How to build sustainable innovation capability in supply chain management. *International Journal of Business and Globalisation*, *19*, 456–476. https://doi.org/10.1504/IJBG.2017.087295

Periac, F., David, A., & Roberson, Q. (2018). Clarifying the interplay between social innovation and sustainable development: A conceptual framework rooted in paradox management. *European Management Review*, *15*, 19–35. https://doi.org/10.1111/emre.12121

Phills Jr., J.A., Deiglmeier, K., Miller, D.T., 2008. *Stanford social innovation review • fall 2008*.

Provasnek, A. K., Schmid, E., Geissler, B., & Steiner, G. (2017a). Sustainable corporate entrepreneurship: Performance and strategies toward innovation. *Business Strategy and the Environment*, *26*, 521–535. https://doi.org/10.1002/bse.1934

Provasnek, A. K., Sentic, A., & Schmid, E. (2017b). Integrating eco-innovations and stakeholder engagement for sustainable development and a social license to operate. *Corporate Social Responsibility and Environmental Management*, *24*, 173–185. https://doi.org/10.1002/csr.1406

Rai, A. S. (2015). The affect of Jugaad: Frugal innovation and postcolonial practice in India???S mobile phone ecology. *Environment and Planning D: Society and Space*, *33*, 985–1002. https://doi.org/10.1177/0263775815598155

Ramanujam, V., & Mensch, G. O. (1985). Improving the strategy-innovation link. *Journal of Product Innovation Management*, *2*, 213–223. https://doi.org/10.1111/1540-5885.240213

Ramos-Mejía, M., Franco-Garcia, M. L., & Jauregui-Becker, J. M. (2018). Sustainability transitions in the developing world: Challenges of socio-technical transformations unfolding in contexts of poverty. *Environmental Science & Policy*, *84*, 217–223. https://doi.org/10.1016/j.envsci.2017.03.010

Rennings, K. (2000). Redefining innovation - eco-innovation research and the contribution from ecological economics. *Ecological Economics*, *32*, 319–332. https://doi.org/10.1016/S0921-8009(99)00112-3

RobecoSAM. (2018). *Country sustainability ranking update - June 2018*.

Saha, R., Shashi, C. R., Singh, R., & Dahiya, R. (2020). Effect of ethical leadership and corporate social responsibility on firm performance: A systematic review. *Corporate Social Responsibility and Environmental Management*, *27*, 409–429. https://doi.org/10.1002/csr.1824

Saunders, M. N. K., & Townsend, K. (2016). Reporting and justifying the number of interview participants in organization and workplace research. *British Journal of Management*, *27*, 836–852. https://doi.org/10.1111/1467-8551.12182

Schot, J., & Steinmueller, W. E. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, *47*, 1554–1567. https://doi.org/10.1016/j.respol.2018.08.011

Seebode, D., Jeanrenaud, S., & Bessant, J. (2012). Managing innovation for sustainability. *R&D Management*, *42*, 195–206. https://doi.org/10.1111/j.1467-9310.2012.00678.x

Shashi, Singh, R., Centobelli, P., & Cerchione, R. (2018). Evaluating partnerships in sustainability-oriented food supply chain: A five-stage performance measurement model. *Energies*, *11*, 3473. https://doi.org/10.3390/en11123473

Silverman, D. (2013). *Doing qualitative research: A practical handbook*. SAGE Publications Limited.

Silvestre, B. S., & Ţîrcă, D. M. (2019). Innovations for sustainable development: Moving toward a sustainable future. *Journal of Cleaner Production*, *208*, 325–332. https://doi.org/10.1016/j.jclepro.2018.09.244

Tate, W. L., & Bals, L. (2016). Achieving shared triple bottom line (TBL) value creation: Toward a social resource-based view (SRBV) of the firm. *Journal of Business Ethics*, *152*, 1–24. https://doi.org/10.1007/s10551-016-3344-y

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509-533.

