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Digital Technology for Supply Chain Management-marketing Integration

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Abstract

The aim of this document is to present a full description of the innovative efforts that have been made over time to develop digital technologies to manage the interfaces between supply chain management and marketing processes, and beyond that the role they play in maintaining supply chain management and marketing (SCM-M). The methodology used is patent analysis, which collects data from six different offices (USA, China, Taiwan, Japan, South Korea and Germany) and uses real samples to perform this analysis. The research also learned of a number of key security technologies related to the Fourth Industrial Revolution (Industry 4.0) that are considered more relevant for the effective integration of SCM-M (i.e.me. Industrial Internet of Things and Cloud Computing). The results of this study provide detailed information on the digital technologies that support SCM-M integration. Concretely, the authors compose the role dispute related to information, storage and elaboration for the integration of SCM-M by wishing on illustrative realities. In addition, the authors present the organizations most involved in the development of digital technologies for SCM-M integration over time and provide evidence of the impact of these technologies in terms of their impact on resulting technology developments.

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Keywords: Innovation, Marketing, Supply Chain Management, Internet of Things, Cloud Computing, Patent Analystics, Industry 4.0, Integration marketing-supply chain management.

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1. Introduction

The Digital technology has transformed the way businesses operate, the way people connect and share information, and the way they engage with the broader public and private sectors. In addition, the digitization of business processes will facilitate the merging of corporate functions and members of the supply chain, so that "the chain becomes an integrated system that is absolutely transparent to all stakeholders involved, from raw material suppliers, items and parts to inventory holders. And manufacture goods." and finally to customers who demand compliance" (Schrauf and Berttram, 2016). As observed by (Ranganathan et al., 2011), the adoption of digital supply chains and advanced marketing approaches faces considerable challenges due to significant investments and key issues connected with the digitization approach. The cost of digitalization is one of the most important variables impacting it. This expense stems from the difficulty in selecting the suitable technology to aid in the digitization process and, as a result, the integration of supply chain management (SCM) and marketing management (M).

It is important to note that SCM and marketing management play distinct responsibilities within firms. It is important to note that SCM and marketing management play different roles within companies.

The SCM function, this is accountable for handling offer-focused processes (e.g. in/out logistics), is moreover had to efficiently supply fee to customers as it allows the company to hold up a high stage of provider and keep away from inventory outs (e.g. Esper, Defee and Mentzer, 2010; Macchion et al., 2015). While the marketing function is needed to live in pace with the unsteady call for that characterizes today' marketplace and decide the most valuable product to deliver (Slater and Narver, 1995). As a result, in network-oriented business models, the necessity to effectively coordinate strategic choices across the network, from customer-oriented to supplier-related, offers a hard and critical issue. It is best understood as the combination of marketing and supply chain strategies. (Jüttner et al., 2010). According to (Boyer and Hult, 2005; Esper et al., 2010, and McKinsey and Co, 2017b), companies that can effectively manage the interface between supply chain management (SCM) and marketing outperform those that excel in just one aspect of marketing or SCM.

However, as highlighted by (Esper et al., 2010, and Alvarado and Kotzab, 2001), current organizational practices still lack a comprehensive understanding of the tools required to support information processing mechanisms that enable the delivery of suitable products to customers while minimizing constraints on supply chain transactions. The timely acquisition, sharing, and analysis of operational and market knowledge is critical to the success of both SCM and the marketing function, as emphasized by (Esper et al., 2010; Mentzer, 2001; Slater & Narver, 1995 and Bhosale and Kant, 2016). As a result, information processing techniques are seen as critical for managing the interface between SCM and the marketing process properly. To improve these information processing mechanisms, there is a growing consensus among researchers, executives, and policymakers advocating for corporate digital transformation in accordance with the fourth industrial revolution

(Industry 4.0) principles proposed by (Kagermann et al., 2013; Theorin et al., 2017, and Deloitte, 2015).

Industry 4.0 is a new phase in the industrial revolution that emphasizes interconnection, automation, machine learning, and real-time data. It aspires to totally revolutionize the way all firms work and adapt, rather than simply embracing new technology and tools to increase efficiency. This transformation enables business owners to efficiently manage and acquire insights into every element of their operations, allowing them to leverage real-time data for higher productivity, streamlined processes, and the adoption of best business practices. Companies can gain a competitive advantage by investing in the combined knowledge of SCM and marketing. This allows them to speed the delivery of products and services to the market while decreasing costs and maintaining better quality.

