When stakeholder pressure drives the circular economy: Measuring the mediating role of innovation capabilities

JAKHAR, Suresh Kumar, MANGLA, Sachin Kumar <http://orcid.org/0000-0001-7166-5315>, LUTHRA, Sunil <http://orcid.org/0000-0001-7571-1331> and KUSI-SARPONG, Simonov

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Suresh Kumar Jakhar

Operations Management Group

Indian Institute of Management, Lucknow,

India

Email: skj@iiml.ac.in

Sachin Kumar Mangla (Corresponding author)

Plymouth Business School,

University of Plymouth,

United Kingdom.

Email: sachinmangl@gmail.com; sachin.kumar@plymouth.ac.uk

Sunil Luthra

Department of Mechanical Engineering

Government Engineering College

Nilokheri-, India.

Email: sunilluthra1977@gmail.com

Simonov Kusi-Sarpong

Portsmouth Business School

University of Portsmouth

United Kingdom

Email: simonov2002@yahoo.com; simonov.kusi-sarpong@port.ac.uk

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Abstract

Purpose: This paper has explored the impact of stakeholder pressures on firm's circular economy initiatives. The organisational responses are quite heterogeneous even when the firms face similar pressure. We have tried to explain this heterogeneity by using innovative capability as mediating variables.

Design/methodology/approach: Empirical survey data from Indian manufacturing firms are obtained and used to test the proposed hypotheses. The hypotheses are grounded in resource-based view of the firm. We used structural equation modelling approach with maximum likelihood methods of approximation.

Findings: The results indicate that exploratory innovation positively influences the firms to adopt circular economy practices, whereas, exploitative innovation capability inhibits the adoption of circular economy practices.

Practical implications: This study provides some guidelines for business managers to focus on developing exploratory innovative capabilities before the adoption of circular economy practices. It further inform policy makers about the role regulatory mechanism plays to encourage/inhibits firms for adopting circular economy practices.

Originality/value: This study is the first to analyze the idiosyncratic behavior of the firms when subjected to stakeholder pressure for circular economy practices adoption. Innovative capabilities (exploratory/exploitative) are able to explain the reason for diverse response to stakeholder response.

***Keywords*:** Circular Economy (CE); Stakeholder pressure; Innovation capabilities; Resource Based View (RBV); Sustainability.

1. Introduction

In recent years, industries are struggling to maintain a balance between their ecological impacts, people welfare and cost benefits in a value chain context. This drives managers to employ circular economy (CE) concepts to optimize resources and manage carbon emissions (Winans et al., 2017; Urbinati et al., 2017). Currently, industries are doing business by using the concepts of linear economy – make, use and disposal of products. Resource (material) flow is an imperative concept of value chain that allows manufacturer to produce required products. In management science, researchers and practitioners submitted linear production model as a mean of resource wastage in several ways. Considering for example, waste generated during production processes, end-of-life waste, and excessive use of energy (Michelini et al., 2017).

In view of growing need of resource depletion rates, industries needs to revolutionise for some novel economic model - CE facilitates in building a resource efficient and regenerative model by optimising the resource used and waste generated (Guo et al., 2017; Mangla et al., 2018a). CE also adds to the economy of both the industry and nation through creating opportunities for investments and new jobs, optimising materials' cost, stabilising product prices, improving supply chain resiliency, and reducing ecological impacts (Lieder and Rashid, 2016).

On a managerial perception, the preposition of enhancing sustainability of supply network has become a contemporary issue in operations and supply chain contexts. (Alcalde-Heras et al., 2018; Brown and Bajada, 2018; Jose Chiappetta Jabbour & Beatriz Lopes de Sousa Jabbour, 2014; Mishra et al., 2018).

CE, a recent buzzword (Ellen MacArthur Foundation, 2012), adds to business sustainability through innovative models of production and consumption (Lopes de Sousa Jabbour et al., 2018) The practises of CE and related activities have been widely recognised by management science professionals; however, the methodical research evaluation of CE is rather unexplored (Korhonen et al., 2018). In line with this, practicing managers are also finding it difficult to develop efficient CE based frameworks to support in transforming their linear business models or build new ones. To help industries, managers may focus on macroloops in CE implementation to deal with product-life issues, promote remanufacturing, redistribution, reuse and recycling, etc (Urbinati et al., 2017). Additionally, industries are required to innovate their supply chain capabilities to adopt such a new concept - CE. In this sense, sustainability focused innovation capabilities assist industries to improve their ecological efficiency and create market value. In doing so, industries need to engage with different internal and external stakeholders and initiate innovative strategies to extract value (Watson et al., 2018). This involvement of different stakeholders (economic and societal stakeholders) allow them to collaborate and work for developing and enabling a circular flow of material and resources efficient (Ranta et al., 2018).

