

An Evaluation of Demand-Driven Chain Contribution to Sustainable New Product Development

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Abstract. Due to variable customer expectations; it is required to highlight the existing gaps in “demand” patterns where the stakeholders observe the end consumers over a focused viewpoint. A systematic critical review is conducted to identify and address the literature gaps in a methodical manner. Given the lack of life-cycle analysis (LCA) in many manufacturing industries, the research presents the use of appropriate strategies for designing new eco-friendly products utilising engineering knowledge and R&D innovation. However, a comprehensive LCA would be carried out in future stages of the research to enable industrial designers to critique the performance and identify the potential environmental impacts associated with the product lifecycle. The research proposes to develop a novel framework for an effective linkage between supply-demand chain approaches and the new product development (NPD) processes considering innovative environmental practices. The results of this study can be utilised by researchers and practitioners researching within similar context.

Keywords. Demand Chain Management, New Product Development (NPD), Environmental Sustainability, Supply Chain Restructuring, Life Cycle Analysis (LCA)

1. Introduction

The research focuses towards examining the concept of demand chain contribution to sustainable new product development process. In present day-to-day changing demands, a key enabler of growth in industrial competition would be research and development optimization and boosting innovation in order to introduce new products and services to the market. New product development (NPD) process necessitates collaboration among all entities of the supply-demand chain. Due to rapidly evolving technology trends and increasing customer expectations; this research attempts to focus on the dynamic “demand” paradigm that implies current, hidden and emerging demand where manufacturers, retailers and media consider the consumers through a specific integrated lens. The close alignment and synergies between marketing and supply chain management as two interrelated parts make an optimal outcome and maximizes the customer value creation with the form of demand chain management (DCM) [1]. Furthermore, environmental sustainability and business ethics are being considered as

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significant bedrocks in generation of new products in manufacturing sector and hence; this research tends to make a further integration of environmental innovation to NPD while being compatible with customer demands in every aspect.

2. Research Approach

The research adopts the method of systematic investigation and structured analysis of the current literature in order to establish data, develop methods, and eventually address the research gaps in a methodical manner. Based on a primary research and a pre-specified protocol [2], systematic review focuses on research questions to identify, synthesize and appraise the high quality research findings to minimize the bias. Research studies adopt five different steps of a systematic review, and explain that an explicit approach helps researchers to gain more rich and accurate answers when addressing the research gaps [3]. Though, this research proposes the following framework illustrated in Figure. 1 in order to organize the whole literature towards precise results that will act as inputs of further research methodology, case investigations and final results.

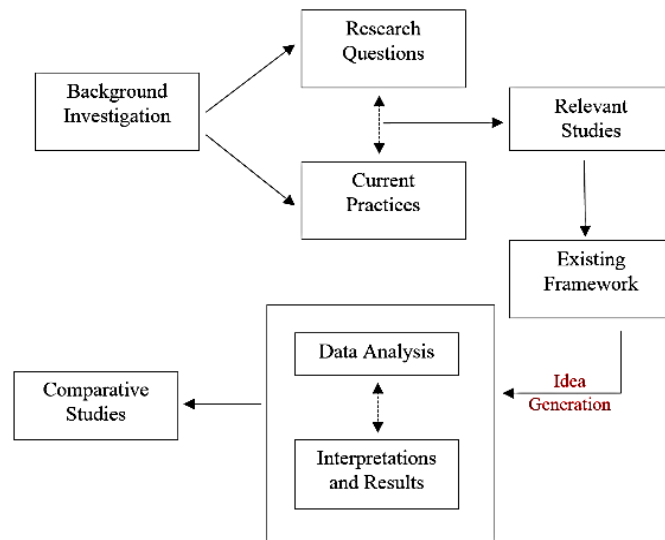


Figure 1. Research framework for systematic literature review.

