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# Evaluation of Big Data and Innovation Interaction in Increase Supply Chain Competencies

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## Abstract

In business today, it means a great deal to uncover meaningful relationships, patterns and trends from the huge stacks of data that are often now available. The explosion in data diversity and volume coming from enterprise content and application data, data from social media, sensor data and also data including streams from third parties is significantly changing the ways and methods of interaction for both companies and their customers. This pressure is felt considerably more in the management of innovation through trying to develop the capability to integrate the supply chain to match the correct methods with the right information. This situation has directed companies into using "big data" in managing both their structured and unstructured data. Big data, which is information, held on a vast scale, can reveal significant potential in its transparency and convenience. To bring about a balanced approach to the use of internal and external information, supporting improved capabilities to better predict future competence, and provide that all important "big picture" through business analytics can improve the vision of businesses through the provision of more in-depth information about how to best access their customers. Improved communication and information links between partners of the supply chain may create major sources of information by bringing together both internal and external resources for customers, partners, stakeholders and suppliers in managing innovation. In this study, it is aimed to provide an extensive literature review on the interaction of innovation and big data in order to increase supply chain competencies and to study the problem, obstacles and driving forces for such interactions, and to consider projections for the future through the application of technology-based methods.

**Keywords:** supply chain competence, innovation management, big data.

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## Introduction

The intense competitive pressure in today's global market environment and the ever-changing product range have driven businesses wanting a share in this market to consider alternative strategies beyond their traditional means of operation. At the core of these strategies are competitive pressures and the constantly increasing and changing demands of their customers. Customers; instead of having a traditional cost-based standard approach, are now turning to businesses that offer both innovative and customizable products matched with the highest quality of service. This orientation is not only about the speed of business movements in the market, but also their diversity and form of construction. This has become much more complicated in systems that operate the relationship between buyer and seller.

Businesses have to transform into integrated structures in order to manage these complex business processes more effectively. This transformation entails redesigning existing business processes and establishing new teams in order to manage it. Today, the characteristic features of large corporations are geographical prevalence, multiple physical locations, and matrix structures, working with third parties, and employing multiple channels simultaneously and synchronously in their customer relationships. Supply Chain Management (SCM) has strengthened its place in business applications as an increasingly important concept. In recent years, the information that businesses possess has begun to be used as a new factor in production, besides material assets such as land, capital and labor. With the impact of the Internet, Cloud Computing and Mobile Technologies, and in order to make SCM more efficient, real-time data is being integrated into the supply chain to realize the design of the structures. Communication and data center technologies form the basis of systems that can best perform these tasks.

When the data sources of companies were surveyed by Accenture in 2013, it was seen that consumer data has a share of 46%, employee data 46%, product data 42% and supplier data 23% (Accenture, 2013). With the acceleration of e-commerce and Internet usage, a new information-centric economy has emerged. The production and acquisition of this new information, as well as its use and sharing, has become a critical factor in business success. Today's information technology systems aggregate and store vast amounts of information related to the supply chain. To take advantage of this capability, businesses need to be able to transform this data into meaningful and actionable business intelligence through analytical applications (Milliken, 2015, p. 23). Organizations are investing in information systems to manage their supply chain datasets that make up "Big Data." However, it is difficult to provide this for organizations with different datasets (Issa, 2013). For this; basic processes should be devised, such as obtaining information from an enterprise, translating implicit information into individual or group information, linking information to other individuals and information, transmitting information between different groups, and generating new information useful to the enterprise. Improved communication and information links between chain members could create a central information resource that brings together all the databases of the composite businesses and provides value to the customers, partners, stakeholders and suppliers in order to govern innovation. However, this transformation is rapidly lagging behind their competitors due to the increasing technology shift, and they are losing out on their market position as a result. The purpose of this study is to evaluate the importance of innovation and big data interaction in supply chains, to evaluate the technologies and methods used, and to identify potential opportunities and values by creating solutions at the very heart of these efforts.

*Big Data Concept and Features*

Big data is the term applied to vast and complex datasets that existing information systems cannot handle. In other words, an amount of data that exceeds the capabilities of known database management systems and software tools to collect, store, manage and analyze data is called “Big Data” (Milliken, 2015, p. 24). Big data analytics are defined by APICS (2012) as “the sum of data and technology that integrates and reports filters, associations and reports that are not available with past technologies, for all available data.” Ohlhorst (2012) explains that the size of the data scale is diverse and that the growth of the data is at an extraordinary speed, so much so that conventional information technologies cannot effectively cope with the data.

