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A COLLABORATION FRAMEWORK TO SUPPORT DECISION MAKING IN NEW PRODUCT DEVELOPMENT WITH THE SUPPLY CHAIN

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ABSTRACT

Management use the supply chain features more frequently, as the increasing rate of product introductions demands more efforts from a business to deliver new products effectively and efficiently. To produce products at the targeted cost, time, and quality, the supply chain must be aligned with product development processes. This will allow manufacturing firms to overcome problems such as (partially) failed product launches due to the lack of timely provision of parts and systems caused by insufficient capacities in the supply chain. With integrated New Product Development (NPD) and Supply Chain Management (SCM), enterprises have the benefit of increased supply chain capability, thus increasing the effectiveness of new product introduction and improving their overall performance. In this research, the authors have tried to link NPD of an automotive manufacturer to its global network of suppliers. The integration points in the integrated NPD and SCM framework will provide guidelines to identifying where critical decision are made in collaboration with the supply chain.

Keywords: New product development; Collaboration; Decision making; Supply chain management

1 INTRODUCTION

New Product Development (NPD) and Supply Chain Management (SCM) are business priorities in manufacturing firms. In the current manufacturing environment where there is increasing pressure on Research and Development (R&D), better NPD and SCM are identified ways to becoming more competitive. At the same time, technology life cycles have shortened so much that there is no time and cost available to bear the load of piles of inventory. The above issues are more significant for time-to-market products. Therefore, to be more competitive in the marketplace, firms have to focus more on NPD-SCM integration. NPD gives an opportunity for transforming market requirements and engineering technologies into marketable products (Ulrich and Eppinger, 2011), whereas SCM is an integral part of any firm for all the stages from customer requirement to product delivery hence suggesting the importance of NPD in SCM process (Soni and Kudali, 2012). Along with tools from project management and concurrent engineering, different tools have been used to assess and integrate customer needs into product design.

It is not an easy task to link these two attributes of a business and could lead to problem. The other issue which has been raised by the literature review is that until now there is no evidence of detailed framework which provides effective linkage between SCM and NPD. In almost every business sector such frameworks and tools are needed to make the impact of linking SCM to NPD (Pero et al.,

2011). Hence the authors aim to investigate and analyse the key decision making points within integrated supply chain functions allowing to identify various functional requirements in the whole period of a NPD project. There is no doubt that SCM and NPD are closely related to each other, for the product to be designed with the help of Information and Communication Technologies (ICT) tools which then distribute the product development tasks within the supply chain features. Effective SCM is the only way which makes it possible to design, organize, and execute all the activities from planning to distribution along the entire supply chain. The other benefit of SCM is that it helps organise and use more productively the network of suppliers, manufacturers and distributors (Zhang et al., 2006). The literature which shows the lack of NPD-SCM integration, and the analysis which has been done by authors while keeping this business requirement in mind, have been discussed in this paper.

2 LITERATURE REVIEW

The literature suggests that most SCM models and methods developed by previous researchers, assume that product design decisions have been already taken. However, it has been recently observed that there is a demand arising for the coordination of SCM and NPD (Primo et al., 2007). The approach called "design for supply chain management" suggests that the NPD-oriented way of business can identify the supply chain constraints at the early stages of product development. All the supporting models of the NPD-oriented approach are based on either simple bill-of-materials (BoM) or more sophisticated product architectures. In the existing tools available, researchers used product architecture-based models more frequently than simple BoMs. Product architecture generation is the process by which the function of the product is allocated to physical components. It has been argued by Ulrich and Eppinger (2011) that the product architecture, rather than simple BoMs, will help in addressing more effectively like the trade-offs between product, process, and supply chain design. Many existing models have shown the relationships between product architecture characteristics and supply chain decisions (Van Hoek et al., 2010). Some other models reported in literature help in dealing with the selection of the appropriate sourcing strategy (Soni and Kodali, 2012); And other models focused on the placement of the differentiation point in the supply chain.

Through a recent literature survey carried out in this project, there is no evidence of comprehensive frameworks which deal with NPD and SCM alignment. However, management still needs tools which explain the impact of new product introduction on the supply chain, and vice versa. The tools should provide guidelines to management team depending on product features and enable them to identify the supply chain decisions that lead to high NPD performance. Base on the limitations in current technologies, two research questions in have been identified which form the focus of this project (as shown in Figure 1).

