

Behind The Eco Innovation Efforts: A Review of Dynamic Capabilities Theory

Lizwa Rashid, Juhaini Jabar, and Samer Shami

Faculty of Technology Management & Technopreneurship, Universiti Teknikal Malaysia Melaka, Malaysia

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ABSTRACT: In the new millennium, scholars and business personal are actively searching a secret recipe on how to support the ability of current generations to meet their needs without compromising the ability of future generations to meet theirs. As many research discovered that eco innovation echoes to the sustainability development, research opportunity knocked the door for knowledge discovery as limited information reveals under this domain. Therefore, the purpose of this paper is to shed light on the role of eco innovation efforts towards sustainable development particularly in the automotive industries. There are five types of eco innovation that highly discussed in the literature namely eco product, process, marketing, organization and institutional. However, the technical eco innovation in forms of product and process relatively embrace by automotive industries as this industry received global forces in order to reduce pollution and waste creation. Furthermore, many scholars acknowledge that the automotive industries behave as a driver to improve sustainability performance. Secondly, this paper will discuss the secret weapons behind the eco innovation efforts underlines product and process innovation by reviewing dynamic capabilities theory. Last but not least, at the end of this paper, new paradigm for new research opportunities in automotive industries will be discussed.

KEYWORDS: Eco Innovation, Dynamic eco innovation practices, sustainability, automotive industry

1 INTRODUCTION

Eco innovation approved as a bridge to achieve sustainability [1]–[3] and manufacturing industries are the perfect medium to achieve the mission [4]. The growing attention of global concerned on sustainability and green practices acquire attention of both institutes and academic to discover the phenomenon. In one hand, more insight into best practices in manufacturing activities developed by OECD as guidance to leverage sustainability development as in [5], while [6][7] reported that, a total of 8516 publications related to green, ecology, environment and sustainability domain released from 1990 to 2010, which 62.6% of the scholar dominated in Business, administrations, finance and economics (BAFE) relatives to other fields. However, the central topics under the umbrella of eco innovation is unbalance as widen knowledge determine at macro and meso level in describing industry and national policy as in [8], [9] compared to micro level explicitly in green innovation management [7], [10], [11] and eco product development [12], [13].

The automotives industry acknowledged as the main contributor for the 20% of CO₂ emission [6] and other source of air pollution such as particulates, sulphur dioxide, nitrogen dioxide, carbon monoxide and hydrocarbons mainly in urban areas [14]. On top of that, the auto industry related on the increasing number of waste by 25,000 tons/day, exploitation of natural resources along the product life cycle (PLC) and indirectly effects to social life; noise pollution, losses from accident and traffic congestion [15]. Therefore, the current trends for the competitive advantage in global automotive industries rest on effective and efficient implementation of green manufacturing throughout introduction of cleaner technology, improves fuel efficiency, and developing green vehicles as the demand of green market increase globally mainly in Europe and United States [16]. Therefore, this paper provides a meaningful review to clarify several questions listed as below:

- a) What are the types of eco innovation efforts in manufacturing activities?
- b) What are the antecedents of eco innovation efforts?
- c) What is the research paradigm of eco innovation in new millennium?

2 THE DIMENSION OF ECO INNOVATION EFFORTS

Eco innovation terminology refers as an ecological, environmental, green and sustainable innovation initiate in most previous publications [2], [7] and the terms have resemblance in the objective to reduce the environmental impacts [7]. As reported in the [17] eco-innovation practices outline its target or object (products, processes, marketing methods, organizational and institutions); which contrary in report by [18], eco target includes product, process, organizational, social and institutional. Meanwhile [19] defines eco target falls as the four categories such as environmental technologies, organizational innovation, product and service innovation and green system innovation. Broad definition of eco innovation can be found in [1], yet, eco innovation definition in OECD manual is a pertinent to organization as useful guidelines ([19], because the innovation definition acceptance worldwide and the innovation information ahead compared to others institution. OECD report in eco innovation in manufacturing industry promoted that eco innovation typology rest on **target**; technical (product and process) and non technical (marketing, organizational and institution) innovation, **mechanism** or methods of changes (modification, redesign, alternatives and creation); and level of **environmental impact** (product life cycle). However, as mentioned by [20], the impact of sustainability development depending on the level of eco innovation implementation. The main dimension of eco innovation practices that acknowledges word wide can be trace in figure 1. Both product and process eco innovation is crucial in order to reduce environmental pollution mainly for the manufacturing industries.