Studies considering stakeholder pressure, innovative capabilities and the CE practices as silos have been published (Lieder and Rashid, 2016; Despeisse et al., 2017; Zeng et al., 2017; Dubey et al., 2018; Ranta et al., 2018; Watson et al., 2018), but a conceptual and theoretical linkage of these research literature stream is still needed (Mangla et al., 2018b). This research attempts to provide a theoretical framework to investigate the relationships between these concepts (stakeholder pressure, innovative capabilities and the CE practices). This framework's conceptual relationship investigation will occur within the Indian manufacturing industry context to help answer the potential questions and test the hypotheses and provide some practical insights and guidelines for managerial implementation. Indian manufacturing sector and supply chains was targeted for this study due to their recent and future growth phenomena (Mehta and Rajan, 2017). It is one of sectors in India with a growing revenue potential reaching some US$ 1 trillion by 2025 (Kusi-Sarpong et al, 2018). Unfortunately, this industrial growth have not match up with technological advancement and organisational practices in manufacturing processes and methods; therefore, little investments have been made. There is therefore the need to improve overall sustainable performance in Indian manufacturing supply chains. One important initiative to help in achieving this goal is by introducing circularity concept (CE practices) into their supply chains.

Stakeholder pressure and innovative capabilities are necessary to create truly CE practices. In this regard, this paper submits the following research enquiries: What is the theoretical framework of relationships between stakeholder pressure, innovative capabilities and the CE practices? How does stakeholder pressure and innovative capabilities affect CE implementation?

The contributions of this paper is three-fold. First, it introduces a unified framework that brings together stakeholder pressure, innovative capabilities and the CE initiatives to very well explain the conceptual and theoretical linkage among these dimensions for upscaling CE. Second, it investigates the relationship and impact of stakeholder pressures on firm's circularity within the India manufacturing sector, providing another perspective of the literature, contributing to the theory. Third, the focus of this work on India and its manufacturing sector is another contribution aiding in the building up of studies from emerging economies on this subject.

This research is organised in six sections. Section 1 presents the motivation and need of this work. Section 2 reviews relevant literature pertaining to the study. Section 3 presents and discusses the theoretical underpinning of the proposed research model by taking RBV. Section 4 describes the proposed methodology for this research. The data analysis and results are presented in Section 5.

Conclusions along with the policy recommendations are discussed in Section 6. Finally, Section 6.1 provides limitations and the scope for future research.

2. Literature Review

This section reviews and discusses the stakeholder pressure; the concept of CE and sustainable innovation capability from the literature to propose a theoretical model for this study.

2.1 Stakeholder Pressure: an overview

A stakeholder is define as "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Edward, 1984; Liu et al., 2018). From a managerial context, stakeholders' participation and engagement are significant avenues, which are considered as a transactional process to accommodate the preferences of their various stakeholder groups. Stakeholders may be internal and external to an orgnisation with both typing significance roles. In addition, external stakeholders are considered as imperative sources of innovation that drives managers to explore how firms can echo their competitive strategy with such transformations (West et al., 2014; Watson et al., 2018).

Due to increased awareness and knowledge of stakeholders on sustainability issues, industries pushes to reconcile the whole life cycle of a product including sourcing, manufacture, use, disposal and recovering the value of product after its end of life. This call for the need to integrate orgnisational value chain capabilities with the stimulating stakeholder issues from a holistic point (Witjes and Lozano, 2016). Govindan and Hasanagic (2018) reported five types of stakeholders in their research, which are given as - workforce, customers, shareholders, the government bodies and NGOs. Derived from literature, stakeholder pressure significantly drives the ecological performance of a business organisation. On a strategic note, managers should ascertain the level of influence of the stakeholders, as it is very difficult to satisfy each requirement of stakeholders for higher business profitability. In order to have an effective CE implementation, managers need to focus equally on stakeholder's criteria along with materials and technological advancements (Naustdalslid, 2014; Ranta et al., 2018). This distinguish the role of stakeholders (external and internal) in implementing CE concepts in improving material recovery capabilities, for accomplishing the sustainable development goals of responsible consumption and production and industry infrastructure and innovations (Mangla et al., 2018b).

2.2 Circular Economy and Sustainable Innovation Capabilities

There has been a severe concern arisen for societies due to increased environmental problems and climate change issues during past few years. Societal expectations are also tumbled due to poor employment, unfriendly working culture, social openness, and the poverty and inequality issues. Economies (developing or developed) also facing severe problematic issues like supply disruptions, taxes and incentive structure, market dynamics, volatility in price structure, which has a major impact on individual firms and whole economies (Jakhar et al., 2018). To manage aforesaid and sustainability related concerns, CE has been evolved as a recent industrial concept and gained significant importance in recent years (Geissdoerfer et al., 2017). Ellen MacArthur Foundation introduced CE in 2012; the idea was to recall the value of products (Butterworth et al., 2013; Despeisse et al., 2017).

The CE could be implemented through various R's concepts: reuse, reduce, and recycle. Reuse allows managers to minimse the consumptions of resources, energy, and labor, which may exceed in case of using fresh materials in producing final products. Reduce also allows managers to upgrade in terms of superior technologies, higher information infrastructure to optimise resources, energy etc. In case of recycling, the used/waste materials are reprocessed for producing the desired product (Ranta et al., 2018). The CE aims to build an economic system – which is restorative and generative in nature. That's a system that seeks to maintain the value of resources to generate economy on a long-term while reducing the generation of waste (European Commission, 2015; Ranta et al., 2018). The CE has also been addressed as a significant agenda in the sustainable development goals. Governmental bodies and international markets are advised to build a circular economy driven ecosystem, which is reflected by treating the environment as a waste reservoir (Lieder and Rashid, 2016; Zeng et al., 2017).