In terms of quantifying the size, today this ranges from tens of terabytes (one terabyte [TB] = 1,000 gigabytes, or $10^{12}$ bytes) to petabytes ($10^{15}$ bytes). In the year 2000, only 800,000 petabytes (PB) of data were stored worldwide. By 2020, that figure is expected to reach 35 zettabytes (one zettabyte [ZB] = one trillion gigabytes, or $10^{21}$ bytes) (Wong, 2012; Yiu, 2012).

Data bursting makes it difficult to store and analyze data within traditional systems (Huddar & Ramannavar, 2013; Zhan, Tan, Pawar, & Tan, 2014). This difficulty can be better understood when considering the existence of many species of data such as texts, weblogs, GPS location information, sensor data, graphics, videos, audio and other online data. This sheer diversity of data requires different equipment and technologies in order to process and store data. However, the use of semi-structured and unstructured data is becoming increasingly important. This data is obtained from search engines, e-mails, log files, social media forums, sensors, and so on. However, the different platforms, applications and technologies make the data more complex (Mohanty, Jagadeesh, & Srivatsa, 2013; Tan et al., 2015). The very success of an enterprise in the digital economy depends on the knowledge obtained from both traditional and non-traditional means, as the ability to analyze all types of deliverables will create more opportunities and more value for an enterprise (IBM, 2013).

IDC (2016) describes Big Data Technologies as next-generation technologies and architecture designed to capture economic value from a wide range of data by capturing, exploring and/or analyzing data at high speed. A Big Data technology stack includes:

- Infrastructures such as storage systems, servers and data center network infrastructures;
- Data organization and management software;
- Analytics and discovery software;
- Decision support and automation software;
- Services include IT support and training related to business consulting, business process outsourcing, IT outsourcing, IT project-based services and Big Data applications.

In the Big Data explanations, some researchers use the term 3V (Laney, 20011), representing Varieties, Velocity and Volumes, while some diversify these components to 5V, with the addition of Verification and Value:

- *Variety:* This component refers to all data, sources and types such as social media, sensor data, CRM files, documents, images, and videos. Due to the cost ineffectiveness of storing data in so many different formats, it would not be possible to store all these in a relational database. In fact, the data found in images, sounds, or pictures, can be completely different from traditional information. The data generated by each source and perhaps through different technologies, raises the issue of dealing with "data type" problems.
- *Velocity:* Data can represent issues at speed, even if its structure is uncomplicated and its volume not that great. The sheer rate of data formation may occur at levels that are difficult to process continuously or within specific time intervals. In most cases, even if the speed is acceptable, the data generated will already be considerable in terms of its volume. Rapidly reproducing data results in increases in line with the increase in transactions and the multiplicity of these transactions.
- *Volume (data size):* Perhaps the most important reason why the concept of big data occurs is that the data volume grows logarithmically every day. As a natural consequence, corporate IT (Information Technology) costs are increasing as the volume of data increases. It is necessary to manage the impact of these increased IT costs by designing a more efficient environment in which all these data are stored and managed. The size refers to large volumes reaching Terabyte or Exabyte levels. According to IDC statistics, the amount of data stored by the year 2020 will be some 44 times that seen in 2009 through data archiving, processing, integration, storage and so on. It is therefore vital for technology to explore how to best cope with this massively increased volume of data (IDC, 2016).
- *Verification:* It is necessary to follow how data is obtained and where it originates. It may be necessary to question the reliability of the data before accepted and to then keep it under constant supervision. During the flow of the data, each layer must be viewed at the right level of security it requires, and to be visible or hidden according to the user.
- *Value:* Big data is expected to generate an intra-organizational value after the data production and processing layers. Otherwise the cost of folding becomes the value obtained. In order to avoid this, interpretation, value addition and analytical studies of the data should be performed. For value, the data should impact the decision-making process only momentarily and must be provided immediately after the correct decision is made.