Some of the key research questions towards systematic review are including:

1. Supply-Demand Chain – *what are the differences between the traditional approaches of supply chain and demand chain management?*
2. Supply-Demand Chain Risk & Threats – *what are the key risks and threats in the NPD process?*
3. NPD Approaches – *which NPD approaches have been adopted to the supply-demand chain?*
4. Environmental Practices – *how would the environmental practices involve in the new product development process?*

5. Life Cycle Management (LCM) Shortcomings – *what are the key shortcomings and how are these gaps addressed?*
6. Supply-Demand Chain, NPD and Environment Practices – *what are the key benefits for linking these three concepts together?*

3. Literature Review

Research studies define the demand chain concept as, "... the whole manufacturing and distribution process may be seen as a sequence of events with but one end view: it exists to serve the ultimate consumer" [4]. Similarly, DCM is explained as "the management of supply production systems designed to promote higher customer satisfaction levels through electronic commerce that facilitates physical flow and information transfer, both forwards and backwards between suppliers, manufacturers and customers" [5]. Another study discussed that the principal driver of demand chain is to accomplish the benefits of the "virtual enterprise" aiming to focus on cost reduction, customer support systems, best NPD and fast speed learning [6]. The innovative demand-driven chain emphasizes is on marketing and creates pull for new products through a network of customers, suppliers and employees [7], instead of pushing supply into the market from the traditional viewpoint of supply chain [8]. Equally, studies also stressed that DCM is in contrast with efficiency and production view in SCM while preserving that effectiveness and customer orientation should be associated with supply chain tasks in order to gain competitive advantage and customer values [9]. Marketing has usually acted as a border line between the company and the consumers in the markets [10]. More profoundly, marketing concentrates on customer value creation in an external view, while supply chain is internally focused on supply-related processes and efficient use of assets. In between, Demand chain is a concept that bridges the gap between these two elements. Therefore, it is essential to reassess the role of marketing within both DCM and the company. An approach facilitated a cross-functional study in addition to a co-development workshop in order to capture supply and demand integration as a very crucial factor [11]. Based on the results, they introduced DCM as a model and proposed a conceptual framework for it with three integrative elements and also derived some propositions for the role of marketing within DCM in managing the working relationships within marketing and SCM.

3.1 New Product Development (NPD) and Supply-Demand Chain Management

Studies define "Product Development" as the transformation process of a market opportunity and a set of assumptions regarding product technology into a product accessible for marketplace [12]. However, a large number of new products do not succeed while entering the market and according to a study, the success rate of NPD in 2012 was potentially 67.5% in US, 48.6% in Asia and 56.8% in Europe [13]. One of the practices within NPD area is concurrent engineering which requires a multi-functional development team mainly focusing on internal collaboration; however, a wider alliance among the whole supply-demand chain would be required due to today's industry high competition. This type of design mainly focuses on internal alliance but in today's world rivalry it is required to arise concurrent design with collaboration of the whole supply-demand chain [14]. In addition to "design for manufacturability" and "design for quality" which encompass a vision from individual firms, "design for supply chain" would be a

more significant term to be explored as an element for NPD achievement. This aim could be obtained with the material supplier's involvement in NPD projects including simple consultations on design plans, effective teamwork with purchaser firm's engineers and giving full liability to suppliers in order to design and facilitate the most effective and updated machinery and systems to be applied in product development process [15]. According to the previous studies, obtaining the best possible consequences from the NPD cycles, organizations need to be transformed from "machinery companies" where strategies are dominant to "innovative companies" where the senior managers inspect to promote process developments by contribution of all the manufacturing personnel [16]. This could be a challenging issue, as most of the corporations often consider short-term fiscal outcomes and tangible assets like equipment and buildings rather than evaluation of the intangible assets of integrated NPD and customer satisfaction which also bring continuous success to their organization. Researchers also studied a world leading bicycle-manufacturing company (Taiwanese GIANT) using knowledge extraction methodology through data mining techniques in order to create customer knowledge patterns and rules to suggest solutions to the aforementioned case firm in terms of demand chain performance [4]. As a result, the extracted data from customer views should be applied into supply chain as an input in order to make integration between demand chain and supply chain operations. This resource knowledge enhances product innovation capabilities, R&D and marketing strategies of the company along with handling product promotions and customer relationship management.