Tidd, J., & Bessant, J. (2009). *Managing innovation: Integrating technological, market and organizational change*. John Wiley & Sons, Ltd.

Tidd, J., & Bessant, J. (2013). *Managing innovation: Integrating technological, market and organizational change* (5th ed., Vol. 112) (pp. 211–212). Wiley. https://doi.org/10.1192/bjp.112.483.211-a

Tilley, F. (1999). The gap between the environmental attitudes and the environmental behaviour of small firms. *Business Strategy and the Environment*, *8*, 238–248. https://doi.org/10.1002/(SICI)1099-0836(199907/08)8:4<238::AID-BSE197>3.0.CO;2-M

Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research: From grounded theory to abductive analysis. *Sociological Theory*, *30*, 167–186. https://doi.org/10.1177/0735275112457914

Truffer, B., & Coenen, L. (2012). Environmental innovation and sustainability transitions in regional studies. *Regional Studies*, *46*, 1–21. https://doi.org/10.1080/00343404.2012.646164

Unilever. (2017). *Report shows a third of consumers prefer sustainable brands* [WWW Document]. https://www.unilever.com/news/press-releases/2017/report-shows-a-third-of-consumers-prefer-sustainable-brands.html (accessed 2.18.17).

United Nations. (2019). *World economic situation and prospects*. United Nations.

Varadarajan, R. (2017). Innovating for sustainability: A framework for sustainable innovations and a model of sustainable innovations orientation. *Journal of the Academy of Marketing Science*, *45*, 14–36. https://doi.org/10.1007/s11747-015-0461-6

Von Pechmann, F., Midler, C., Maniak, R., & Charue-Duboc, F. (2015). Managing systemic and disruptive innovation: Lessons from the Renault zero emission initiative. *Industrial and Corporate Change*, *24*, 677–695. https://doi.org/10.1093/icc/dtv018

Wagner, M., & Llerena, P. (2008). *Drivers for sustainability-related innovation: A Qualitative analysis of renewable resources, industrial products and travel services. Bureau d'Economie Théorique et Appliquée, UDS, Strasbourg*.

Watson, R., Wilson, H. N., Smart, P., & Macdonald, E. K. (2018). Harnessing difference: A capability-based framework for stakeholder engagement in environmental innovation. *Journal of Product Innovation Management*, *35*, 254–279. https://doi.org/10.1111/jpim.12394

Wesseling, J. H., Niesten, E. M. M. I., Faber, J., & Hekkert, M. P. (2015). Business strategies of incumbents in the market for electric vehicles: Opportunities and incentives for sustainable innovation. *Business Strategy and the Environment*, *24*, 518–531. https://doi.org/10.1002/bse.1834

Whetten, D. A. (1989). What constitutes a theoretical contribution? *The Academy of Management Review*, *14*, 490–495. https://doi.org/10.5465/AMR.1989.4308371

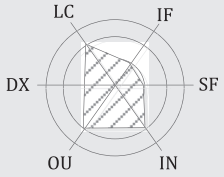
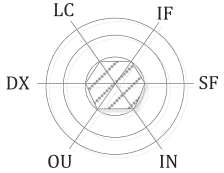
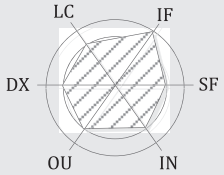
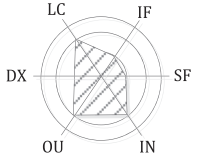
World Bank. (2013). *Indonesia: Research and Development financing*.

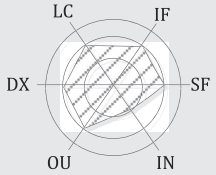
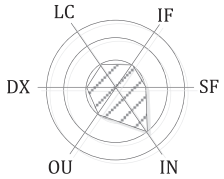
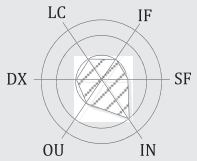
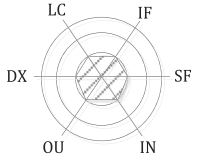
World Bank. (2015). *Enterprise surveys indicator descriptions* (pp. 139–150).

