Development of a conceptual framework to introduce new automotive variants: Insights from new product development research in automotive domain

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Abstract

This study develops a conceptual framework by reviewing and analysing the implications of critical competencies from new product development (NPD) research in the automotive domain towards the successful and rapid introduction of new automotive model variants in the Indian marketplace. The outline of this study towards this conceptual framework is to determine and establish the key organizational competencies so as to successfully and rapidly introduce the new automotive model variants by the manufacturers in the business of Indian automotive domain.

Keywords: Organizational competencies, New automotive variants, Automotive domain

Introduction

In response to the competitive market among original equipment manufacturers (OEMs) in the business of automotive domain, regulatory pressures on energy efficiency, passenger safety, emission control, rapidly changing technologies, shorter product life cycle and so on, variance in choices among demanding customers leading to fluctuations in global vehicle demand, proliferation of model variants, and low capacity utilization of OEMs, the OEMs from India are attempting to increase their research and development

(R & D) efficiencies, in terms of rapid development and launch of new model variants. These challenges experienced by the Indian OEMs in the automotive domain urge to develop a conceptual framework in order to successfully and rapidly introduce the new automotive variants.

Over the past two decades, several researches conducted in the area of new product development (NPD) as inferred by Cross (2007), have indicated that this competency is associated with very complex business processes that cut across functional boundaries and require industry-specific knowledge to launch feasible solutions that are commercially viable.

However, an all-encompassing academic study taking into consideration the interaction, integration and harmonization of various capabilities and competencies that culminates in organizational core competencies in accordance with Barney et al. (2011) for achieving excellence and success in NPD in the automotive domain for a developing country like India is limited in the extant literature.

Thereby, the scope of this study is limited to identification and determination of the set of organizational competencies, and the review and analysis of the relative importance of the capabilities associated with these competencies aimed at the successful and rapid development and launch of new automotive model variants in Indian organizations.

Motivation towards the study

Well (2013) suggested that there would be an urgent need to understand more clearly the scope and barriers to growth afforded by business model innovation, both in the automotive industry and more widely, particularly with respect to sustainability. As per the news published by Progressive Digital Media Transportation News (2014), German automobile manufacturer British Motor Works (BMW) introduced a new model variant of its sports activity coupe, the BMW X6 being available from December 2014. The features of BMW X6 models would include adaptive LED headlights, comfort access including hands-free tailgate opening and closing, the navigation system with touch controller, Bang & Olufsen surround-sound system and new rear entertainment system. According to Kley et al. (2011), activities have been initiated in all the domains but these are often being realized as pilot ventures with undefined/unclear business model structures. From the viewpoint of these discussions, the need to address and establish the key organizational competencies arises so as to successfully and rapidly introduce new automotive variants in the business of Indian automotive domain.

Conceptual framework to introduce new automotive variants

This conceptual framework to study the key organizational competencies for introducing new variants in automotive domain has been broadly designed based on two major aspects - to describe the growth of research and the research streams to introduce new automotive variants during the last 17 years from 2001 to 2017, and to identify the focus of innovation, framework development and performance measurement in the introduction of new automotive variants.

The organizational competencies to introduce new automotive variants, are a set of integrated key capabilities which are unique, inimitable, non-substitutable, and flexible for re-configuration and re-deployment. The classification of these organizational competencies have been done based on the characteristics of different capabilities within these competencies, being crucial for the introduction of new automotive model variants in the marketplace and have been discussed below accordingly.

Design and Delivery Competency (DDC)

Owen et al. (2011) conceptualized a new approach of integrated DDC solutions that aim to radically improve performance with the application of innovative processes, such as integrated project delivery. Although, these innovations are seen to develop in isolation, with little consideration of overarching interactions between people, process and technology. In context to DDC, the key issue according to Davis et al. (2011) in creating value is to provide benefits (including access to resources and capabilities) that are perceived by the customer to be greater than costs, which includes money, time, and effort, associated with obtaining these benefits. The literature support identifying the critical capabilities - prototyping and testing capability (PTC), flexibility (FLX), concurrent engineering (CE), digital manufacturing capability (DMC), and project management capability (PMC), under DDC are addressed in the Table 1.