Generally, NPD approach is considered as a high-cost and time consuming issue. However, various factors can influence on NPD approach success and the most important are the characteristics of process, product, market and strategy [17]. As well as various researches, which focused on customer satisfaction in NPD success, the necessity of suppliers' integration in this area was explored [15]. Therefore, the participation of suppliers could be considered from the early stage in NPD processes such as providing materials or technology application to the finishing stages such as packaging and distribution. Many managers and researchers mention involving suppliers as external constituents as a "black box" in NPD team. Coordinating product, process and supply chain design within the early supplier integration (ESI) was considered as a vital linking method in this case [15]. The researchers visited manufacturing companies in US and Japan and met the NPD managers in order to identify their barriers in process of integrating suppliers in product developments and also to understand when and in what level of responsibility suppliers would be involved in NPD.

3.2 New Product Development (NPD) and Sustainability

A profound comparison between the concepts of conventional design and sustainable design was identified, which stated that due to a mismatch between sustainable principles and conventional design priorities and the differences between their characteristics, developing an effective association between these two requires new approaches [18]. Conventional design, in particular industrial design refers to particular sets of knowledge and skills that are being applied since early 20th century in order to design products for large-scale distribution [18]. It presents mass-produced products to mass markets, which often have a short life span. Accordingly, sustainable design is a new journey of exploration with an uncertain route and unknown territory that industrialists, economists and politicians face complications in understanding them and the ways to associate it with long-established industrial and economic models. Due to this, sustainable designers

do not seem to be in a comfortable zone, since the existing conventional methods are unsustainable and being a sustainable designer is to be on an undefined ground. Besides, the sustainable approach is not oppositional as fighting with new circumstances and modification of existing models is not an effective strategy and changes towards sustainable culture take time and requires incremental steps. By contrast, industrial designers develop new products in a long-established and well-defined framework which mainly focuses on boosting sales, financial profits and growth enhancement, inattentively of a responsible contribution to material culture [18]. It is suggested that traditional cultures can be excellent references for sustainable designers to exert inspirations into diversity and richness of folk appropriate design. However, it would be a challenge for them to find ways to integrate the local and global aspects in order to create products which are compatible with the desire of the modern societies. NPD development teams will be dealing with three important factors when aiming to incorporate environmental concerns and NPD. Different aspects of greening related to design specifications such as market demands, environmental attributes and product functionalities make greening a complex procedure [19]. From market perspective, some aspects of product specifications important by a development team might not be important to consumers and they might have a neutral vision regarding the environmental aspects of the product they purchase. From design perspective, environmental attribute refers to recyclability, recycled content, fuel efficiency, toxic content reduction and emission-related performance [19].

3.3 Demand Chain and Sustainability

Studies presented a conceptual framework for sustainable demand chain management (SDCM) that takes the customer perspective and transforms the traditional purchasing methods focused on SC flow while taking goals from the triple P's of the business [9]. The author suggests that the sustainable value performance is a concept that needs to be defined from the customer sustainability dimensions as an output rather than the suppliers' perspective which result in creation of sustainable value proposition. However, according to a study in a developing country; customers, local community and employees act as neutral factors to motivate an adhesive company towards sustainability and going greener [20]. This can be due to cultural gaps and social unawareness of environmental sustainability dimensions and the premium price of eco-friendly products both for industrial and home customers which need to be further addressed [20].

4. Research Observations and Gaps

The research gaps existing in this field would be lack of innovative demand-driven chain, lack of cross-organizational collaboration and shortage of R&D for eco-friendly products in developing countries. Hence, addressing the research gaps and improving the engineering efficiency towards product sustainability as well as business profitability, a complete "life-cycle analysis" would be investigated within this research. Reducing the development costs and launch time, this research also seeks to minimize the supply chain risks and threats in product development process and if necessary organize a plan to redesign the traditional SC structure in order to put it under the control of the company. Meanwhile, the potentials of manufacturing industry for being adapted to sustainable product development will be evaluated and also the requirements, limitations,

opportunities, new industrial issues, academic challenges and critical factors will be studied taking into consideration not only the engagement of different entities of the supply-demand chain but also the environmental aspects of doing so. Further investigation of the literature will be undertaken in order to identify more research gaps within the proposed field in order to support the detailed research objectives.

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