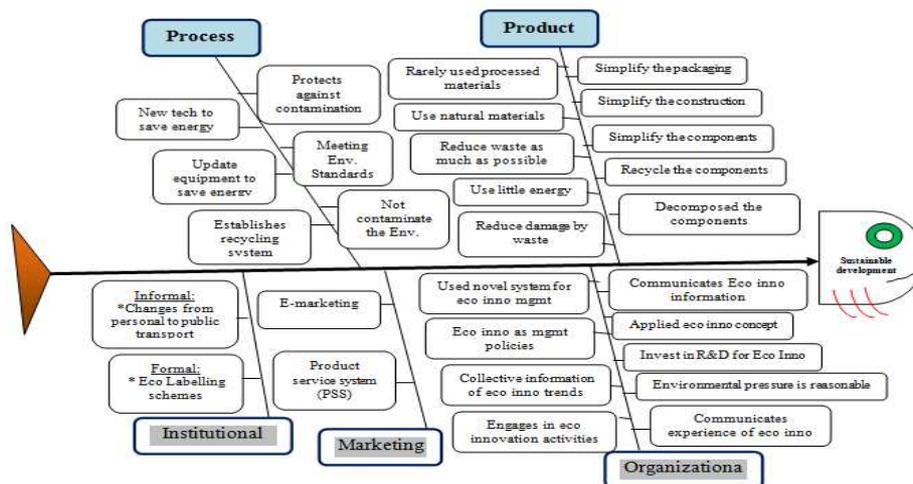


Figure 1: Eco innovations: the backbone of sustainable development

3 ANTECEDENTS OF ECO INNOVATION EFFORTS: THE EVOLUTION OF DYNAMIC CAPABILITIES THEORY

The accurate approach of competitive advantage was highly debated in the strategic management literature since a decade as a firm required a bullet weapon for competitive edge. Therefore, scholars have developed theoretical model as guidance on a right way to win a rival. In one hand, some authors were emphasized on producing the unique product to success in market [21]. Meanwhile, others are referring on utilizing internal resources. One of the prominent theory that has been developed and extensively discuss on resources as a vehicles for business sustainable was proposed by [22] and [23]. Both of them agreed that by exploiting the resource base in firm is useful as a bridge to sustain a competitive edge. [23] In his articles, accentuated the needs of exploiting current resource and building new resources as ones of the firm strategic advantages.

Consequently, [22] has concluded that firm's resource in forms of physical, human and organizational capital correlate as source of competitive advantage if they possess in four basic requirement namely valuable, rare, imitable and non substitute or renown as VRIN attributes. In the similar vein, [24] explored that's resource in forms of tangible resources (financial or physical) or intangible (employees knowledge, experience and skills) embedded in firm that's is crucial on developing and manufacturing a product. However, in the academician words, scholars used interchangeable terms between resources and capabilities when there are clear boundaries between these two terms. Resources can be referred as an assets, competencies, organizational process, information and knowledge that rooted in firm and enable the organization to perform its activities, while capabilities much related on the continuous process management to build the valuable resources base.

Therefore, to provide insight on differencing between two terms, dynamic capabilities theory arises latter on to complement resource base theory (RBV). [25] discovered that dynamic capabilities theories is the extension of the RBV theory because the core of theory is discussing on how to achieve sustainable advantage through valuable, rare, imitable and non substitute resource and renew it associated with high demand of velocity market. The RBV theory can best describe on how firm respond in stable and predictable market while a dynamic capability approaches highly relevant in the volatile environment. Dynamics capabilities approaches purely described how firm managers utilized resources in attempts to win the battles in high technology industries and grounded by the creative destruction.

By referring to [26], dynamic defines as firm capacity to renew its own competence in order to adapt the rapid changing in internal and external environment. Capabilities describe as a key role of firm strategic management in adapting, integrating and reconfiguring internal and external skills, resources and competencies to achieve sustainable advantage. Other than that, dynamic capabilities as well defines in many way; [27] has acknowledge capabilities as “core capabilities” to represent the firm’s strategic activities, while “organizational capabilities” from point of view [28] and “organization competencies” by [29] to address firm capabilities.

The initial proposal on describing firm dynamic capabilities in market conditions can be undertaken in both strategies; established in the environment or vibrant environment [30]. However, [25] and [31] discovered that dynamic capabilities approaches are prudent in three market conditions as; (i) incremental dynamic capabilities (ii) renewing dynamic capabilities (iii) regenerative dynamic capabilities. On one hand, in the managerial perceptions, both in incremental and renewing dynamic capabilities market, relies on improving current resource base and extending of resource mix respectively. On the other, in the regenerative dynamic capabilities, firm strategy rest on renewing the recent resource that’s no longer applicable and not meeting the requirement of new resource composition. [31] in articles stress out that’s to deal with the dynamics environment, the capabilities is not solely building inside the firm but also need to configure with the external resources, so that firm could attain sustainable advantage. In the conclusion, for firm to attain sustainable advantages it is much dependent on how firm manipulating its internal or external resources.