Building on the arguments presented above, this study aims to bridge the gap in knowledge in the industry by offering an in-depth and all-encompassing description of digital technology and their respective roles in managing the interface between SCM and the sales process, as well as a comprehensive insight into the innovation efforts required to develop such solutions in a short timeframe. To put it another way, the following part provides the theoretical framework for the thesis that certain digital technologies support Industry 4.0 within the field of academic research as proposed by (Jüttner et al., 2007). The third part describes the technique applied to this research, whereas the fourth part reveals the outcomes of the patent analysis. Finally, the fifth part looks into the study's theoretical and practical consequences.

2. Literature review

2.1 SCM-M Integration

The provision of customer service within the value chain is essentially the domain of two targeted areas: marketing and SCM. Collaborative integration between the organization's marketing and SCM functions is critical to fully exploit potential service improvements (Christopher, 1993; Bowersox et al., 1995; Mentzer and Kahn, 1996). Cooperative interdepartmental integration largely involves informal processes supported by trust, mutual respect and data sharing, shared responsibility for decisions, and collective responsibility for outcomes (Mentzer and Kahn, 1996). CPFR may be a technological innovation tool originally protected by the Voluntary Inter-Industry Trade Standards (VICS) in 1998, described by VICS as a set of newer business practices that use the Internet and EDI to achieve two goals: radically reduce the inventories and expenses. While increasing customer service. Various definitions and subsequent explanations of CPFR can be found in the literature and an analysis derived from the VICS definition can be seen below. For example, Fliedner (2003) defines CPFR as a web-based approach that will coordinate a variety of supply chain management processes, such as production and purchase planning, demand forecasting, and inventory replenishment.

The primary goal of CPFR (Collaborative Planning, Forecasting, and Replenishment) is to improve the precision of demand forecasting and inventory management by encouraging consumer and supplier collaboration through a unified planning approach enabled by effective data sharing mechanisms. As a result, the ultimate goal of CPFR is to generate value for both supply chain participants and end customers, resulting in enhanced overall supply chain performance. According to studies by (Attaran and Attaran, 2007 and Fliedner, 2003), this improvement includes higher service levels, lower procurement costs, shorter cycle times, lower inventory levels, lower forecast errors, and faster interactions across the value chain. It is critical to note that CPFR's primary focus is on improving supply chain management (SCM) performance and is dedicated to building a system that prioritizes efficient delivery operations. However, as stated by (Yao et al., 2013), CPFR is less likely to promote specialized demand-driven procedures that enable enterprises to efficiently respond to variations in demand and identify the most valuable items over time. According to (Moorman and Rust, 1999), it is the marketing role within a firm that performs research on customer preferences, market competitiveness, and provides viable options for new product offerings. As a result, it has been stated that organizations that rely entirely on demand or supply-side strategies may fail to create customer value, highlighting the rationale for integrating SCM and marketing operations, as suggested by (McKinsey and Co, 2017a and Pero and Lamberti, 2013).

According to (Jüttner et al., 2007), effectively integrating supply chain management (SCM) and marketing (M) entails three primary tasks: balancing the alignment of supply and demand processes, structuring the integration of processes with customer segments, and managing the operational relationship between the marketing function and SCM. These jobs are inherently complex, requiring businesses to use information management approaches to utilize market insights across the supply chain. In turn, they should use supply-side information to optimize the effective distribution of their products. Given the need for extensive selection and dissemination of operational and market information, numerous studies have unequivocally recognized the critical need for effective methods to improve knowledge exchange and processing between functions and throughout the supply chain, as discussed by (Jüttner et al., 2010. As is widely known, the most effective answer to this dilemma rests in the digitalization of business processes in accordance with Industry 4.0 principles. Companies that digitalize their processes, in particular, can improve their ability to acquire, analyze, and distribute operational knowledge by implementing cutting-edge digital technologies such as cloud computing and big data analytics, as indicated by (PwC, 2016 and Ranganathan et al., 2011).

