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Information Exchange Research Opportunities

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**ABSTRACT**

Building upon the concept of information exchange for business sustainability that gathers, stores and makes available the data related to business processes and products including their basic raw materials, manufacturing processes, the end of life of the product and its potential recycling contributed by organizations through which this product has traveled, we conceptualize how the information from such information exchange will affect traditional methods of doing business and outline research opportunities emerged as a result of interaction of the information exchange and businesses. Further we discuss potential contributions of information exchange towards environmental performance and business sustainability of firms.

**KEYWORDS:** Information Exchange, Business Sustainability, Environmental Performance, Big data, industrial ecology

**INTRODUCTION**

Today's economy runs on information. On one hand, companies want to make right investment in right information technologies and systems to manage information that is being generated by themselves internally as well as by sources external to their organizations. Efforts to synthesize this information and utilize it in their organizational setting differ from firm to firm depending on the level of resources and constrain the firm function in (Keller, 1994). But their goal remains to generate stake holder value by making the best use of the information which they have access to. On the other hand, because of rising environmental stewardship goals, companies utilize the information to redesign strategies, products and processes that fit with their environmental objectives. These two objectives are often considered as conflicting. However, when considering the sustainability point view, information can be utilized in such a way that company continues to be environmentally responsible and at the same time keeps growing stakeholder value. To make strategic sustainability decisions, firms need access to accurate external information. Therefore, if there was a centralized data warehouse or an information exchange that gathers, stores and makes available the product lifecycle information associated to business processes and the composition of the products, managers and decision makers across firms will be able to make appropriate sustainability related decisions (Jagani, Wallace, & Kunnathur, 2016). The data gathered by this information exchange are expected to be contributed by various participating organizations through which the product and its components

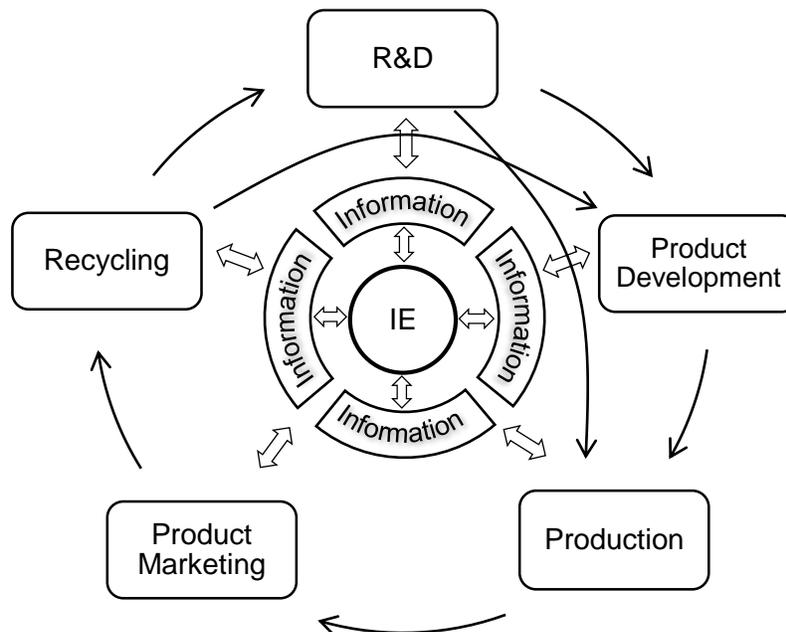
travel during the complete lifecycle. It can make the highest possible contribution to business sustainability goals supply chain or industry wide. This data is not limited to carbon emission or hazardous composition that the product and its components emits during its life cycle but also business processes, manufacturing processes as well as social impact information that each components has made during their journey to the product. This paper outlines various research opportunities during interaction of information exchange and firms who uses it.

The rest of the paper is organized as follows. First, we conduct an extensive literature review to identify the current themes on how information affects traditional methods of doing business. Concurrently, we identify research gaps in the literature and we call for research that bridge these gaps. Next, we identify the overlaps or crossover in business process which information form information exchange creates. Finally, we discuss potential contribution of information exchange towards environmental performance and business sustainability of firms.