CE helps in transforming the linear production systems (purchase, produce, use and disposal) into closed systems. Better still, CE presents a circular consumption model for organisations to optimize resources and conserve energy (Su et al., 2013; Urbinati et al., 2017). The CE based models have gained considerable attentions throughout the world (developing and developed economies) to enhance business sustainability (Despeisse et al., 2017; Mangla et al., 2018a).

The acceptance of CE will require organisation to develop innovation capabilities such as eco-innovations. The eco-innovation could also be understood as "the production, application or exploitation of a good, service, production process, organisational structure, or management or business method that is novel to the firm or user, and which results, throughout its life cycle, in a reduction of environmental risk, pollution and the negative impacts of resource use (including energy use) compared to relevant alternatives" (Kemp and Pearson, 2007). The eco-innovation initiatives will facilitate firms in closing the loop of product life cycle and recovering the value of products from waste.

Carrillo-Hermosilla et al. (2010) argued that, the significance of sustainable innovation is to enhance ecological performance while evaluating the environmental impacts of production systems. Sustainability in hinged on innovation and thus, sustainable innovation in central to achieving sustainability (Kusi-Sarpong et al., 2018). Therefore, CE is the indicator of a business shift underpinned by the way manufacturer produces, consumers consume and people behaves, while responding to the ecological and societal needs (Hofstra and Huisingh, 2014; Prieto-Sandoval et al., 2018).

3. Theoretical Underpinning: Resource Based View

Wernerfelt (1984) proposed that resources of an organization combined together in a unique way can provided sustainable competitive advantage. This resource based view (RBV) of an organization postulates that resource (physical and intellectual) are accumulated over a long period of time and are differentially distributed among the firms in the industry (Lavie, 2006). The resources which are VRIN (Valuable, Rare, Inimitable and Non-substitutable) leads to long lasting advantage for the firms in the industry (Barney, 1991). Hart (1995) argued that natural environment is also a key resource and firms should consider the challenges and opportunities imposed by natural environment.

Many studies on environmental performance use the resource-based view (either singly or in combination with Stakeholder theory (Freeman, 1984) as a launch pad for theorizing. This is because truly “sustainable” strategies tend to be developed over a long period of time and possess the properties of VRIN (McGee, 1998). Circular economy practices are the most advance practices for environment protection and are developed through unique combinations of physical and intellectual resources which ultimately is considered to be VRIN (Sarkis et al., 2010). However, extensive empirical testing has failed to conclusively support that adoption of circular economy practices always leads to a higher performance and competitive advantage for business organizations. Even when firms are pressured to adopt these practices, they tend to generate heterogeneous responses (Darnall and Edwards, 2006; Berrone et al., 2013). Does this mean that the theory is flawed? The answer is "NO." As argued below, we assert that the basic theoretical underpinnings of the business case of sustainability are correct, but the key construct that mediates the transformation of stakeholder demands into implementing circular economy practices is missing. This may be explained by the lack of capabilities as defined by the RBV. The capabilities to pursue innovation plays most important role to foster firms to adopt advanced sustainability practices such as circular economy (Porter and van der Linde, 1995; Jaffe and Palmer, 1997; King and Lenox, 2002; Brunnermeier and Cohen, 2003; Buysse and Verbeke, 2003; Berrone et al., 2013). A firm's competitive advantage depends on its ability to innovate in ways that its rivals cannot easily imitate. Environmental innovation is opined to be a valuable policy for managers to follow for adoption of circular economy (Berrone et al., 2013). Therefore, business organizations will try to exploit their distinctive innovative capabilities for adopting sustainable innovations.

Interestingly, both innovation types (i.e., exploratory/exploitative) may not lead to competitive advantages. The skills and capabilities for exploratory innovation are necessary for survival and long-term competitiveness (Mueller et al., 2013). Rivals find it difficult to imitate exploratory innovations. First-mover advantages may last for a comparatively long time, which may increase the duration of monopolistic advantages and high returns (Benner and Tushman, 2003). Exploitative innovation however is aimed at creating and commercializing improved or refined products, services, and business models to meet the needs of existing customers or markets (Benner and Tushman, 2003).

Since exploitative innovation is less resource intensive, profitability gains occur only in the short run (Mueller et al., 2013). Furthermore, exploitative innovation strategy works on continuous-improvement methods and focus on well-defined objectives. Such a strategy is process intensive, easy to imitate and duplicate quickly. Based on the above theoretical argument, we posit that the heterogeneity of a business organization in terms of strategic innovative capabilities can be a most significant source of variation in organizational response to circular economy demands. We propose the following hypotheses:

Hypothesis 1: A firm which has exploitative innovative capabilities, would respond to stakeholder pressure negatively for adoption of biological circular economy practices.

Hypothesis 2: A firm which has exploitative innovative capabilities, would respond to stakeholder pressure negatively for adoption of technical circular economy practices.

Hypothesis 3: A firm which has exploratory innovative capabilities, would respond to stakeholder pressure positively for adoption of biological circular economy practices.

Hypothesis 4: A firm which has exploratory innovative capabilities, would respond to stakeholder pressure positively for adoption of technical circular economy practices.

4. Methodology

We used structural equation modelling approach to empirically test the proposed hypotheses for circular economy practices adoption. The proposed relation is mediated by the exploratory and exploitative innovation capabilities (Figure 1). To evaluate mediation, we firstly considered the direct path and then evaluated the relationship mediated by both innovation capabilities. If the direct path between stakeholder pressure and circular economy practices becomes insignificant in the presence of exploratory/exploitative innovative capabilities as mediator constructs then we consider it full mediation. If both paths (direct and via mediator variable) are significant then we consider partial mediation. Finally, if indirect path is insignificant and direct path is significant then we consider no mediation.

