Impact of Green Supply Chain Internal integration on Green Supply Chain Innovation with moderating effect of Big Data Analytics Capability

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ABSTRACT

The significance of big data investigation has been at the cutting edge of exploration for data frameworks, the board activities, the executives and vital administration in local areas. Earlier examinations have written about the effect of big data analytics capabilities (BDAC) for further developing organizational innovation and organizational integrations, authoritative coordination and production network hierarchical advancement. Though, there has been a shortage of research with respect to the field of big data in supply chain ambidexterity problem and authoritative execution within an organization. To address these research gaps, this investigation draws on the authoritative perspective on combination dependent on providers and clients under the unexpected impact of large information investigation abilities. The reason for this exploration is to examine the impact of GII, as far as intervening elements of GSCI and GCI on GI. This examination additionally explores the directing effect of BDAC on the connections between the GII, GSCI and GCI which is ultimately affecting the GI. It is to inspect when and how organizations assemble BDAC to work on GI and gain upper hand.

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LIST OF ABBREVIATIONS

GSCII -------- Green Supply Chain Internal Integration

GSCSI ------- Green Supply Chain Supplier Integration

GSCCI ------- Green Supply Chain Customer Integration

GSCI ----------Green Supply Chain Innovation

BDAC -------- Big Data Analytics Capability

BDACM ----- Big Data Analytics Capability Management

CHAPTER 1: INTRODUCTION

1.1 Introduction

The developing awareness in Big Data has driven associations to substitute Big Data Analytics (BDA) for their businesses especially in supply chains (SC) (Dubey et al., 2018). The essential objective of supply chain management is to get significant data that allows them to all the more likely measure, foresee, uncover discreet examples and afterward further develop seriousness (Lamba and Singh, 2017). Big data analytics is adapting in a manner in which supply chain management (SCM) practices this information, respectively inside via coordination of conditional data frameworks, and remotely via Internet of Thing (IoT), cell phones and the online media (Chavez, Yu, Jacobs, and Feng, 2017). For organizations, this most recent pattern holds new freedoms yet additionally unforeseen new encounters for delivering new exchange models and taming existing tasks, subsequently generating market profits (Shukla and Tiwari, 2017).

With the increase of worldwide climate issue and confronting green obstructions of worldwide trading, green manufacturing becomes many nations' financial advancement techniques also known as economic development techniques (Khan, Zaman, and Zhang, 2016). The production research writing perceives two sorts of green supply chain innovations. Green supply chain innovation utilizes cleaner sourcing of materials and production advancements to (re)design items and packaging. Green innovation utilizes green procurement, production and transportation advances without changing the final product. Early proof shows that green innovation could drive upper hand by competitive advantage, however later research recommends the ineffectiveness within green innovation (the green process innovation process side). Along these lines, the impacts on green innovation might change. Green innovation is demonstrated to be emphatically connected to environmental and firm performance, however the green final product failed to work on natural execution in China (Huang and Li, 2017).

1.2 Background:

The new way of observing business exercises and modern mechanization has made an enormous volume and assortment of semi-organized or unstructured information, and it is the reason the expression "Big Data" has been studied so commonly. The monstrous datasets can be incorporated, removed and changed into helpful information by means of large information advances so the business would acquire benefits in this aggressive market. The associations that have installed enormous information advances in examining information would further develop benefits and execution substantially (Akhtar, Frynas, Mellahi, and Ullah, 2019). The fruitful accounts of huge information applications have been analyzed in various regions like electronic business (web based business) and market knowledge (Li, Chi, Hao, and Yu, 2018).

1.3 Research Gap/Rationale

To get diverse benefits from SCs, it is critical to combine BDAC with executives' proficiency. On the one hand, organizations involved in GSCC require highly qualified executives to respond quickly and reduce the problems of GSCC while simultaneously maximizing its benefits. BDAC, alternatively, may let executives access several data sources at the same time while improving control and teamwork with powerful analytics capabilities (Mandal, 2019). In this situation, it is critical to understand the role of BDAC and big data analytics management capabilities (BDAMC) in achieving superior suppliers and a competitive edge in GSCC. Also, requiring managers to use BDAC might reduce the risks associated with GSCCCI and coordination (Wamba et al., 2017). These are some of the reasons why SC require skilled managers who may benefit from BDAC and its skills to better evaluate the SC’s national borders. Despite extensive study in GSC, the issue of how BDAMC will assist SCM in reducing risks in GSC owing to increasing competitiveness linked with the usage of BDAC in SC remains unresolved. In this regard, we aim to establish the function of BDAMC in the overall SC, as well as SC coordination and integration throughout the GSCC process. In other words, how may BDAMC effect GSCC in a SC? Increasing need from organizations to source worldwide more effectively encourages enterprises and top executives to profit from BD, facilitating the development of competitive advantage and, as a result, greater firm performance. Thus, the primary goal of this article is to assess the predicted impacts of BD and BDAC on GSCC and business performance. Previous research papers investigated the impact of employing BD and BDAC in many parts of GSCC and GSCCM (Akter and Wamba, 2019; Wamba et al., 2017; Waller and Fawcett, 2013).

1.4 Problem Statement

To reap the benefits of big data (BD) and executives' skills in SC, it is critical to use BDAC with executives' abilities. On the one hand, organizations involved in GSCC require highly qualified executives to respond quickly and alleviate the obstacles of GSCC, as well as to maximize its benefits. BDAC, on the other hand, may let executives access several data sources at the same time while also improving control and collaboration with powerful analytics capabilities. In this context, it is critical to understand the role of BD and big data analytics management capabilities (BDAMC) in achieving better suppliers and gaining a competitive edge in GSC.

Furthermore, requiring executives to use BDAC might reduce the risks of SCI and coordination. These are some of the reasons why SC require skilled executives who can take use of BDA and its capabilities to better evaluate the SC’s national borders. Despite extensive study in GSC, the topic of how BDAMC will assist SC executives in reducing risks in GSC owing to increasing competition connected with the usage of BDA in SC remains unresolved. In this regard, we seek to establish BDAMC's function in the overall SC, as well as SC innovation and integration throughout the GSC process. To put it another way, how may BDAMC affect GSC in a supply chain? Increasing need from organizations to source worldwide more effectively drives enterprises and top executives to profit from BD, facilitating the development of competitive advantage and, as a result, higher firm innovation and performance.

1.5 Research Question(s):

From the above context, following are the questions:

RQ1: What is the impact of Green SC Internal Integration on Green SC Supplier Integration?

RQ2: What is the impact of Green SC Internal Integration on Green SC Innovation?

RQ3: What is the impact of Green SC Internal Integration on Green SC Customer Integration?

RQ4: Does Green SC Supplier Integration mediates Green SC Internal Integration and SC Innovation?

RQ5: Does Green SC Customer Integration mediates between Green SC Internal Integration and Green SC Innovation?

RQ6: Does Big Data Analytics Capability moderates Green SC Internal Integration and Green SC Supplier Integration?

RQ7: Does Big Data Analytics Capability moderates Green SC Internal Integration and Green SC Innovation?

RQ8: Does Big Data Analytics Capability moderates Green SC Internal Integration and Green SC Customer Integration?

1.6 Research Objectives:

RO1: To investigate the impact of Green SC Internal Integration on Green SC Supplier Integration.

RO2: To investigate the impact of Green SC Internal Integration on Green SC Innovation.

RO3: To investigate the impact of Green SC Internal Integration on Green SC Customer Integration.

RO4: To examine the Green SC Supplier Integration mediates between Green SC Internal Integration and SC Innovation.

RO5: To examine the Green SC Customer Integration mediates between Green SC Internal Integration and SC Innovation.

RO6: To examine the Big Data Analytics Capability moderates Green SC Internal Integration and Green SC Supplier Integration.

RO7: To examine the Big Data Analytics Capability moderates Green SC Internal Integration and Green SC Innovation.

RO8: To examine the Big Data Analytics Capability moderates Green SC Internal Integration and Green SC Customer Integration.

1.7 Significance of the Study

It will be helpful for upcoming future researchers so that they can benefits from my research in their own ways. This will add literature in academia. This study will help to understand the strengths and directions of the relationship between green supply chain integration and green supply chain innovation with an effect of big data analytics capabilities. To what extent Big Data Analytics capabilities in Pakistan can impact the relationship between Green SC Integration and Green SC Innovation in the manufacturing sector of Pakistan.

CHAPTER 2: LITERATURE REVIEW/ THEORETICAL FRAMEWORK

2.1. Green SC internal integration (GSCCII)

Beginning with the SCI and GSCCM literature, GSCCII is possible (Wolf 2011). For example, the use of GSCCM methods such as interior and exterior GSCCM, asset retrieval, and an eco-blueprint to monitor SC climate concerns is used. While the term GSCCM encompasses a broad range of concepts, Wolf (2011) argues that SCI methods that create resource ties more efficient and examine the influence of such actions on manageability execution' (Wolf 2011, 222). GSCCII is an essential thought in SCM (Fawcett and Magnan 2002; Simatupang and Sridharan 2002). For example, data exchange and collaboration are among the coordination components established in intra-categorized combination and also between authoritative practices in the SCI framework (Wong, Boon-itt, and Wong 2011). A variety of experimental investigations have shown GSCCI to have diverse execution benefits (Setyadi 2019, Song, Cai, and Feng 2017; Wu 2013; Yu et al. 2014) with just a slender confirmation of its unique joining systems.