## LITERATURE REVIEW

Figure 1 is a representation of interaction of Information Exchange (IE) with Business processes. The arrows from information to each of the five critical business processes are the research opportunities which will lead to business sustainability of firms.

Figure 1: Proposed Research Opportunities



### Affecting R&D

A firm' ability to recognize the value of external information and make commercial use of it is critical to its innovative performance (Cohen & Levinthal, 1990). Since, organizational knowledge creation depends crucially upon the information processing capacities of the organization, firms need to carefully manage external information. Zahra and George (2002)

argues that it is firms absorptive capacity, based on type of work force, infrastructure and organizational culture, that transforms the available knowledge into innovative ideas. An organization assimilates information about the environment through environmental scanning activities, and this information is communicated to and is shared between functions and departments (Frishammar & Åke Hörte, 2005). Though, it is necessary for this information to be evaluated by door keepers for making key decisions, this information at further stage contributes to the knowledge base of the firm. To our knowledge there is no research that identifies the external information in the terms of ecological data of product and process which a firm gets access to and further relates it to the R&D performance of the firm. Access to the information from information exchange increases the potential of idea generation. This affect R&D by providing environmental, competition as well as technical information and projection to identify suitable choices. The information can be used to develop new materials, new components and new process. This paper calls for research on how external ecological information regarding a product or process that a firm has access will affect R&D activities of the firm.

### **Affecting Product Development**

There is already an adequate research done on relationship of information sharing and new product development (NPD) (Le Dain & Merminod, 2014; Wu, Ming, He, Li, & Li, 2014; Zhou & LI, 2012). When companies integrate internal knowledge for NPD using cross-functional team, it is known as internal integration (Koufteros, Vonderembse, & Jayaram, 2005) or concurrent engineering (Koufteros, Vonderembse, & Doll, 2001). However, companies often use external knowledge from suppliers, market or customers to improve product design. This is known as external integration (Koufteros et al., 2005; Petersen, Handfield, & Ragatz, 2005). Rigby & Zook (2002) with a sample of innovative companies argue that the companies that are concerned about product innovation uses external information to gain competitive advantage. Information on processes of other firms as well as environmental impacts of raw materials, components and processes obtained from the information exchange will provide a completely new external knowledge and consequently offer a different dimension to product design considering the sustainability aspects. This could not only affect the product design step of NPD by choosing right materials that go into the product but also further steps like market projection, competition information, distribution and usage pattern of the product.

### **Affecting Production of Products (Manufacturing Process)**

External integration (Koufteros et al., 2005) is positively associated with manufacturing process improvements (Droge, Jayaram, & Vickery, 2004). On one hand, customers are the driving force behind radical process change (Davenport, 2013). Competition forces companies to increase quality, delivery speed and timeliness of the product. On the other hand, competitors and suppliers provide companies with the information that determines their processes (Avermaete et al., 2004). Information systems plays an important role in transporting the information from the source to the user firm. Tarafdar & Gordon (2007) uses resource based view to demonstrate how information systems affects the success of process innovation in an organization. Firms use IS competencies to enhance their ability to conceive, develop and implement process innovations. Previous researchers have focus on generic information as a source of knowledge that shapes companies process. However, the information from the information exchange is a specific sustainability related information that can be used to make choices about use of types of energy, sustainable practices, education and training of employees and controlling exposure to harmful environmental hazards in a process. Information systems can play a crucial role in

reducing energy consumption, and thus CO<sub>2</sub> emissions. Watson, Boudreau, & Chen (2010) explains importance of information in one equation;

Energy + Information < Energy, (Watson et al., 2010, pp. 24)