Insert Figure 1 Here

4.1 Instrument development

In order to measure stakeholder pressure, we comparatively analyzed the existing scale from the literature. After comparative analysis, we choose the scale from Buysse and Verbeke (2003). There are two reasons for choosing this scale. Firstly, this scale covers most of the key items present in all other scale. Secondly, the reliability & validity of this scale is already established in an empirical study of Indian manufacturing organization (Jakhar, 2017). This scale divides the stakeholder construct into four categories namely: regulatory, external primary, internal primary and secondary stakeholders. We used five point Likert scale ranging from 'no influence' to 'very strong influence'.

To measure practices for circular economy, we analyzed the relevant scales from extant literature. Most of the literature on circular economy agrees on the fact that broadly circular economy practices can be divided into two categories namely: 1. Biological (renewable flow management) 2. Technical (stock management). We did not find any tested scale in extant literature in Indian context using empirical study. Therefore, we decided to develop a new scale and generated a pool of items for measuring circular economy practices. We present this pool to an expert panel. The panel consists of 4 members from industry dealing with circular economy issues; 2 academicians actively doing research on circular economy and 2 senior environmental ministry official dealing with policy issues related to circular economy. The members were presented with the pool of items individually and asked to add/delete the items if they feel all relevant dimensions are not covered. Finally, all the modifications were integrated and presented to all members of the panel for arriving at a consensus. After several round we were able to present a scale agreed by all experts. We considered five point Likert scale ranging from "not considering" to "successfully implemented".

To measure a business organization's capabilities for pursuing exploratory and exploitative innovations, we adopted a valid and reliable scale from Jansen et al. (2009). Kortmann *et al.* (2014) and Rathore et al. (2018) also used this scale to study innovation in Indian manufacturing organizations. The final scale with all the constructs and their measuring items is presented in Table 3.

4.2 Study Sample

In this study, we considered Indian manufacturing organizations to gather the survey data on stakeholder influence for circular economy practices adoption mediated by exploratory and exploitative innovation capabilities. We gathered individual firm level data from senior level executives directly dealing with issues related to circular economy. Due to high economic growth and its resultant impact on environmental degradation, the manufacturing organization in India would be an ideal firm to test the proposed hypotheses on circular economy practices adoption (Jakhar 2015). We considered firms in various manufacturing industries that employed 100 or more full time employees and firm operates in their respective industry for at least 10 years or so. The reason for this condition is that exploratory innovations sometime lasts for 3 to 5 years and organizations should have completed a couple of projects. For building our sample, we used the listing of the firms in Bombay stock exchange. We collected a list containing information about 946 manufacturing firms satisfying the above criteria.

We followed Dillman's (2000) five-point contact protocol for data collection. We used two methods of data collection namely: personal visits and online survey. In the recent literature specifically for empirical studies in operations management similar approach has been applied to enhance response rate (Shafiq *et al.*, 2014). We received 276 complete responses. An industry wise classification of the sample is provided in Table 1.

Insert Table 1 Here

5. Results and Discussion

5.1 Measurement Model

We constructed 11 first order construct from 36 items (measurement variable). We tested the measurement model by examining individual item reliability, internal consistency, and discriminant validity.

Insert Table 2 Here

In our model item loading values ranged from 0.61 to 0.87 (table 2) and found to be statistically significant ($p < 0.01$). It indicates that the amount of variance of an items is significantly explained by underlying construct rather than error due to measurement. Therefore, item reliability is established in our model.

We used three test to establish the internal consistency for each latent construct in our measurement model. First, the Cronbach alpha value ranged from 0.75 to 0.91 (table 3) which is higher than the threshold value 0.7. We calculated *composite reliability* by using the formula provided by Fornell and Larcker (1981) using the input data as standardized loading and measurement error of the measurement scale. The composite reliability value ranged from 0.87 to 0.92 (see table 3) and sufficiently above the considered threshold value of 0.7. Finally, we calculated the average variance extracted by using the formula provided by Nunnally and Bernstein (1994). As given in table 3, the calculated values of the average variance extracted ranged from 0.69 to 0.78 and exceeded the threshold value of 0.50. All three test establishes the convergent validity of the measurement model.

Insert Table 3 Here

To establish discriminant validity, the squared correlation value between constructs must be smaller than the square root of average variance extracted of each construct. Table 4 shows the correlations between latent variables with square root of average variance extracted (SQRT AVE) in the diagonal. As can be seen from the table that squared correlation values are sufficiently lower than the SQRT AVE and established that conceptually similar concepts are distinct.

Insert Table 4 Here

Since the survey data were collected from single respondent from every firm, it may cause common-method variance and thus systematic measurement error. To evaluate common-method bias within the data, Harmon's single factor test was conducted (Podsakoff et al., 2003). No single factor emerged from factor analysis which could explain reasonably significant share of variance among measurement items therefore an inference can be drawn that common method variance is not present.

After establishing the reliability and validity of measurement scale, we tested the proposed hypotheses in structural model as discussed below.