The cost-benefits of GSCCI are still being debated (Wong, Wong, and Boon-itt 2018). It can be described in part by the employment of several measuring measures. To explain ecofriendly and financial presentation, Paulraj, Chen, and Blome (2017) merged features of GSCCI and GSCCI hooked on unique wide supportable SCM framework. Different presentation impacts may be achieved through the application of changed hierarchical methods by varied GSCCI aspects, which obviously leads to not the same conclusions, according to this broad perspective. Customer collaboration has been shown to be further successful than supplier support in terms of increasing ecofriendly (Lopes de Sousa Jabbour et al. 2017). The GSCCI aspects (GSCCII, GSCCCI, and GSCCSI) have been demonstrated to have various ecofriendly, price, and monetary profits (Wong, Wong, and Boon-itt 2018).

Rather than viewing the three GSCCI magnitudes as assets that can be used to generate reasonable compensations from the R-NBV (Setyadi 2019; Song, Cai, and Feng 2017; Wu 2013; Yu et al. 2014), they are not the same info handling capabilities they produce are what lead to different presentation outcomes. To back up our claim, we look into their hierarchical methods in the context of a supply chain from an OIPT standpoint (Schoenherr and Swink 2012; Wong, Boon-itt, and Wong 2011). As a result, the job insecurity grows, decision-makers' information requirements and processing capacity need be raised in order to retain a certain LOP (Galbraith 1973). Numerous hierarchical tools, such as pyramid and management by procedures and objectives, info systems, and adjacent links, can boost info processing capability (Galbraith 1973). Hierarchical techniques such as info sharing, cooperation, process connections, and aim sharing through efficient sections and organizations have been shown to be effective in the past.

To better understand what statistics handling volume, GSCI and GCI might boost, this research analyses particular hierarchical methods employed by both. To incorporate a corporate plan along with administration structure and practical collaboration to solve ecofriendly challenges, GSCCII employs chain of command, information give-and-take, incorporated schemes, and cross-functional teamwork as methods (Wong, Wong, and Boon-itt 2015). Industry and ecofriendly administration objectives and duties are incorporated through such processes. Different functions are driven by an incorporated ecofriendly organization system to incorporate ecofriendly criteria into worker codes of conduct, marketable choices, and resource managing choices. Cross-functional communication, collaborative preparation, and the execution of ecofriendly organizational activities are all aided by an incorporated info system based on a manufactured goods lifespan perspective. An incorporated information exchange and processing capability is provided by classified management, an incorporated strategy, and the organization structure.

Information exchange, cooperation, and closed-loop process connections are some of the strategies that GSCI use with dealers (Flynn, Huo, and Zhao 2010; Wong, Wong, and Boon-itt 2015). Partnership with suppliers are emphasized in order to cooperatively solve ecofriendly challenges. A focus business aids suppliers that seek technical and financial assistance through GSCI. To allow strategic info sharing, cooperation, and closed-loop procedure connections with consumers, GCI depends on inter-organizational incorporation tools such as info interchange and partnership (Flynn, Huo, and Zhao 2010; Wong, Wong, and Boon-itt 2015). Info sharing and team work provide fresh data for associates to comprehend, so boosting the ability of both GSCI and GCI in a SC to handle data (Yu et al. 2019).

Previous research has assumed that the three GSCCI factors have similar influence on operative and economic presentation results (e.g. Setyadi 2019; Song, Cai, and Feng 2017; Wu 2013; Yu et al. 2014). Three GSCCI dimensions provide varied information processing from an OIPT standpoint, and hence may balance each other to further boost info processing capability. Incorporation of processes and advertising departments may result in fresh insights that can be used to inform customer hierarchical. GSCCII is favorably related to GSCCSI and GSCCCI, according to Wong, Wong, and Boon-itt (2018). Such outcomes implies to GSCCII may help GSCCSI and GSCCCI by providing more information capacity. It implies that the GSCCII aspects collaborate in some way to provide the information processing capability needed to mitigate the risks related with green manufactured goods and procedure improvement.

2.2. Green SC innovation

Ecological technology, methodologies, and management systems are used to decrease ecofriendly effect by decreasing supply use and pollutant discharges. Green innovation (Christmann 2000; Klassen and McLaughlin 1996). Design and procedural adjustments are required at any step of a product's lifecycle in order to reduce its ecofriendly effect (Huang and Li 2017). Businesses may be less enthusiastic about making the switch to greener production and logistics practices if green innovation entails a complete rethink of the product. Investing in green innovativeness, or both, may have a considerable impact on presentation, according to some researchers (Christmann 2000). As a consequence, we have divided green initiatives in two categories: goods and processes. As a result of product and packaging (re)design that incorporates green principles, green innovation occurs (Huang and Li 2017). For further information on this topic please see Chen et al (2006). Ecofriendlyly friendly product design sometimes requires significant changes to the product's technology, components, and design (Christmann 2000). When it comes to the term "green product innovation," most people think of eco or green product design, but we include green packaging in our definition (Huang and Li 2017, Liu and Liu 2018, Sroufe 2003, Wu 2013;

Zhu and Sarkis 2004). (Hao et al. 2019; Huang and Li 2017; Min and Galle 1997). Such as, a laundry machine that uses fewer water or energy, or packing that can easily be recycled, are examples of green supply chain innovation that may help reduce ecofriendly impacts.

GPI happens when green values are included into manufactured goods and packing (re)design to increase product quality and distinction (Huang and Li 2017). (Chen, Lai, and Wen 2006). GPD frequently entails considerable modifications to the technology, materials, and design of the product (Christmann 2000). While most people think of GPI as ecofriendly manufactured goods scheme (Huang and Li 2017; Liu et al. 2018; Sroufe 2003; Wu 2013; Zhu and Sarkis 2004), including GPI in our definition (Hao et al. 2019; Huang and Li 2017; Min and Galle 1997). GPI will minimize ecofriendly consequences both in the process of manufacturing and when customers use the green goods or packaging.

GPI is described as "changes made to production processes and systems in order to reduce energy consumption, pollution, and waste recycling" (Li et al. 2016, 1092).In production practices methods might considered as a restricted definition of GPI, we broaden the scope of GPI by including green sourcing (Roberts 2003) and green logistics (Christmann 2000; Lin and Ho 2011). GPI emphases on lowering excess energy usage during obtaining, manufacturing, shipping wanting product remodel (Christmann 2000). By claiming ecofriendly advantages from their manufacturing and logistical actions by investing in GPI. Customers will not benefit from ecofriendly gains since the product design remains unchanged.

2.3. Big Data Analytics Capability (BDAC)

It's becoming more widely accepted that large-scale data analysis is critical to achieving an organization's goals (Davenport, 2006; Manyika et al., 2011; Prescott, 2014; Mishra et al., 2016, 2017; Roden et al., 2017; Ren et al., 2017; Choi et al., 2017; Fosso Wamba, 2017; Jabbour et al., 2017), but it's still (Galbraith, 2014). Big data, according to Manyika et al. (2011), are data that are large, fast, and varied enough to create it hard for a BDAC to be agile in the SC. Queen Mary University of London has downloaded this document. At 08:44 on March 26th, 2018 (Pacific Standard Time), a business uses conventional and customary ways to manage, analyses, and extract useful information. Analytical methods include developing and disseminating reports, designing and implementing statistical and data-mining models, examining and envisioning data, making logic of it, and further similar procedures (Grossman and Siegel, 2014, p. 20). BDAC may thus be considered an organization facility with tools, methodologies, and procedures allowing data to be processed, visualized and analyzed in order to provide insights that allow data-driven operational planning, decision making and implementation (Srinivasan and Swink, 2017). BDAC helps companies to assess supply and demand uncertainty in the framework of SCM (Waller and Fawcett, 2013; Hazen et al., 2014; Wang et al., 2016).

BDAC is a method of handling, treating, and investigating big data, which includes capacity, variability, quickness, truthfulness, and significance of the data. It aids companies in evaluating their presentation and gaining economic benefits (Wamba et al., 2015; Aceto et al., 2020; Wamba et al., 2017). Field information and investigation should be regarded simultaneously, as is clear now. BDA offers a variety of benefits to businesses, including IT infrastructure, organizational benefits, management benefits, and so on (Wang et al., 2016; Wang et al., 2018). All of this emphasizes, necessity of BDAC in various aspects of SCM. The opportunities that the BD presents for a company can help that company increase their regular production and competence stages (Chen and Zhang, 2014). We employ BDA refers to techniques of studying big statistics sets, because BD is infinite and requires the correct instruments and methodologies to be evaluated. (Sivarajah et al., 2017). Indeed, among general practitioner and decision-makers in businesses, BDA has become a hot subject. Given the rapid advancement of information technology and BDA, we will be able to attain these advantages more efficiently (Sharma and Loh, 2009). It is critical to coordinate the depth and opportunity of BD in SCM systems, as it is through other finest practices, according to Ji-fan Ren et al. (2017). Recognizing the important success criteria for BDA managers and SCI. It is believed that BDA's part is intertwined with supply chain management and GSC flows.

We suggest a BDAC model based on a variety of collected works on BDA, IS achievement, and the adding value function of IT. (2011). There are three levels, first two deal with presentation and budget discount concerns, and the third with the customer and their profitability. BDAC is divided into three aspects in another classification: BD-IFC, BDA-MCC, and BDA- PEC (Wamba et al., 2017). Significance of BDAC, particularly organization competence, developing the SC tactics and improving organization presentation, this study attempts to examine the collected works on BDAC in the GSC practice and hierarchical required. It comprises of preparation, result oriented, synchronization, controller and assists businesses in managing IT resources according to business goals in an organized manner (Kim et al., 2012; Akter et al., 2016). BDAC has been used for organizations, to make tactical decisions, chain and product scheme, preparation, logistics, and other areas (Wang et al., 2016).

