The Role of Sustainability in Operations Management

David Opresnik, Marco Taisch

Introduction

Operations Strategy plays a crucial role in linking business strategy with Operations and has at least two great challenges. The first one is to formulate an Operations Strategy in line with the business strategy and the environment and secondly to implement it. This issue becomes even greater when dealing with sustainability, as it is a novel operations strategy that can be extremely hard to effectively formulate (plan) (Berns et al. 2009) and implement (Epstein & Roy 2001; Cruz et al. 2006), as it is too often vaguely defined in business strategies. Paradoxically, the trend of sustainability is spreading very fast among manufacturing enterprises. Nonetheless, managers are aware that they risk of failing in dealing with sustainability (Berns et al., 2009). Consequently middle and operations managers need guidance on managing Operations Strategies focused on sustainability, for which much more research need to be undertaken. However, even though that many definitions of sustainability exist, none offer enough details needed to clearly delineate and position the concept of sustainability into a manufacturing enterprise to undertake systematic research, based on which sustainability related patterns, guidelines and methods with strong managerial implications could be derived. Namely, research should be able position sustainability initiatives into existing strategic and operations managements of manufacturing enterprise, enabling managers to align it with their existing manufacturing and business strategies, thus additionally bridging the potential gap between management and operations.

Therefore the aim of this article is to build stronger theoretical foundation in the field of sustainability (only environmental) in manufacturing enterprises that would enable the design of strategies, guidelines and theories, that will help increase the effectiveness of the implemented sustainability initiatives into the existing operations and their efficiency. Concretely, this means that the exact role of sustainability in manufacturing enterprises has to be identified; by role it is meant the “characteristic or expected behavioral pattern in a particular setting” or also “the function performed by something in a particular situation or process” (Anon 2014). To clearly delineate and position the concept of sustainability, the first research question is: “What is the position of sustainability (environmental) in a manufacturing enterprise in the strategic and operational management?” The answer will have to encompass also its impact and what impacts it. The answer will position sustainability within the manufacturing enterprise and set clear boundaries. The second question goes as follows: “How can the management of sustainability, as previously defined, be researched in order to enable the identification of best practices and managerial guidelines?”

Abstract. Sustainability in manufacturing is one of the new trends among manufacturing enterprises. However, paradoxically it stands on multiple definitions, that are often much too vague. Thus manufacturers are facing great challenges during the formulation and implementation of sustainability initiatives. Consequently, the aim of this article is to provide theoretical foundations of explicitly sustainability in operations management with the further on research objective to identify patterns and provide managerial guidelines in formulating and implementing sustainability. Namely, there is a great lack of systematic research in the research field in question. Hence, the objective of this article is to position sustainability (environmental) into a manufacturing enterprise into both managerial levels - strategic and operational. In a second step, a framework depicting the relationships, impacts, functions and limits of sustainability in Operations Management is designed. It has been identified that sustainability can act as an Operations Strategy, which consequently encompasses a set of Sustainability Operations. In the Operations Strategy the phase of strategy formulation is present, where all the planning is undertaken, while all the execution is performed during implementation. The core question in planning a Sustainability Operations Strategy is to identify “where” its impact will be visible, which can also represent a starting point for research. However, before designing it, the impact of business and manufacturing strategies must be taken into consideration, as also the legislative and competitive environment. Finally, the need for a dedicated sustainability taxonomy capable of encompassing all its Sustainability Operations Strategies (i.e. indicating where to be sustainable) and its Sustainability Operations (i.e. indicating how to execute the strategies) has been identified. In addition of being a mechanism trough which research could be conducted, such taxonomy would present a “bridge” between management and operations.

Keywords: sustainability, manufacturing, operations strategy, operations management
The following four research objectives are to be met. Firstly, the positioning of sustainability within the enterprise will be performed. In a second step, after defining the role of sustainability, it will be scrutinized which information are needed to manage sustainability in such a context and of course to research it. Consequently, it will result in a framework depicting the relationships among the concepts and presenting the main steps in exploiting sustainability in manufacturing enterprises. Among others the article will provide not only the core questions in relations to sustainability, but also where to start research of sustainability according to the positing and what is missing yet to perform a systematic research. The results will be beneficial mostly for the research of Sustainability in manufacturing enterprises with the specific aim further on to identify best practices and develop guidelines about developing sustainability initiatives and implementing them.

The methodology and the main concepts are briefly introduced. Then in the third section sustainability is first positioned within the manufacturing enterprise in strategic and operations management. After the limits and the concept clear delineation is performed, the second part of the section develops a framework how to manage sustainability and what are the key questions that managers and researchers must be attentive to when exploiting sustainability.