2.2 Towards Industry 4.0: enabling technologies

The term Industry 4.0 was coined in 2011 by the German association "Industries 4.0" in 2011 at the Hanover Fair as a strategy to reduce increased competition from abroad and to differentiate Germany and the European union industry from other international markets. The association of executives, students and policymakers marked the fourth period of the industry advocating the digitization of business processes (Kagermann et al., 2011). Indeed, the basic notion of Industry 4.0 is to alter corporate processes by embracing digital technologies that make it easier to connect equipment, supply networks, manufacturing facilities, end products, and customers. This makes it easier to collect and share real-time market data and operational information. The federal government's initial endorsement of the Industry 4.0 concept is articulated in the "High-Tech Strategy 2020 for Germany," as described by (Kagermann et al. 2013). Many other countries have followed Germany's lead and developed their own Industry 4.0 programs. For example, the United Kingdom launched "UK CAPTULT-High Value Manufacturing," a strategic plan including university and industry stakeholders aimed at boosting the adoption of digital technologies in the country's manufacturing sector. Similarly, the United States launched the American Manufacturing USA effort, France launched the Industries du Future initiative, and the Netherlands launched the Dutch Smart Business program. These projects offer firms advantages like as funding alternatives and tax credits to support industry-aligned planning and adoption of digital technology, in line with Industry 4.0 concepts. Recently, the Italian Ministry of Economic Development unveiled the Italian Plan for Industry 4.0, with the goal of boosting R&D expenditures in both the public and private sectors to advance digitization in corporate operations. This project, as promoted by (Calenda, 2016), is in line with Industry 4.0's broader objective.

In summary, the goal of Industry 4.0 is to improve digitization and promote the integration of corporate operations both horizontally (across several functional areas) and vertically (through the full value chain, from development and procurement to manufacturing, sales, and customer support). This method enables the gathering of full knowledge about operations, inbound and outbound logistics, market demands, and interactions with customers and products in real time. As a result, digital businesses can collaborate closely with customers and suppliers within industrial digital ecosystems, adapting as needed to effectively manage the interface between supply chain management (SCM) and marketing functions, as discussed by (Ranganathan et al., 2011; Schrauf and Berttram, 2016).

Finally, this paper comprehensively describes the allowing technology: cloud computing; industrial IoT; (see Table 1 for extra details). The allowing technology mentioned on pinnacle of include regularly notion of applicable in the industry 4.0 domain, succeeding section discusses the set of them which might be essential to SCM-M integration.

Table 1: Enabling Technologies

Enabling Technology	Descrition
Cloud computing	Cloud computing allows numerous users to share IT software and hardware resources through the internet, allowing data to be readily stored and retrieved remotely (Sultan, 2013).
Industrial IoT	Industrial IoT, often known as IIoT, refers to the use of IoT technology in operations aimed at both meeting demand and managing supply (Del Giudice, 2016). It stresses the ability of devices and machines with different protocols and architectures to interact with one another, allowing for real-time data sharing across the whole value chain (Li et al., 2015).

3. Methodology

3.1 Patent analysis

We apply patent analysis to provide a comprehensive summary of the innovation dynamics that characterize the key technologies for SCM-M integration. When we use the term patent analysis, we tend to be guided by an examination of a range of characteristics of technological progress and innovation activities that characterize a particular company or technological area (Kim and Lee, 2015). (Albino et al., 2014) assessed organizations and countries primarily engaged on advancing low-carbon energy technology through time using patent analysis. Meanwhile, (Zheng et al., 2014) analyzed joint patent activity to confirm worldwide technological cooperation. In this context, patent analysis elucidates the scope of patents granted to a certain company and provides insights on the company's technological maturity and strategic direction. Similar research can be found in the sphere of digital solutions (e.g., Chang and Fan, 2016; Ardito et al., 2017), highlighting the applicability and significance of patent analysis in this arena.

The findings of this type of research have important consequences for policy creation as well as managerial decisions. In terms of policy, patent analysis is commonly used to shape public policies, such as energy legislation (Mueller et al., 2015). Patent analysis tools, when viewed through a technology management and planning lens, enable organizations to identify emerging innovation trends, distinguish technology pioneers from followers, and assess the viability of entering or maintaining involvement in a specific technological domain (Ernst and Omland, 2011). Finally, patent research assists businesses in finding digital technologies suited for combining supply chain management and marketing (SCM-M) and provides essential assistance in implementation efforts. To help you understand these ideas better, we have included actual examples that highlight the functions of well-known technology).