It is commonly used in Info Technology training GSC (Bharadwaj, 2000; Santhanam and Hartono, 2003), and it is derived from SM (Ryu and Lee, 2013; Van Der Zee and De Jong, 1999). According to research, modest benefit is gained through deploying and employing unique, treasured, unique assets and competencies (Bhatt and Grover, 2005). Despite the ease with which resources may be replicated based on IT capacity, many characteristics that a business possesses that contribute to continued modest benefits are difficult to copy (Santhanam and Hartono, 2003; Hämäläinen and Inkinen, 2019). Furthermore, any initial capacity may always be used to gain a lasting modest benefits. We regard BDAC to be a key organizational competency that leads to modest benefits in the BD surrounding GSC, as Wamba et al. (2017) remark. Without BDAC, however, achieving a modest edge and operative supply supervision is difficult. BDAC and methods that managers may employ have received a lot of attention in the SC literature since it has been a serious subject in SCM literature (Waller and Fawcett, 2013; Wang et al., 2016). The impact of BD on business presentation (Wang and Hajli, 2017). As a result, the role of BD in SCI and SCM has been underlined in a variety of situations. The literature on the use of BDA in SCM is extensive and complex. The application of it in GSC in the SC is the major focus here.

2.4. Theoretical framework

In order to mitigate the risks associated with green SC innovation, enterprises must increase their data processing capacity. With this in mind, it is important to understand how reconciliation tools may be used in numerous intra- and inter-authoritative cooperation (with providers and consumers) to help further enhance data handling skills (Wong, Boon-itt, and Wong 2011, 2015). So research uses Galbraith (1973)'s OIPT to clarify in what way companies lessen their susceptibility to item and cycle progression via GSCCI. Galbraith (1973) found that the bigger the assigned vulnerability, the bigger the amount of data that management must handle throughout task implementation in order to accomplish a certain level of presentation. Order and administration by guidelines/goals are two examples of mix instruments used to reduce risk in an organization while the rise of data frameworks and sidelong linkages helps to increase data handling capacity (Galbraith 1973). Each GSCCI component (GSCCII, GSCCSI, GSCCCI) uses a variety of joining systems, such as varying levels of coordination, data exchange, collaboration, and cycle links, to set separate data handling restrictions among utility offices, provisions, and consumers (Wong, Boon-itt, and Wong 2011, 2015).

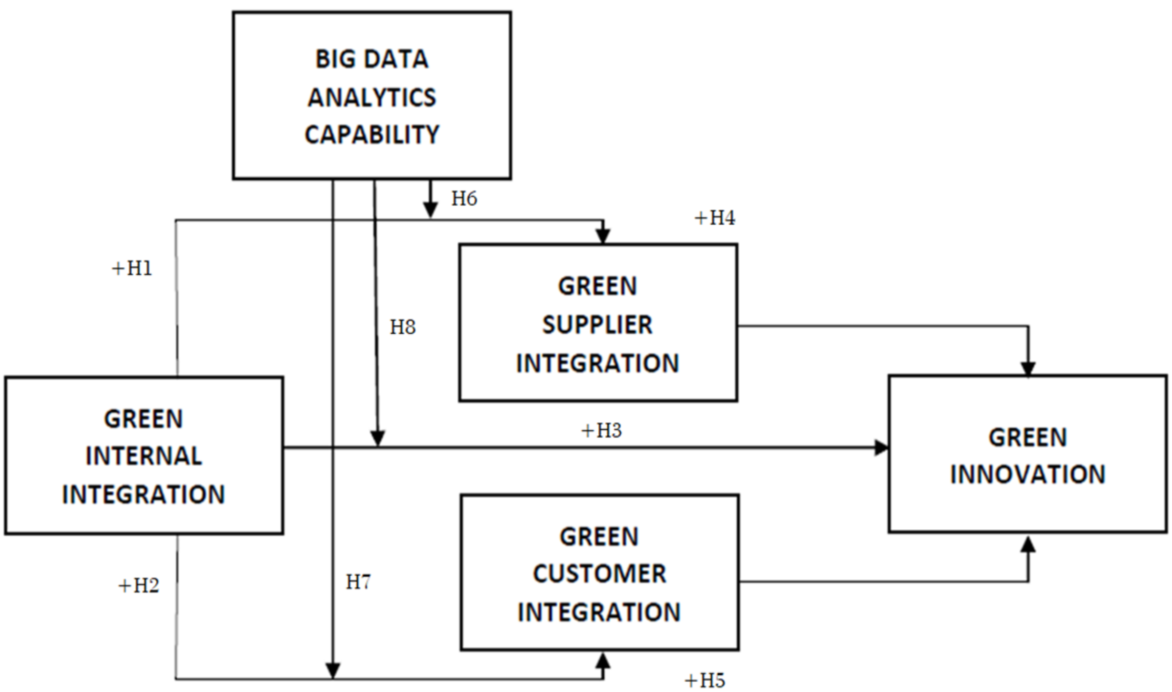


Diagram 1

2.5. Hypothesis development

2.5.1. Relationships among GSCCI dimensions

GSCCII employs a variety of hierarchical strategies to accomplish strategic hierarchical of environmental criteria into company strategy (Flynn, Huo, and Zhao 2010; Wong, Boon-itt, and Wong 2011). (Wong,Wong, and Boon-itt 2015). From the standpoint of OIPT, hierarchy is a key hierarchical mechanism for reducing strategic uncertainty (Galbraith 1973). To guarantee that strategic intentions are matched with environmental goals, GSCCII depends on categorized incorporation instruments such as allocating authority to the suitable pyramid (Ettlie and Reza 1992). Another major hierarchical method is incorporated administration systems. Klassen and Whybark (1999) contend that an incorporated administration system motivates various purposes to collaboratively analyses ecofriendly effect, make investment results and training provisions, and build new cross-functional synchronization methods.

From an OIPT standpoint, objective arrangement is another hierarchical technique for reducing ambiguity (Galbraith 1973). Then, as a reward for achieving long-term growth, senior management will set lofty targets (Hofer, Cantor, and Dai 2012; Montabon, Sroufe, and Narasimhan 2007). It will integrate ecofriendly objectives, presentation, and duties into codes of manner, as well as coordinate practical profitmaking and HR choices through several purposes (Margerum and Born 2000; Tari and Molina-Azorin 2010). Thus, GSCCIIallows cross-functional statement, synchronization, and cooperation (Zhu and Sarkis 2004; Zhu, Sarkis, and Lai 2012) to a firm's value chain operations, manufacturing and logistics. According to Wong, Wong, and Boon-itt (2018), GSCCII motivates efforts to incorporate with contractors (GSCI) and consumers (GSCCII). It will be little assurance plus asset in green supplier and customer hierarchical if GSCCII does not play a strategic role. As a result, we propose:

H1: GSCC Internal Integration is positively associated with GSCC Supplier Integration.
H2: GSCC Internal Integration is positively associated with GSCC Customer Integration.

2.5.2. Relationships among GSCCII on GSCCI

According to hypotheses H3, H4, and H5, the three scopes of GSCCI (GII, GSCI, and GCI) are major backgrounds of green product/ process innovation. These assumptions are since each improvement scheme needs overall information (Cohen and Levinthal 1990) as well as measures to eliminate uncertainty (Rogers 2003). Firms cope with uncertainty, according to OPIT, by lowering facts handling demands and boosting facts handling volume (Daft and Lengel 1986; Galbraith 1973). The problems in identifying which ecofriendly practices or expertise to embrace, as well as determining how to justify and realise their economic advantages, represent the uncertainties that face green innovation. The use of hierarchical instruments such as pyramid, info sharing, and cooperation aids in the reduction of such reservations (Galbraith 1973; Wong, Boon-itt, and Wong 2011).

Categorized instruments such as pyramid, info sharing, incorporated management systems, and objective configurations, GSCCII may stimulate green innovation. GSCCII combines professional and ecofriendly organization tactics to capitalize in green invention by clarifying strategic options. Information interchange generates knowledge on environmental technology. IMS (Margerum and Born 2000) and green invention in strategy, obtaining, processes, packing, and logistics may be driven by classified categorized tools (Ettlie and Reza 1992). (Shrivastava 1995). Such categorized tools boost internal info handling capability, allowing manufactured goods scheme action to be line up to produce items that permit for superior valuing, rate competence, and eco-competence; obtaining as well as processes to attain rate lessening through rate and left-over bargain creativities (Mentzer et al. 2001); and packing scheme and logistics actions to remain reformed in order to permit reprocessing as well as lessen carbon discharges. As a result, we propose:

H3: GSCC Internal Integration is positively associated with GSCC Innovation.

By increasing information processing capability, hierarchical between GSCI and GCI helps decrease tactical ambiguity. SC hierarchical may be thought of as SC info processing and combined clarification techniques to minimize ambiguity, since it improves the ability of SC participants to read between the lines (Yu et al. 2019, 789). GSCCII makes practice of a variety of info processing processes. The interchange of info with dealers on objectives, duties, policies, profits, finest practices, and presentation criteria yields new information (Lai and Wong 2012; Rao 2002). To recycle expired items or modules, info interchange, systematizes, and incorporates closed-loop procedures and related ecofriendly forecasting and presentation organization with dealers (Bowen et al. 2001; Kleindorfer, Singhal, and Wassenhove 2005; Montabon, Sroufe, and Narasimhan 2007). Supplier assistance offers suppliers with support and information (Hu and Hsu 2010; Rao 2002; Wong et al. 2012) and assists dealers in becoming extra price effective via energy and reserve investments (Grant, Trautrims, and Wong 2017). Joint goal-setting and problem-solving are driven by upstream collaborative instruments (Vachon and Klassen 2008). Team work, particularly through minor dealers (Srivastava and Gnyawali 2011), assists in acquiring technical skills from a variety of sources (Lee and Klassen 2008). Supplier's info processing capability improves, they may be able to supply greener raw supplies and first-hand expertise in order to help them green their green manufactured goods strategy, obtaining, processes, and logistical actions.

H4: GSCC Supplier Integration mediates the relationship between GSCC Internal Integration and GSCC Innovation.