Wu, G. C. (2017). Effects of socially responsible supplier development and sustainability-oriented innovation on sustainable development: Empirical evidence from SMEs. *Corporate Social Responsibility and Environmental Management*, *24*, 661–675. https://doi.org/10.1002/csr.1435

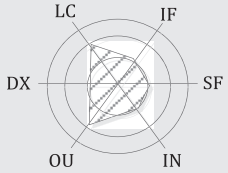
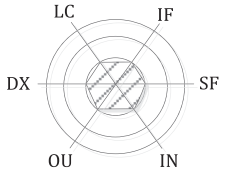
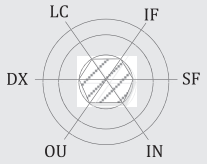
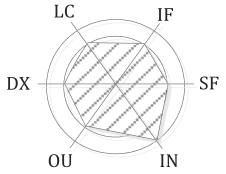
How to cite this article: Harsanto, B., Kumar, N., & Michaelides, R. (2024). Sustainability-oriented innovation in manufacturing firms: Implementation and evaluation framework. *Business Strategy and the Environment*, 1–23. https://doi.org/10.1002/bse.3740

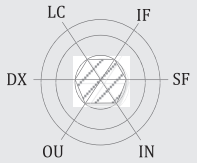
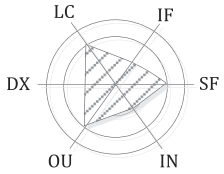
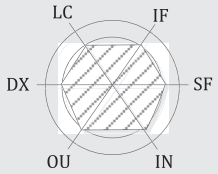
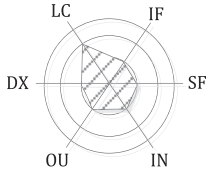
APPENDIX A: Detailed analysis of SOI approach patterns across 25 cases

Firm	Innovation focus (technology ↔ people)	Sustainability focus (economic ↔ environmental & social)	Integration intra-organisational (stand-alone ↔ integrated)	Integration inter-organisational (insular ↔ systematic)	Ambidexterity (exploitation ↔ exploration)	Emphasis on physical lifecycle (manufacture ↔ use & end-of life)
A, meat processing 	(1) The focus of SOI is technical, for example, offering healthier traditional food by introducing preserving rendang (traditional Indonesian meat) technique that is durable without preservatives.	(1) The effect of their SOI is mainly for the internal economics of the firm, for example, offering healthier product and process is driven by market penetration and business development reason.	(2) Innovation still centred on the owner. Nevertheless, integration within the firm helped by management system they have, for example, ISO (for SMEs) and GMP/good manufacturing practices.	(2) Integration outside more systematic even though have not influenced policy yet, for example, with governmental agencies for facilitation of certification.	(1) Recently just focus on exploiting current demand, that is, rendang in packaging which developed 2010 (then recognised nationally by SME Food Innovative Award 2016 and 2017).	(2) Emphasis on manufacture and use through, for example, offering healthier product and application of ISO and GMP to ensure innovation comply with those systems.
B, slippers and bags 	(1) The focus of SOI is technical improvement, for example, the use electric heaters for the embossing process of slippers, which results in better product quality and energy efficiency.	(1) Main effect of SOI is economics. Some products use eco-friendly materials, but the proportion is still small, and it is chosen based on aesthetics and efficiency.	(1) SOI initiatives still centred on owner and its family, for example, material selection (including eco-friendly materials/minor), machine modification and waste handling initiatives.	(1) Integration outside is insular oriented, for example, the emboss process modification is intended to overcome internal problems related to quality and cost efficiency.	(1) Limited to exploiting current demand. For example, exploiting current demand on slippers and bag with ordinary materials with no/little effort to explore new area for future business.	(1) Emphasis on manufacture phase, for example, embossing process with a less consumption on both energy and human resources required to do the task.
C, rice products 	(3) The focus of SOI is not only technical but also a wider system, for example, since the beginning their innovation intended to improve local material as well economic level of the local farmers.	(2) The biggest effect is on the economic where the company expanded rapidly in the last decade. Social effects also feel by improving economic level of local farmers.	(2) Not entirely dependent on top management, but also to middle-level managers, for example, in managing relationships with farmers as long-term suppliers. Integration also helped by certification (HACCP).	(2Integrate with society in a more systematic way, for example, collaboration with farmers for long-term supply, media to raise awareness, and with local government to raise the prestige of local rice.	(2) Exploiting current demand but also moderately explore new things for future business, for example, NPD that is healthier and more practical for consumers. Currently waiting patent for the brand.	(2) Emphasis on manufacture and use through, for example, offering healthier product and application of HACCP to ensure the innovations can comply with that system.
D, leather products 	(1) The focus of SOI is limited to technical aspect, for example, the development of a more ergonomic leather jacket adjusts the body shape for bikers.	(1) Main effect of SOI is economic, for example, local sourcing and empowering women around production facility to help embroidering work is mainly for firm efficiency and profit.	(1) The initiative is still centred on the owner and input from workers is still limited. No management system yet and no plan in nearly future for implementation of any system.	(1) Insular, for example, limited communication outside the consumers and involvement with peers' association is limited because of confidentiality of leather concoction.	(1) Limited to exploiting current demand with slight modifications to existing products, for example, offering elastic leather to shape body that is ergonomic for bikers.	(1) Emphasis on manufacture phase, for example, work arrangements through work divisions for faster and energy efficient in processing the order from consumers.