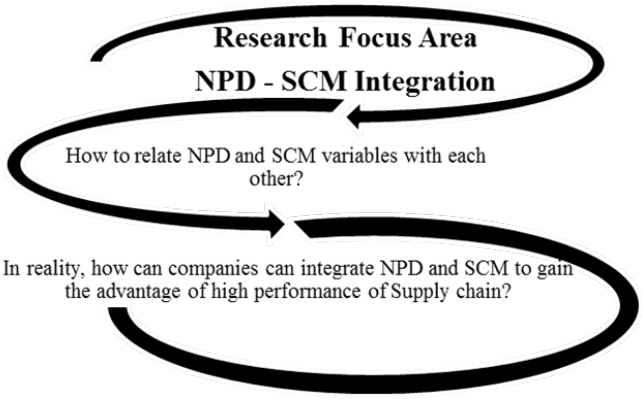

Figure 1: Research questions that form the research focus in NPD – SCM Integration

For analysing these research areas, the authors have followed the research path in two phases. In a first phase, the current available literature dealing with NPD-SCM integration and their dependencies and formulation of generalised features of the framework was analysed. This identified features of generalised frameworks, developed at an early stage of the research process, improved understanding

of how in supply chain the new products are being affected. In the second phase, an exploratory case study of OEM and Tier1 supplier relationship was conducted, to identify the key decision making points. On the basis of these new findings, the features of generalised framework were analysed and then finally combined with the findings from the literature and the case study to develop the alignment framework and to formulate four key decision making points indicating the relationships between NPD and SCM variables.

The alignment of SCM and NPD should lead to an improvement in the performance of both NPD and the supply chain, which can be measured in many different ways (Sharifi et al., 2006). In particular, performance is tightly linked to the concept of delivered variety. Delivered variety refers to the number of different products a company actually delivers to the market and must be defined in relationship to efficiency and responsiveness. If the delivered variety does not keep pace with the customers' orders, then the firm is facing operational problems such as backlogs, stock-outs or overstocks. If it matches, then performance is expected to be high (Carillo and Franza, 2006).

3 METHODOLOGY TO INTEGRATE PRODUCT DEVELOPMENT AND SUPPLIERS

The idea of integrating product development phases in the supply chain has been proposed by the authors (Hasan, Shah and Gao, 2012) and it has been observed that there are so many different aspects existing, including the one which the authors focussed more, i.e., to identify the key decision making points in Original Equipment Manufacturers (OEM) and supplier relationships.

By conducting the industrial investigation in ABC Company (a large international automotive OEM, operating globally and has more than 160,000 employees in 70 plants worldwide with thousands direct and indirect suppliers), the contact has been established with one of their direct local supplier named XYZ Ltd. The XYZ company supplies casting parts for their car engines body to ABC Company. After analysing the complete OEM's product development process in line with the supply chain, it has been observed that when the ABC Company asked their Tier1 supplier for the quotation through RFQ (Request for Quotation) document, the supplier goes through the processes shown in Figure 2.

