An Examination of Product Development Approaches within Demand Driven Supply Chains

Abstract

Purpose – Innovation has been considered as the most important factor in today’s global and competitive environments for meeting growth, customer demands and expectations for any product development environment. This research study examines the concepts of sustainable development, its practices and impacts within demand driven supply chain environments. This paper is part of a wider project and within later stages of the study, a novel framework will be developed in order to link new product development (NPD) and demand chain management (DCM) aspects from the analysis of the research findings.

Design/methodology/approach – This research has adopted the approach of descriptive method which tends to examine demand chain concept and its evolution through recent years, while having a particular focus into NPD projects.

Findings – The paper investigates early study models through key findings of the literature that focuses on demand chain and NPD for the use and implementation of sustainability measures within manufacturing environments. The research study highlights the need for incorporation of NPD-DCM through the entire business ecosystem entities and also through the flow of information, materials and resources within the structure of the supply chain. The study finds out the key hurdles of the companies towards adoption of demand-driven supply chains in NPD environments, such as lack of cross-organisational association and lack of innovative demand chain frameworks.

Originality/value – The novelty of the research is to develop an early understanding within demand driven supply chains, considering the product development programmes particularly focused on marketing activities. The study provides future researchers with a platform to undertake studies within similar function of demand driven supply chain environments.

Keywords Demand chain management (DCM), Environmental practices, New product development (NPD), Supply chain management (SCM), Sustainable development.

Paper type Literature Review

1. INTRODUCTION

It has been widely noted that Supply Chain Management (SCM) is considered as an approach to satisfy customer needs towards products and services and hence companies would need to integrate their core business processes through their supply chain networks (Walters, 2006). More recently, there has been huge growth towards the concept of DCM in line with SCM that focuses on various key activities of business, including product design, development, marketing and wider aspects of strategic development of their products and services (Jüttner et al., 2007; Hilletofth, 2011; Lun et al., 2013). Research studies have highlighted DCM as a broad scope comparing that towards SCM, as it also concentrates on the development of key understanding of consumer demands as well as improving the organisational capacity within the product and service optimisation while managing to satisfy the needs of the market demands and that of customer expectations (Lun et al., 2013). The key focus of this study is to gather evidence at the preliminary stages to develop and understand the concepts of DCM and the contribution, linkages and approaches towards sustainable new product development processes. Current business and customer focused environments are evolving rapidly because of the necessity to manage and address all of consumer expectations, preferences and requirements within the market space. Similarly, recent advancements in technology including the use of Big Data, Internet of things (IoT) and Business Analytics applications are also considered as key factors that drive this
change within the environments. Manufacturers are now considering products with shorter lifecycles, increased product offerings and variety and shorter lead times for product maturations within the markets. All of these are factors that impact overall performance of the business due to the increased uncertainty within the market (Awwad and Akroush, 2016). Hence, much of current competition not only focuses on different competing firms, but also the supply chain networks, thus allowing the transfer of single autonomous supply chain networks to multiple supply chain entities (Vural, 2015). This paper utilises a comprehensive review of literature in order to apply its results using a qualitative research method within the later stages of the study. The hurdles, needs and opportunities of the manufacturing companies would be discussed in order to present the findings and discussion and also to bridge the gap between theory and practice. The scope and structure of this research study is based upon the integration of NPD and DCM which will be considered through all processes of the business in order to facilitate the product portfolio and to allow the creation of unique competitive advantages linking customer values within the product portfolio. Also, environmental sustainability and business ethics are considered as significant towards the generation of new products for many of the manufacturing sectors.

2. LITERATURE REVIEW

The paper presents the literature review to further allow the researcher to gather evidence towards the adoption of sustainable practices within NPD processes in any demand driven supply chain environment. The findings from the literature aims to provide the framework that will allow the analysis of applications and methods for using sustainable and environmental practices within demand focused manufacturing sectors.

2.1 An Overview of Demand Chain Management

Early researchers initiated the first early research towards DCM through considering the nature of the demand towards firm’s products and integrating the key aspect of the product through its functionality and that of innovativeness within the market (Rainbird, 2004; De Treville et al., 2004; Walters, 2006). It was also identified that many of the functional products were ideally fast moving consumer products that were readily available within the market place and which had the potential towards meeting the needs and requirements of the customers (Walters, 2006). These products were not subject to massive changes over time and hence were suitable to get adopted to DCM principles (Walters, 2006). Similarly, the demand-driven supply chain (DDSC) concept has been evolving since 1950s staring with TOYOTA’s demand-driven Kanban system as a key part of its just-in-time (JIT) production system. This is then continued by introduction of first electronic-data-interchange system (EDI) and point-of-sale (POS) during 1980-90’s (Budd et al., 2012). Research studies also focused towards designing a supply chain network that was able to link and fulfil the demand patterns linked to the overall function of the supply chain. In the earliest model developed, all of the functional products (fast moving consumer goods) required an efficient supply chain (SC) network where the total cost of production, transportation, and inventories are minimised (Walters, 2006).
Studies highlight that DCM mainly focuses towards the importance of efficiency and production, similar to that of SCM and it should be linked appropriately with the relative aspects of supply chain activities to achieve higher competitive advantage with customer satisfaction (Vural, 2015). It has also shown through research that the competitive situation has advanced the pace of innovation through its discovery, implementation, introduction and diffusion into the market space. This has forced many companies to use continuous innovation within their products and services to provide and satisfy better performance from the consumers (Caputo et al., 2016). It has been noticed in recent years, that the power focus has been shifted from producers, manufacturers and retailers more towards buyers and end users (Mahmood and Kess, 2016).