As reported by [32] in the special issues of dynamic capabilities; current debates and future directions reveals that there was little evidence of framework development in dynamic capabilities in diverse industries and national setting. Furthermore, [31] highlighted the important to study dynamic capability for the new comings research agendas to help managers improved the source of firm sustainability by answering “what dynamic capabilities look like in organizations, how they are deployed, and how context may impact upon them?”[25]. As referring to the [32] argument, dynamic capabilities is much related to the innovation adoption and how the organization react to complement the turbulent market changes, thus, dynamic innovation capabilities model have been proposed by authors [33]–[36] to complete the puzzle of core competencies required to successfully manage technical eco innovation.

4 THE LINKAGES OF ECO INNOVATION WITH DYNAMIC CAPABILITIES: A NEW RESEARCH OPPORTUNITIES

[37] mentioned a formula to success in market positioning; firm are encourages to stop depending on producing a superior product, but relies on exploiting firm core competencies in knowledge, skills, management process and routines[29].The literatures of firm’s core competencies or called dynamic capabilities provide a fertile ground to bloom since the introduction of RBV theory by Jay Barney in 1991. Dynamic capabilities approached answering how firm generates new “value creation activities” through efficient resource management by having specific strategy and organizational process [30] supported that the theory is representing the organizational behavior on how renewing their assets and stock resource for the sustainability advantage [26].

As opposed to the traditional dynamic capabilities that’s relies on the organizational routine [26], [27], new concept of dynamic capabilities is referring as an organizational specific process or “firm best practice” [30], [38] in effectively managing activities. According to [30], dynamic capabilities reside in the managerial levels in return is not promising sustainable advantage, therefore firm required to effectively organize their resource base with the “synergistic activities”. Thus, there were three authors describing the process of building dynamic capabilities reside the firm which is [30] and [25] who are following [26] works. Based on their conceptual model, the “synergistic activities” comprise of creative integration assets and resource, reconfiguration the knowledge base, gain and release research through knowledge creation routines, leveraging knowledge by replicating a process and lastly, learning activities.

Researchers under the umbrella of dynamic capabilities believes that this theory is pertinent to represent organization specific strategies and management [30] to enables innovation, new product and process development, alliances, manufacturing, human resources and organizational learning to overcome internal and external changes of environment [26].The preliminary framework developed were discussing on firm capabilities to manage new product development based

on firm core capabilities was discovered by [27], [39] and [28]. Research performed by [27] underlined the importance of utilizing the organization core capabilities as it performs as a mirror of knowledge collection embedded in employee's knowledge & skills, technical systems, managerial system and values and norms. Meanwhile, [39] in their holistic research view of product development strategy concluded that effective product development routine involved different functions or expertise such as team members, project leader, senior managers, customers and suppliers as a result for higher firm performance [30]. In a similar vein, [28] has highlighted the importance of various functional and integrative capabilities in terms of internal-external integration and technological-marketing capabilities to advance new product and process efficiency. However, as per se, the resource-based theory is full with novel variables, yet organization capabilities in return obligate an exploratory research in particular business and industry specific settings.

[40] Uncovered ten factors forced firm to transform their business model for their own survival. One of the most significant forces in the 21st century is much related to the environmental concern. The ideas to be environmentally friendly were represented through introducing of the green product and implementing green manufacturing. Therefore, rapid growing of authors in the area of technical eco innovation is emerging and they are aggressively proposing theoretical model and empirical research to support the argument on how firm could produce an eco product innovation and influence green manufacturing practices to the entire stakeholders.

[41] captured that firm performed sustainable competitive advantage in forms of pollution prevention, product stewardship and sustainable development [42]. As the pollution prevention and product stewardship create values on lowering cost and firm base competition respectively, sustainable development served as a market positioning in the future. According to [41], the mentioned triple environmental approach needed a different strategy for effective management and implementation. Thus, [43] and [44] conducted an empirical and conceptual research to shed light on core capabilities that's crucial to effectively implement technical eco innovation efforts. Both authors proposed a conceptual framework based on resource-based perspective and [44] extended the model initiated by [39]. The summary of core capabilities encountered in literature review can be assessed in table 1. In table 1, the main construct for dynamic capabilities drawing from three main perspectives derives from pioneers authors from each domain namely new product development [27], [28], [39], innovation management [34]–[36] and eco design [43], [44]. Amass findings from the previous researchers echo to the establishment of dedicated construct for dynamic eco innovation practices in four main pillars listed as below:

(A) Technology Collaboration

Technology collaboration can be defined as one of the elements reside firm dynamic capabilities which is describing inter firm relations and enables tacit knowledge sharing between a buying and supplying organization in strategic areas like product development, process re engineering and technical training. The integration scope occupied in both structural changes also infrastructural aspects related to methods and managerial systems [45] and [46].