GSCCII employs similar hierarchical strategies to boost info processing capability intended for accepting downstream marketplaces. GSCCII include communicating with customers on environmental objectives, practices, and strategies, cleaner manufacturing technologies, and manufactured goods lifecycle effect (Darnall, Jolley, and Handfield 2008; Vachon and Klassen 2008; Wang, Chen, and Song 2018; Zhu et al. 2008). Consumers develop additional awareness of the issues and backing the struggles of such practical providers, resulting in stronger and longer customer relationships (Dyer and Singh 1998). GSCCII manages customer message and team work. Collaboration by consumers develops reciprocal environmental obligations and collaboratively attains ecofriendly objectives (Lee, Kim, and Choi 2012; Vachon and Klassen 2008; Zhu et al. 2008). GSCCII employs marketplace hierarchical processes to provide customers with more ecologically friendly goods (Ettlie and Reza 1992). Team work encourages the exchange of ecofriendly effect info and ecofriendly concerns, as well as the formulation of cooperative choices to reduce ecofriendly influence (Vachon and Klassen 2008; Wong, Wong, and Boon-itt 2015). Team work plus exchange of info aid in the coordination of closed-loop procedures and logistics preparation processes. Enlarged info volume aids in identifying then influencing client demands, and new information may improve green manufactured goods strategy, packing, and logistical activities.

H5: SC Customer Integration mediates the relationship between SC Internal Integration and SC Innovation.

2.5.3. Relationships among BDAC dimensions

With this goal in mind, we conducted a literature study to identify all of the elements that might influence this connection and, ultimately, business performance. Furthermore, we believe that by being assisted by pertinent variables, we may add to the literature on supply chain integration. As a result, we intend to investigate whether the alignment of BDAC influences level of acceptance and efficacy of SCI in GSC, building on the firm link among BDAC and operational integration. Gualandris et al. (2014) affirmed in order to improve innovation, executive's obligation is to assess the atmosphere of suppliers as well as the effective team work among them. The importance of SCM in GSC cannot be overstated. Handling a worldwide marketing network with several contractors necessitates extra tries to positively deal with challenges. Executives require varied info (e.g., not just diverse elements in multiple cultures, ecosystems, etc., but also great distances) to determine the best approach (Kim and Chai, 2017). As a result, they must collect and evaluate massive amounts of data. Firms must be aware of the substantially faster pace of change in the professional atmosphere, statistics, and knowledge (Su and Gargeya, 2012). A variety of technologies have been developed to facilitate business-to-business interactions through improved information exchange, communication, and cooperation (Subramani, 2004). Managers may improve all of these unequal relationships and data within and outside of a corporation by utilizing information technology via supply chains (Subramani, 2004). Taking everything into account, the second hypothesis is stated:

H6: Big Data Analytics Capability moderates the relationship SC Internal Integration and SC Supplier Integration.
H7: Big Data Analytics Capability moderates the relationship SC Internal Integration and SC Customer Integration.

Rendering to Haensel and Hofmann (2018), info sharing (e.g., regarding contractors, purchasing objectives, facilities, goods, and so on) is a critical component of the purchase process. In reality, info and expertise show a significant part in discovering first-hand possibilities plus sources (Cantwell and Zaman, 2018). Corporations get large amount of info from all available sources, which necessitates the development of appropriate analytical management abilities and tools for use in conclusion-building processes (Gandomi and Haider, 2015). For the reason that of the unstable industry climate, businesses' need to take the greatest excellence in their goods while procuring abroad, Bagul and Mukherjee (2019), efficient synchronization across diverse portions of a chain may cut expenses and improve overall innovation performance. This collaboration in procuring methods comprises the incorporation of info and various measures and processes, as well as increased openness, calculation, and combined preparation (Bagul and Mukherjee, 2019). The transition from efficient SC to global operations necessitates relative internal and external supervision, as well as the coordination of viewpoints based on supply chain architecture, personnel, and manufacturing location. In-house (e.g., team work across product design, procuring, manufacture, transactions, and circulation functions) and outside (e.g., team work across suppliers and customers) incorporation assists businesses in sharing strategic info by increasing clarity and efficiency in preparation and manufactured goods development (Wong et al., 2011; Prajogo and Olhager, 2012). Gualandris et al. (2014), on the other hand, have recently demonstrated that these various courses should be well-incorporated inside a firm or across organizations. The prevalent incorporation, which includes combining info technologies and statistics streams from several sources, helps businesses to respond efficiently (Frohlich and Westbrook, 2001; Golini et al., 2017). To be utilized realistically, strategic track down necessitates dealer managing and well-incorporated statistics across the SC. Between these two points, SCM is in charge of SC tasks such as effective incorporation and management (Copacino, 1997; Lambert and Cooper, 2000; Lambert et al., 1998).

Implementing sourcing techniques that include operational info sharing with appropriate suppliers would be reflected in the SCM process (Gualandris et al., 2014). In accordance with the above considerations, we develop the research hypothesis as follows:

H8: Big Data Analytics Capability moderates the relationship SC Internal Integration and SC Innovation.

CHAPTER 3: RESEARCH METHODOLOGY

Research methodology

Research is defined as an effort to explain GSC in a methodical manner in order to add to new knowledge and make a major contribution (Saunders et al., 2016). Research provides explanations in the form of logical linkages rather than a simple recounting of views. It is rigorously carried out to add to current information by following a concise research methodology, which is defined as a theory for doing research (Saunders and Rojon, 2014).

The study title, research questions, and available resources define the essential drivers for choosing the best research approach. As a result, detailing the procedures used to gather data and evaluate it methodically is critical in order to find answers to research questions and achieve the study's objectives (Saunders et al., 2016). The present study used a research design protocol to operationalize data collecting techniques and used a positivist approach to examine individual respondents' attitudes and actions.

3.1 Population

The frame denotes a list of units including name of personnel, households, along with businesses that take part in the survey population. It points to coverage of a target population and data collection choice. In statistics, population frame provides the basic frame or source from which sample is drawn.

Five-point Likert scale ranging one to five strongly disagree, 2 as disagree, 3 as neutral, 4 as agree and 5 being strongly agree were employed.

3.2 Rationale of employing Likert scale

With categories of five replies, the rationale for using a Likert scale for the present study reflects a neutral mid-point. This approach focuses on the collection of replies to the supplied statements to determine the participants' attitudes. Furthermore, it produces higher-quality data that is simple to grade and administer. Furthermore, on a five-point Likert scale, the answer rate is unaffected (Sobedi, 2016).

3.3 Sample selection

According to Blumberg, Bramlett, and Kogan (2013), sample selection is based on the study needs, goals, and financial constraints. To create the best sample selection, a researcher must choose one of the two sampling techniques at this point of the study process. For a researcher, there are two sampling approaches available: probability sampling, which ensures that each participant in the population is given a chance, and non-probability sampling, which does not. Because the present research is quantitative in nature, and the emphasis was on picking easily and readily accessible materials, this study sought to use a non-probability-based sample methodology that depended on convenient sampling. Personnel from the supply chain department who have worked or are now working in the supply chain department were chosen as a sample. The sample was chosen at random, with each member having an equal chance of being chosen on an odds basis (Blumberg, et al., 2013). After inputting the population number, the population frame was established based on the sample size determined using the Rao soft calculator.

A population of 350 potential responders was selected from two organizations' supply chain professionals, with a sample size of 135 chosen as a representative sample. The response rate was still around 90%. The choice is based on Loehlin's (2000) results, which show that a sample size of 100-200 people may be maintained if the model comprises two to four variables. Furthermore, a sufficient sample size from Supply Chain-related people is likely to be sufficient to provide a representative sample. This step of the research process, according to Pérez (2016), allows a researcher to make modifications to the sample size for data collecting and analysis. In the population, the suggested calculation for an optimal sample selection should be roughly 5% or slightly higher (Blumberg et al., 2013). This comprises data from both the open field and the target sample (Pérez, 2016).

3.4 Unit of analysis

Experienced personnel of supply chain departments of Manufacturing Industry of Pakistan covering Islamabad, Faisalabad, Sialkot, Gujrat and Gujranwala are the unit of analysis. Respondents were contacted through personal contacts, SECP database and Chambers of Commerce of respective cities.

3.5 Type of study

The type of study remained correlational in which effect of independent variable (Green SC Internal Integration) was observed on dependent variable (Green SC Innovation) selected for the study.

3.6 Time horizon

In a research context, there are two sorts of temporal dimensions that interact with the study participants. The first is known as cross sectional, in which data is collected at a single point in time, and the second is known as longitudinal mode of time dimension. The present study, on the other hand, will use a cross-sectional time dimension method, justifying its existence as a rudimentary snapshot, logical flow of variables in temporal order to get the participants' impressions (Saunders et al., 2016).

3.7 Researcher' strength

A researcher' backend and frontend knowledge on the area under investigation primarily serves as a researcher strength.

3.8 Instrument development/selection

As the survey was carried out as an integral part of degree program to research the role Green SC Internal Integration and Green SC Innovation) having an impact of Big Data Analytics Capability, the study employed a web-based online survey through adapting a self-administered questionnaires on account of its versatility, swiftness as well as cost effectiveness.

During the progression of instrument development, adaption of a structured questionnaire was undertaken to get targeted responses from SC people (managers and non-managers) and get their opinions on Big Data Analytics Capability as a result of Green SC Internal Integration and Green SC Innovation in the manufacturing industry of Pakistan.

Chee Yew Wong, Christina W.Y. Wong & Sakun Boon-itt (2020): Effects of green supply chain integration and green innovation on environmental and cost performance, International Journal of Production Research.

Santanu Mandal, (2018) "The influence of big data analytics management capabilities on supply chain preparedness, alertness and agility: An empirical investigation", Information Technology & People.