A similar study compares different firms towards achieving competitive advantages through the concepts of DCM (Hilletofth, 2011). The study states that those firms that adopt demand driven practices are focused more towards the managing and coordination of total demand processes. This is achieved through the provision of high value and fulfilment of market demands within the consumer cycle (Hilletofth, 2011). Contrary to that, those firms that focus towards supply driven practices are focusing on the managing and coordination of supply processes (SCM) that allow them to retain their competitive advantage through the provision of comparative value at a much lower cost to the customer (Hilletoft, 2011). Hence, it’s easily reflected that marketing focuses towards creation of customer value and supply chain is focused towards supply related processes with the efficient use of resources. Thus, demand chain is providing the linkage to bridge the gap between the marketing and supply chain principles (Jüttner et al., 2007). Demand chain could be applied in a wide variety of industries such as aircraft industry as a SCM approach in order to deal with risks and threats associated with supply chain redesign approaches, whereas it has been argued within the Boeing 787 Dreamliner development programme (Naghi Ganji et al., 2017b).

The Boston Consulting Group provides a research report regarding the concept of Demand-Driven Supply Chain (DDSC), which makes a deep insight through the demand chain concept and the gradual improvements in processing speed and computing power which enable rapid information sharing through a customer-centric approach (Budd et al., 2012). They considered DDSC with a more IT vision and believe that the storage capabilities are now unlimited thanks to advances in technology and cloud-based systems. The DDSC is defined as “a system of coordinated technologies and processes that senses and reacts to real-time demand signals across a network of customers, suppliers, and employees” (Budd et al., 2012). By emerging the new global and complex business environments over the recent decades, the long reaction time of supply chains began to improve with the aid of IT platforms, communication facilities (Budd et al., 2012) and reduction of communication costs (Ogawa and Piller, 2006). Some leading consumer-product companies such as Procter & Gamble and Walmart have started applying DDSC strategies to their planning processes with the aid of using POS data, information sharing and partnering with their suppliers in order to improve their service levels, overcome market challenges and boost customer satisfaction (Ogawa and Piller, 2006). Unexpected changes of market conditions are now getting traceable and therefore many costly and time-wasting issues such as inventory fluctuations and production schedule alterations would be avoidable (Budd et al., 2012). Comparing the traditional supply chain and DDSC, it is revealed that nowadays the flow of
information and products are rapidly increasing and becoming completely trackable across the entire supply chain.

DDSC is mainly based on four key pillars. First, the demand and inventory levels need to be clear and transparent across the whole supply chain. Second, a strong infrastructure helps the supply chain entities to adjust and correspond to instant changes in supply and demand. Third, coordination among the supply chain stakeholders enables them to operate more efficient and organized, and fourth optimization of whole supply chain performance provides companies with cost reductions and enhances customer service (Budd et al., 2012).

Other research studies facilitate a more cross functional base to capture supply and demand integration. Through the initial studies, researchers were enabled to propose the conceptual framework integrating the three elements (process, configuration and social interaction) towards the role of marketing in DCM that enabled the linkage and relationship between marketing and SCM as seen through Table 1 (Jüttner et al., 2007).

Table 1 The roles of marketing within DCM (Jüttner et al., 2007; Naghi Ganji et al., 2017c)

<table>
<thead>
<tr>
<th>Demand Chain Management Element</th>
<th>Relevance in Marketing</th>
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| **Process** - Managing the integration between the demand and supply processes | • Facilitating the process integration by disseminating customer and market information;  
• Evaluating marketing activities from integrated process perspective;  
• Fostering a demand rather than a supply-based integration of information needs. |
| **Configuration** - Managing the structure between the integrated processes and customer segments | • Linking external, customer-facing segmentation with internal segmentation of production, logistics and sourcing;  
• Obtaining knowledge about changes in customer needs as a basis for structural adaptation requirements of the supply chain. |
| **Social interactions** - Managing the working relationship Between marketing and SCM | • Exchanging information with SCM such as defined customer segments and new customer/product opportunities;  
• Collaboration within SCM partners for information sharing. |