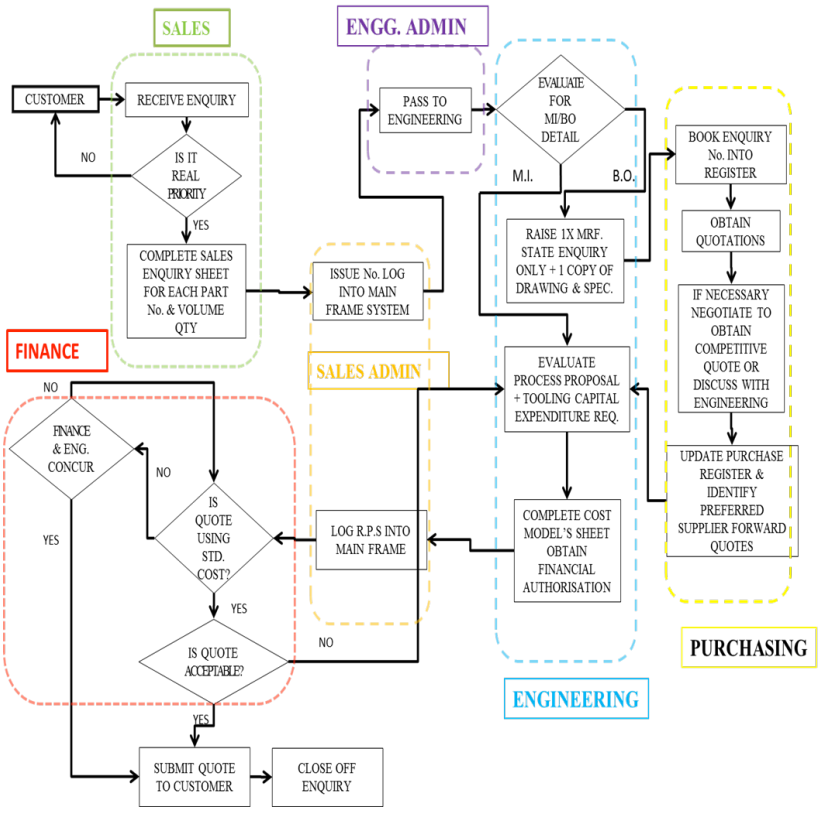

Figure 2: XYZ Company's Early Stage Processes When Collaborating with ABC Company.

The analysis of new product development in OEM (ABC Company) and its Tier 1 supplier (XYZ Ltd) has been done in this research. The main aspect which has been identified in the analysis is feasibility. The analysis has been performed to identify their new product development processes as the whole car engine assembly, which is an integrated view of ABC Company and XYZ Ltd.

4 DECISION POINTS IDENTIFIED AND USED TO TEST THE FRAMEWORK

The whole supply chain has been evaluated for Tier 1 suppliers of the OEM, i.e., the companies which provide manufacturing capability. Based on the concept of Kenneth Preiss (1999): about the process, it has been observed that for any business process, the following decision points need to be clarified which define the process more functionally. These features are as follows: Function, Control, Input and Attributes. Figure 3 shows the basic supply chain activity flow starting from customer requirements and ending with product reaching the customer. the figure also highlights the detailed activity flow described in a functional way namely NPD, Production and Delivery/Distribution.