5.2 Structural Model

Figure 1 shows the proposed relationships of the structural model. The data were analyzed using the statistical package AMOS 20 by using the maximum likelihood estimation method. We tested the model fit by using a diverse set of model fit indices (we considered a mix of absolute, parsimonious & noncentrality-based fit indices). Table 5 shows the Goodness-of-fit indices for the structural model. χ^2/df value turn out to be 1.97 (which is sufficiently lower than the suggested value <3). Similarly, other values are also satisfying the recommended criteria, and these recommends that the proposed structural model fits well to the collected.

Insert Table 5 Here

5.2.1 Testing of the Hypotheses

Table 6 presents the structural model paths results. The path coefficient between all stakeholders' constructs and exploitative innovation is positive and statistically significant (β value ranged from 0.34 to 0.41 with all $p<0.01$). The path coefficients between three stakeholders' (except regulatory) and exploratory innovation is also positive and statistically significant (β value ranged from 0.45 to 0.51 with all $p<0.01$). However, the path coefficient between regulatory stakeholder and exploratory innovation is negative and statistically significant ($\beta = -0.45$, $p<0.01$). Which indicates that all stakeholders positively influence the Indian manufacturing firms to adopt exploitative innovative practices. The same is the case for exploratory innovative practices the only deviation is with regards to the relationship between regulatory stakeholder and exploratory innovative practices. The regulatory stakeholders in India negatively influence the exploratory innovative practices.

Insert Table 6 Here

The path between exploitive innovation capabilities and circular economy practices (both Biological & Technical) is negative and statistically significant (β value ranged from -0.39 to -0.47 with all $p<0.01$). This indicates that the firms with higher and higher exploitative innovative capabilities will tend to adopt lesser and lesser circular economy practices. Moreover, in the presence of exploitative innovation construct as mediator construct the direct relationship between all stakeholder pressure groups and circular economy practices is statistically insignificant (β value ranged from 0.06 to 0.20 with all $p\geq0.07$). These results show strong evidence of complete mediation of the relationship between stakeholder pressures and the adoption of circular economy practices (both Biological & Technical), by mediator exploitative innovation. Thus, Hypotheses 1&2 are strongly supported.

The path coefficients between explorative innovation capabilities and circular economy practices (both Biological & Technical) is positive and statistically significant (β value ranged from 0.53 to 0.58 with all $p<0.01$). Moreover, in the presence of explorative innovation capabilities as mediator variable the direct path between stakeholder pressure group and circular economy practices becomes statistically insignificant. These result establishes the complete mediation of explorative innovation capabilities for the relationship between stakeholders of Indian manufacturing firms and adoption of circular economy practices. There hypotheses 3 & 4 are also fully supported.

6. Conclusions and country implications

There exists a broader consensus in extant literate that various stakeholder groups do influence the manufacturing firms to adopt circular economy practices. However, different firms under similar stakeholder groups adopts diverse circular economy practices. In this paper we attempted to resolve this larger puzzle that "why firms adopt diverse circular economy practices despite being subject to similar stakeholders' pressure". Here we posit that innovative capabilities developed over time plays a key role in guiding firms to adopt the circular economy practices. In the literature, the innovative capabilities are divided into two categories namely: exploitative and exploratory innovative capabilities. Our results show that exploratory innovative capabilities only positively influence firms to response to various stakeholder pressure. However, regulatory stakeholder also negatively influence both exploitative innovative capabilities as well as circular economy practice (both Biological & Technical). The reason for the same may be explained by the regulatory mechanism followed in India. The command & control regulatory mechanism is used for circular economy practices adoption in India. In this type of mechanism, the manufacturing firms are allocated an upper emission cap in three-year block. Firms are required to submit their emission level in prescribed Performa. If any firms emit less that limit than no incentive is attached to it. However, if a firms emits more than the limit than a penalty is attached with lowering its emission quota for subsequent years. Here we propose that the reason for negative influence may lies in this regulatory mechanism and its implementation process. First, no incentive attached if firms emits less (no monetary incentive such as tax holidays and no carry forward). Furthermore, a great emphasis is placed on bureaucratic reporting process rather than actual reduction. Firms can easily get away by tweaking the process. Moreover, no incentive to invest resource in reduction beyond limit. As opposite to this, European Union follows market based regulatory mechanism where firms have incentive to adopt circular economy practices as much as possible to reduce environmental damage. In this mechanism, if a firm reduce emission beyond its allocated quota the surplus credit can be sold in the credit market. Firms which emit more should buy those excess emission credits in the market. Here we propose that India policy maker should think to shift from command and control mechanism to market based mechanism to positively influence firms to adopt circular economy practices.

6.1 Firm and Managerial implications

The exploratory innovative practices work as complementary capabilities for circular economy practices adoption. As we look very closely to circular economy practices they require significant changes to products and processes. For example, business redefinition requires firms to make drastic changes to develop new products for bottom of the pyramid. These practices require unique set of capabilities with are valuable, rare, inimitable and non-substitutable. For firms with exploratory innovative capabilities it becomes easier for them to adopt these circular economy practices for sustainable competitive advantages. Moreover, for firms with exploitative innovative capabilities they try to implore their existing process and capabilities and opposite to the needs of circular economy practices. Furthermore, firms may also come into inertia and develop resistant to change. However, firms with exploratory innovation capabilities are tuned to adopt rapid changes.