*Big Data Sources*

Big data is composed of information with high data production speed and high data variability as well as high volumes, and provides advanced leveling support, meaning deduction from data and process optimization. However, this requires new methods of information processing and analysis. The increase in the variety and quantity of data leads to increased demand for businesses to provide more real-time responses and decisions. Techniques such as Hadoop and MapReduce are used to access big data (Cohen, Dolan, Dunlap, Hellerstein, & Welton, 2009; Huddar & Ramannavar, 2013; Zikopoulos & Eaton, 2011). Apache Hadoop is open-source software that allows users to easily use distributed operating platforms. It has the ability to cope with large quantities of data in a secure, efficient and scalable manner. MapReduce is a programming model that works with big datasets, and can be parallel processed and applied on Hadoop. It is used to distribute big datasets among multiple servers (Dean & Ghemawat, 2008).

90% of the data on the internet has been created since 2016, according to an IBM Marketing Cloud study (IBM, 2017). People, businesses, and devices have all become data factories that are pumping out incredible amounts of information to the web each day. In 2014, there were 2.4 billion internet users. That number grew to 3.4 billion by 2016, and in 2017 300 million internet users were added – making a total of 3.8 billion internet users in 2017 (Kemp, 2017). This is a 42% increase in people using the internet in just three years.

Companies collect trillions of bytes of data related to their customers, suppliers, operations and products. Millions of sensors in systems such as mobile phones, vehicles, work machines, smart meters, etc., transfer various applications that they produce in the era of “Internet of Things.” By the end of 2016, Uber had 40 million monthly active users. Venmo processes $74.7 million in transactions every day (Schultz, 2017). Wal-Mart handles more than a million customer transactions each hour and imports those into databases estimated to contain more than 2.5 petabytes of data. Radio frequency identification (RFID) systems used by retailers and others can generate 100 to 1,000 times the data of conventional bar code systems. More than 5 billion people are calling, texting, tweeting and browsing on mobile phones worldwide. Organizations are inundated with data – terabytes and petabytes of it. To put it in context, 1 terabyte contains 2,000 hours of CD-quality music and 10 terabytes could store the entire US Library of Congress print collection. Exabytes, zettabytes and yottabytes definitely are on the horizon. Data is pouring in from every conceivable direction: from operational and transactional systems, from scanning and facilities management systems, from inbound and outbound customer contact points, from mobile media and the Web (Saas, 2012).

The number of smartphone users is forecast to grow from 2.1 billion in 2016 to around 2.5 billion in 2019, with smartphone penetration rates increasing as well. Just over 36 percent of the world’s population is projected to use a smartphone by 2018, up from about 10 percent in 2011 (Statista, 2018). In this digital world, all of the data generated through communication, searches, purchases and shared transactions made daily by every consumer represents stored data.

Today, when a customer wants to follow traces on Facebook, it involves processing information such as photos, music, and video which cannot be associated with known reporting systems. Worldwide, 38.6% of the online population use Facebook. There are 1.37 billion daily active users. 47% of Facebook users only access the platform through mobile. Facebook adds 500,000 new users every day; 6 new profiles every second. Hive is Facebook’s data warehouse, with 300 petabytes of data . Facebook generates 4 new petabytes of data per day. Users generate 4 million likes every minute. More than 250 billion photos have been uploaded to Facebook and this equates to 350 million photos per day (Smith, 2017).

The applications of big data in different areas is also remarkable; examples of which are: the Los Angeles Police and the University of California using big data technologies before committing their data (Grill, 2013); the Google “Flu Trends” app uses search words to detect the spread of the influenza virus (Google, n.d.); statistician Nate Silver predicted the senate election results in 2012 for each independent province (CFAR & Branwen, 2012).

The analysis of big data is expected to provide significant savings and new possibilities by moving the decision support of many critical areas of knowledge to a higher dimension. These areas include health, employment, industrial productivity, crime reduction and the management of security, resources and natural disaster mitigation planning. While big data applications have a large share in the financial services, insurance, retail and health sectors, their use in the manufacturing sector is also now becoming widespread. For example, companies such as Rolls Royce and Ford have been successfully using big data for risks of supplier mismanagement and for avoiding forecast failures prior to risk creation (Goodwin, 2013).