Table 1 – Literature support for capabilities identified within DDC to introduce new variants

Literature Citations	**Context of Study**	**PTC (D1)**	**FLX (D2)**	**CE (D3)**	**DMC (D4)**	**PMC (D5)**	**Impact on introducing new model variants**
Lantada and Morgado (2012)	Manufacturing sectors including automotive domain	✓					Enables cost-effective and time-efficient product development
Chiang et al. (2012)	144 Manufacturing firms from USA inclusive of automotive domain		✓				Increases the range of new variants
Koufteros et al. (2002)	Respondents from 244 manufacturing firms including automotive sector			✓			Affects the NPD cycle time independently rather than interactively
Mueller (2012)	Additive manufacturing (AM) equipment manufacturers for automotive components	✓			✓		Positive impact
Hillson (2003)	Project-based organisations in manufacturing sector				✓		Positive impact
Lee et al. (2011)	Global manufacturing companies in the automotive domain				✓		Positively influences
Morgan and Liker (2006)	Review of the book content – "The Toyota Product Development System"				✓	✓	Positive impact

Transformational Competency (TRC)

Zhang and Lado (2001) had identified one of the vital organizational competencies - transformational competencies (TC) as one of the potential sources of firm's sustained competitive advantage. These authors had defined 'TC' as "organizational capabilities required to advantageously convert inputs into outputs" which encompass innovation and entrepreneurship, organizational culture, and organizational learning, and plays a significant role in harnessing innovation and entrepreneurship, fostering organizational learning, and promoting an innovation-based organizational culture. Lawton and Michaels (2001) addressed this aspect of TC as the organization's core competencies that offers an organization a tool to achieve cost reduction, competency enhancement and revenue generation/growth implying strategic outsourcing, and as the paradigm shift away from a relatively indirect (even remote) relationship between the firm and its consumers and towards a direct interface between the organization and its customers. The various key capabilities – value engineering (VE), reverse engineering (RE), product analytics (PDA), innovation capability (IC), and knowledge management (KM), determined within TRC are reviewed in the Table 2.

Table 2 – Literature support for capabilities identified within TRC to introduce new variants

Literature Citations	**Context of Study**	**VE (T1)**	**RE (T2)**	**PDA (T3)**	**IC (T4)**	**KM (T5)**	**Impact on introducing new model variants**
ElMaraghy et al. (2012)	Manufacturing and Design Firms in automotive domain	✓					Reduces the complexity in engineering design
Mukhopadhyaya (2009)	Manufacturing Sectors in automotive domain	✓					Positive impact; Efficiently identifies the unnecessary design cost
Brunelière et al. (2014)	Manufacturing Sectors (from France) in automotive domain		✓				Highlights promising and innovative results to introduce new model variants
Chandler et al. (2011)	Gartner's business analytics framework for manufacturing enterprises			✓			Positive impact
Lee et al. (2011)	Global manufacturing companies in the automotive domain			✓			Positively influences
Sundin and Dunback (2013)	6 OEMs, mainly the SMEs in automotive domain		✓		✓		Positively influences
Kumar and Dutta (2017)	124 respondents including Indian engineering industries in automotive sector				✓	✓	Positively influences

Relational Competency (RLC)

Paulraj et al. (2012) defined relational competencies (RC) as one of the core organizational competencies that influence the patterns of SCM practice and can improve the performance of a supply chain. Various studies including Chen et al. (2004), Fabbe-Costes and Jahre (2007), Omar et al. (2012), Paulraj et al. (2008), Paulraj et al. (2012) and Swink et al. (2007) had specifically revealed about the significance of three relational competencies - cooperation, integration and communication in prior literature studies. Some of the literature studies recognizing the crucial capabilities – coordination and collaboration capability (CCC), supplier relationship management (SRM), strategic alliance capability (SAC), and brand management capability (BMC), under RLC are being cited in the Table 3.

Table 3 – Literature support for capabilities identified within RLC to introduce new variants

Literature Citations	Context of Study	CCC (R1)	SRM (R2)	SAC (R3)	BMC (R4)	Impact on introducing new model variants
Hongyi Sun et al. (2010)	Study based on data sources from over 600 manufacturers in 21 countries	✓				Positive impact
Petersen et al. (2005)	Manufacturing locations in Japan and US, inclusive of automotive domain	✓	✓			Positively influences
Kumar and Dutta (2017)	124 respondents including Indian engineering industries in automotive sector	✓				Positive impact
Prange (2010)	Manufacturing Sectors inclusive of automotive domain			✓		Positive impact
Atuahene-Gima (2005)	Manufacturing sectors and design firms inclusive of automotive domain				✓	Positive impact
Brunner et al. (2008); Jana (2008)	Manufacturing Sectors in Automotive, Electronics and Hardware Domains				✓	Positively influences

Management Competency (MGC)

Top management initiative and support is a key aspect in order to achieve new, product innovativeness and profitability. Based on the observations with respect to several studies in accordance with Lacity et al. (2012) in the area of NPD, human resource management capability of an organization have positive influence on knowledge management, innovation, design and development, flexibility and new product innovativeness. The key capabilities – technology management capability (TMC), information management system (IMS), product development strategy (PDS), and human resource management (HRM), identified within MGC are highlighted with the support of literature studies in the Table 4.