From a managerial perspective, managers may encourage at an organizational/operational level the adoption of the most influential and well connected variables that may impact greatly and cause other variables to change leading to an increased overall performance outcome. Managers can also focus and invest resources on the "less connected, less reinforced and more immature" variables as the well-connected variables may have already been implemented and hence developed or mature, and that may explain the reasons for the relative causation/connectivity.

6.2 Future Research Directions

In this paper we considered cross sectional data obtained using empirical survey method from Indian manufacturing organizations. An industry specific study may reveal deeper understanding of the inherent intricacies of particular industry. Moreover, survey data can be combined with secondary data (such as content analysis of reports) to strengthen the reliability and validity of the findings. A longitudinal study over several years can provide better understanding of how stakeholder pressure, innovative capabilities and circular economy practices changes over time.

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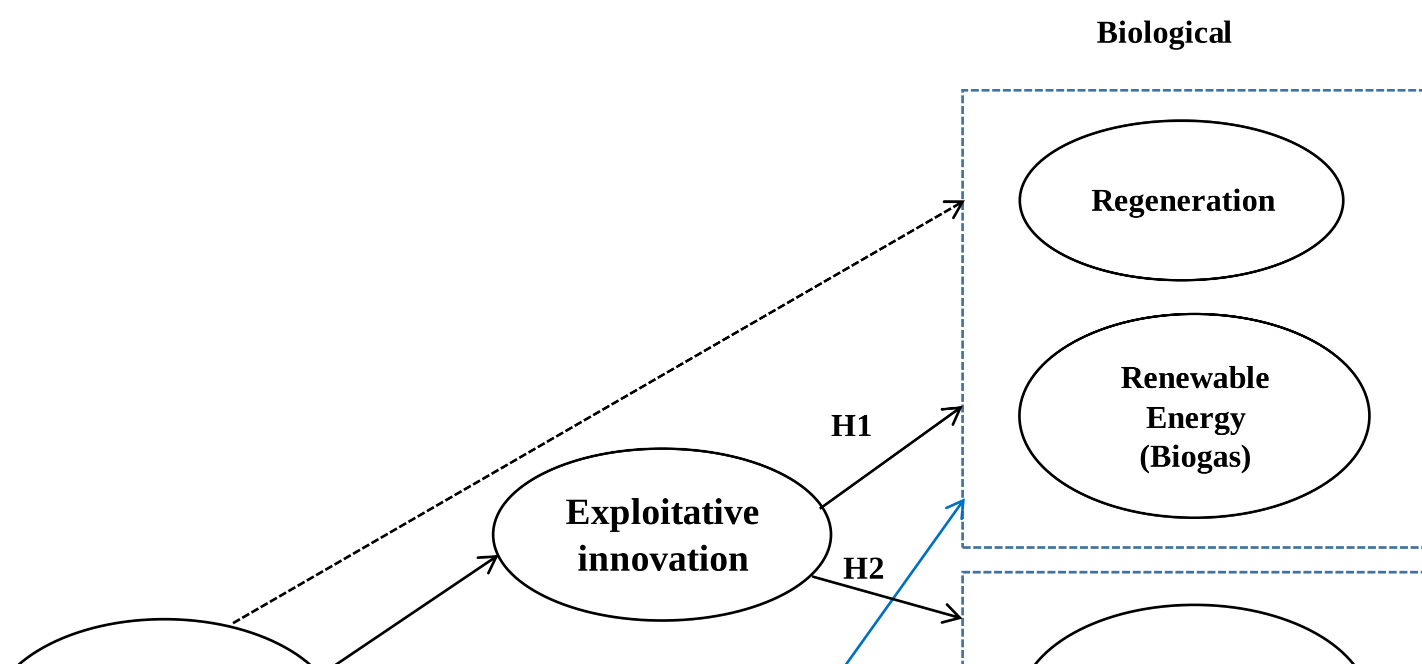
Biological
Regeneration
Renewable Energy (Biogas)
H1
Exploitative innovation
H2

Table 1 Description of the sample		
4 Digit SIC Code	Description	Number of responses in stage (%)
1000	Metal Mining	11(3.99)
1311	Crude Petroleum & Natural Gas	9(3.26)
2200	Textile Mill Products	23(8.33)
2300	Apparel & Other Finished Prods of Fabrics & Similar Matl	16(5.8)
2400	Lumber & Wood Products (No Furniture)	14(5.07)
2510	Household Furniture	17(6.16)
2600	Papers & Allied Products	15(5.43)
2800	Chemicals & Allied Products	10(3.62)

2851	Paints, Varnishes, Lacquers, Enamels & Allied Prods	14(5.07)
3011	Tires & Inner Tubes	11(3.99)
3100	Leather & Leather Products	14(5.07)
3220	Glass & Glassware, Pressed or Blown	12(4.35)
3241	Cement, Hydraulic	15(5.43)
3310	Steel Works, Blast Furnaces & Rolling & Finishing Mills	21(7.61)
3452	Bolts, Nuts, Screws, Rivets & Washers	12(4.35)
3510	Engines & Turbines	8(2.9)
3620	Electrical Industrial Apparatus	16(5.8)
3711	Motor Vehicles & Passenger Car Bodies	18(6.52)
3713	Truck & Bus Bodies	11(3.99)
4011	Railroads, Line-Haul Operating	9(3.26)
Total Responses		276
Response Rate % (of total 946 firms)		29

