

A Literature Review and Research Opportunities on Dynamic Capabilities Theory and Eco Innovation Efforts

Nlizwa Rashid, Juhaini Jabar, Salleh Yahya, Haslinda Musa,
Faculty of Technology Management and Technopreneurship
Universiti Teknikal Malaysia Melaka
nlizwa84@yahoo.com

Abstract: The purpose of this paper is to describe the role of eco innovation efforts and the relationships with the sustainable development in manufacturing industries particularly in the automotive industries. The outcomes of this paper attempts to describe types of eco innovation efforts from technology and non-technological dimension. Furthermore, the cutting edge of this paper presents constructs for dynamic capabilities related to the eco innovation efforts. Finally, this paper presents the new research opportunities for eco innovation research mainly in developing countries.

Keywords: Eco innovation, dynamic capabilities, sustainability development, automotive industries

I Introduction

Eco innovation approved as a bridge to achieve sustainability[1]–[3] and manufacturing industries are the perfect medium to achieve the mission for pollution reduction [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],[6],[7] reported that, a total of 8516 publications related to green, ecology, environment and sustainability domain released from 1990 to 2010, which is 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[8],[9] compared to micro level explicitly in green innovation

management [7],[10],[11] and new product development [12],[13].

The automotive 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 increased 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 new research opportunity of eco innovation in new millennium?

II The dimension of eco innovation efforts

Eco innovation terminology refers as an ecological, environmental, green and sustainable innovation initiate in most previous publications according to [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** as in figure 1. As per figure 1, level of eco innovation can be either incremental to radical changes and each of them provides a different environmental impact [20] and involved with complex technology and create value to the system [1],[21].

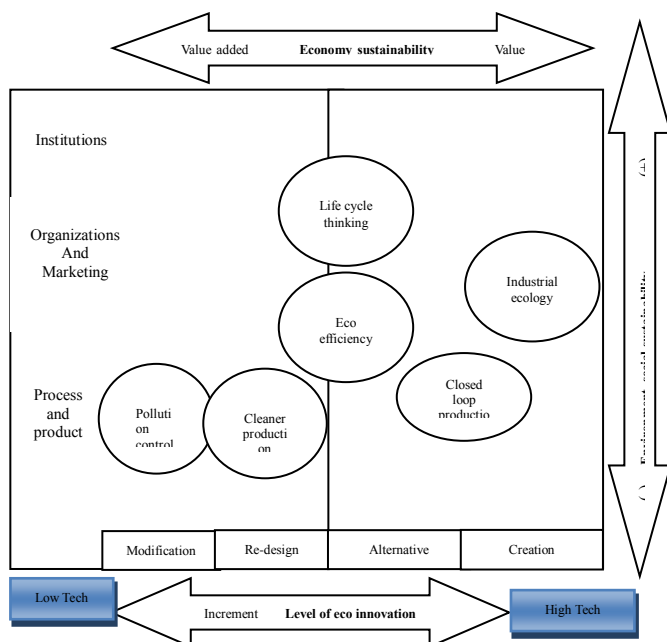


Figure 1: Conceptual diagram of radical-incremental eco innovation towards sustainability development.

III Antecedents of eco innovation efforts: The cutting edge of Dynamic capabilities theory

The accurate approach of competitive advantage was highly debated in the strategic management literature since a decade as 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 [22]. 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 [23],[24]. Both of them agreed that by exploiting the resource base in firm is useful as a bridge to sustain a competitive edge. According to [24], firm need to accentuated of exploiting current resource and building new resources as ones of the firm strategic advantages.

Consequently, [23] has concluded that firm's resource in forms of physical, human and organizational capital correlate as a 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, [25] 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** is much related on the continuous process management to build the valuable resources base.

Therefore, to provide insight on differencing between two terms, dynamic capabilities theories arise latter onto complement resource base theory

(RBV). [26] 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 used to describe how firm managers utilized resources in attempts to win the battles in high technology industries and grounded by the creative destruction.

By referring to [27], 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 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; [28] has acknowledge capabilities as “core capabilities” to represent the firm’s strategic activities, while “organizational capabilities” from point of view [29] and “organization competencies” by [30] 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 [31]. However, [26],[32] 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. [32] 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 [33] 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, [32] highlight the important to study dynamic capability for the new comings research agendas to help managers improve 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?”[26]. As referring to the [33] argument, dynamic capabilities is much related to the innovation adoption and how the organization react to complement the turbulent market changes, thus, the construct for dynamic capabilities theory have been proposed by authors [34]–[37] to defining type of core competencies required to successfully managed technological eco innovation.

IV The linkages of eco innovation with dynamic capabilities: A new research opportunities

[38] 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[30].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.[31]supported that the theory is representing the organizational behavior on how renewing their assets and stock resource for the sustainability advantage [27].