### **Affecting Demand**

Appropriately designed environmental standards can prompt production of innovative products by firms with lower total cost of a product or increased value (Porter & Van der Linde, 1996). Lowering the cost of products generate higher demand. Additionally, companies can use inputs, viz. raw materials, labor, etc., more efficiently enhancing resource output that makes firms more competitive. Wüstenhagen & Bilharz (2006) outlines the driver being radical growth behind green power demand in Germany during 1973 to 2003. They conclude that growth of green marketing by the company is followed by strong customer demand. Handfield, Walton, Seegers, & Melnyk (1997)'s interviews with environmental managers of five organizations and suggest that in order to be successful for an organization, environmental management strategies must be integrated into all stages of the value chain, which includes all of the processes from product design, procurement, manufacturing and assembly, packaging, logistics, to distribution. If the organization utilizes information from the exchange, they can affect demand by implementing proper education program, green advertisements, enriching products with better features and ultimately reducing carbon footprints. How sustainability information impact product demand yet to be explored.

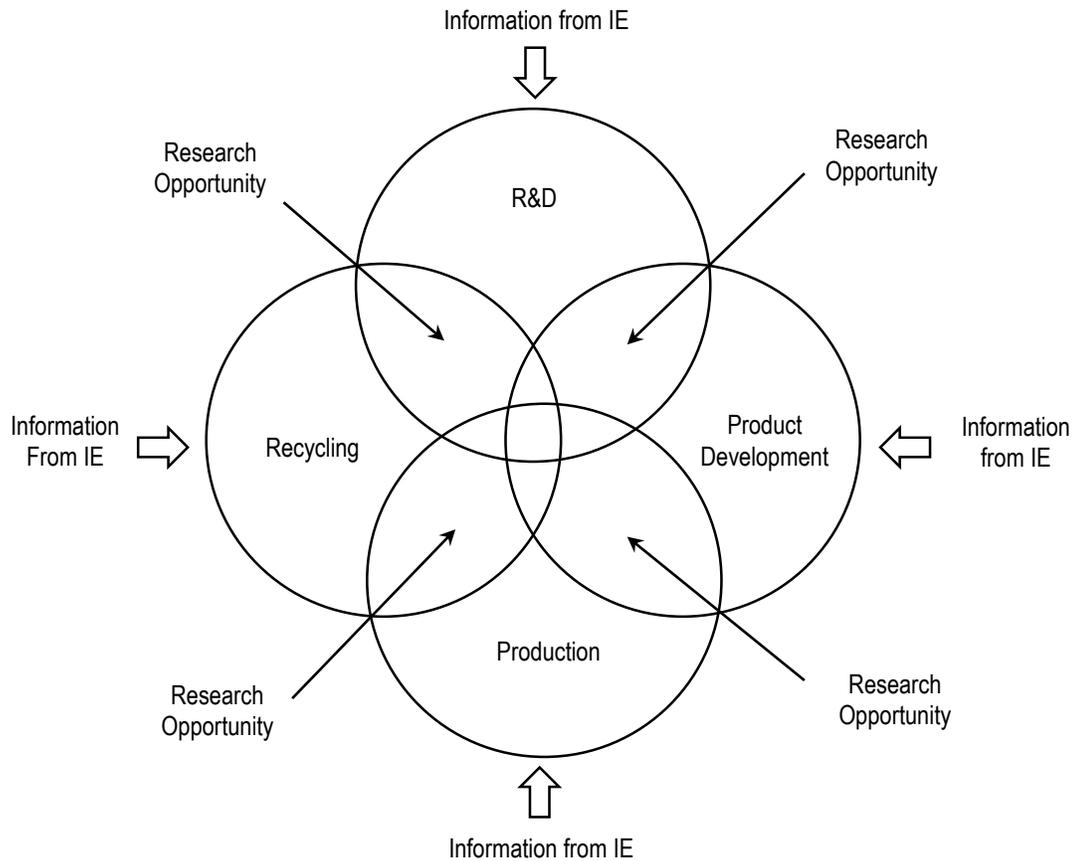
### **Affecting Recycling and Reuse**

Hischier, Wäger, & Gauglhofer, (2005) compared the environmental impact of waste electrical and electronic equipment recycling with that derived from incineration of all waste and primary production of the raw materials, waste electrical and electronic equipment recycling is considered valuable from an environmental viewpoint. Spath & Weule (1994) identifies need of gathering ecologically relevant product data both for recycling using computer aided information systems. Their conceptual paper calls for systematized approaches using intelligent software for disassembly planning and recycling. Potentially valuable options for the creation of micro-scale recycling markets or assistance with material management are often provided by third parties such as recyclers and logistics providers (Simpson, 2010). Information sharing with either immediate supply chain partners or distant companies improves the organizational learning and find solutions to problems regarding complex management such as recycling. Information sharing can be facilitated by a common information exchange that can provide firms with alternative disposal and recycling choices, possibility of participation in waste exchanges and thus making a larger industrial ecosystem.

### **The overlaps created by Information systems**

Inundation of information from the IE will bring the business processes closer creating overlapping activates. Firms will see processes that have common activities. Concurrent engineering (Koufteros et al., 2001) is an example from the past that was result of information integration in R&D, new product development and production. As shown in Figure 2, each overlaps will result in new investigation area. Data-driven sustainable R&D, product development and manufacturing tools, best practices, and standards that address cross-industry needs to help develop products and processes that offer not only economically competitive products but also with reduced environmental impact that are socially equitable. Discussion section below highlights the research needs.

Figure 2: Research opportunities from overlaps created by information systems