In this case, the demand chain transformation at Heineken Company is examined in some major aspects including efficient customer response (ECR) with the form of category management, vendor management inventory (VMI) and early supplier involvement (ESI) as useful practices (Vollmann and Kordon, 1998). Moreover, many successful companies like Zara and Dell benefit from adoption of the DCM principles to their businesses (Walker et al., 2000) in order to increase their profitability and competitive advantage by close association of supply and customer elements such as product availability, delivery accuracy and responsiveness. It is discussed that DDSC has got the potential to be expanded to a wide range of industries such as retail, consumer products, automotive, aerospace and defence due to its nature of end-to-end visibility and enhanced processes. For instance, aerospace
and defence industry have logistical challenges requiring a high number of complex products at the right time and due to costly high inventory levels, these companies need to work closely with their suppliers in order to coordinate different activities (Budd et al., 2012). Marketing function will be resilient to alterations and hence, the whole supply chain needs to be involved in marketing activities, customer priority decisions and more significantly needs to deny marketing decisions if they are not in line with business profitability. In essence, it is suggested that the relationship triangle of SCM, DCM and marketing can act as a business enhancement option which also creates the superior customer value (Jüttner et al., 2007; Walker et al., 2000).

To distinguish the differences between SCM, DCM and DDSC, further interpretations can be provided. In a nutshell, SCM perspective starts with suppliers moving downstream to manufacturers and end-users. This creates a push system for the new products while entering the market. In contrary, DCM perspective starts with customer specific demands moving upstream to manufacturers and suppliers and this can be facilitated through the important factor of marketing. Hence, marketing act as a coordinator moving from SCM to DCM approaches. This means that in order to start with customer needs within NPD projects, innovative marketing practices such as collective customer commitment or postponement can be utilised in order to bridge the gaps between company and its customers which provides company with fruitful ideas as well as customer value creation and high level of satisfaction. On the other side, DDSC is a term coined by some authors which highly focuses on the IT applications, shortening the information flow time and providing with real-time information through the supply chain entities (Budd et al., 2012). Therefore, DCM and DDSC are very similar in nature and targets, and there are only few differences within their focus and strategies.

2.2 New Product Development and Innovation

It is evidenced that manufacturing firms in order to be more competitive in market, must continuously update their product offers in order to better satisfy the customers’ requirements. The integrated NPD and SCM enterprise has the benefit of increased supply chain capability, thus increasing the effectiveness of new product introductions and improves enterprise’s performance (Van Hoek and Chapman, 2007). According to Figure 2, NPD relates to most departments in the manufacturing companies, while the main sections such as marketing, design and engineering sections should be included in.

Marketing departments are the one to connect industry with customers and their role is to capture the knowledge of customer requirements, market analysis and opportunities to produce new product (Vinayak and Kodali, 2014). The department which defines product concepts as to meet customer requirements is Design; they are the one who creates realistic requirements after the approval of customer. Manufacturing function is basically an engineering department which defines the requirements for material purchase, distribution, and the whole supply chain (Vinayak and Kodali, 2014). Research studies demonstrate that NPD innovation is also important towards achieving success within manufacturing processes and is necessary to meet the requirements and expectations of the customers (Vinayak and Kodali, 2014). Similarly, innovation within organisation is often depicted as useful change tool that can be incremental or radical within the product or process and a measure
towards the success of the product and that of the organisation within the competitive market place. Within the current global environments, companies have to adopt and practice innovative principles and methods to their product and service functions to enable them to compete within the markets while reducing the product life cycle and lead times to meet the demands (Vinayak and Kodali, 2014).

Researchers identify product innovation as a critical element to the success of the product which is highly related to the sustainable business success in turn providing better business opportunities for growth, expansion and maturity within new areas (Cooper and Kleinschmidt, 1995; Awwad and akroush, 2013; Cheng and Shiu, 2008). Similarly, process innovation refers to the aspect of using new innovative production and operations methods and using new technological advancements such as additive manufacturing to improve their overall production processes (Maravelakis et al., 2006). Similar study has emphasized heavily upon process innovation that could result in product innovation and likewise product innovation which could force process innovation on manufacturing organisations. This further proves that there is a strong linkage of product and process innovation that should be considered as an important factor during the NPD process (Maravelakis et al., 2006).

Market innovation is considered as a newer approach which companies have been adopting in order to scale and utilise the target market (Maravelakis et al., 2006). This is also linked to the wider discussion of innovation and especially product innovation towards market research, advertising and promotion, which also relates heavily towards using the four Ps concepts for any new opportunities within the market, including entry and threats of new markets. The concept of market innovation is very central and important to product innovation and likewise product innovation is the central focus for product novelty (Vinayak and Kodali, 2014). Market innovation would be further investigated in the next section by (Ogawa and Piller, 2006) as an important factor considering demand chain role within product development processes through recent practices that tend to engage the customers from the very early stages of the product design (Naghi Ganji et al., 2017c). It is also stated that the most vital success factors for innovation and NPD projects are reduction in development process, cost and time reduction in product manufacture, products with high levels of customization, added value products, effective internal and external associations, proper timing for product launch and less competitive markets (Chen and Shiu, 2007). Within international markets, the pre-development and development activities, high demand of foreign markets and well-established advertising activities can differentiate the successful and unsuccessful products, while product characteristics have lower influence in this matter (Haluk Koksal, 2014). On the contrary, some authors disagree with this statement and believe that the product characteristics and new inventions have great impact on the success of new products as the process of diffusions suggests (Roger, 2003).
2.3 NPD and Demand Chain Management