As opposed to the traditional dynamic capabilities that's relies on the organizational routine [27], [28], **new concept** of dynamic capabilities is referring as an organizational specific process or "*firm best practice*"[31],[39] in effectively managing activities. According to [31], 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 [31],[26] who are following [27] 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 [31] to enables innovation, new product and process development, alliances, manufacturing, human resources and organizational learning to overcome internal and external changes of environment [27]. The preliminary framework developed were discussing on firm capabilities to manage new product development based on firm core capabilities was discover by [28],[40],[29]. Research performed by [28] was underline the important of utilization the organization core capabilities as it perform as a mirror of knowledge collection embedded in employee's knowledge & skills, technical systems, managerial system and values and norms. Meanwhile, [40] in their holistic research view of NPD 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 [31]. In a similar vein, [29] has highlighted the important of varies 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 resources based theory is full with novel variables, yet organization capabilities in return obligate an exploratory research in particular business and industry specific settings.

[41] Proposed 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 on the environmental concern. [42] captured that firm performed sustainable competitive advantage in forms of pollution prevention, product stewardship and sustainable development [43]. As the pollution prevention and product stewardship creating values on lowering cost and firm base competition respectively, sustainable development serve as a market positioning in the future. Thus, [44],[45] conducted an empirical and conceptual research to shed light on core capabilities that's crucial to effectively implement eco innovation. Both authors proposed a conceptual framework based on resource based perspective and [45] extended the model initiated by the [40]. The summary of organization core capabilities can be asses in the table 1.

A systematic literature review was conducted to trace the significant conceptual paper in the Google Scholar database. Thus, eight conceptual papers identified discussing the same construct for the dynamic capabilities theory under new product development [28], [29], [40], innovation management [35]–[37] and eco/green manufacturing [44], [45].Therefore, findings from the previous papers echo to the establishment of four main construct that drive the organization to eco innovate as below:

(A) Technology Collaboration

Technology collaboration can be defines as one of 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 likes 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 as in [46],[47].

(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 relatives to others factors [48]–[50] and another relies on the performance base rewards [49], [51] and green team formation [28], [32], [35], [40], [44], [45].

(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[37], [52], [49].

(D)Environmental Management System Strategy

Environmental management system Strategy acknowledge as the heart of firm best practice and described as company's specific planning and vision to be realized [53]. According to [54], [55], EMS strategy has positive impact towards the eco innovation efforts and improve employee commitment towards eco initiatives [49].

V. Conclusion: Opportunities for future research

Research under the umbrella of eco innovation central in developed countries such as Netherlands, Italy and Germany since 1990 [7] under Macro and Meso level which is focusing in the industry and national policy levels [10]. However, lack of growing scholars emphasized on Micro level [13],[7],[10]. As there is increasing attention on measuring the precise construct in which is prominent on driving firm's eco innovation effort, this research is meaningful to shed light on the Dynamic capabilities theory as the heart of firm's initiatives on achieving sustainable development. Furthermore, as recommended by [46], it is critical to review critically the dedicated construct underline dynamic capabilities theory based on local context factors specially in Asia and developing countries[51].Thus, the proposal of the relationship describe as in figure 2 below:

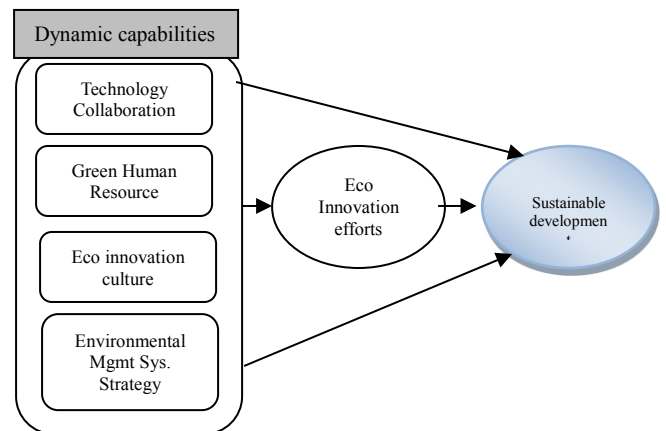


Figure 2: The relationship dynamic capabilities and eco innovation towards sustainable development.

As indicate in the figure 2, four construct is important to drive company to eco innovate and directly support sustainable development. Arising of intention in dynamic capabilities theory has knocked door for further examination in Malaysian manufacturing research particularly in the automotive industry. According to [56], automotive industry approved as ones of rich stream of industries as its promising an economy growth mainly in developing countries in terms of opening room for employment [57] and social development through knowledge transfer with foreign firm[58],[59]. Malaysian auto industry is

par as Thailand performance and hold the top three positions in the ASEAN car market [60] and drive the development of other industry because of “industry of industries”. Thus, this industry is crucial to help government initiatives to ‘*Go Green*’.

TABLE 1: MAIN CONSTRUCTS FOR ECO INNOVATION UNDERLINES DYNAMIC CAPABILITIES THEOR

Main Construct for dynamic capabilities / Authors		New product development			Innovation management			Eco Innovation	
		[28]	[40]	[29]	[36]	[37]	[35]	[44]	[45]
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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