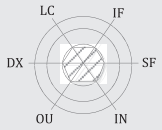
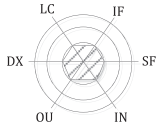
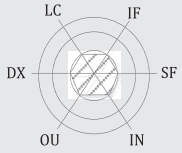
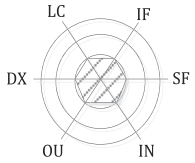
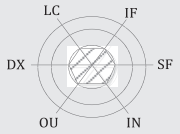
E, mushroom floss 	(2) the focus is not only technical but also beyond it, for example, producing the first floss in Indonesia made from mushrooms that is healthier (substituting meat) and forming mushroom supply chain.	(2) in addition to economic effects, it also provides social effects on the surrounding environment, for example, farmers in terms of supplier, educational institutions in terms of entrepreneurial spirit.	(1) the size of the company is still small, so it is still centred on the owner in various innovation initiatives. At the moment, they do not yet have an integrated management system.	(2) not only internal oriented, the SOI also contributes to the relationship relations with society, for example, with mushroom farmers around the city as long-term suppliers.	(2) exploit the current demand of mushroom floss while trying to explore the development of new healthier product, for example, vegan floss besides not-meat based, also without onions.	(2) emphasise on manufacture, for example, development of safer and energy efficient production process; as well use phase, for example, healthier product for daily consumption.
F, coach builder 	(1) SOI focusing on technical and aesthetic aspects, for example, placing air conditioners in the front of vehicles' bodies for more energy efficient consumption.	(1) Main effect of innovation is economics in term of cost efficiency and gaining profit for business continuity, for example, cooperation with youth organisation in the surrounding area for iron waste handling.	(2) Integration helped by internal system and certification they have, for example, in 2016 they received they were chosen as 1 of 17 certified coachbuilders from a major coach manufacturer in Indonesia.	(1) Engage with specific party outside the firm for compliance not specifically for SOI, for example, vehicle manufacturer and ministry of transportation for technical safety, compatibility and aesthetics.	(1) Almost all of it is exploitative, for example, development coach body design or more efficient electrical installation. The nature of exploration in coach builder industry is relatively slow.	(1) Emphasis in manufacture phase, for example, safer design and production process and minimization of solid waste from manufacturing process.
G, denim fabric 	(1) The SOI focuses on upgrading production facilities, for example, machine renewal to the latest technology that make the production process quicker and more energy efficient.	(1) Effect of innovation is mainly economics, for example, energy efficient machine for higher quality and quantity that directly related to the cost efficiency and increase the profit.	(2) Innovation in organisation is conducted specifically in the R&D department whose duty is to make innovations. Integration helped by management system (ISO 9001) they have.	(1) Innovation is aimed insularly, for example, to meeting market expectations in terms of production quality/ quantity and gain internal efficiency in production.	(1) Emphasis is on exploitation of current demand and start for exploration. Their R & D still focusing on pattern development for their products.	(1) Firm emphasis is on manufacture phase, for example, by using a newer technology machine so that the production process become faster and energy efficient.
H, textiles 	(1) the SOI focuses on technical, for example, by modify their water cleaning techniques so that their water jet loom (WJL) machines efficiency increases.	(1) the main effect of their SOI is still economics in term of cost efficiency and business development, for example, water cleaning technique is conducted for economic reasons.	(1) even though it has more than a hundred employees but initiates of innovation are still centred on the owner, for example, material selection. There is no quality or environmental management system yet.	(1) SOI implementation is internal oriented, aimed at cost efficiency, which used for survival and internal investment in the form of new machines and buildings.	(1) emphasis is on exploitation of current demand, for example, water recycle, and water cleaning technique intended to maximise fulfilment of current demand.	(1) emphasis is on manufacture phase, for example, production efficiency improvement through water cleaning technique modification, and water recycle.