Research defines Product Development as the transformation process of a market opportunity and a set of assumptions regarding product technology into a product accessible for marketplace (Krishnan, 2001). NPD is an element which can empower supply chain drivers and cause the fulfilment of market growing requirements; however, it is mentioned as an expensive and time-consuming practice (Sharifi et al., 2006). According to a report on product development performance metrics and practices within 211 US businesses, 90% of the best performers, compared to only 44% of worst performers, have got a clear and well-defined NPD development process guiding NPD projects from idea to launch (Cooper and Edgett, 2012). A research paper explores the factors that bring uncertainty to the process of NPD and cause struggles for companies for on-time delivery of products or projects (Martinich, 2015). In addition to the technical complications of product development, other NPD uncertainty factors are mentioned as STORRM term including resource capability, social or global economic conditions, technology changes, organizational changes, resource adequacy, regulatory changes and market conditions (Martinich, 2015). In addition to the NPD uncertainties, three risk factors are identified for NPD process including marketing, organizational and technological elements which is very common to the NPD’s own components. These factors need to be identified, analysed and monitored by different tactics such as learning from customers, sourcing external knowledge and integrating internal knowledge (Mu et al., 2009). It is recommended for firms to identify the physiological attitudes of potential customers regarding their desired needs in order to match their NPD projects with them (Mu et al., 2009). Based on a theoretical model, supplier association act as a key component of NPD and customer involvement applies a positive effect on it as well as cross-functional integrations, whereas all of the three factors create an integrated NPD which leads to the success of financial performance (Tan and Tracey, 2007). The enhanced involvement from the manufacturing staff, suppliers and customers is required towards bridging better relationships between the independent and the dependant variables which is the ultimate purpose of customer satisfaction with six established factors as
As identified in figure 2, NPD programmes requires a robust relationship with supply chain functions especially engagement of suppliers, end-users and manufacturing departments. Having the customer satisfaction element in the last box as dependant variables, proves the fact that the ultimate target of NPD and SCM interrelations is customer satisfaction and hence, replacement of customer requirements at the start of supply chain towards a demand-driven chain would help the NPD success. In this case it is important to identify, which strategies can assist the organisations to build the relationships between their NPD functions, suppliers and customers within supply chain.

![Identified framework linking NPD and supply chain (Tan and Tracey, 2007).](image)

The innovative marketing practices are one of the strategies which can engage customers within NPD approaches. This can be interpreted that NPD approaches can be linked with DCM practices in order to be more effective towards NPD success. The conventional market research towards NPD purposes is a traditional and heavy form of market research for testing new product concepts including “focused groups” which has several limitations (Ogawa and Piller, 2006). First, the results of the test is based on a few number of consumers and does not indicate the feedbacks of broader populations. Second is that people are not provided by the exact benefits of the products and have often only got the verbal explanations of concepts without knowing their unique features (Ogawa and Piller, 2006). Third, the focused groups are not able to quantify the real customer purchasing, profitability and other information, rather they only collect people attitudes regarding a new product. Besides, “test marketing” is a market experiment stimulation conducted in a field laboratory comprising actual stores and real buying situations where the customers do not know they are engaging on a market evaluation test (Businessdictionary.com). Due to the expensive and time-consuming nature of this concept, it would be more suitable for the moving packaged goods rather than durable (heavy) goods (Ogawa and Piller, 2006). Through a survey of 500 companies, it is revealed that only 50% of them used a focus group method and 25% of them used another two methods of market research which are risky towards the NPD process. Authors express that regular excuses of companies not applying such methods is that the customers are not consistent in terms of decision for purchasing products and therefore many companies prefer to develop new products only based on revising their existing offerings rather than
evaluating customers. This approach may put the manufacturers in a danger of non-innovative and unwanted products (Ogawa and Piller, 2006). In terms of demand chain perspective, in a Chinese company study, it is claimed that DCM is very much dependant on associations with external market situation and among the internal ones, market management, SCM and organisation management are the most significant ones in towards demand chain performance (Ye and Lau, 2017).

Alternative solutions such as “postponement and mass customization” can be replaced by focused groups or test marketing in order to enhance the forecasting accuracy by better dealing with the uncertain market reactions (Ogawa and Piller, 2006). In postponement strategy, manufacturer predesigns the product and manufacturing process is divided to two different stages. First generic components are built to stock and then once the company got the information regarding the market demand, the parts will be assembled into final goods. However, mass customization strategy is reverse and the customer design their own products using a configuration system by choosing their preferences an then the products are being manufactured on demand. Both these strategies provide opportunity for more flexibility while minimizing the risks of NPD, however they still require a redesign of both processes and products which impose higher costs at the operational level (Ogawa and Piller, 2006). Moreover, keeping smaller lot sizes requires complicated purchasing patterns and manufacturing operations. Besides, mass customization necessitates an “elicitation system” for transferring individual preferences to precise product features. The two mentioned strategies are more discussed through literature rather than industry applications (Ogawa and Piller, 2006).