*Use of Big Data in the Supply Chain*

Big data for business management has a great potential to showcase new ways of organizing, learning and innovation, while managing more complex database decisions (Kiron, 2013; Yiu, 2012). It can also play an important role in strengthening customer relationships, managing business risk, improving transactional effectiveness, and improving product and service delivery (Issa, 2013). It is unavoidable to take advantage of the key roles of information sharing and innovation in SCM so that complex IT relationships can be effectively managed in an intensive global trading environment, value added outputs can be created through these processes and competitive advantage gained from an increase in supply chain performance. Strategic relations and cooperation between the SCM elements should be seen as links that form and maintain a common whole with a systematic approach. If this is ensured, the ultimate customer value increases, costs are reduced, manufacturing flexibility is provided, business processes are improved, and organizations are willing to learn and participate in the process. In addition, each unit focuses on core competencies as it will do the job as a specialist, and the quality and diversity of the services and products offered will also increase the advantage against competitors in the global market. Today, the increasing complexity of networks in the supply chain, along with the growing, diverging and independent moving markets, requires rapid technology, short product lifecycles, coordination among the chain members and strong links.

The ability to use big data provides significant opportunities for businesses to outperform their competitors (Oh, Teo, & Sambamurthy, 2012; Tan et al., 2015). For example, retailers can increase the potential of business margins by 60% by touching on the values hidden within big data. Although large amounts of capital and time are required to set up big data platforms and technologies, the long-term gains of competitive advantage from big data are very important (Tan et al., 2015; Terziovski, 2010). Many researchers point out that the preferences and needs of customers can be better understood through customer loyalty cards and social media knowledge.

It is said that the US healthcare can generate a potential annual value of US$300 billion through big data. It is also emphasized that the White House sees “big data” as a national weapon in support of health care and national security (Mervis, 2012). However, it is estimated that the commercial value of personal position data around the world is estimated at US$600 billion a year (Davenport & Harris, 2007; La Vallee, Hopkins, Lesser, Shockley, & Kruschwitz, 2010). With big data, different benefits can be obtained for different sectors, as well as values created between sectors (Mishra, Modi, & Animesh, 2013). In fact, supply chain has the power to bring together the knowledge of different people or groups communicating with each other. Businesses can use techniques such as predictive analytics, data mining, case-based reasoning, explanatory data analysis, business intelligence and machine language learning in analyzing unstructured data to help customers understand their preferences and requests. In addition, many researchers emphasize the importance of big data analysis to develop new products (Manyika et al., 2013; Tan et al., 2015). Analytical reports used in supply chains include descriptive analytical reports (key performance indicators [KPI], control panel), operational level reports (predefined inquiry logic reports, queries that improve decision making and determine the need for end-user action), forecasting analytics (improving processes such as forecasting, customer relationship management and inventory control) and optimizing output (business rules and basic decision models) (Milliken, 2015, p. 24).

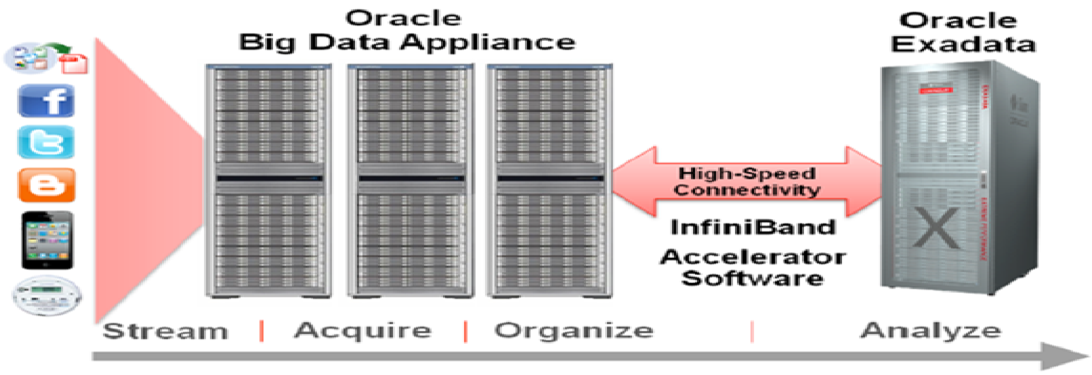
Businesses can instantly aggregate and speed up their operations and increase their productivity through mobile communications and cloud computing methods supported by intelligent devices, resulting from transactions made by employees, customers, suppliers, or assets. Through these methods, they can also see real-time data from vehicles and devices they use in their activities such as production, distribution and storage. They can also gather information about customers in real time, from the interfaces they provide them with, from applications and from social media and similar media. At this point, it is critical for businesses to decide which data they want to aggregate in real time. This decision requires imagining the whole data cycle. Collection of critical data can be gathered by means of traditional and informal “offline” forms, surveys, documents and documents, as well as instantaneous and “online” web, digital forms and documents, systems and methods such as communication methods and applications centers. Users of these methods can also acquire the ability to make the right decisions with the most comprehensive and up-to-date knowledge.