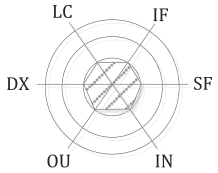
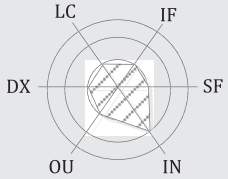
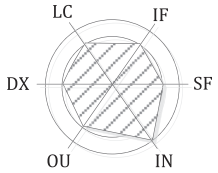
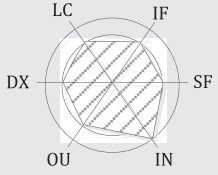
(Continues)

I, spices and sauces 	(1) focus SOI is on technical, for example, producing spices and sauces in packaging from various ingredients using certain technique and without using MSG (monosodium glutamate).	(1) the dominant effect is still in the economic form of increasing profit and the survival of the company. Social effects are still very limited by purchasing raw materials in the form of fish from local fishermen.	(1) still centred on the owner and there is no integration of a sustainable innovation process to all employees. No plans yet for implementation of quality or environmental management system.	(2) although small in size, the firm is progressive in establishing relations with large retailers for marketing, and relevant government agency for business development.	(1) Firm's emphasis is on exploitation of current demand, for example, add flavour variants for similar healthier products. Exploration efforts exist but are still very limited.	(2) Firm's emphasis is on manufacture and use phase, for example,. a hygiene process and sourcing from local fishermen (manufacture), and healthier product without MSG (use).
J, textiles 	(1) SOI practiced by process improvement, for example, through machine renewal making them faster and more energy efficient, also improvement in waste treatment.	(1) the biggest effect is still economic for the firm, for example, machine renewal is intended to cost efficiency; water treatment improvement is to avoid punishment from relevant governmental agency.	(1) still stand-alone in nature, for example, firm's SOI in terms eco-efficiency is still limited to production division and not yet comprehensive to all parts of the organisation.	(1) the integration is limited, for example, linkages with the environment agency forced by the fact that the firm experienced environmental issue in the past few years.	(1) Firm's emphasis is on exploitation of current demand, for example, machine renewal with more energy efficient one intended to maximise fulfilment of current demand.	(1) emphasis is on manufacture phase, for example, production process that is more time and energy efficient to ensure fulfilment of orders from consumers.
K, wood processing 	(1) the focus of SOI is technical and have not moved than that, for example, the use of electric wood planers and jointers for more precise and energy efficient work.	(1) mainly economics, for example, wood waste handling through sales to third parties has an impact on waste reduction, but this is more economically motivated.	(1) integration inside still stand-alone. It is owner oriented and not yet integrated in the whole company, for example, model development, material selection and wood waste handling.	(1) relation to society is limited with the focus on getting orders, for example, communication with the Chinese community in their city who like premium wood products.	(1) Firm's emphasis on exploitation. There is almost no special effort to explore significantly new product, process, or organisational method for future business.	(1) the focus is on manufacture phase, for example, waste wood handling from production process. After that, nothing is specifically done for the phase use and end-of life.
L, ICT hardware 	(2) A high-tech firm but their focus of SOI is not only technical but also indirectly to the wider society, for example, national identity card readers, gas installation to houses (first in Indonesia).	(2) the main effect of SOI is on economic and social aspects in terms of profit from governmental/business projects, for example, national identity card reader, fibre optic and gas installation to houses.	(3) SOI integrated helped by management system they have, for example, EMS ISO 14001 and internal firm regulations in term of rewards to innovative ideas that lead to commercialisation.	(2) integration outside more systematic even though not influenced policy yet. Linkage is built, for example, universities for research, other business/government for NPD.	(2) doing exploration beside exploitation through cooperation with university & research Centre. However, exploitation is still stronger than exploitation.	(2) emphasis on SOI both manufacture and use but not yet on end-of life, for example, innovation comply with EMS in manufacture; broad impact of their product in the use phase.