## DISCUSSION

Concept of IE is similar to electronic health information exchange (Hersh et al., 2015) which allows doctors, nurses, pharmacists, other health care providers and patients to appropriately access and securely share a patient's vital medical information electronically improving the speed, quality, safety and cost of patient care. IE for sustainability will allow managers of the participating firms to make strategic decision related to sourcing, R&D, production, marketing and recycling of the products based on the information obtained from IE. Information will affect several business processes of firms that aim for business sustainability. For these firms, participation to such IE will be a powerful competitive weapon by adding new IT capabilities (Mata, Fuerst, & Barney, 1995) and attributes that will provide business sustainability.

Investigative research needs to be conducted into the following issues to fill the research gaps mentioned earlier. Several studies and investigation needs to be done to address questions related to the IE and the firms that affect business process. There are obviously overlapping areas as discussed in the previous section. The flow on information to the firm from the IE and to the IE from the firm will enumerate several issues.

As a first priority, detailed exploratory studies need to be done to identify business environments and business processes that can benefit from the aforementioned information based firm centric

sustainability vision. Further, based on the findings of these exploratory studies, more focused studies would have to be done to better understand the problems and develop concepts and solutions. Next, case studies, pilot studies, and longitudinal studies need to be done to flesh out and elaborate on the identified issues and concerns which may uncover hidden issues that may require further investigation.

A comprehensive model needs to be developed for selecting the IE information to import, and the effective deployment and use of that information, to inform and/or impact. An effective strategy has to be formulated and implemented for selection of platform that best suits the needs of firms as well as most convenient for the handling large amount of data. Infrastructure needed to collect and deploy the IE information has to be thought considering the resource barriers that will be lost as well as erected to stem competitive advantage.

Finally, a study of the openness of the business environment as well as their existing sustainability practices to instigate the willingness of firms to participate in the information exchange has to be done. Modifications and the associated challenges in the firm's business practices that benefit from the IE information in achieving firm sustainability needs also to be studied.

## CONCLUSION

It is difficult to make strategic decisions for business sustainability with information from a single entity or even a supply chain. A high level information, from a network of firms and business processes associated with this network of firms needs to be gathered and deployed to make such decisions. Based on the proposal for IE which will act as a repository of data that can be used for business sustainability of the participating firm as well as issues related to IE and firms that are identified by Jagani et al. (2016), this research has recognized various areas that information affects business processes. Ultimately brings processes closer creating overlaps and offering opportunities for research for achieving sustainability. Further, based on the research gaps that we identified from the interaction of information systems and the business process, we suggested new areas for research and issues that need to be addressed by the IE in developing and maintaining IE. We conclude that there is a huge potential contribution of information exchange towards environmental performance and business sustainability of firms.

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