Wamba, Samuel Fosso; Gunasekaran, Angappa; Akter, Shahriar; Ren, Steven Ji-fan; Dubey, Rameshwar; Childe, Stephen J. (2016). Big data analytics and firm performance: Effects of dynamic capabilities. Journal of Business Research,

3.9 Data collection procedures

As stated earlier, quantitative method grounded in positivist paradigm was followed to collect and analyze new data. The key data collection practically advanced through sampling participation and distribution of surveys via online for analyzing data at the next stage of the research process. Prior to this stage, as already narrated in section 4.3, an adequate sample size was determined in a scientific manner by employing Rao soft calculator available online and keeping in view of target population.

A quantitative based data collection method was followed as the survey approach to collect pertinent data on the impact/effectiveness of Green SC Internal Integration and Green SC Innovation with the moderation variable Big Data Analytics Capability. Rationale of following quantitative method was due to its specialty to cover wide population and quantification of the variables through their variability (Tait, Voepel, Zikmund & Fagerlin, 2010).

3.10 Data analysis techniques

SPSS version 26.0 will be deployed as the main statistical software for analyzing the preliminary data by conducting data screening to identify the outliers or any missing data in order to make sure that data under analysis is accurate. Moreover, data cleaning is imperative to get the response rate. The results acquired through the scale as well as population, assessing reliability & validity, hypothesis testing as well as further discussion are made as a part of data analysis. Hair, Black, Babin, and Anderson, (2010) cited Gorsuch (1983) that endorsed five respondents minimum for each construct with exceeding 100 participants for each data analysis.

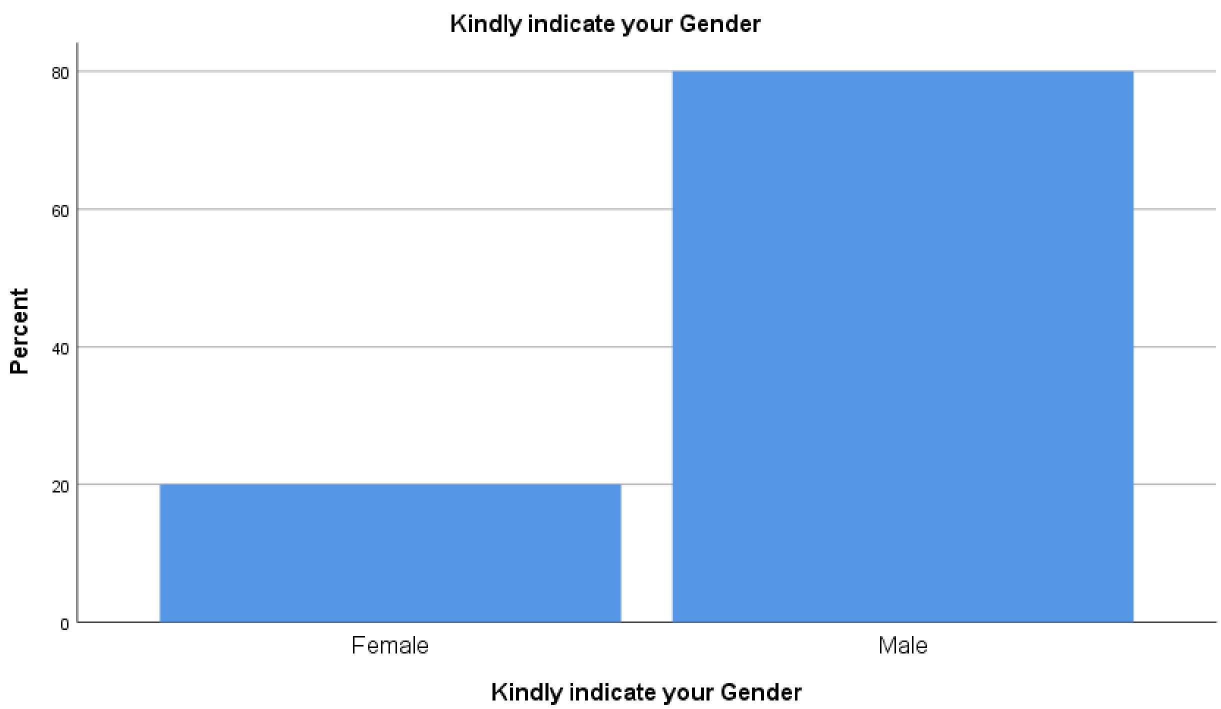
CHAPTER 4: DATA ANALYSIS & INTERPRETATION

4.1 Demographic Statistics

Kindly indicate your Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	58	20.0	20.0	20.0
	Male	232	80.0	80.0	100.0
	Total	290	100.0	100.0	

Table 1

The results shown in Table 1 illustrates 290 participants in which 80% were male and 20% were female. The graphical representation of the results is given as under:



Graph 1

How much experience do you have of supply chain in any company?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 5 years	203	70.0	70.0	70.0
	6 - 10 years	73	25.2	25.2	95.2
	Over 10 years	14	4.8	4.8	100.0
	Total	290	100.0	100.0	

Table 2

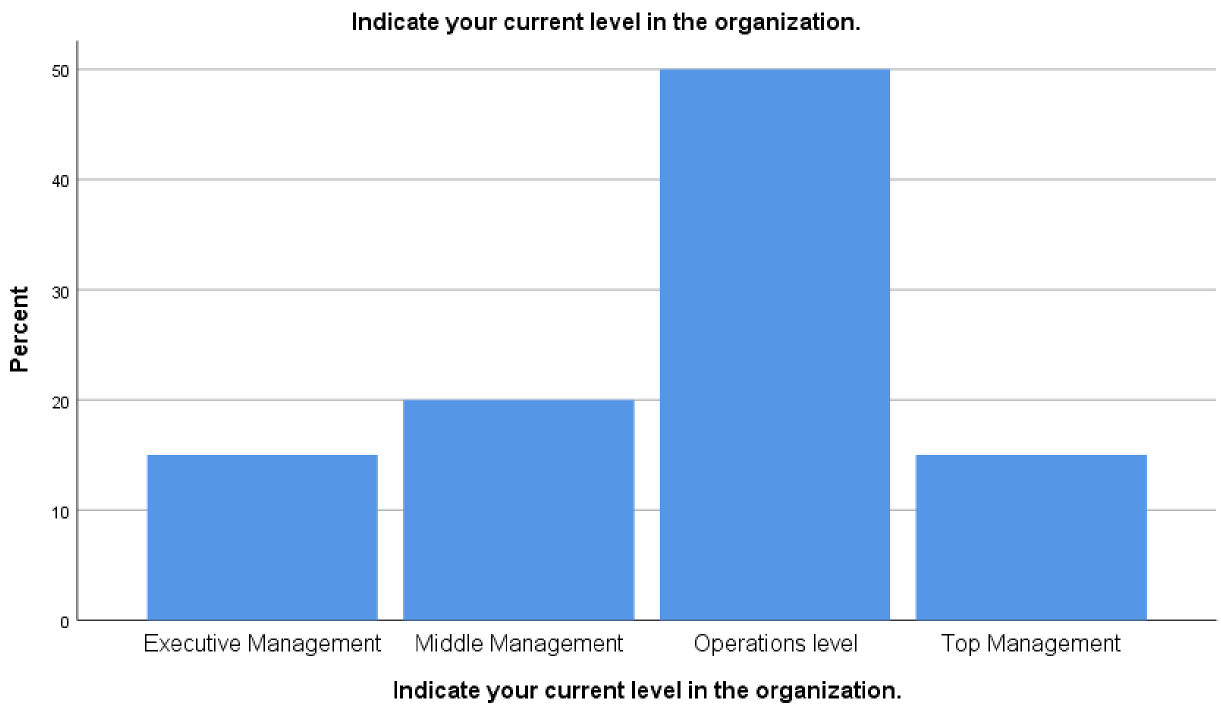
The results reflected in Table 2 presents participants of three work experience groups in which 203 personnel (70%) from 0-05 years of experience, 73 personnel (25.2%) from 06-10 years of experience and 14 personnel (4.8%) from over 10 years of experience. The graphical representation of these results is given as under:

Graph 2

Indicate your current level in the organization.					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Executive Management	43	14.8	14.8	14.8
	Middle Management	58	20.0	20.0	34.8
	Operations level	145	50.0	50.0	84.8
	Top Management	44	15.2	15.2	100.0
	Total	290	100.0	100.0	

Table 3

The results reflected in Table 3 presents participants of four organizational level groups in which 43 personnel (14.8%) working as executive management, 58 personnel (20%) working as middle management, 145 personnel (50%) working as operational level and 44 personnel (15.2%) working as top management. The graphical representation of these results is given as under:

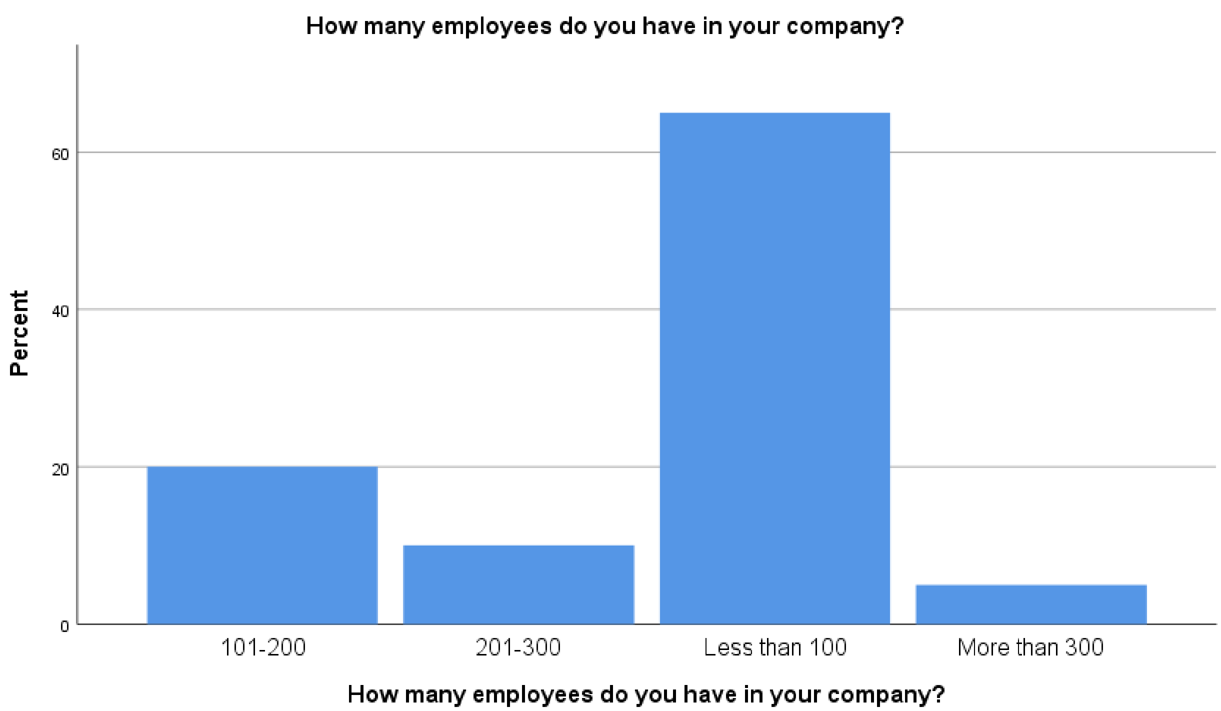


Graph 3

How many employees do you have in your company?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	101-200	58	20.0	20.0	20.0
	201-300	29	10.0	10.0	30.0
	Less than 100	188	64.8	64.8	94.8
	More than 300	15	5.2	5.2	100.0
	Total	290	100.0	100.0	

Table 4

The results reflected in Table 4 presents participants of four organizational size groups in which 58 personnel (20%) working in 101-200 employee size company, 29 personnel (10%) working in 201-300 employee size company, 188 personnel (64.8%) working in less than 100 employee size company and 15 personnel (5.2%) working in more than 300 employee size company. The graphical representation of these results is given as under:



Graph 4

What is your qualification level?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Doctorate	14	4.8	4.8	4.8
	Graduation	220	75.9	75.9	80.7
	Intermediate	42	14.5	14.5	95.2
	Post-Graduation	14	4.8	4.8	100.0
	Total	290	100.0	100.0	

Table 5

The results reflected in Table 5 presents participants of four qualification size groups in which 14 personnel (4.8%) are doctorate, 220 personnel (75.9%) are graduates, 42 personnel (14.5%) are intermediate and 14 personnel (4.8%) are post-graduate. The graphical representation of these results is given as under:

Graph 5

4.2 Descriptive Statistics

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Green Supply Chain Internal Integration	290	1	5	3.5864	0.3751
Supply Chain Supplier Integration	290	1	5	3.5860	0.3833
Supply chain Customer Integration	290	1	5	3.5800	0.3921
Green Supply Chain Innovation	290	1	5	3.5738	0.3875
Big Data Analytics Capability	290	1	5	3.5860	0.3710
Valid N (listwise)	290				

Table 6

The results shown in the above table are based on descriptive statistics of different variables. Green Supply Chain Internal Integration reflects high mean value at 3.5864 with SD 0.3751 while Green Supply Chain Innovation gets low mean value at 3.5738 with SD 0.3875. This indicates that Green Supply Chain Innovation requires additional support of Supply Chain Supplier Integration, Supply Chain Customer Integration and the use of Big Data Analytics Capability in order to cover the is the lag that needs to be addressed.

4.3 Reliability Statistics

Reliability Statistics		
Constructs	No. of Items	Cronbach's Alpha
Green Supply Chain Internal Integration	15	0.861
Supply Chain Supplier Integration	20	0.896
Supply chain Customer Integration	14	0.860
Green Supply Chain Innovation	27	0.927
Big Data Analytics Capability	27	0.920

Table 7

The results expressed in the above table reflect the internal reliability of all constituting elements. Big Data Analytics Capability got high reliability value at 0.920 comparing with other variables; however, Green Supply Chain Innovation gotten highest value at 0.927. The said findings are in line with that presented by Sekaran (2003) that holds <0.60 a poor reliability value, 0.70 to <0.8 an acceptable range while >0.80 and above considered very good and = 0.9 excellent.

4.4 Correlations

Correlations						
		Green SC Internal Integration	SC Supplier Integration	SC Customer Integration	Green SC Innovation	Big Data Analytics Capability
Green SC Internal Integration	**Pearson Correlation**	1				
SC Supplier Integration	**Pearson Correlation**	.876**	1			
SC Customer Integration	**Pearson Correlation**	.860**	.878**	1		
Green SC Innovation	**Pearson Correlation**	.890**	.899**	.899**	1	
Big Data Analytics Capability	**Pearson Correlation**	.895**	.903**	.909**	.926**	1

**. Correlation is significant at the 0.01 level (2-tailed).

Results shown in the above table are about correlation analysis; the rationale of application of correlation test provides whether strength of relationship exists among the variables; that is indicative of presence of linear relationship among variables. The results given above express linear correlation in nature.

All the variables carry positive and significant correlation with each other.

4.5 Normally Distributed Data

Statistics						
		GSCII	**GSCSI**	**GSCCI**	**GSCI**	**BDAC**
N	**Valid**	290	290	290	290	290
	Missing	0	0	0	0	0
Skewness		1.060	1.021	0.943	0.991	1.285
Std. Error of Skewness		0.143	0.143	0.143	0.143	0.143
Kurtosis		2.460	2.488	2.931	2.992	2.734
Std. Error of Kurtosis		0.285	0.285	0.285	0.285	0.285

Table 9

Results shown in the above table are about normally distributed data; the rationale of application of normally distributed data test provides Skewness and Kurtosis exists among the variables. As per the results above the variables are skeweness=0 distributions, whereas, all the variable are in negative distribution (Kurtosis). The results given above express linear correlation in nature.

4.6 Regression Analysis

<u>Relationship between Green SC Internal Integration and Green SC Supplier Integration</u>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	0.375	0.105		3.585	0.000
	Green SC Internal Integration	0.895	0.029	0.876	30.818	0.000
a. Dependent Variable: Green SC Supplier Integration						
b. R^2=0.767, F=949.731, *P<0.001						

Results delineated in the above Table indicates that regression coefficient values at Beta value=0.375, t=3.585, F= 949.731 at *p* value .000 highlights the association of correlation Green SC Internal Integration and Green SC Supplier Integration while R^2 value at 0.767 indicates variation in single element in Green SC Internal Integration effects Green SC Supplier Integration to the extent of 76%. F value at 949.731 indicates model fit.

<u>Relationship between Green SC Internal Integration and Green SC Customer Integration.</u>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	0.356	0.113		3.144	0.002
	Green SC Internal Integration	0.899	0.031	0.860	28.597	0.000
a. Dependent Variable: Green SC Customer Integration						
b. R^2=0.74, F=817.805, *P<0.001						

Results delineated in the above Table indicates that regression coefficient values at Beta value=0.356, t=3.144, F= 817.805 at *p* value .002 highlights the association of correlation Green SC Internal Integration and Green SC Supplier Integration while R^2 value at 0.74 indicates variation in single element in Green SC Internal Integration effects Green SC Customer Integration to the extent of 74%. F value at 817.805 indicates model fit.

<u>Relationship between Green SC Internal Integration and Green SC Innovation.</u>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
	(Constant)	0.276	0.100		2.757	0.006
	Green SC Internal Integration	0.920	0.028	0.890	33.172	0.000
a. Dependent Variable: Green SC Innovation						
b. R^2=0.793, F=1100.350, *P<0.001						

Results delineated in the above Table indicates that regression coefficient values at Beta value=0.276, t=2.757, F= 1100.350 at *p* value .006 highlights the association of correlation Green SC Internal Integration and Green SC Supplier Integration while R^2 value at 0.793 indicates variation in single element in Green SC Internal Integration effects Green SC Innovation to the extent of 79%. F value at 1100.350 indicates model fit.

<u>Relationship between Green SC Internal Integration and Green SC Innovation with Mediation of Green SC Supplier Integration</u>

Total Effect of X on Y					
Effect	**se**	**t**	**p**	**LLCI**	**ULCI**
.9196	.0277	33.1715	.0000	.8651	.9742

Direct Effect of X on Y					
Effect	**se**	**t**	**p**	**LLCI**	**ULCI**
.4563	.0484	9.4332	.0000	.3611	.515

Indirect Effect(s) of X on Y				
	Effect	BootSE	BootLLCI	BootULCI
GSCSI	.4633	.0498	.3686	.5621

Results delineated in the above Tables indicates that direct regression relationship coefficients of Green SC Internal Integration and Green SC Innovation values of LLCI= 0.3611 and ULCI= 0.5515 are ≠ 0 and the indirect regression relationship coefficients of Green SC Internal Integration and Green SC Innovation with the mediating effect of Green SC Supplier Integration values of LLCI= 0.3686 and ULCI= 0.5621 are ≠ 0, which indicates a significant effects between the Green SC Internal Integration and Green SC Innovation thus satisfying this hypothesis.