3.2 Text Mining

Six Data mining, also known as data discovery from data, is the automatic or convenient extraction of patterns representing insights from data implicitly stored or collected in vast databases, data warehouses, the Internet, other large data stores or data streams. In recent years, data mining techniques have been widely used in numerous fields such as government, business, finance, education and transportation. The main step in data mining is to collect pieces of data from a proxy database. The second step is to normalize the information to organize it for data mining. In the third step, the data is processed, and various models are tested on the data set. According to this study, data processing shows the connection between data.

With the help of the Intellectual Property Technological Innovation System (IPTech); Text Mining is managed using M-Maps and T-Maps in Innovue (IPTech). M-Maps and T-Maps are sets of maps generated from information sets used in search engines (https). http://www.innovue.ltd/en/). Figure 1 shows the Intellectual Property Technological Innovation System (IPTech) platform is the patent master association of the world's largest intellectual property offices together with the patent organization and therefore the World Property Organization. The software system has a search engine that can assimilate similar patent families using the keywords mentioned in the patent abstract. This platform will make it possible to analyze patent trends in terms of filings, distribution and variety of subjects per year. A total of 3859 patents used in this study that fell victim to this technique were analyzed. Request a specific lookup supported language and main IPC code related to SCM-M integration.

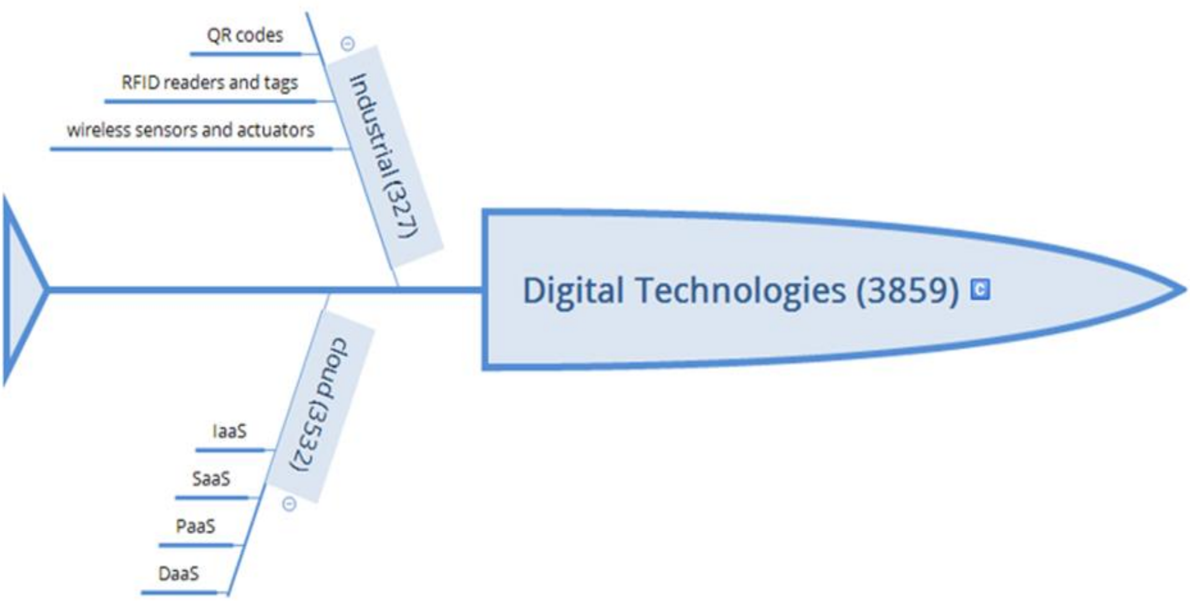

Figure 1: the Intellectual Property Technological Innovation System

3.3 Data Collection

Database for collecting patents for well-known classes (e.g. industrial IoT and cloud computing,). The data provided relates to the annual growth of patent publications from 6 different countries (USA, Taiwan, China, Japan, South Korea and Germany) and also to 15 high figures appearing in the Innovue database IPtech. The analysis was assigned victimization in the Innvue IPtech database, configured to capture 15 companies with the most effective investigative skills with claims for the 2016-2019 period.