1. Methodology

Two main steps are undertaken. First the conceptualization of sustainability in a manufacturing enterprise is performed. Therefore the following steps will be followed:

- The limits are set by defining the concepts involved, which provides the ‘building blocks’ for theorizing (Reynolds 1971); this will enable to position sustainability into the levels of Operations Strategy and Operations.
- Afterwards linkage (relationships) among the concepts will be created (Reynolds 1971), depicting the forces impacting sustainability and the relations with the main managerial functions.
- Possibilities of theoretical evolvement of sustainability are finally presented.

After defining the role and impact of sustainability, thus identifying ‘what is it’, it is defined how this can be effectively and efficiently managed. To perform such analysis, the main functions of management are taken through which the role of sustainability as part of operations management is analyzed. Furthermore the nexus of the presented framework relies on theoretical foundation arising from strategic management.

2. Concepts

There are three main concepts involved in the article – sustainability and operations management.

There exist multiple definitions of sustainability, where the Triple Bottom Line depicts clearly the relations. Nonetheless, this article focuses only on environmental sustainability (eco-efficiency and eco-effectiveness).

However, when talking about managing sustainability, we do call upon only efficiency measures, but also sustainability oriented strategies enabling to modify the current business models that are based on the idea to sell as much products as possible, hence not being adequate in terms of sustainability (Garetti & Taish 2012). Hence, a need for managing sustainability arise. Based on multiple authors’ definitions, Starik and Kanashiro (2013) defined sustainability management as the formulation, implementation, and evaluation of both environmental and socioeconomic sustainability-related decisions and actions. While other management theories explained the need for and advancement of sustainability management, none of those theories appear to have the unique features, benefits, opportunities, challenges, or orientations to assist individuals, organizations, and societies to move toward sustainability as much and as soon as appears necessary (Starik & Kanashiro 2013). Furthermore, Schrettle et al. (2013), based on also on other findings, identify that it is still unclear why certain enterprises adopt sustainability practices while others do not and under which circumstances firms can realise competitive advantage by their adoption. Consequently, there is also no descriptive model, which supports decision making of firms facing sustainability challenge (Schrettle et al. 2013), managers especially lack the right information upon which to base decisions and when enterprises do act, their execution is often flawed (Brens et al. 2009). Hence more research on the topic of sustainability with the objective to design dedicated managerial guidelines that will be capable to be aligned with specific operational context; thus being capable to align specific set of complex manufacturing operations with the business strategy when formulating and implementing a sustainability project. Therefore it is necessary to identify how sustainability can be formulated and deployed through operations management.

Academics and practitioners who believe that the study of operations is limited to operational matters are fundamentally misunderstanding the contribution of operations management to strategy and, more importantly, the huge potential that operations has to deliver sustainable competitive advantage (Slack 2005). Thus, environmental sustainability is not only about pure operations but also about their strategies. Some authors recognize sustainability to be a sustainable operations strategy (Bettley & Burnley 2008). According to Bettley (2008) operations strategy has been defined as the major decisions about, and strategic management of: core competencies, capabilities and processes; technologies; resources; and key tactical activities necessary in any supply network, in order to create and deliver products or services and the value demanded by a customer.

Corbett (2009) proposes a typology for sustainable operations management that is based on the life cycle
stages of a product and the three dimensions of sustainability. Although very simplified, it points towards the direction towards a basis for systematic research of sustainability in operations management, through which theory advancement can be undertaken. Namely, still today there exist none of systematic classification of operations strategies focused on sustainability and put into context. There has been some effort within the broader context of operations management to develop taxonomies (Adam, 1983), though operations strategy literature is still quite weak on taxonomical research, both at the conceptual and empirical level (Adam & Swamidass 1989), although that through this mechanism hidden patterns and configurations can be discovered, which would benefit operations managers.

3. Sustainability in Operations Management

First sustainability is positioned within the enterprise, where the concept is defined through its delineation. Through this process the limits, relations with other relevant concepts are set and its functionalities described. The first two steps are necessary in conceptualization (Reynolds 1971). In the second subsection, it is shown how this concept can be managed effectively and efficiently.

### 3.1 Positioning of Sustainability in the enterprise

The role and positioning of sustainability in strategic and operations management has first to be established. It will also be the first step in setting the limits to the conceptual framework. In Figure 1, two main levels are depicted (horizontal) - strategic management and operations management. The former defines the business development path of the enterprise, thus defining a business strategy and diverse business tactics. Moreover, it acts as a boundary for operations management, because the objective of the operations strategy is to support as much as possible the business strategy in its predefined competitive advantages; thus the business strategy acts as the boundary of operations strategy. The focus of this article is solely on the bottom layer, thus on Operations Management (with bolded borders in Figure 1). Figure 1 has three columns, the first one showing the decision levels in the enterprise that could be called also the main categories, the second one represents sub-classes of possibilities within each of the two main classes. In this column, sustainability is classified, with the aim to position it in the multilevel framework of the enterprise. As the third column briefly depicts examples of sustainability positioned in the various levels.