<u>Relationship between Green SC Internal Integration and Green SC Innovation with Mediation of Green SC Customer Integration</u>

Total Effect of X on Y					
Effect	**se**	**t**	**p**	**LLCI**	**ULCI**
.9196	.0277	33.1715	.0000	.8651	.9742

Direct Effect of X on Y					
Effect	**se**	**t**	**p**	**LLCI**	**ULCI**
.4640	.0445	10.4187	.0000	.3763	.5516

Indirect Effect(s) of X on Y				
	Effect	BootSE	BootLLCI	BootULCI
GSCSI	.4557	.0474	.3630	.5513

Results delineated in the above Tables indicates that direct regression relationship coefficients of Green SC Internal Integration and Green SC Innovation values of LLCI= 0.3763 and ULCI= 0.5516 are ≠ 0 and the indirect regression relationship coefficients of Green SC Internal Integration and Green SC Innovation with the mediating effect of Green SC Customer Integration values of LLCI= 0.3630 and ULCI= 0.5513 are ≠ 0, which indicates a significant effects between the Green SC Internal Integration and Green SC Innovation thus satisfying this hypothesis.

Relationship between Green SC Internal Integration and Green SC Supplier Integration with Moderation of Big Data Analytics Capability

Model Summary						
R	**R-SQ**	**MSE**	**F**	**df1**	**df2**	**p**
0.9159	0.8389	0.0239	496.3921	3.0000	286.0000	0.0000

Model

	coeff	se	t	p	LLCI	ULCI
Constant	.8629	.5786	1.4913	.1370	-.2760	2.0019
GSCII	.1600	.1563	1.0239	.3067	-.1476	.4676
BDAC	.4136	.1657	2.4958	.0131	.0874	.7397
Int_1	.0513	.0396	2.5554	.0040	-.0267	-.1293

Results delineated in the above Tables indicates that direct regression relationship coefficients of Green SC Internal Integration and Green SC Supplier Integration with the moderating effect of Big Data Analytics Capability values of LLCI= -0.0267 and ULCI= -0.1293 are not with the same sign, which indicates no effects between the Green SC Internal Integration and Green SC Supplier Integration because of moderator, thus satisfying this hypothesis.

Relationship between Green SC Internal Integration and Green SC Customer Integration with Moderation of Big Data Analytics Capability

Model Summary						
R	**R-SQ**	**MSE**	**F**	**df1**	**df2**	**p**
0.9151	0.8375	0.0253	491.2300	3.0000	286.0000	0.0000

Model						
	coeff	se	t	p	LLCI	ULCI
Constant	3.5767	.0106	337.0629	.0000	3.5558	3.5975
GSCII	.2398	.0561	4.2753	.0000	.1294	.3502
BDAC	.7311	.0584	12.5216	.0000	.6161	.8460
Int_1	.0273	.0407	53.3335	.0000	-.0528	-.1074

Results delineated in the above Tables indicates that direct regression relationship coefficients of Green SC Internal Integration and Green SC Customer Integration with the moderating effect of Big Data Analytics Capability values of LLCI= -0.0528 and ULCI= -0.1074 are ≠ 0, which indicates a significant effect between the Green SC Internal Integration and Green SC Customer Integration, thus satisfying this hypothesis.

Relationship between Green SC Internal Integration and Green SC Innovation with Moderation of Big Data Analytics Capability

Model Summary						
R	**R-SQ**	**MSE**	**F**	**df1**	**df2**	**p**
0.9361	0.8763	0.0188	675.1174	3.0000	286.0000	0.0000

Model						
	coeff	se	t	p	LLCI	ULCI
Constant	3.5718	.0092	390.3370	.0000	3.5538	3.5898
GSCII	.3179	.0484	6.5729	.0000	.2227	.4131
BDAC	.6716	.0503	13.3396	.0000	.5725	.7707
Int_1	.0164	.0351	87.6798	.0000	-.0526	-.0855

Results delineated in the above Tables indicates that direct regression relationship coefficients of Green SC Internal Integration and Green SC Innovation with the moderating effect of Big Data Analytics Capability values of LLCI= -0.0526 and ULCI= -0.0855 are ≠

0, which indicates a significant effect between the Green SC Internal Integration and Green SC Innovation, thus satisfying this hypothesis.

4.7 Hypothesis Testing

Hypothesis Testing					
	Hypothesis	**R-sq**	**t-Value**	**P-Value**	**Decisions**
H1	Green SC Internal Integration is positively associated with Green SC Supplier Integration.	0.767	30.818	0.000	Supported
H2	Green SC Internal Integration is positively associated with Green SC Customer Integration.	0.74	28.597	0.000	Supported
H3	Green SC Internal Integration is positively associated with Green SC Innovation.	0.793	33.172	0.000	Supported
H4	Green SC Supplier Integration mediates the relationship between Green SC Internal Integration and Green SC Innovation.	0.7673	33.1715	0.000	Supported
H5	Green SC Customer Integration mediates the relationship between Green SC Internal Integration and Green SC Innovation.	0.7396	28.5973	0.000	Supported
H6	Big Data Analytics Capability moderates the relationship Green SC Internal Integration and Green SC Supplier Integration.	0.8389	2.5554	0.004	Supported
H7	Big Data Analytics Capability moderates the relationship Green SC Internal Integration and Green SC Customer Integration.	0.8375	53.5335	0.000	Supported
H8	Big Data Analytics Capability moderates the relationship Green SC Internal Integration and Green SC Innovation.	0.8763	87.6798	0.000	Supported

Table 9

The results expressed in the above table indicates that the test analyses include Root Square Value, t-Value and *P*-Value indicate the presence of significant and positive relationship at significant *p* values 0.000; these lead to support that all hypotheses stand accepted.

CHAPTER 5: CONCLUSION

5.1 Discussion

Drawn on the pertinent literature on Green SC Internal Integration, this research worked on to seek improvement in the Green SC Innovation using Big Data Analytics with Green SC Supplier Integration and Green SC Customer Integration through robust testing in the light of formulations of the resource-based view (RBV). Big Data Analytics Capabilities were modelled as an extra resource for the business firms. Thus, the association of Big Data Analytics Capabilities with Green SC Innovation was grounded in the RBV. Precisely, the Big Data Analytics Capabilities enabled to simplify the available resources from inside and out of the jurisdictional boundary of the firms.

The results specify that the Big Data Analytics Capabilities better able to attain efficiency in supply chain network to enhance Green SC Innovation in terms of quality, cost, and delivery performance that positively affects firm sustainability in terms of financial, environmental as well as social sustainability. Furthermore, the study resorted to explore the impact of Big Data Analytics Capabilities adopting strategy on Green SC Innovation and reveals that Big Data Analytics Capabilities effects performances positively. The emerging Big Data Analytics Capabilities has not only brought revolution in the domain of supply chain in the world of supply chain in itself but left a significant effect on business applications (Attaran, 2017). It seems that the Big Data Analytics Capabilities applications was least investigated academically to examine its effects on Green SC Innovation (Schoenherr and Speier-Pero, 2015). This study therefore studies whether Big Data Analytics Capabilities on partnering with supply chain can deliver the required performance.

Results based on cross-sectional data propose that Big Data Analytics Capabilities adopting enables suppliers and customers with internal functions to develop integration amid their processes efficiently. This directly influences Green SC Innovation. The study sets out to seek empirical evidence on how Big Data Analytics Capabilities influences performance and innovation of the supply chains as well as the firm. This further display that a rise in performance and innovation of supply chain has positive linkage with significant rise in organization innovation. Entire the eight hypotheses find support in a positive and significant mode. The magnitude as well as substantial path coefficients prove an added support to the research model.

Information exchange, cooperation, and closed-loop process connections are some of the strategies that GSCCI use with dealers (Flynn, Huo, and Zhao 2010; Wong, Wong, and Boon-itt 2015). Partnership with suppliers are emphasized in order to cooperatively solve ecofriendly challenges. A focus business aids suppliers that seek technical and financial assistance through GSCI. To allow strategic info sharing, cooperation, and closed-loop procedure connections with consumers, GSCCCI depends on inter-organizational incorporation tools such as info interchange and partnership (Flynn, Huo, and Zhao 2010; Wong, Wong, and Boon-itt 2015). Info sharing and team work provide fresh data for associates to comprehend, so boosting the ability of both GSCCSI and GSCCI in a SC to handle data (Yu et al. 2019).

Previous research has assumed that the three GSCCCI factors have similar influence on operative and economic presentation results (e.g. Setyadi 2019; Song, Cai, and Feng 2017; Wu 2013; Yu et al. 2014). Three GSCCCI dimensions provide varied information processing from an OIPT standpoint, and hence may balance each other to further boost info processing capability. Incorporation of processes and advertising departments may result in fresh insights that can be used to inform customer hierarchical. GSCCII is favorably related to GSCCSI and GSCCCI, according to Wong, Wong, and Boon-itt (2018). Such outcomes implies to GSCCII may help GSCCSI and GSCCCI by providing more information capacity. It implies that the GSCCII aspects collaborate in some way to provide the information processing capability needed to mitigate the risks related with green manufactured goods and procedure improvement.

By adopting Big Data Analytics Capabilities, one can get a score of functional advantages in face of traditional ICT related SCI for achieving better operational efficiency in the fields of inventory sharing, order status, tracking, demand forecasting, induction of latest software and hardware, robust data accessibility along with data networks (Jede and Teuteberg, 2015).

5.2 Conclusion

The main objective of this research was to evaluate the role of Big Data Analytics Capabilities on performances of Green SC Innovation in an organization using the Green Customer and Supplier Integrations. Importance of Big Data Analytics Capabilities is acknowledged for business organizations; the phenomenon was less explored with regard to supply chain innovation of the business organizations; hence needs empirical verification. Results indicate that Big Data Analytics Capabilities services positively impacts supply chain innovations. Further impacts the financial and marketing performances of the organization. Results of this study mainly add to the current literature on the relationship amid Big Data Analytics Capabilities and Green Supply chain and organizational integrations and performances.

This study seeks to offer new information at the juncture of green SC and organizational performance. Furthermore, respondents observed that Big Data Analytics Capabilities has the potential to assist enterprises for achieving high quality Data services without investing much on on-premises platform.