M, mountain slippers 	(1) focus of SOI is technical, for example, developing a healthier work environment by the use of air blower machines to clean excessive dust in production facilities.	(1) the main effect of SOI is economics; for example, the uses of non-chemical supporting materials to help reduce existing waste is for suitability, availability, and efficiency reasons.	(1) SOI initiative centred on the owner and top management, for example, design of new product that is safer, material selections and modification of process for a healthier environment.	(1) the SOI is singular oriented to resolve internal problems, for example, air blower dust cleaner related to employee health problem, which became an issue in the past.	(1) Firm's focus is on exploitation. There is almost no special effort to explore significantly new product, process, or organisational method for future business.	(1) Firm's emphasis is on manufacture, for example, blower machine for cleaner work environment in the production facility during manufacture phase.
N, organic cosmetics 	(2) focus of SOI is not only technical, e g. organic certification and influencing their consumer behaviour through the use of organic cosmetics without mercury.	(2) in addition to economic effects, that is, business development, innovation, their SOI also has a positive impact to social, for example, safer non-mercury cosmetics for mid-low consumers.	(1) despite having a small special R & D, the innovation development process is still dominantly carried out by the owner, for example, raw material ideas, market development, and machine modifications.	(2) in addition to business development, product innovation is also intended to help provide cosmetics that are safe for consumers, that is, using natural materials from the sea.	(1)Firm's emphasis is on exploitation current demand. There are efforts to explore new materials to be used in production, but the scope is still very limited.	(2)on physical life cycle, firm's emphasis is on manufacture phase, for example, hygiene and efficient production process; and use phase, for example, non-mercury cosmetics safer for consumer use.
O, leather bags 	(2) SOI focuses on not only the technical but also for wider society, for example, production and showrooms facility in the middle of a village that helps significantly the village's development.	(2) economic effects are indicated by good business growth. It also provides tangible effects to the social environment, that is, empowering tanner and smaller businesses in the surrounding area.	(2) the firm has developed a mechanism so that innovation is not too dependent on the owner, but also to some key staff who make coordination in innovation run smoothly.	(2) engage with a diverse actor but not yet influenced the policy, indicated, for example, the showroom has been visited by Indonesia's vice president as well first and second lady.	(2) doing exploration beside exploitation through development of new domestic markets because of declining demand from their main markets in Europe.	(2) Firm's emphasis is on manufacture phase, for example, vegetable tanning for their leather materials; and use phase, for example, their 'vegetable tanning' products are more durable and safer.
P, cakes and cookies 	(1) SOI focus is technical, for example, offering healthier products and process, using premium materials and hygienic production process compared with competitors to gain profit from the niche market.	(1) SOI carried out, for example, reuse of paper used in the production process, is performed mainly in order to achieve economic effect in terms of production cost efficiency.	(1) still centred on the owner, not integrated yet and not implemented or planned in the near future to implement quality or environmental management system.	(1) innovations carried out are still oriented internally for business development, for example, healthier cookies for the primarily to gain more profit from the niche market.	(1) Firm's focus is on exploitation. There is almost no special effort to explore significantly new product, process, or organisational method for future business.	(2) Firm's emphasis is on manufacture phase, for example, premium materials and clean process; and use phase, for example, healthier products for market consumption.