From a customer-centric point of view, in order to avoid the costly product failures, companies are now transforming from their sophisticated traditional/conventional market research patterns and forecasting capabilities into a novel methodology called “collective customer commitment” which mainly engage the potential customers into the innovation processes and ask for their commitment for early purchasing even before the final development and manufacturing processes (Ogawa and Piller, 2006). This commitment needs to be a mutual strategy adopted by the companies as well in order to reduce the NPD risks from the customer side in order to make them loyal and trusted. Collective customer commitment is a combination of postponement and mass customization strategies while containing its own features as well. This can be considered as “Configuration” element of demand chain and its relation to marketing in terms of customer segmentations and interactions as external entities with manufacturing company (Petersen et al., 2005). On the contrary to postponement, it begins the full manufacturing process only when the real purchasing commitment of customers is proved for a specific item, which eliminates the risk of product failures and provides economies of scale. Besides, in contrast to mass customisation, it does not interact with individual customer and replaces expensive elicitation process by early contribution of some expert customers in order to develop and revise the product concepts, though ensuring pre-orders from a large group of customers. The authors also express that regular surveys of potential customers after new product introduction can highly prevent them from further risks of failures (Ogawa and Piller, 2006).
Table 2  Options for collective customer commitment preventing NPD risks (Ogawa and Piller, 2006).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Source of new product designs</th>
<th>Alternatives</th>
</tr>
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<tbody>
<tr>
<td>Source of new product designs</td>
<td>Company ideas</td>
<td>Customer ideas</td>
</tr>
<tr>
<td>Connection with customers</td>
<td>Cooperate with external existing community (such as customer opinion platforms)</td>
<td>Build a community for correciation of new products</td>
</tr>
<tr>
<td>Preselection of ideas</td>
<td>Company panel</td>
<td>Customer competition</td>
</tr>
<tr>
<td>Minimum order size</td>
<td>Predefined: Decisions are based on the development and manufacturing costs of the first production batch.</td>
<td>Predefined: Decisions are based on the development and manufacturing costs of the first production batch.</td>
</tr>
<tr>
<td>Commitment</td>
<td>Monetary: Customer has to pay at the moment of preordering.</td>
<td>Good practice: Customer promises to buy product.</td>
</tr>
<tr>
<td>Incentives</td>
<td>None for participating customers</td>
<td>Special preorder prices for early customers and awards for user designers</td>
</tr>
<tr>
<td>Reorders</td>
<td>Determined by conventional planning and forecasting</td>
<td>Dependent on continuous commitment from community</td>
</tr>
<tr>
<td>Organization</td>
<td>Project- or competition-based process</td>
<td>Ongoing process</td>
</tr>
<tr>
<td>Relation to conventional product development and market research</td>
<td>Supplement the conventional process for developing radical new product concepts.</td>
<td>Replace the conventional process and serve as the underlying business model for entire company.</td>
</tr>
</tbody>
</table>

There are various “collective customer commitment” practices depending on the desired level of customer association, however, all of them have one common characteristic which is full transparency of the entire development process from initial consumer ideas to final product introduction and commercialisation (Ogawa and Piller, 2006). This disclosure is in contrary to the traditional NPD practices that designers tend to keep the products in confidentiality out of their rival eyes and looking for market demands which would even not exist. Increasing the information flow between consumers and company is now facilitated thanks to the IT advancements, therefore the entire product development process is automated towards collective customer commitment (Ogawa and Piller, 2006). Table 2 illustrates different parameters of collective customer commitment concept and further provides the possible options and alternatives, where the left column demands less interaction of customers and the right one requires high interaction of them which is advantageous for the NPD success of businesses. It should be mentioned that, there is always a need to balance the internal knowledge of the market and technical constraints and the customer ideas. Therefore, there might be some product designs desired by customers which are then evaluated by company as non-efficient, whether in terms of time, cost, quality or legal considerations (Ogawa and Piller, 2006). The mentioned practice could be effective in two different situations; first when testing the innovative products where customers have a little experience and hence the market research is unclear, and second for developing products with small and diverse market segments. Several case companies are studied regarding application of collective customer commitment strategies preventing the NPD failures (Ogawa and Piller, 2006). These companies include a wide range of industries and services such as fashion, cleaning, musical instruments, automobile, chemical industries and even real estate agencies. Companies such as Adidas, BMW, Procter & Gamble and 3M have also adopted strategies to engage user innovative ideas into their NPD systems through IT platforms. Table 3 indicates different collective customer commitment approaches already undertaken by some famous global companies.
Table 3 Adoption of customer commitment practices preventing NPD risks (Ogawa and Piller, 2006).