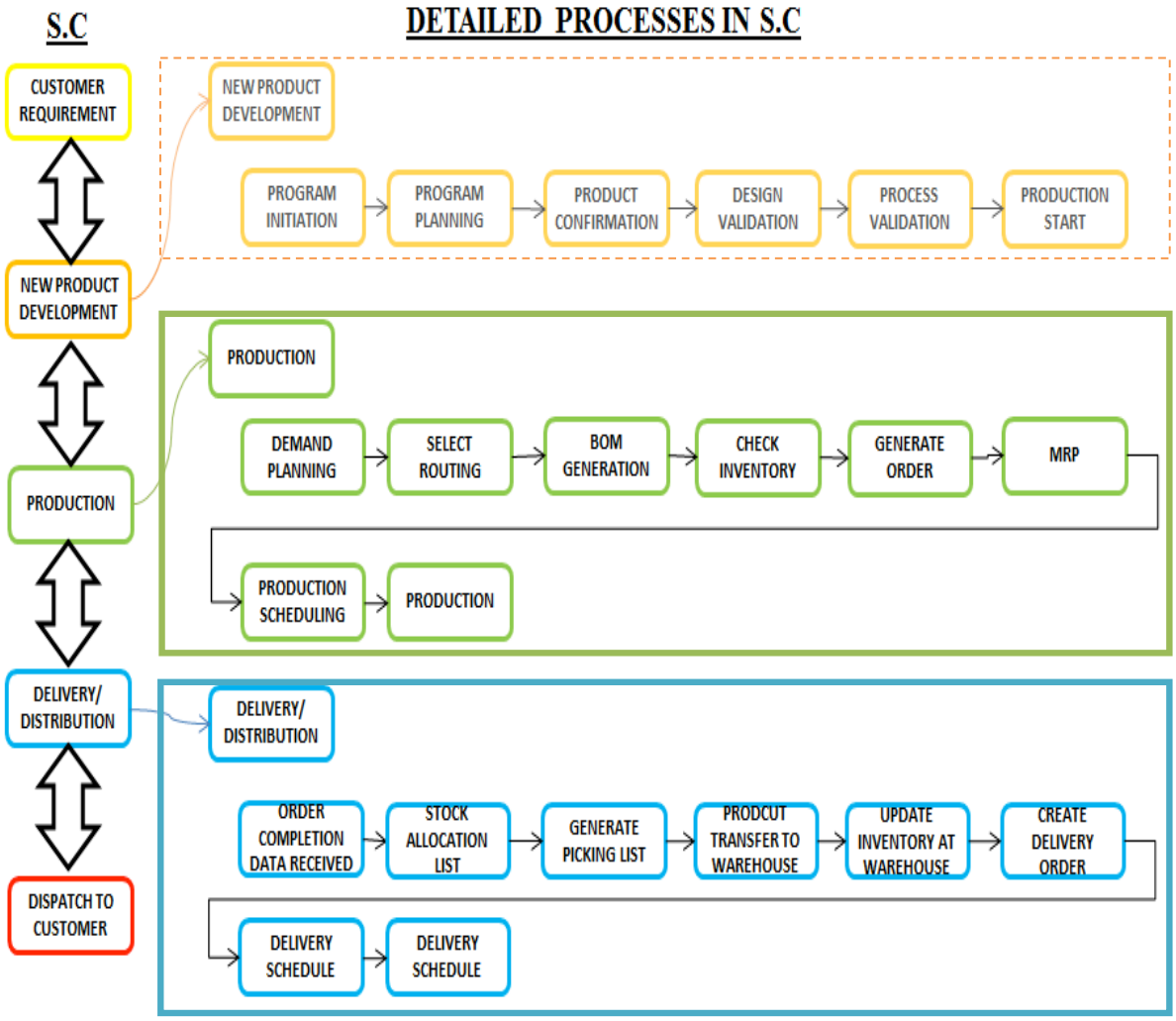

Figure 3: The Supply Chain Processes with Detailed Sub-processes Used as Case Study

The Kenneth Preiss model concept has been kept in mind while the decision point analysis has been done in the selected domain for case study (i.e., production and delivery/distribution). By looking at the basic framework of supply chain in which product starts from customer requirement and goes to the final stage where it has been delivered to customer in a market, there are many steps that a product has to go through before goes to the end of the production line. While transforming those steps in a same Kenneth Preiss model of process, the following features have been categorised in the Figure 4.

	PRODUCTION	DELIVERY/ DISTRIBUTION		
		Warehouse	Logistics	Retailer
Functions	Demand Planning Select routing BOM generation Check Inventory Generate order to production department MRP Production Scheduling Production	Order completion data received Stock allocation list check Generate picking list Product transfer to warehouse Update inventory at warehouse	Received update of inventory Create delivery order Delivery schedule	Delivery schedule Delivery
Control	Market Trend Report. Customer Requirement Logistics Urgent release Orders	Production order Warehouse demand	Market requirement Distributors requirement	Sales analysis Trend analysis
Input	Concept development Market Survey Inventory level Cost Market analysis	Inventory level Urgent customer demand	Customer requirement Urgent customer demand	Market requirement Seasonal demand
Attributes	Batch Size Stoppages Shift Time Pull or Push Actions on Input/output	Queue to hold orders for pick Activity to pick Queue to hold order for delivery Picking quantity Queue to hold goods ready for sale Activity to model customer demand Activity to generate urgent orders Goods for delivery	Batch size Duration Priority	Customer demand Maximum arrival First arrival Interval Lot size

Figure 4: Decision point analysis in production and delivery/distribution of ABC Company – XYZ Ltd.

5 CONCLUSION

The goal of this research is to develop a methodology for effective NPD-SCM integration for new product development. So far the early results of integration has been achieved and the results of manufacturing side has been analysed also where different key decision points have been identified. By looking at the bigger picture, where OEM's product development processes linked by Tier 1 supplier's product development processes, it has been identified that different key decision making points exist and by analysing these key decision points, the framework may be redesigned, in order to transform this into a generalised framework including all the business aspects.

In the future, other decision points such as feasibility, time, cost and performance might be merged within this proposed methodology. Some of the further work required, covers the analysis of

developed model in various extended enterprise scenarios, identifies effects of various variables in the product development process on the performance of supply chain management and vice-versa, and characterises the model for accommodating different business processes of collaborating partners in the product development process.

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