Table 2. Results of Measurement Model					
Measurement paths	Unstandardized regression weight	Standard error	Critical ratio	Standardised regression weight*	Item reliability
External primary stakeholders					
→Local Customer	1.00	fixed		0.88	0.72
→Offshore customers	1.48	0.09	10.62	0.76	0.66
→Local suppliers	1.32	0.14	9.20	0.68	0.61
→Offshore suppliers	1.37	0.11	10.24	0.73	0.64
Secondary stakeholders					
→Local rivals	1.00	fixed		0.89	0.84
→International rivals	1.14	0.21	8.84	0.78	0.71
→International treaties	1.22	0.18	10.40	0.84	0.82
→NGOs	1.38	0.10	13.68	0.86	0.78
→ Press & Social Media	1.26	0.15	11.78	0.88	0.76
Internal primary stakeholders					
→Employees	1.00	fixed		0.77	0.66
→Shareholders	1.52	0.06	14.57	0.91	0.82
→Financial Institutions	1.46	0.12	13.48	0.86	0.74
Regulatory stakeholders					
→Domestic (and regional) governments	1.00	fixed		0.89	0.75
→Domestic public agencies	1.28	0.17	11.42	0.85	0.69
Regeneration					
→Extraction of biochemical feedstock	1.00	fixed		0.77	0.68
→ Farming/collection	1.32	0.13	8.64	0.80	0.71
Renewable Energy					
→ Biogas generation	1.00	fixed		0.90	0.87
→Use of wind and solar system	1.25	0.14	10.23	0.85	0.79
→Renewables flow management	1.41	0.09	13.24	0.88	0.81
Eco Design					
→ Product & process life cycle analysis	1.00	fixed		0.92	0.82
→ Product durability and recyclability	1.38	0.16	12.43	0.87	0.77
→ Design for easy disassembly	1.22	0.12	9.86	0.85	0.73
Recirculation					
→Reuse/Redistribute products	1.00	fixed		0.78	0.68
→Refurbish/ Remanufacture	1.33	0.14	10.87	0.72	0.65
→Recycle product	1.28	0.19	9.76	0.69	0.61
Business redefinition					
→ Developing products for zero environmental impact	1.00	fixed		0.86	0.72
→Environment as a key driver for business growth	1.12	0.21	11.24	0.71	0.63
→Designing products for bottom of the pyramid	1.30	0.15	9.84	0.78	0.69
Exploratory innovation					

→Our organization accepts demands that go beyond existing products and services	1.00	fixed		0.78	0.68
→We commercialize products and services that are completely new to our organization	1.26	0.21	8.84	0.73	0.61
→We frequently utilize new opportunities in new markets	1.34	0.18	10.27	0.81	0.67
→Our organization regularly uses new distribution channels	1.41	0.15	12.54	0.89	0.70
Exploitative innovation					
→We frequently make small adjustments to our existing products and services	1.00	fixed		0.79	0.71
→We improve our provision's efficiency of products and services	1.45	0.09	13.64	0.92	0.85
→We increase economies of scales in existing markets	1.38	0.12	12.54	0.83	0.75
→Our organization expands services for existing clients	1.41	0.11	10.27	0.86	0.77
* Statistically significant at p<0.01.					

Table 3. Psychometric property of first order measurement scales.							
S. No	Latent Variables	Mean	Variance	Number of items	Cronbach's alpha	Composite reliability	Average variance extracted
1	External primary stakeholders	0.58	0.06	4	0.75	0.91	0.75
2	Secondary stakeholders	0.62	0.09	5	0.81	0.89	0.71
3	Internal primary stakeholders	0.67	0.11	3	0.79	0.87	0.69
4	Regulatory stakeholders	0.71	0.14	2	0.91	0.92	0.78
5	Regeneration	0.63	0.10	2	0.85	0.87	0.71
6	Renewable Energy	0.57	0.07	3	0.81	0.89	0.74
7	Eco Design	0.52	0.04	3	0.87	0.93	0.79
8	Recirculation	0.68	0.15	3	0.82	0.90	0.72
9	Business redefinition	0.56	0.02	3	0.91	0.87	0.69
10	Exploitative innovation	0.71	0.12	4	0.85	0.92	0.78
11	Exploratory innovation	0.65	0.09	4	0.87	0.89	0.73

Table 4. Correlations between latent variables (square root of average variance extracted in the diagonal)

Latent Variables	1	2	3	4	5	6	7	8	9	10	11
1	0.87										
2	0.17	0.84									
3	0.12	0.15	0.83								
4	-0.08	0.13	0.16	0.88							
5	0.23*	0.18	0.12	-0.25*	0.84						
6	0.07	0.14	0.36**	-0.24*	0.15	0.86					
7	0.31**	0.14	0.17	-0.21*	0.20	-0.05	0.89				
8	0.14	0.10	0.23*	-0.39**	0.14	0.15	0.22*	0.85			
9	0.09	0.21*	0.08	-0.13	0.16	0.17	0.12	0.18	0.83		
10	0.17	-0.15	0.15	0.24*	0.24*	0.27*	-0.19	-0.22*	-0.20*	0.88	
11	0.19	0.22*	0.07	-0.36**	0.12	0.07	0.21*	0.24*	0.26*	0.13	0.85