<table>
<thead>
<tr>
<th>Company</th>
<th>Type of Company</th>
<th>Collective customer commitment practices towards NPD purposes</th>
<th>Type of product</th>
</tr>
</thead>
</table>
| Threadless | Fashion apparel – T-shirts with colorful graphics (American) | • Relying on customers, hobbyists and graphic designers  
  • Customers evaluate the designs from zero to five scale in Threadless website from  
  • Company produces between four to six new designs each week  
  • Creators of the design are awarded 1000$ each  
  • Company produces only the top scoring submissions and those designs that have received sufficient number of pre-orders from the interested customers | • T-shirts with colorful graphics  
  • Ties  
  • Polo T-shirts |
| Maji | Household/food apparel (Japanese) | • Creates professional specs based on members’ new designs on website (user-developed items)  
  • Evaluates the feasibility of first production batch and the sales sustainability of the highest ranked ideas  
  • After confirmation of minimum order quantity customers will be asked for pre-orders and company proceeds with manufacturing and distribution | • No-frills products – no brand name or label with 20-30% lower prices than other brand  
  • A type of beanbag sofa with a special filling for more stability and taking less space than traditional sofas  
  • A stylish portable lamp  
  • Freedom shelf bookshelf with a hanging mechanism which is movable and does not damage the wall |
| Yamaha | Musical instruments (Japanese) | • Relying on customers and existing user community  
  • Hobby musicians desired instruments to play without spending too much time for practicing  
  • Design team came up with an electronic guitar that indicates song notes with small lights on fingerboard for the users to follow  
  • Applied suggestions of customers for adding amplifiers and battery power  
  • Minimum pre-orders received  
  • Company sold the item 3 times more than the sales of this instrument category | • Electronic guitar with light indicators |

Based on the literature reviews of this study, the innovative marketing practices along with IT applications can be considered as two significant facilitators of NPD and DCM linkage. Innovative marketing practices provide with an efficient customer relationship which can acts as input towards the early stages of product development further resulting in increase of NPD success rate. On the other side, IT applications such as Industry 4.0 and additive manufacturing are the novel NPD approaches that can provide with sustainable pillars by shortening the distance between manufacturers and customers, increase profitability and efficient customer response. Hence, the relationships between NPD and DCM could be further interpreted by creation of a novel framework within later stages of this study considering all the influential factors.

2.4 Sustainable Development and Green Product Development

In today’s product development environments, in addition to customer responsiveness, several factors are getting high consideration. Sustainability factors especially minimization of environmental impacts are vital elements which are getting attention for the products from cradle to grave which benefit business owners, end-users and the planet. Sustainable development is a task with multiple dimensions which can cover a broad range of eco-friendly operations from efficient design, production and usage. Likewise, green product development is among the operations which corresponds to customer demands, business profitability and environmental conservation. Hence, a specific attention is paid to this subtopic towards final discussions. Sustainable production and consumption are described as “involving business, government, communities and households that contributes towards environmental quality with the use of efficient production and natural resources through the
minimisation of waste and key optimisation of products and services” (Brundtland Commission, 1987). Sustainable development proves to be an undefinable and unachievable goal that many businesses aims to target but fails to fulfil its core goals successfully. Along with the financial, legislations and staff pressure, market pressure plays an important role in changing the industrial behaviour towards sustainable practices and some companies set some guidelines called “suppliers’ charter” introducing the environmental criteria they require from their supplier firms (Mackenzie, 1991). From the market perspective, one of the most frequent issues regarding the green products is the high costs involved and their premium price that often causes the product failure (Drozdenko, 2011). One of the major reasons for the eco-friendly products’ higher price is the low market demand and the new concept of greening that lead the manufacturers to produce cheaper products regardless of their life cycle, maintenance costs and environmental impacts. Eco-friendly is getting famous gradually, however it is still an emerging industry that have not been placed in people routine life and purchasing selections, especially in the developing countries. Hence, this is a very critical aspect of green products’ premium price as people are not still well-informed and cultivated regarding the benefits of such products and hence the demand is low. Besides, some countries have officially coined the eco-labelling schemes as trustworthy symbols attached to the products in order to provide consumers with independent information regarding the products they purchase and help them change their consumption patterns towards getting more environmental responsible (Naghi Ganji et al., 2017c; Erskine and Collins, 1997). Hence, in order to increase the success rate of green products, there are some strategies that can be adopted by companies including boosting consumers’ awareness regarding advantages of green products, creating customer trust by use of eco-labelling schemes, investment of R&D towards development of eco-friendly products and finally innovative marketing practices from the very early stage of product development which can partly confirm the product success within the market. Such marketing practices can be utilised for green products and therefore, can be classed as sustainable marketing as well, since they contribute on all the sustainability pillars such as profitability enhancement, social satisfaction and environmental conservation.

2.5 New Product Development and Sustainability Practices

The key advantage towards sustainability and its core opportunities refers towards solutions within existing environments and addressing key business problems to be able to deliver better sustainable products and services or its combinations (Hansen et al., 2009). It has also been described that the search and focus of innovative measures and practices leads to better sustainability related opportunities (Schaltegger, 2014). With the rapid changes to customer demands and that of better and advanced practices that have been applied within product based manufacturing environments, many companies are now operating in less secure and more complex structures in order to facilitate these rapidly evolving changes within the manufacturing requirements. The organisational focus is more towards high value manufacturing on short term rather than just focus towards long term relationship development between all connected parties of the supply chain including suppliers and customers.