(Continues)

Q, carpets and rugs 	(1) SOI focus is technical, for example, the use of a machine that more efficient uses 9 needles and is designed for a factory building with minimal noise.	(1) SOI carried out is still intended to be aimed at cost efficiency, for example, healthier work environment to avoid cost caused by sick employees.	(1) SOI practices, for example, a safe and non-noisy work environment are still add- on. No certification implemented or planned to be implemented.	(1) engage with large companies and governments to assist market expansion indicated but not specific for SOI.	(1) focus is on exploitation with almost no efforts to explore significantly new product, process, or organisational method.	(1) emphasis is on manufacture phase, for example, efficient machine and low noise in production facilities.
R, other food products 	(1) SOI focus is technical, for example, improvement in food materials which are healthier and development of herb supplement.	(1) SOI orientation is still internal oriented to gain cost efficiency and greater profitability for business continuity.	(1) SOI carried out is still an add-on and has not become an embedded part in the company. No management system yet.	(1) orientation of their SOI is singular, for example, modification of package and introduction of herb supplements is to keep the business going.	(1) focus is on exploitation with almost no efforts to explore significantly new product, process, or organisational method.	(1) emphasis is on manufacture phase, for example, healthier raw materials and NPD (herb supplement) related to existing products.
S, food souvenirs 	(1) the focus is technical, for example, producing typical Jakarta food by empowering homemakers from the family welfare Programme (PKK).	(1) SOI carried out, for example, family welfare Programme (PKK) is still in order to achieve economic effects in terms of cost efficiency and business continuity.	(1) SOI practices, for example, reducing production waste are still spontaneous and not embedded yet in the firm. No plans for the implementation of a management system.	(1) empowerment of family welfare program is carried out for the purpose of mutualism, namely meeting production targets and increasing their income.	(1) focus is on exploitation with almost no efforts to explore significantly new product, process, or organisational method.	(1) SOI emphasis is on manufacture phase, for example, waste handling and involvement of homemakers in the production process.
T, school uniforms 	(1) SOI focus on technical, for example, reducing convection waste cooperate with third parties to help create a cleaner work environment.	(1) SOI carried out, for example, the reduction of production waste is still in order to achieve economic effects in terms of gaining profit, cost efficiency and business continuity.	(1) SOI practices, for example, process improvements a waste handling is still add-on and have not been integrated in firm. Not implemented management system yet.	(1) engagement with outside the firm is limited. The firm engage with large enterprises but not specific for SOI and more for business development in general.	(1) focus is on exploitation, for example, convection waste handling mechanism, with almost no efforts to explore significantly new product, process, or organisational method.	(1) SOI emphasis is on manufacture phase, for example, minimise waste handling from convection production process through cooperation with third parties.
U, duck processing 	(1) focus of SOI is technical, for example, machine development and local sourcing by cooperating with duck farmers in the city.	(1) SOI conducted, for example partnerships with local duck farmers, is still in order to achieve economic effects in terms of cost efficiency and business continuity.	(1) SOI practices are add-on and have not become embedded cultures within the company. There is also no plan to integrate the quality or environmental management system.	(1) engage with society but not specifically for SOI, for example, communication with the trade service and large firms for facilitation of exhibition.	(1) focus is on exploitation, for example, supplying duck and related spices with flavour variants. No/little efforts for exploration.	(1) SOI emphasis is on manufacture phase, for example, local sourcing from local duck farmers and machine development for a better production process.