5.3 Managerial implications

Under the aegis of digital age, business organizations feel the need to seek ways for controlling their cost efficiency to upsurge overall performance. FindinGSC drawn by this research study accentuates that Big Data Analytics Capabilities impacts positively on green supply chain innovation (GSCCI), progressive business organizations ought to implement Big Data Analytics Capabilities, which proves a cost-efficient way to integrate the business processes to bring improvement in GSCCI (Wamba et al., 2015).

The current work has undertaken an empirical verification to observe the influence of Big Data Analytics Capabilities on GSCCI leaving much implications for managerial and non-managerial staff to grasp understanding on the positive interaction amid Big Data Analytics Capabilities and GSCCI. The enhanced understanding can enable managerial and non-managerial staff to develop optimal strategies in order to differentiate and streamline supply chain operations.

5.4 Practical implications

Diagnosing the potential benefits associated with Big Data Analytics Capabilities technologies as reported by this study, it is incumbent upon retail managers to comprehend the high order significance of supply chain that needs support from Big Data Analytics Capabilities technology for improving SC performance eventually effects organizational performance. This study retorts to fill the gap in literature by offering conceptualization of the different dimensions of supply chain innovation and organization performance in context of Big Data Analytics Capabilities technologies.

5.5 Limitations and future research

Although the current work aims to generate an insights of a significant dimension of Big Data Analytics Capabilities and organizational innovation, the initial limitations were faced on account of sample size as well as nature of location. Future research may work with more increase in sample size. As the study was conducted in Pakistan where application of Big Data Analytics Capabilities could not be explored easily, so realizing its potential, the results were abound to deliver perceived usefulness of the technology. The current research was delimited to observe the effects of Big Data Analytics Capabilities on green supply chain innovation; future research may identify some other aspects of supply chain resilience and explore Big Data Analytics Capabilities system for its analytical potential to evaluate large data sets through Big Data Analytics Capabilities as well as predictive capability of larger data analytics.

We feel that survey research has its own set of limitations. As a result, future researchers may be able to use case-based methodologies to solve certain outstanding problems. Finally, our research sample's demographics may restrict the generalizability of our finding GSC. As a result, the research finding GSC should be taken with caution in different circumstances.

We recognize that any study that employs a survey-based technique frequently confronts a generalizability problem. It is quite difficult to obtain a sample that can legitimately claim to be representative of the entire population. Nonetheless, additional study should be undertaken over a longer period of time with samples from various businesses, countries, and informants with varied backgrounds.

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APPENDIX A

A1. QUESTIONNAIRE

DEMOGRAPHICS

- Kindly indicate your Gender.
- How much experience do you have of supply chain in any company?
- Indicate your current level in the organization.
- How many employees do you have in your company?
- What is your qualification level?

GREEN SUPPLY CHAIN INTERNAL INTEGRATION

II-1: Integrated Performance and business

- Integrate responsibility in business strategy.
- Establish business strategy based on the balance between commercial and performance goals.
- Establish a unified performance and business strategy.
- Establish business strategy which reward top management based on successful achievement of performance goals.

II-2: Internal integrated performance management system

- Performance management system integrates performance responsibility into employee codes of conduct
- Performance management system includes performance criteria into commercial decisions
- Performance management system integrates performance criteria into resource management decisions
- Integrate performance, quality and other standards into one management systems
- Performance management system based on life-cycle approach

- Performance management system supported by an integrated information system

II-3: Cross-functional collaboration for performance management

- All functions cooperate to achieve performance goals collectively
- Develop mutual understanding of performance responsibilities among functions
- All functions work with each other to reduce performance impacts
- All functions jointly plan to resolve performance-related problems
- All functions jointly make decisions about ways to reduce overall performance impacts

Reference:

Chee Yew Wong, Christina W.Y. Wong & Sakun Boon-itt (2020): Effects of green supply chain integration and green innovation on environmental and cost performance, International Journal of Production Research.

<u>SUPPLY CHAIN SUPPLIER INTEGRATION</u>

SI-1: Exchange performance information with suppliers

- Exchange information about performance goals with suppliers
- Exchange information about performance practices with suppliers
- Exchange information about cleaner production and technologies with suppliers
- Exchange information about product performance requirements with suppliers
- Exchange information about life-cycle performance impacts of products with suppliers

SI -2: Provide performance assistance to suppliers

- Help suppliers to improve performance awareness
- Guide suppliers to establish their own performance programs
- Provide resources to help suppliers to purchase equipment for pollution prevention, wastewater and recycling
- Facilitate learning among suppliers in the same industry

- Assist suppliers to improve the performance performance of supplier processes
- Help supplier to share performance best practice information with each other

SI -3: Integrate performance management process with suppliers

- Integrate management of closed-loop return process with suppliers
- Integrate process of measuring performance impact with suppliers
- Integrate process of managing performance initiatives with suppliers
- Integrate process of managing distribution and outbound logistics planning with suppliers

SI -4: Performance collaboration with suppliers

- Cooperate with suppliers to achieve performance goals collectively
- Work with suppliers to gain mutual understanding of performance responsibilities
- Work with suppliers to reduce performance impacts
- Jointly plan with suppliers to resolve performance-related problems
- Jointly make decisions with suppliers about ways to reduce overall performance impacts

Reference:

Chee Yew Wong, Christina W.Y. Wong & Sakun Boon-itt (2020): Effects of green supply chain integration and green innovation on environmental and cost performance, International Journal of Production Research.

<u>SUPPLY CHAIN CUSTOMER INTEGRATION</u>

GCI -1: Exchange performance information with customers

- Exchange information about performance goals with customers
- Exchange information about performance practices with customers
- Exchange information about cleaner production and technologies with customers

- Exchange information about product performance requirements with customers
- Exchange information about life-cycle performance impacts of products with customers

GCI -2: Integrate performance management process with customers

- Integrate management of closed-loop return process with customers
- Integrate process of measuring performance impact with customers
- Integrate process of managing performance initiatives with customers
- Integrate process of managing distribution and outbound logistics planning with customers

GCI -3: Performance collaboration with customers

- Cooperate with customers to achieve performance goals collectively
- Work with customers to gain mutual understanding of performance responsibilities
- Work with customers to reduce performance impacts
- Jointly plan with customers to resolve performance-related problems
- Jointly make decisions with customers about ways to reduce overall performance impacts

Reference:

Chee Yew Wong, Christina W.Y. Wong & Sakun Boon-itt (2020): Effects of green supply chain integration and green innovation on environmental and cost performance, International Journal of Production Research.

GREEN SUPPLY CHAIN INNOVATION

Sourcing

- Sources non-hazardous/toxic materials
- Sources from suppliers who comply with performance regulations, e.g. REACH

- Sources performance friendly raw materials

Operations

- Controls operations process to reduce waste from all sources
- Monitors operations process to reduce waste from all sources
- Audits operations process to reduce waste from all sources
- Uses cleaner technology to reduce waste from all sources

Logistics

- Utilizes cleaner transportation modes
- Improves vehicle fill
- Careful schedule transportation routes to reduce emission
- Compact packaging the reduces space requirement

Innovation

- Designs products to reduce consumption of materials
- Designs products to reduce consumption of energy
- Designs products to reuse, recycle, and recovery

Packaging

- Recycles packaging
- Reuses packaging
- Reduces packaging

Cost-Reduction

- Cost reduction per business transaction
- Cost reduction on energy savings
- Cost reduction on waste disposal

Performance

- Reduction in hazardous/harmful materials used in manufacturing product/service delivery
- Reduction in the use of electricity
- Reduction in total fuel consumption used in transportation of products/services
- Reduction in total paper used
- Reduction in total packaging materials used
- Reduction in air emissions
- Reduction in solid waste disposal

Reference:

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BIG DATA ANALYTICS CAPABILITIES

Planning

- Innovative opportunities for the strategic use of business analytics are continuously examined in your firm.
- Adequate plans for the utilization of business analytics are implemented in your firm
- Business analytics planning processes are done in methodical ways in your firm
- Business analytics plans for better adaptation to changing conditions are adjusted in your firm

Decision-making

- Having invested in business analytics, the effect they will have on the productivity of the employees' work is evaluated in your firm.

- Having invested in business analytics, it is projected how much these options will help end-users make quicker decisions in your firm.
- Having invested in business analytics, we estimate whether they will consolidate or eliminate jobs in your firm
- Having invested in business analytics, the cost of training that end-users will need is estimated in your firm
- Having invested in business analytics, the time that managers will need to spend overseeing the change is estimated in your firm

Coordination

- Business analysts and line people meet regularly to discuss important issues in your organization
- Business analysts and line people from various departments regularly attend cross-functional meetings in your organization
- Business analysts and line people coordinate their efforts harmoniously in your organization
- Information is widely shared between business analysts and line people so that those who make decisions or perform jobs have access to all available know-how in your organization

Control and Integration

- The responsibility for analytics development is clear in your organization
- Your organization is confident that analytics project proposals are properly appraised
- Your organization constantly monitors the performance of the analytics function
- Your organization is better than competitors in connecting (e.g. communication and information sharing) parties within a business process
- Your organization is better than competitors in bringing detailed information into a business process
- Integration Information with key suppliers is shared more quickly than with your competitors in your organization

Global sourcing

- Collaborative approaches with key suppliers are developed faster than your competitors in your organization
- You join the decision-making with key suppliers more quickly than your competitors in your organization
- Integration activities across the supply chain are improved faster than your competitors in your organization
- More frequent contact with supply chain members is established than your competitors in your organization
- You have got financial outcomes and access to lower priced products from changing in sourcing direction in your firm
- You have got technological outcomes from changing in sourcing direction in your firm
- You have got more intangible resources from changing in sourcing direction in your firm
- You have got better quality control and access to higher quality goods from changing in sourcing direction in your firm

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