1. External primary stakeholders, 2. Secondary stakeholders, 3. Internal primary stakeholders, 4. Regulatory stakeholders, 5. Regeneration, 6. Renewable Energy, 7. Eco Design, 8. Recirculation, 9. Business redefinition, 10. Exploitative innovation, 11. Exploratory innovation.
* p<0.05 (2-tailed); ** p<0.01 (2-tailed)

Table 5. Goodness-of-fit indices for structural model

Indices	Measures	Model value	Recommended Value
Chi-Square (χ^2)	evaluates overall model fit, the magnitude of discrepancy between the sample and fitted covariance matrices.	1062	---
Degree of Freedom (df)	The total number of observations {available - used to estimate parameters}.	540	---
χ^2/df	Adjusts for sample size.	1.97	<3
Goodness of Fit Indices (GFI)	The proportion of variance accounted for by the estimated population covariance.	0.91	>0.8
Root Mean Square Error of Approximation (RMSEA)	Absolute measure of fit, based on the non-centrality parameter.	0.048	<0.10
Comparative Fit Index (CFI)	Incremental measure, based on the non-centrality measure.	0.93	>0.9
Incremental Fit Index(IFI)	Relative fit index, analogous to R^2.	0.93	>0.9

Table 6. Structural model* paths							
Antecedent variable	**Consequent variable**	**Unstandardized regression weight**	**Standard error**	**Critical ratio**	**p value**	**Standardized regression weight**	**% Change****
External primary stakeholders	Exploitative innovation	0.41	0.16	5.07	***	0.37	11.55
Secondary stakeholders	Exploitative innovation	0.38	0.17	4.98	***	0.34	10.7
Internal primary stakeholders	Exploitative innovation	0.36	0.14	4.81	***	0.31	10.14
Regulatory stakeholders	Exploitative innovation	0.34	0.08	4.65	***	0.33	9.58
External primary stakeholders	Exploratory innovation	0.45	0.13	5.17	***	0.38	13.85
Secondary stakeholders	Exploratory innovation	0.51	0.16	5.32	***	0.46	15.69
Internal primary stakeholders	Exploratory innovation	0.48	0.09	4.91	***	0.41	14.77
Regulatory stakeholders	Exploratory innovation	-0.45	0.21	5.87	***	-0.42	-13.8
Exploitative innovation	Regeneration	-0.42	0.08	4.63	***	-0.46	-13.3
Exploitative innovation	Renewable Energy	-0.39	0.09	4.97	***	-0.34	-13.7
Exploitative innovation	Eco Design	-0.47	0.07	4.49	***	-0.41	-18.1
Exploitative innovation	Recirculation	-0.41	0.06	4.37	***	-0.37	-12.1
Exploitative innovation	Business redefinition	-0.46	0.08	4.98	***	-0.42	-16.4
Exploratory innovation	Regeneration	0.52	0.12	5.07	***	0.44	16.51
Exploratory innovation	Renewable Energy	0.57	0.14	5.13	***	0.52	20
Exploratory innovation	Eco Design	0.58	0.12	5.27	***	0.54	22.31
Exploratory innovation	Recirculation	0.53	0.13	5.16	***	0.47	15.59
Exploratory innovation	Business redefinition	0.54	0.15	5.03	***	0.50	19.29
External primary stakeholders	Regeneration	0.18	0.05	1.56	0.09	0.12	---
Secondary stakeholders	Regeneration	0.12	0.07	1.43	0.11	0.08	---
Internal primary stakeholders	Regeneration	0.08	0.12	1.24	0.06	0.03	---
Regulatory stakeholders	Regeneration	-0.19	0.10	1.89	0.08	-0.11	---

External primary stakeholders	Renewable Energy	0.07	0.03	2.02	0.13	0.02	---
Secondary stakeholders	Renewable Energy	0.16	0.08	1.71	0.08	0.13	---
Internal primary stakeholders	Renewable Energy	0.20	0.14	1.16	0.07	0.09	---
Regulatory stakeholders	Renewable Energy	-0.15	0.11	1.19	0.12	-0.12	---
External primary stakeholders	Eco Design	0.06	0.07	1.20	0.14	0.01	---
Secondary stakeholders	Eco Design	0.14	0.05	1.17	0.12	0.10	---
Internal primary stakeholders	Eco Design	0.17	0.12	1.12	0.18	0.09	---
Regulatory stakeholders	Eco Design	-0.18	0.10	1.18	0.07	-0.13	---
External primary stakeholders	Recirculation	0.08	0.05	2.07	0.15	0.02	---
Secondary stakeholders	Recirculation	0.15	0.11	1.13	0.21	0.12	---
Internal primary stakeholders	Recirculation	0.05	0.01	1.19	0.17	0.02	---
Regulatory stakeholders	Recirculation	-0.17	0.14	2.21	0.09	-0.12	---
External primary stakeholders	Business redefinition	0.19	0.12	1.14	0.06	0.14	---
Secondary stakeholders	Business redefinition	0.20	0.17	1.16	0.23	0.17	---
Internal primary stakeholders	Business redefinition	0.08	0.05	2.01	0.09	0.02	---
Regulatory stakeholders	Business redefinition	-0.13	0.08	1.15	0.14	-0.10	---

*** $p<0.01$. **This column indicates the % change (increase/decrease) in consequent variable one-point increase in antecedent variable on five point Likert scale. *The path between stakeholder groups and circular economy practices became statistically insignificant in presence of exploratory/exploitative innovations.