![Figure 1: Positioning of Sustainability in the enterprise](image)

From a strategic management perspective, sustainability can be seen as a business tactic, which role is to support a business strategy (e.g. help increase product differentiation through sustainability in the product design, thus creating the possibility to access to a new customer base). However, this article does not try to advance research in strategic management; hence the perspective of Sustainability as a business tactic is not analyzed, however it was needed to clarify, as the role of sustainability throughout the enterprise must be presented. At this point, the question is where sustainability can be positioned within the level of Operations Management? From that onward, what impacts it and on what it has impact on?

First, the intent is to position sustainability as an Operations Strategy, making it a specific type of it. According to Slack and Lewis (2011), Operations Strategy is defined as the total pattern of decisions which shape the long-term capabilities of any type of operations and their contribution to the overall strategy, through the reconciliation of market requirements with operations resources. This would mean that a Sustainability Operations Strategy would have to define (propose) a pattern of decisions impacting its operations – thus it is chosen which operations are to be implemented, their capabilities and the pattern of usage. However, still arising from Slack’s and Lewis’ definition, it must take into account the impact of market requirements, while making an impact (supporting) on the existing overall business strategy. This calls for an alignment between the Sustainability Operations Strategy with the market and the business strategy, however the alignment more later. Hence sustainability can be seen as an Operations
Strategy, if it fulfils those requirements. Secondly, sustainability is positioned within Operations. This means that multiple types of Operations have the characteristics of being sustainable (environmentally) or are applied in such way to have a sustainable impact on a specific part of the value chain. This classification is not novel, as for instance sustainable operations improve the competitive position, as such initiatives will prove difficult to replicate (Gupta & Palsule-Desai 2011). This article will not employ the term “sustainable operations”, as it implies that an operation is sustaining (pertaining), which does not indicate the usual meaning that is targeted (decrease of environmental impact); hence the term “sustainability operations” will be used instead, indicating operations with characteristics or effects of sustainability. Consequently sustainability can design a Sustainability Operations Strategy, for which Sustainability Operations are used.

Hereafter a short example of positioning sustainability in various levels of the enterprise is presented. This is the case of a manufacturing machine tool enterprise which business strategy is based on differentiate its products by specific product characteristics. It decided to initiate with a business tactic of introducing green, energy, optimized products, with the aim to support its existing business strategy of product differentiation (Porter 1996). From the business tactic the Operations Strategy is developed (although depends on the enterprise, it can be done directly from the business strategy), which has a higher level of details. In this case the Operations Strategy focused on Sustainability represents the improvement of the product design and its functionalities (energy) in terms of sustainability. Of course, an Operations Strategy does not provide such low level of detail, but it is enough to make our point. Finally, in order to implement such Sustainability Operations Strategy specific Operations that are sustainability oriented have to be implemented, like R&D in energy efficiency, dedicated energy monitoring procedures, product design etc. From this short example, it is visible that the Sustainability Operations Strategy is bounded by the business strategy, while Sustainability Operations are bounded by Sustainability Operations Strategy. Consequently, Sustainability Operations Strategy must take into account the targeted competitive advantages coming from the business strategy and the existing competitive priorities coming from the manufacturing strategy. Thus, it is seen that Sustainability Operations Strategy is not an independent strategy.

After defining the role that sustainability can play at the operations management level, the following section analyzes how the management of Sustainability as an Operations Strategy or as set of specific Operations can be researched. Namely, it is referred to “management” of this concept, as the final aim is to enable manufacturers to easier operationalize this concept.

3.2 Managing Sustainability

Sustainability can be managed as an Operations Strategy and/or as Operations, which form the strategy. Hence, Sustainability Operations Strategy and its Sustainability Operations are undividable and must be analyzed together, so to analyze how they can be managed.

As any idea starts with first making a strategy and then operationalizing it, we lean on the rich existing literature of strategic management. To understand how a Sustainability Operations Strategy goes from an idea state to an actual operation, we took Huff’s (1987) framework presenting dimensions of strategic process research. More exactly, this means that we divide in two separate steps - strategy formulation and implementation. Strategic process research deals with those two steps and does create the link between the research characteristics directly with the financial performance of the enterprise; this would be already a “content” type of research, which does not come into play, as we believe that it is not possible to isolate adequately the observed phenomena in order to create a cause-effect relationship. Finally formulation and implementation of Sustainability Operations Strategy can be researched first in a prescriptive form (“how things are done”) and then based on the previous results using a normative approach (“how things should be done”) (Huff & Reger 1987), bringing improvements into the research field. Consequently, the following two questions represent the nexus of the research framework for Sustainability Operations Strategy presented in Figure 2: a) How to formulate a Sustainability Operations Strategy and how to implement it?