To achieve this, manufacturers would need to enhance their operational abilities through adopting and linking the traditional manufacturing requirements such as lean and agility with wider business
strategies including, marketing, sales, technology adoption and product and process innovation measures within their environments (Pham and Thomas, 2011). Hence, the concept of NPD and Sustainability are highly important aspect that focuses on organisations to introduce new markets that enables their growth through higher customer and product diversification measures. NPD development teams will be dealing with three important factors when aiming to incorporate environmental concerns and NPD.

Utilising the existing theoretical models, a model is illustrated in Figure 3 that explains the emerging risks and challenges towards the incorporation of environmental issues into product development (Berchicci, 2005). Different aspects of greening related to design specifications such as market demands, environmental attributes and product functionalities make greening a complex procedure. From market perspective, some aspects of product specifications that are 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. When focusing on these parameters, due to their misalignment with customer preferences, the chances of new product success will be reduced. Likewise, there might be an incompatibility between environmental attributes and traditional products attributes, or product functionalities like safety and reliability. Effective communication and cooperation between different entities and NPD teams would be a very beneficial factor for product success (Cooper and Kleinschmidt, 1995; Dougherty, 1992). However, various interpretations about innovation and different mind-sets of people in large firms seem to be a barrier and cause the failed performance of the new products (Naghi Ganji et al., 2017c).

![Figure 3 Influence of environmental concerns on product performance (Berchicci, 2005; Naghi Ganji et al., 2017c).](image)

Based on a theoretical framework, Katsikeas et al (2016) executed an empirical research. They categorized three main groups as critical incentives that result in eco-friendly product development strategies and finally lead to product development effectiveness. Senior managers as dominant authorities in each organisation have the ability to empower the employees in order to change their mind-sets towards thinking greener. Gavronski et al (2011) found that manager’s commitment, support and believing in corporate environmental responsibility, move them to communicate with employees to make them realize the firm’s environmental roles and the strategies that are necessary for critical green activities. Moreover, according to Menguc et al (2010), the more managers are passionate
regarding environmental preservation, the more they can encourage the staff towards ethical approaches towards greening. According to the EMS evaluation of an adhesive manufacturing company, among all the company shareholders’ challenges, generation of new products including eco-friendly and conventional products were only regarded as 4%. Whereas, 36% of the shareholders were assessed as important components to influence the company towards development of new products and environmental management system (EMS) adoption (Shah et al., 2016).

The review of literature highlights the need for incorporation of NPD-DCM through the entire business ecosystem entities and also through the flow of information, materials and resources within the structure of the supply chains. The study finds out the key hurdles of the companies towards adoption of demand-driven supply chains in NPD environments, such as lack of cross-organisational association, lack of innovative demand chain frameworks and shortage of R&D for eco-friendly products in developing countries.

3. RESEARCH METHODOLOGY

The purpose of the paper is to explore and evaluate the current world literature in order to extract knowledge and make an appropriate foundation towards continuing the later stages of the study. Various angles of the topic would be considered through different attitudes of the international authors to gain a thorough understanding of the opportunities, strengths, weaknesses and hurdles within the proposed phenomenon. Different studies were analysed through a literature review method following by a critical discussion and hence, contributing to the literature knowledge by developing more insights into different dimensions and key elements of the study. In a nutshell, this paper seeks to shed some lights on the previous efforts, current trends and future potentials and research directions within the field of DCM having a special focus on sustainability within NPD environments. This will be further utilised within the next stages of the research including data collections, final discussions and results.

![Figure 4 Preliminary conceptual framework: interrelationships of sustainability, supply chain and NPD](image)

According to the review of literature, a preliminary framework is generated in order to illustrate the interconnections between different concepts of this research (Figure 4). The framework starts with triple bottom-line of sustainability as significant initiative of this research (Environment, Ethics and Economy). However, environmental aspect will be the main focus within this research, due to its
significance on conservation of our living earth for future generations. Sustainability factors further influence on supply chain structure based on customer requirements, also acting as initiatives towards success of NPD projects (Vural, 2015). As literature suggests, IT applications (Budd et al, 2012) and innovative marketing approaches (Petersen et al., 2005; Ogawa and Piller, 2006; Jüttner et al., 2007 and Ye and Lau, 2017) act as effective tools facilitating the ultimate goal of any supply chain and NPD project which is customer satisfaction. The question will be, to what extent the final component (Enhanced customer responsiveness) can be addressed and hence, this factor needs to be validated after one year from implementation of this framework within the company.

Before case study investigation, the updated literature will be also taken into account in order to impose the required modifications or improvements. Moreover, the framework will be further discussed and enhanced with the aid of case company executives before the survey questionnaire and interview conduction. This will give them pre insight regarding the research as well as smooth transfer of information. Therefore, the final research framework for examination and testing will be shaped based on the literature review and research gaps. Afterwards, different hypothesis will be extracted out of the final framework.