The search algorithm keyword-based strategy (Ardito et al., 2018). It is worth mentioning that there is no established categorization scheme for Industry 4.0 technologies. Table 2 shows the exact search phrases used in patent analysis. We investigate these terms in the patent specifications. Table 2 also shows the total number of patents registered in each category after the search method is completed. When a patent application is submitted, we typically collect detailed information for each patent, such as the filing and grant year, inventors, patent holders, and citations both granted and received.

Tabel 2: keywords and sample size

Enabling Technology	Keywords	Application period	Clasification (if any)	Number of retrieved patents
Industrial	"industrial" AND ("IoT" or "Internet of Things")	2016-01-01 2019-12-31	G16Y	327
Cloud computing	"Cloud computing"	2016-01-01 2019-12-31	None	3532
Total				3859

4. Result and discussion

This section provides a comprehensive definition of patent activities related to industrial IoT and cloud computing at the technology and framework level. In detail, we tend first to do an analysis of the number of patents at the technology level. The number of annual patents is used as the lifetime of renewed innovation efforts. In addition, we offer an in-depth study of how well-known technologies support the integration of SCM-M by providing examples from management practice. Second, the analysis at organizational level is omitted. Therefore, we managed to highlight the organizations that are most concerned with the development of Industry 4.0 solutions for SCM-M integration.

4.1 Technology-Level Analysis

A few numbers show the trend in patent development for industrial IoT solutions over time. Development trends are projected with respect to the year of publication of the application. Although the year of filing additionally reflects the amount once the patent was actually developed, it leads to skewed results when examining trends over time as the length of the examination process typically averages 3-5 years (Haupt et al., 2007), the patents are therefore newer and probably not identifiable. Therefore, we tend to analyze the number of patents by year of publication, which shows that the trend in patent activity is constantly evolving (see Figure 2). In addition, the trend of patent activity began to increase from year to year until 2018 its development began to stagnate this is probably due to the mature technology used (e.g. RFID).

Figure 2: Temporal Trends in the domain of Industrial IoT

According to the definitions supplied (Li et al., 2015; Ardito et al., 2018), Industrial IoT comprises a diverse set of technologies that can be divided into more established solutions and newer developments. RFID readers and tags (e.g., patent numbers US16,649,192, KR1,020.207.013.410, JP2,020.553.339) and short-range communication (NFC) solutions (e.g., patent numbers US16,328,456, JP2,018,006,642, DE202,019,104,739) fall under the former category. These technologies were developed between the mid-1990s and the mid-2000s. The latter group, on the other hand, refers to the coming generation of wireless sensors and actuators that emerged in the late 2010s and are regarded as the future of Industrial IoT (Lee and Lee, 2015), adore smart sensors and positioning technologies everyplace and in stores. (e.g. US, South Korean and Japan patent range US16,649,192, KR1,020,207,013,410, JP2,020,553,339). for period of time IP and observance across SCM and their marketing functions has already begun. The working principle of the RFID system is to carry out the process of reading the radio frequency stored in the tag, then the received information is sent to the database. and its purpose is to automatically identify the data transmitted by portable devices. Wal-Mart, for example, has lately introduced an RFID strategy requiring its suppliers to tag forklifts, racks, and pallets. This allows Wal-Mart to collect data on pallet movement across the supply chain. Furthermore, Wal-Mart's suppliers mark promotional product boxes and pallets, eliminating data redundancy across supply chain players and mitigating the bullwhip impact during promotional periods. Wal-Mart is currently working with its suppliers to build a store-level point-of-sale/positioning system and a wireless network in order to maintain inventory levels in its locations. According (Lu, 2014), this strategy ensures that shelves are continuously filled and inventory is closely checked. All of these circumstances improve operational efficiency, allowing Wal-Mart's marketing unit to obtain specific data. This information enables them to develop marketing strategies focused at meeting customer preferences wherever and whenever they appear. In essence, these digital technologies allow for the facilitation of both supply-focused and demand-focused activities, resulting in enhanced value for customers.

