

The product-market system approach to adopt life-cycle thinking in organisation management

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Abstract. Pushed by public demand and regulations, the firms' role in society is gradually changing from shareholder profit maximisation to societal shared value creation. Despite the positive market's response in adopting sustainability as a business key driver, there is still a long way to go before companies can assess the full life-cycle impacts of their entire activities, products, and services regarding the triple bottom line. A gap remains in how businesses can set up sustainable products' strategies within their wider business strategy and systematically replicate successes. Working together with an infrastructure company in the UK, we assessed how life-cycle thinking adoption could be pursued during management operations in the sustainability framework. It has emerged the necessity of a socio-technical system describing the life-cycle of products and services' market proposition alongside the business model and business strategy concepts. We defined it as the product-market system as it aims to relate the life-cycle of product market proposition to the wider firms' sustainability performances. It builds on LCT and multi Capitals approaches, and it should help firms address their role within the market and society they operate. Its use should help multi-product businesses to align their product strategies around established targets and values.

1 Introduction

Despite encouraging signs, economies and societies globally are still far from achieving sustainability, defined in the Brundtland report in 1987 as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" [1]. The Brundtland report calls out the responsibility of any generation toward future ones and the ecosystem within which they live, addressing equity and justice issues. The

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Triple Bottom Line remains one of the fundamental principles of sustainability: preserving the environment and society in the economic framework of human activities.

Governments, citizens, and private enterprises shape our society by acting together while being interdependent. Whereas society's demands are mainly satisfied by the private sector, firms depend on the environment for the resources required to perform their activities and on society for generating the demand for goods and services. Nevertheless, the private sector has contributed to the global risk the human society faces, dictated by the duty of shareholders' short-term profit maximisation [2]. Therefore, businesses not only have the responsibility to reinstate a sustainable balance between economic activities, the environment, and society, but also it ultimately works in their own interest.

Because of this awakening, sustainability relevance in business management is rising [3]. In the last few years, firms' marketing embraced the sustainability call on their own. However, purpose-driven firms require more than words and goodwill [4]. In some cases, a more sustainable and more ethical management has shown the ability to guarantee profits in a fast-changing global market and the long term, unlocking disruptive potential [5, 6].

While minimising negative impacts – especially environmental impacts – has been the focus of firms' approach to sustainability, recently, suggestions that businesses should also focus on positive impacts of products and services alongside negative ones are becoming more prominent [2, 7]. Even though mitigating externalities and potential societal harm is still a fundamental requirement for firms to be sustainable, that alone is not enough if their products are not “giving back” to society and nature more than they take. This idea of a “net positive” product is not only very complex to realise in practice but also almost impossible to quantify in numerical terms due to the variety of societal implications and intangible indicators.

The product-market system is proposed to be used in association with the business model and business strategy concepts when making business decisions at the early stage of product design and innovation to embed such a vision into the decision-making process. The necessity of a new distinct concept has emerged from the industry's engagement to distinguish monetary considerations from the shared value creation process. The two aspects are necessary to design and implement a sustainable business model. Section 2 illustrates the methods used. Section 3 shows the instrumental principles (IPs) for the product-market system framework and compares them to the business model ones. The IPs have been the foundational building blocks of the product-market system definition and framework, as discussed in Section 4. The conclusions are reported in Section 5, inviting future research to move from the 'customer-demand oriented' business model philosophy to a 'society's needs oriented' one.

2 Methods

The development of the product-market system framework was realized in three steps.

First, informal conversations and field notes have been collected from the industrial partner about the business model's definition and practical application for business management concerning sustainability. Feedback has been collected from various profiles, such as the Business Developer Manager, Clients and Markets Directors, Project Managers, and Directors of different sectors. The conversations regarded how the business model is defined and applied to achieve business “success”.

Second, the literature of business model definition and innovation has been reviewed with thematic analysis. nVivo has been used to perform the open coding of the definitions of business models, concepts, and categories that have been sorted by common themes under a Grounded Theory methodology [8]. The complete literature used for the thematic analysis at its discussion is out of the scope of the current paper and will be discussed in future publications. From the initial 11 themes found throughout nVivo in the business model literature, four main themes were selected to establish the four Instrumental Principles (IPs) for the business model concept and were combined in the business model definition. The four main themes are Modelling, Multilevel framework, System thinking, and Value. The same approach has been used to analyse corporate sustainability and life cycle thinking literature. The final set of five IPs for the product-market system has been obtained from the coding. The IPs for the product-market system are Modelling, Multilevel framework, Life-Cycle Thinking, Shared Value, and Normative purpose. Definitions for both business model and product-market system are proposed based on the IPs, but they are also out of this discussion's scope.