V, crab processing 	(1) focus of SOI is technical, for example, process improvement towards a cleaner production process and empowering homemakers in production, which is cost effective.	(1) SOI conducted, for example, partnerships with local homemakers is still in order to achieve economic effects in terms of cost efficiency and business continuity.	(1) implementation of SOI, that is, family empowerment in the village and the implementation of cleaner production SOPs are still partial in the production section and have not been integrated.	(1) engagement with society is limited, for example, the supply of labour and compliance of the production process with the regulations of the relevant local regulatory agency.	(1) focus is on exploitation, for example, traditional crab processing. No/ little efforts to explore significantly new product, process, or organisational method.	(1) SOI emphasis is on manufacture phase, for example, a cleaner crab process to ensure the durability of their products when delivered to business buyers who will export them abroad.
W, optical cable 	(1) focus of SOI is technical, for example, modification of optical cable products with fewer materials and cheaper prices without reducing product's functionality.	(1) economic effects are still dominant in SOI, for example, in offering fibre optic products with the same function but fewer resources with a business motive.	(2) SOI is incremental to existing product designs, namely optical cables. The firm has quality management systems, for example, optical-related regulations have made SOI more integrated.	(1) innovation in the form of optical cable modification is done for addressing internal needs, that is, increasing sales to large business buyers through mass and cheaper product.	(1) focus is on exploitation, for example, efficient production. Currently no/little effort for significantly new innovations. Efforts for R&D carried out by their foreign partner.	(1) SOI emphasis is on manufacture phase, for example, efficient production process, minimise waste, and modification of their existing product to provide larger quantity and cheaper price.
X, snack producers 	(2) SOI focus on technical as well providing a healthier snack, for example, the use high tech machine in the production process through implementation of ISO 22000 Food Safety Management.	(2) in addition to economic effects, the company's innovation also targets social aspects, that is, providing affordable quality snack and formation of a special team to assist disaster recovery.	(3) The SOI is integrated starting from the vision mission, and helped by implementation of various integrated standards, for example, ISO 22000 and SNI (Indonesia National Standard).	(2) even though it has not reached the stage of influencing policy, as a public listed company it engages with broad parties, for example, with society, government, and media.	(2) doing exploration beside exploitation through their R&D division and development of new abroad markets (Southeast Asia plus China and India).	(2) Firm's emphasis is on manufacture and use phase, for example, best raw materials, hygiene production process (manufacture), and healthier snack for consumers (use).
Y, milk processing 	(2) SOI focus not only technical, for example, providing hygienic milk products with high local content production machinery. Received Gold 2015 SNI Award for this effort.	(2) in addition to economic effects, company innovations also provide social effects, that is, providing accredited laboratories and water treatment handling in collaboration with third parties.	(3) Fully integrated, for example, the implementation of ISO 9001 quality management system, ISO 22000 as well FSSC 22000 to ensure that various innovations are on high food safety standards.	(2) Engagement with a wider system related to certification and accreditation, for example, their laboratory that has been accredited to ISO 17025 so that it can be utilised by the public.	(2) Doing exploration beside exploitation, for example, development of new machinery awarded Gold 2015 SNI and high-quality laboratory recognised by ISO 17025.	(2) Firm's emphasis is on manufacture and use phase, for example, highly hygiene milk processing process (manufacture), and healthier product for consumers (use).