Mobile Internet is at the forefront of these efforts. In addition to the increasing popularity and speed of the Internet, the application enrichment on smart devices is steadily increasing. In this way, employees working in departments such as sales, marketing, supply chain, technical support, human resources, IT, finance, administrative affairs, especially senior management, can access such information from any place, any time.

Another technology, “Digital Services,” allows businesses to reach information workers and customers in an instant and effectively. These services allow employees to have a variety of competencies ranging from remote training communication campaigns to immediate and on-the-spot customers, enabling individuals in different locations to work in the same environment, with payment systems running on the Internet and mobile devices. These competencies enable businesses to collect instant data from customers and employees, as well as providing information to inform people, job assignments and campaigns by taking instant action in light of critical information resulting from the analyzed data.

In the world of “Internet of Things,” also called inter-machine communication (M2M), the transmission of data between many devices is ensured and it is possible to instantly collect environment and status information which is continuously transmitted to central systems. Cloud Technologies aim to transform IT infrastructural needs from a material and operational burden on companies into a tool that facilitates their main businesses. If 80% of the data in today‘s world is unstructured, no data is found in any company‘s database and no data is found in customer relationship management modules, only 20% of data will have a limited relationship with customers. Information such as applications, usage histories, prior known preferences, and locations collected over the network are the basis of the large data concept. Specialized profiling of big data makes it possible to take the correct actions and correct proposals for the right person, at a right or wrong place. Big data derived from an operator‘s own processes can create a very important input for process engineering and resource optimization when processed and used correctly. The “Oracle Big Data Appliance,” shown in Figure 1 as the working example, operates in-house with an InfiniBand (40GB/second) network and makes it possible to communicate at least four times faster than through conventional architecture (Oracle, 2011). It can also be fully integrated with other Oracle engineering systems.

**Figure 1.** Oracle big data applications and exadata model usage




According to this model (Oracle, 2011);

Step 1 - Data Flow: Different types of data from multiple sources are not transferring to the system. At this stage, the system‘s flow of data is prepared and configured to be installed on the Oracle Big Data Appliance.

Step 2 - Collecting and Organizing: The data is stored and stored on the Oracle Big Data Appliance, and therefore on the HDFS (Hadoop Distributed File System), with high volume, variety and speed. HDFS defaults to “Hadoop Cluster” (on a total of 18 nodes) by “triple mirroring” (hiding the incoming data as three copies).

Step 3 - Analysis and Reporting: After exporting the data from Oracle Big Data Appliance, “Map/Reduce” in Java code imports the form to be uploaded to a relational database, and exports data to Oracle Exadata via InfiniBand and importing relational data.

*Big Data and Innovation Interaction in Increase Supply Chain Competencies*

Innovation has become a driving force in achieving sustainable growth and increasing social prosperity. Innovation, which plays such a crucial role for the market, is regarded as a key element in ensuring productivity, profitability and performance improvement for businesses. In addition, innovation is viewed as a sustainable growth tool and creates new employment opportunities while creating a creative, energetic work environment.

Along with technological improvements, flexibility, speed and productivity increase, changes in the requirements of the information society, shortening of the product lifespan and shortening of new product offer periods have led to an intense competitive environment. Businesses have had to deal with products, services and information flows from suppliers to customers as a whole in order to ensure a balance between competitiveness and customer needs in the face of these changes. This change needs to be closely monitored in order that businesses can both increase their competitiveness and develop successful innovation strategies. Members who have different areas of expertise within the supply chain can control the flow of information, products and funds under a single management frame and collaborate to facilitate the implementation of innovation strategies.