Together the two sets of Instrumental Principles build the knowledge base for the theory embedding life cycle thinking into sustainable business management. The framework discussed in Section 4 has been obtained built by the five IPs with more concrete definitions underlying them. This activity translates each IP – valid as a general concept – into a specific aspect adopted by the framework.

Future studies will test the proposed process on innovation projects via the iterative case studies approach [9, 10]. The results of those applications will be discussed in future publications.

3 Results

The industrial feedback obtained via informal conversation showed that decision-makers preferred the case of sustainability and profitability considerations separated on two dedicated tools during the decision-making process, rather than merging both analyses into one framework. Therefore, a different concept that assesses the Life cycle of products and services as part of the broader system was needed.

Together the two sets of Instrumental Principles shown in **Table 1** constitute the foundation of knowledge for the theory embedding life cycle thinking into business management. Additionally, they highlight the difference between the scope of the business model and the product-market system.

Business models have their own validity as a tool for companies to make a portfolio of products and services profitable, thus continuing to operate. The product-market system highlighted the impacts and interactions that the product life cycle has on the broader external system (market-environment-society) in a way that cannot be captured by the business model alone. However, the product-market system does not aim to replace the business model with an equivalent version for sustainability but rather to inform decisions better when both are employed together.

Table 1. Instrumental Principles for the Business Model and the Product-market system frameworks.

Business Model IPs	Product-market system IPs
MODELLING: a simplified description of real business processes surrounding and supporting a specific product or service.	
MULTI-LEVEL FRAMEWORK: processes in a socio-technical and socio-ecological system, involving material flows and stocks, and monetary and ethical values with different special and temporal dimensions.	
SYSTEM THINKING: clarify the nature of the ecosystem where the product's business activities take place.	LIFE CYCLE THINKING: measure or assess the impact and benefit pathways generated by the product life-cycle as part of the broader external system
VALUE: describe the way the product delivers value for the external system to justify investments.	SHARED VALUE: support businesses in identifying and creating shared value. The shared value is defined as the ability to satisfy societal and environmental needs in a long-term perspective.
NORMATIVE PURPOSE: must aim to drive a sustainable vision of society.	

4 The Product-market system framework

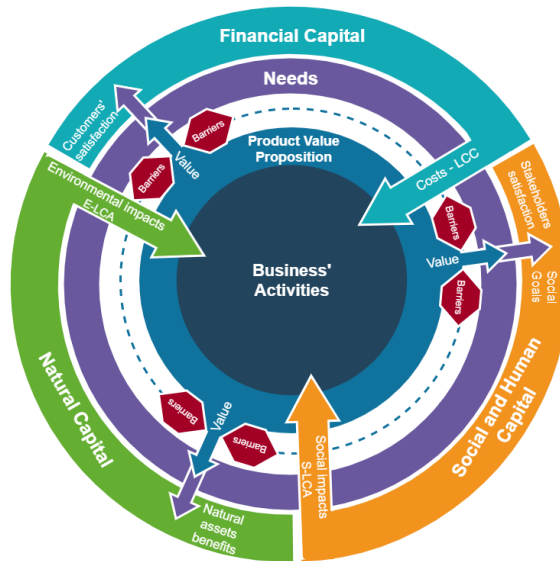
We propose the framework in **Figure 1** to describe the role played by businesses in the shared value creation process. It has been designed to focus decision-makers on long-term performances at the early stages of product development and design alternative market proposals. It helps to distinguish which products and services more likely generate positive long-term effects on the external system based on life cycle system thinking.

Products and services expected to be more sustainable are the ones that target needs in common between the three pillars of sustainability and share synergy with other needs, creating a balance between subjective and objective needs. Other attributes are to minimise negative impacts generated by the business' activities, integrate the three areas with positive feedback loops, and include external actors with an active role in these loops when examining their needs.

The dashed line represents the boundaries between the enterprise and the external socio-ecological system. The Capitals approach is selected to evaluate the changes generated by the enterprise on the system. Each capital is expressed by its own set of actors, depending on the case study. Satisfying the needs of these actors constitutes delivering value to the system [12]. Different value streams can be identified depending on the satisfied actors. Internally, the enterprise performs activities necessary to produce the product value proposition: the channels through which the enterprise can deliver value to the external system satisfying the

identified needs. However, its capacity to fulfil the needs can be reduced by external barriers, while the impacts are generated during the Life Cycle of its internal activities.