Table 4 – Literature support for capabilities identified within MGC to introduce new variants

Author (Year)	Context of Study	TMC (M1)	IMS (M2)	PDS (M3)	HRM (M4)	Impact on introducing new model variants
Cho and Lee (2013)	Automotive sector	✓				Positive impact
Sudarsan et al. (2005)	Key Suppliers associated with Manufacturing Sectors including automotive domain	✓	✓			Positive impact; Supports the full range of Product Lifecycle Management (PLM) information needs
Snow et al. (2011)	Blade.org, a purposefully designed collaborative community of firms dedicated to the continuous product development and commercialization			✓		Positive impact
Lacity and Willcocks (2012)	Outsourcing clients and service providers inclusive of automotive sectors				✓	Positively influences new product innovativeness (NPI)

Customer Perceived Value (CPV) - A Surrogate Measure of NPD Success

CPV is considered as a mediator variable based on the interpretations by Swinarski et al. (2006), which acts as a surrogate measure of NPD success to introduce new automotive variants. It impacts an organization's business performance measures in terms of customer retention, repeat orders, and revenue growth through the customer references. The value of products perceived by the customers is equivalent to the benefits that the customers get from utilizing a product or service which exceed what it costs to acquire and use it. These benefits expressed and measured as the CPV are derived in terms of safety (SFT), reliability (RLB), sales and service support (SSS), and conformance to regulatory norms (CRN). These measures of CPV are the outcomes on successful and rapid introduction of new automotive model variants in the competitive market of automotive domain through the implications of critical competencies and the key capabilities within these competencies.

Safety (SFT)

From the viewpoint of Dieter and Schmidt (2017), 'safety (S)' involves designing products that will not injure people or damage property, and "a safe design is one that instills confidence in the customer and does not incur product liability costs. Based on the studies conducted by these researchers – Delaney et al. (2005), Fleming and Silady (2002), and Ahmed et al. (2011), a desire level of safety has to be achieved in safety-critical systems for which the design process encompasses bare-bones design, add-on design, and the reliability analysis of the entire system and they are performed with the feedback between each other.

Reliability (RLB)

As discussed by Dieter and Schmidt (2017), 'reliability (R)' measures the ability of a component or system to operate without failure in the service environment which is expressed as the probability of the component functioning for a given time without failure'.

Conformance to Regulatory Norms (CRN)
The related points of interest cover control of environmental pollution, ease of disposal of the product at the end of its productive life cycle, reduction of noise and incorporation of adequate and appropriate safety measures (e.g. anti-lock braking system, seat belt reminder, child lock functionality check, air bags, conformance to frontal crash test norms at 64 Km/hr, etc.), as per the norms laid out by Central Motor Vehicle Rules (CMVR, 1989), and Bharat New Vehicle Safety Assessment Programme (BNVSAP, 2017).

Sales and Service Support (SSS)
Saccani et al. (2007) highlighted the relevance of these attributes that extend the value of a product, and improve the 'experience' a customer derives from purchasing and using the product. The sales support covers not only the case with which the product is made available to the customers but also the necessary guidance and training required for successfully using the product while the service support works on the resolution of complaints received during the emergent phase of a product.

Success Measures for Product Introduction (SMPI)
These are the indicators to reflect the performance of an organization's business over a period of time. In the context of NPD and launching of a new product in the market by a firm, the incremental changes in the value of these measures over a period (usually ranging from six to twelve months) indicate whether the NPD and launching has been successful or not. The measure of success to introduce new model variant is usually evaluated along multiple matrix. One of the best measures of success to introduce new automotive model variants in the business of automotive domain will be encompassing time-to-market (TTM), diffusion rate (DR), and revenue growth (RG).

Time-To-Market (TTM)
As per the discussion by Dieter and Schmidt (2017), for many of the consumer products, the more valued product will occupy the market first and thereby, much focus and attention is required to minimize the 'TTM' urging for the necessity of some sort of project (development) team to target the reduction in TTM as such this will lead to three vital competitive advantages - extended product's life, increased market share, and higher profit margins.

Diffusion Rate (DR)
According to Al-Alawi and Bradley (2013), DR of a new automotive variant can be measured by the rate with which the new product is accepted by the market which also, indicates the level of acceptance of the product by the consumer.

Revenue Growth (RVG)
A growth in this measure means that there has been an increase in the level of adoption of the product variant because customers have found it more useful compared to the price level in accordance with Pauwels et al. (2004).

Concluding Remarks
The insights from this study develop a conceptual framework to successfully introduce the new automotive variants in the competitive market of Indian automotive sector characterized by a high level of customer acceptance and reduced time-to-market with an incremental rise in revenue growth. The ability to quickly introduce the new automotive variants by the means of key organizational competencies will become not only one of

the key determinants for business transformation but also the primary enabler for survival and growth of most of the Indian organizations in the automotive domain.

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