Supply chain systems consist of many complementary applications. These include the production of products, inventory, planning and coordination of all the processes up to the sending and receiving of the finished products to the customers (Attaran & Attaran, 2004, p. 418; Erciş & Can, 2013, p. 100). Operations managers need to assess how they can blend big data to increase supply chain innovation as much as they can to make reality-based strategic decisions. Innovation is an essential tool built on competition and is an integral part of the implementation components that are best positioned to implement. Therefore, output related to innovation directly affects business productivity. In this context, ongoing improvements to any product or production technology, such as learning, problem solving, product development, process development, can be regarded as the skills needed for businesses to successfully execute their applications. These abilities are practices that can improve innovation in a clear way.

According to Arlbjørn, deHaas, and Munksgaard (2011), supply chain innovation can be divided into a supply chain network, supply chain technology, or a supply chain process (or a combination thereof) that can be involved in the functions of an enterprise or a supply chain in order to enhance new value creation for its stakeholders. Increasingly, researchers point to supply chain innovation, an important tool in improving supply chain performance and delivering significant benefits to companies (Flint, Larsson & Gammelgaard, 2008; Koçoğlu, 2010, p. 54; Krabbe, 2007). These benefits are crucial, not only in providing a complete supply chain visibility, but also in significantly improving customer response times, enabling new products to be available in a shorter time, with lower inventory levels and enabling decision-making processes. Manyika et al. (2011) and Wong (2012) argue that big data gives businesses an important opportunity to improve supply chain operations and innovation. Businesses can create new ideas that are important for innovation with big data, or they can understand their products, customers and their markets. On the other hand, the main problem for managers is to establish an analytical infrastructure on how to handle big data to support enterprise innovation capabilities.

In a globalized, extended supply chain, ownership of data is distributed among many enterprises. An organization does not have a single full overview, and an integrated SC system and data architecture can rarely be created because of the lack of a common system and standard amongst enterprises and too much fragmentation. Good planning can ensure that supply chain management is successful. Process-related information should be easily shared by all members of the supply chain. This information should also assist companies in their production and marketing practices (Erciş & Can, 2013, p. 100; Tarn, Razi, Wen, & Perez, 2003, p. 360).

Today, innovation is inevitable, but brings with it many risks for companies. There are various risks that can be encountered when preparing plans based on estimates. These risks may include not giving the necessary input to innovation activities, not cooperating with members in the supply chain, and not adopting the innovation of other members (Ercis & Can, 2013, p. 100; Sammarra & Biggiero, 2008, p. 803). The most important of these risks is the response to the innovation, as it is difficult to change the structure of a company formed through past experiences (Bstieler, 2006, p. 61; Erciş & Can, 2013, p. 100). If the resistance to innovation can be overcome, cooperation with goals and predictions can be made easier. The main problem to be solved is therefore not a technological hurdle. For this purpose, the use of information technology is only a tool for providing supply chain integration. The main problem is that supply chain members share no common purpose (Anholt, 2004, p. 161; Erciş & Can, 2013, p. 100).

Supply chain and logistics research has also started to emphasize the importance of innovation in SCM. The European Logistics Association emphasizes the transformation of organizational skills and resources into competitive advantage, such as low cost and high customer value, through differentiation and the participation of SCM in the process (Flint et al., 2008; Koçoğlu, 2010, p. 54). According to ELA's 2004 report, information sharing and cross-border use of information for supply chain collaboration for the benefit of this purpose should create value transfer from suppliers to end users (Flint et al., 2008; Koçoğlu, 2010, p. 54).

Product innovation is based on several determinative factors in SC relations. These are; (i) the duration of supply chain relationship, (ii) trust in supply chain relationship, (iii) contractual perspective, and (iv) organizational learning dimensions (Çağlıyan, 2009; Koçoğlu, 2010, p. 52). Depending on the changes taking place in the global arena, the enterprises realize and even transfer new product development activities in the supply chain network by including their partners.