Figure 1. The proposed Product-market system framework



An overview of the Capitals will help identify the value upstream and downstream in play. The Financial Capital is affected by customers' satisfaction. It can generate financial capital in terms of profits for the enterprise that will overcome costs and allow the enterprise to continue its business activities.

The Human Capital comprises stakeholders' needs at a personal level without necessarily involving monetary exchange. The downsides to this value stream to consider are the potential negative impacts business activities can have on the stakeholders – i.e., reduction in wellbeing, privacy concerns, risks to health and safety, etc.

The Social Capital focuses on improving social networks and the condition of communities and society in its totality. The actors to consider are the social goals that can be positively or negatively affected by the product as defined by sustainability and social experts. A comprehensive and developed guideline for social goals to refer to is the UN's Sustainable Development Goals (SDGs) agenda [11]. Drawbacks are all the business' externalities that move society farther from achieving these social goals rather than closer.

The Natural Capital addresses the needs of natural assets such as water, air, and land quality and biodiversity in limiting physical externalities such as greenhouse gas emissions, reducing resource depletion, and incentivising responsible production and consumption. Environmental and sustainability experts should be involved in the decision-making process to preserve or improve the quality and quantity of natural stocks listed as natural assets' needs.

Finally, all business activities have costs, consume resources, generate waste and could cause harm. These are all negative values downstream that increase needs' pressure for some actors and should be considered in the decision-making process. Life Cycle Thinking should be applied alongside business consideration during the market proposition if the business

intends to assess the full sustainability performance of the product. Assessments (Environmental LCA, Social LCA, and LC Costing) can be used to assess each value downstream. Business decisions that generate such negative pressures on the external system produce divergent satisfiers [12]. Those decisions should be highlighted with the decision-making process and rejected for more convergent impact pathways, targeting the product that compromises the needs' satisfaction of the socio-ecological system actors.

Future research will test a procedure to apply the framework, from a qualitative assessment of the industrial ecosystem, collecting priorities from broader stakeholders using Multi-Criteria Decision Analysis, and testing the adoption of quantitative evaluations of impacts via to the LCAs by the industrial sector.

5 Conclusion

Digital and Innovation projects have been selected to test the product-market system framework for future case studies. These case studies will be investigated and discussed in future publications. The aim is to test the ability of the proposed framework in embedding sustainability consideration into product development and incentivise project managers to include shared value and LCT consideration in the market proposition.

The product-market system is expected to help decision-makers during product and services market proposition design when used with the existing business model framework. In this perspective, it is expected to fill the gap identified as a Sustainability Assessment tool that can guide decision-makers in systematically approaching corporate sustainability decision-making, learning from best practices, and replicating success.

The shared value creation process plays a central role in the product-market system framework as it determines what is considered Value in this context. The value definition adopted, as described previously, focuses on the identification of needs and on the process put in place to satisfy them; needs of potential clients, as well as needs of other stakeholders and even of society and nature in its entirety, with the end goal of a long-standing, sustainable system. Businesses can potentially identify and design products that satisfy common needs between the three pillars and the clients, adopting what is here called a “society's needs-oriented” approach as a step further from the “customer's demand-oriented” approach.

References

1. G. H. Brundtland, Report of the World Commission on environment and development: *"our common future."* UN, (1987). /
2. M. E. Porter, M. R. Kramer, *Harv. Bus. Rev.*, **89**, 62–77 (2011).
3. M. Preston, PwC 17th Annual Global CEO Survey, PwC. (2014).
4. M. Mazzucato, R. Kattel, *IIPP Brief* **7**. (2019).
5. R. M. Kanter, *How Purpose-Based Companies Master Change for Sustainability*. in *Leading Sustainable Change*, OUPJ, 111-139, Oxford, UK (2015).
6. R. Henderson, *Reimagining Capitalism in a World on Fire*. (2020).
7. T. Dyllick, Z. Rost, *J. Clean. Prod.* **162**, 346-360 (2017).
8. J. M. Corbin, A. Strauss, *Qual. Sociol.* **13.1**, 3-21 (1990).
9. K. M. Eisenhardt, *AMR* **14.4**, 532-550 (1989).
10. R. E. Stake, Sage Publications, CA, US: Thousand Oaks. (1995).

11. UN. Retrieved from <http://www.un.org/sustainabledevelopment/sustainable-development-goals/> (2015).
12. M. Max-Neef, The Apex Press, New York, NY (1991)