(B) Green Human Resources

Green Human resource is part of firm's best practices in managing companies' resources related to the human or called employees to drive sustainability initiatives. At the heart of literature under GHRM, training is primarily linked towards environmental innovations relative to other factors [47]–[49] and another relies on the performance-based rewards [48], [50] and green team formation [27], [31], [34], [39], [43], [44].

(C) Eco Innovation Culture

"Eco innovation cultures" defines as shared values and beliefs of the organization and providing guidance to the employee's perceptions, attitude and behavior in their daily work [36], [51], [48]. To ensure the success of eco innovation efforts, supervisory behavior en route to increase employee's environmental initiatives [52].

(D) Environmental Management System Strategy

Environmental management system Strategy acknowledged as the heart of firm best practice and described as company's specific planning and vision to be realized [53]. With heavy commitment of the environmental management system by the entire system to the environment reduction lead to the sustainability development [54][55][56].

5 CONCLUSION: OPPORTUNITIES FOR NEW RESEARCH AGENDA

The automotive industry considered as a dynamic sector which is dealing with an upgrading technology capability, customer preferences, and managing suppliers for the auto components. According to [57], automotive industry approved as one of rich stream of industries as its promising an economy growth mainly in developing countries in terms of opening room for employment [58] and social development through knowledge transfer with foreign firm [59]. In South East Asian

region, the competition to win the domestic market is between Malaysia, Thailand and Indonesia [57]. Even though Thailand remains as a “Detroit of Asia” as a results from the successful implementation of industrial cluster policy[60], but Malaysian performance is par as Thailand and hold the top three positions in the ASEAN car market due to the strong dominance of the domestic market in Malaysia [61].

However, in the 21st century, due to environmental issues arose due to industrialization activities resulted on creation a green vehicles and green manufacturing. According to the YAB Dato Seri Mustafa Mohammad in the NAP 2014 launching ceremony, he emphasized the new trend of challenged for the global automotive industry is on ‘how to reduce the Green House Gas as well as the CO₂ emissions’, as the on the road vehicles play a role as a main contributor for the 23% of global CO₂ emission. Therefore, the governments around the world have implemented various incentives to encourage the implementation of both eco product and eco process that is significantly reduced environmental pollution. Besides that, one of the government's initiatives is building a competitive and sustainable domestic automotive industry. Thus, it is meaningful to study the antecedents of technical eco innovation efforts as the outcomes will provides an insight on building sustainable automotive industry central at the developing countries [20].

Table 1: Main construct of dynamic capabilities

Main Construct for dynamic capabilities / Authors		New product development			Innovation management			Eco/green innovation	
		[27]	[39]	[28]	[35]	[36]	[34]	[43]	[44]
Technological capabilities	R&D capabilities (Scientific expertise/employees skills)	X	X	X	X	X	X	X	X
	Manufacturing capabilities (Physical assets enables process Innovation)	X		X	X	X		X	X
	Specific set of design capabilities	X		X				X	X
	Technological complementarities (knowledge)			X					
External capabilities	Managerial process (external communication, socialization)	X	X	X	X	X	X	X	X
	Managerial system (empowerment, incentive, recruiting)	X	X	X	X				X
	Absorptive structures (network of collaboration)	X	X	X	X	X	X	X	X
	Culture and values for external absorption	X	X	X	X	X	X	X	X
Internal capabilities	Managerial process (internal communication, integrative strategies, political and financial support, subtle control)	X	X	X	X	X	X	X	X
	Managerial systems (job training, collective brainstorming, incentive)	X	X	X	X	X	X	X	X
	Integrative structure (process integration, organization reengineering)	X	X	X	X	X	X	X	X
	Culture and values for internal integration	X	X	X	X	X	X	X	X
Marketing capabilities	Market research tools (empathic design)	X	X	X	X				
	Strategic marketing management			X	X			X	X
	Marketing mix policies (4Ps)			X				X	
	Marketing complementariness			X					

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