![Figure 2: Sustainability in Operations Management](chart)

- Manufacturing Strategy (with competitive priorities)
- Environment (legislative and market)
- Sustainability Operations Strategy
- Business Strategy (with competitive advantages)

1. Plans:
   - Where (in the value chain) - Impact
   - What (operations) - resources
   - Who (in the value chain) - stakeholders
   - How to organize this process?

2. Execute operations
   3. Organize
   4. Lead, motivate
   5. Control

Formulate

Plan review
In the second step the questions about formulation and implementation were linked with the basic managerial functions, with the objective to bring out concrete questions that have to be answered during each of those two phases. In the strategy formulation fits the managerial function of “planning”, through which must be designed all relevant information to perform the implementation, which is the second step. In this step the plan is executed. The formulation of the strategy is in the domain of the Sustainability Operations Strategy, while the actual implementation, is taking place in the lower level Operations. The formulation step should answer the following basic key questions:

a) Where (in the value chain) – The place of impact of the Sustainability Operations Strategy has to be defined, it is the core information upon which researchers and managers can direct their selves. However it has to be defined in such a way it will be understandable to managers as well as technical staff, thus making a sort of “bridge” between the strategic and operational world. This calls upon the design of a dedicated sustainability taxonomy encompassing the entire manufacturer’s value chain. It would not provide only a common meaning, but moreover it would represents a basis for further classification and analyses through which new information, that are not visible at the first glance, could be derived; for instance groups which are best characterized by the “gestalt” of the commonalities they share (Miller & Friesen 2007). Unfortunately, studies using taxonomies to characterize the strategic posture of operations are limited (Sum et al. 2004), and the one dedicated to sustainability in manufacturing are, as far our knowledge goes, nonexistent. Such taxonomy would also enable researchers to link the “where” with the “how”, where management is more interested in the first question, whereas technical experts are more related to the second question. Thus, such taxonomy could be seen as the bridge between management and operations.

b) How – What Sustainability Operations are needed to execute the Sustainability Operations Strategy has to be identified. Again at this point, a common representation of the activities throughout the manufacturer’s value chain is needed, so to be able to pin-point the Operations that are going to be affected by the change. Such common representation shows also a basis for controlling and monitoring.

c) Who (in the value chain) – Which stakeholders are involved; this information is derived after defining the place of impact and the operations involved, as only then the amount of change is known.

d) How to organize this process – Addressing change management processes are out of the scope of this article.

Based on those answers not only managers can easier design their operations strategies, but also research can create typologies. The two most essential questions in Sustainability Operations Strategies in the planning phase are the “where” and “how”, however the “how” is the consequence of the “where”. Hence the primary starting point of research in Sustainability Operations Strategy is to analyze the “where”. This decision is dependable upon two sets of factors:

a) Internal alignment – first with the business strategy, meaning the Sustainability Operations Strategy has to support a certain competitive advantage and secondly with the manufacturing strategy (arising from the business strategy) and its competitive priorities (Frohlich & Dixon 2001) (i.e. quality, manufacturing flexibility, delivery etc.).

b) External alignment – first the legislative environment; if it supports a specific set of Sustainability Operations, it is worth taking it into account. Secondly, the market competition, where one can benchmark itself against competition on an existing market and obtain new insight.

This means that four elements described earlier (points from a-d) represent the context of a Sustainability Operations Strategy. Thus researchers are motivated to collect not only the information about the place of impact, but also about the context. Only this way results can be seen as objective and useful on the long term to managers.

4. Conclusion

At this point, the results of the article were beneficiary mostly for research focused on identifying best practices and guidelines in setting-up and implementing Sustainability Operations Strategies, hence enabling managers to exploit more effectively as also efficiently sustainability in their enterprise. The first result positioned sustainability in operations management, by defining clear roles and limits. Consequently, it has been found out that Sustainability is an Operations Strategy that in order to be operationalized it has to be formulated and implemented. As seen, the first step is critical, dealing with the most important question of “where” an enterprise in the value chain should be sustainable. The presented framework depicts that the business and manufacturing strategies have to be taken into account as also the legislative and competitive environment. However providing a framework and positioning in details sustainability, is not enough for research to identify hidden patterns from industry and provide guidelines to mangers based on a deeper, systematic and rigorous analysis of Sustainability Operations Strategies of manufacturers. Therefore it was called upon a mechanism through which both Sustainability Operations and Sustainability Operations Strategies throughout the entire manufacturer’s value chain could be classified, hence designing such a dedicated taxonomy. Such taxonomy would also enable researchers to link the
point of impact of sustainability with the “how” indicating which Operations are necessary for execution.

References