A case study based method will be conducted in order to collect data and evaluate the manufacturing company strategies from sustainable demand chain perspectives during the implementation of NPD projects. The AS-IS is the current status of the company and the way its current processes are taking place and hence, called AS-IS. Within the content of this research, AS-IS study seeks to describe the characteristics of sustainable demand chain practices considering new product development processes within a global manufacturing company based on the collected data from document research and industry association data. The case company provides with the information and input data for examination and testing of the hypothesis towards major research concepts. This would be facilitated through appropriate software application for qualitative data analysis and path modelling. Data validation and verification will be the next step which will be undertaken within the form of final discussions and analysis of study outcomes. As a result, the final framework or model will be proposed towards the association and linkage of sustainable demand chain within NPD projects, in order to fulfil all the research objectives, gaps and questions and contributing to theoretical knowledge within the relevant industrial studies.

Figure 5. illustrates the comprehensive research design procedures in detail. The proposed study framework is generated to provide an accurate and effective roadmap towards the scope of the research. After exploration of the most recent review of literature relevant to the field of study and the research gaps in knowledge within this area, the main research gaps and problems were identified. The research gaps identified within this domain are lack of innovative demand-driven chain, lack of cross-organizational collaboration and shortage of R&D for eco-friendly products in developing countries. They will be addressed through the evidence-based research established on a mixed method data. Consequently, the effective linkage between the research elements will create the research framework for the critical discussions and recommendations for further 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.

Figure 5  Proposed research steps.

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. In doing so, the authors will take into consideration not only the engagement of different entities of the supply-demand chain but also the environmental aspects. Generally, the research seeks to minimize the potential risks associated with supply chain redesigning by analysing the most recent industrial cases in order for successful launching of new sustainable products as well as business profitability and prosperity (Naghi Ganji et al., 2017a).

4. CONCLUSION AND FUTURE STUDIES

This research paper has sought to investigate the close associations between the new concept of demand chain and NPD practices with a perspective of sustainability principles within the manufacturing environments. It is discussed that in today’s world market competition it is necessary for the companies to replace their traditional vision of supply chain with the customer-centric demand chain practices. In this regard, marketing activities plays a vital role in bridging the SCM and DCM practices towards a sustainable business either in terms of environment, economic and/or ethics. Hence, the close ties between marketing and supply chain as two distinct entities cause the DCM concept to act as a value creation element towards the prosperity of customer driven markets. Demand chain could be applied in such manufacturing industries as a supply chain tool which acts beyond its
roles of efficient physical supply of products and therefore it is essential to make a balance between customer fulfilment as dependent variables and supply chain efficiency. DCM is also defined as a tool which provides balance between supply and demand processes within internal and external operations of the organisation in order to provide with the competitive advantage. In some cases, it is revealed that demand chain practices could be applied to reduce the supply chain redesign risks and make a dynamic interaction between suppliers, company and customers. As a result, the major principles of DCM adoption include the supply-demand chain association, IT support and organisational capabilities.

There are still some research gaps existing in this field that need to be investigated including lack of cross-organisational association regarding DCM practices, lack of innovative demand driven chain framework and shortage of R&D for eco-friendly products in some developing countries. Moreover, the environmental side of sustainability and business ethics should be discovered as important factors towards the process of NPD within the manufacturing sectors. It is obvious that manufacturing companies, especially in competitive markets, need to regularly update their variety of products and services to survive within today’s global market. Senior managers of the company should use the demand chain features more frequently, as the increased rate of product introductions demand more from a business and need more efforts to deliver the new products effectively and efficiently.

Towards addressing the research objectives, the most recent world literature will be further studied in order to identify more profound and detailed research gaps, hurdles and challenges that companies may experience through this field. The mentioned gaps be addressed through the evidence-based research established on a mixed method data. As a result, the authors seek to develop a novel model/framework comprising main concepts of NPD and DCM also focusing on sustainability elements. The creation of the final framework will be initiated by extraction of some research hypothesis from the literature review, followed by case study investigations and hypothesis testing. The final framework tends to improve the engineering and manufacturing efficiency along with management practices of the company to move the company towards product sustainability and customer changing demands. This task would be achieved by validation of the framework through its adoption within the case company that will help the product development departments such as design, manufacturing and marketing to involve the customers and demand chain practices and further build a sustainable demand chain management as suggested by late authors (Vural, 2015).

This paper and its findings suggest future researchers to develop further integration models/frameworks linking NPD and environmental perspective together in order to make a responsive demand driven chain which is focused on customer real demands to become highly competitive in market. As a future research task, the research also intends to minimize the potential risks associated with supply chain redesigning by analysing the most recent industrial cases in order for successful launching of new sustainable products as well as business prosperity. Similarly, the capabilities of manufacturing industry for being adopted to sustainable NPD will be investigated along with the critical factors, limitations, requirements, opportunities, new industrial and academic challenges of doing so, not only considering the engagement of different stakeholders but also the environmental requirements of doing so.
References