The fact that global markets have an increasingly homogeneous distribution of capabilities requires businesses to turn to their SC partners in order to deliver new information and technologies worldwide, product technology and process innovations. In the literature, the role of the supplier in the process of innovation creation is questioned and it is emphasized that enterprises will increase their financial performance by innovating through SC integration (Cooper, Lambert, Douglas, & Pagh, 1997; Kim, 2009; Koçoğlu, 2010, p. 53; Petersen, Handfield, & Ragatz, 2005; Tan, 2001). Businesses can manage to create innovations in terms of a cross-organizational learning perspective (Bakhshi & McVittie, 2009; Koçoğlu, 2010, p. 54). A successful example of this can be seen in the SC structure based on the integration of Kraft Foods with Safeway. With SC innovations, applications of storage and shelf-life of critical products ceased to exist and thus the yield of this product increased by 167% (Flint et al., 2008; Koçoğlu, 2010, p. 54). In the process of innovation with suppliers, integration will result in enterprises having an increasing potential for innovation, such as complementing the weaker points and combining their areas of expertise (Soosay, Hyland, & Ferrer, 2008; Koçoğlu, 2010, p. 54). From this information, it can be said that SC innovations trigger unified and mutual learning processes between chain members.

According to the GE Global Innovation Barometer (2013), businesses are making preparations to assess the potential of big data. 53% of the surveyed firms were of critical importance for the successful innovation capability of the data mining both inside and outside; and 63% stated that they had developed the potential use of big data for innovation. In addition, Mexico, Brazil, Turkey, and Nigeria have been shown as champions of great dedication in this research.

In a survey of Third Party Logistics Service Providers (3PL), 97% of shippers indicated that 3PL is important for database-based decision making for the success of supply chain activities and processes (Langley, 2014). Large retailers are exploiting big data capabilities to monitor customer experience, reduce fraud and improve on-time recommendations (Tweney, 2013). However, real-time detection and diagnostics in the manufacturing sector help reduce cost by providing efficient automation benefits, while big data analytics help real-time measurement and improving quality management (Wilkins, 2013).

## Conclusion

The success of supply chain management depends on good planning including all processes and members, and all the information needed about the processes can be easily obtained by the members in the chain. The competence status of the parties for the partnership and the risks that may arise from this relationship should be determined. In addition, mutual trust and commitment must be created between members in order to reduce uncertainty and costs, increase service quality, provide marketing advantage, and to increase balanced growth and profitability. This trust can contribute to greater cooperation, less conflict, more accurate decisions under uncertainty, less inclination to end partnerships, and a willingness to innovate. Setting the rules for the supply chain partnership can provide for a sharing of responsibilities including innovation plans, determination of the level of service standards and performance control. Thus, according to the results obtained, benefits and risks related to the partnership, facilitating elements and rules can be observed.

Immediate collection of data from different channels in the supply chain is evaluated when they are processed instantaneously and become inferences that will support making critical decisions and helping businesses shape their next steps. When implementing this step, businesses will be able to achieve more rational deductions by combining the richness of the data and internal analytical skills with external analyzes, in collaboration with partners with big data, in addition to data from internal sources such as CRM and ERP. Processes such as sales, distribution, installation, maintenance/repair, and stock management can be accelerated and become more efficient with data processing. Thus, many applications that create value for customers will be realized, and be able to better target their customers as a result of well-analyzed data.

Big data has the advantage of possessing valuable knowledge that includes customer behaviors, market demands, changing needs, preferences and more important insights that help businesses grow and adapt quickly to change. To ensure having this capability, businesses must develop appropriate network infrastructures, strengthen their analytical skills, and improve the intelligence of their business operations. In order to integrate largescale data analysis into their systems, companies must drill down in depth into their operations, processes and databases.

By providing innovation and big data interaction in their supply chain, businesses can create more accurate and detailed order and purchase information about product stocks by creating and storing more digital data about the supply chain, and creating opportunities to use this information in actions that improve innovation performance. Constructive analysis of big data in the supply chain should make effective use of the decision-making process by making deep and complex information more meaningful. Resulting improvements can then be realized in ensuring quality and productivity management; effective implementation of technological requirements; efficiency of sales forecasting; improvements in new product development; improvements in inventory management and inventory performance, better customer relation strategies, better communication with customers and suppliers, cost efficiency in procurement, and the management of logistics activities. In addition to all of these benefits, businesses can use this data to derive differences, opportunities and priorities to explore innovation resources, models, markets, practices and technologies throughout the entire supply chain.

## Notes

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