Another method in this regard is to first apply Industrial IoT solutions on products and customers (McKinsey & Co, 2017a), then construct supply chains based on the insights gained. Zipcar, for example, collects data from cutting-edge location technology, smart sensors, and more traditional RFID and NFC systems. This information enables them to assess the relationship between the vehicle and the driver. This data, when elaboration, is extremely useful for the selling perform to investigate and better perceive however customers feel and their attitudes throughout the journey. When shaping the customer profile, the SCM perform of Zipcar will offer the automotive they realize softer for the customer (McKinsey & Co, 2010). Taken together, these examples highlight however victimization IoT solutions helps corporations collect and {supply} raw supply and demand-side data, that is then translated and accustomed to match supply and demand strategies. It's value mentioning that in each case, additional} mature IoT technologies were adopted at the same time (Ardito et al., 2018). The beingness of the 2 kinds of solutions could explain the growing trend of patent activity mentioned earlier (Figure 2). the increasing technology during this field can contribute wide to industrial IoT in order that it may be helpful for firms to run their business, particularly to integrate the functions of the supply chain and marketing functions.

Figure 3 presents the emerging technological innovation trends over the years in the cloud computing field in cloud computing. Due to the patents being revealed, the interest in cloud computing technology is growing, and this may be related to the emergence of high-speed networks, which allow fast access to remote data. Therefore, it is very important for companies to stay abreast of technological developments in order to remain competitive in the industry by adopting the latest technological advances.

Figure 3. Temporal Trends in the domain of Cloud computing

Figure 3: Temporal Trends in the domain of Cloud computing

Cloud computing patents includes technologies that alter varied forms of services, like Infrastructure as a Service (IaaS) (e.g. US, Taiwan and South Korean patent number US12,492,813, TW102.118,174, KR1,018,378,300,000, DE112,018,000,226), software as a Service (SaaS) (for example US, Taiwan and Germany patent number US15.148.032, TW101.119.061, DE112.112.002.362), Platform as a Service (PaaS) (e.g. US and Taiwan patent number US1.611.119.351, US16.557.682, TW106.144.806), and data as a Service (DaaS) (e.g. US, Taiwan and South Korean patent number US15,628,350, TW108,138,530, KR1,020,160,140,717). This service is largely concerned with the organization, sharing, and customization of remote network infrastructure (IaaS), IT platforms (PaaS), third-party organizational systems and applications (SaaS), and data (DaaS). In essence, cloud computing facilitates the sharing of structured data (for example, market and operational information) over a distributed IT infrastructure that allows for flexibility and remote access. As a result, the expenses of establishing complicated and dedicated IT systems within the business and across the supply chain are reduced (IBM, 2010). As a result, cloud-based solutions are becoming more popular, particularly with the goal of integrating data from supply chains and marketplaces.

Cloud computing technologies can help with integration by allowing supply chain stakeholders to collaborate. Pfizer, for example, obtains remote access to real-time product information across the whole value chain when it converts to a cloud solution. Pfizer can also collect data from countries where product monitoring is difficult, such as Kenya (Financial Times, 2012; Ardito et al., 2018). The rapidly increasing demand for cloud-based solutions has produced an industry that has drawn a slew of new participants. Salesforce.com, for example, now provides a wide range of cloud-based customer relationship management products. With the use of cloud computing by integrating information internally (such as SCM and marketing functions) for the better. in other words, the activities of the marketing function (such as service after and before selling products) become more responsive, this will be supported by inventory management and distribution of goods to end consumers in the SCM function to be better. thereby increasing the company's competitive advantage in the industry.

4.2 Organizational-level analysis

Tables 3-6 list the foremost patent-intensive organizations (15 top) for every digital technology below investigation. The primary column displays the name of the organization, whereas the second column shows the amount of patents, and also the third column shows the share of patents.

In step with Table 3, ranking of industrial IoT solutions is referred to strong force IoT portfolio 2016, LLC and Telefonaktiebolaget LM Ericsson. wherever each companies come back from the U.S. IoT patent domain with a share rate of technological innovation within the IoT domain of 71.98% and 3.89%, respectively. both companies are engaged in technology and telecommunications technology services. whereas the remainder of the IoT patent domains are distributed among several other companies. this implies that US companies conducting research in this area have a key role in developing technologies in the IoT domain.

With respect to cloud computing, it clads that solely US companies were dominant (Table 4). Among the businesses included, we can consider the companies International Business Machines Corporation, Microsoft Technology Licensing, and VMWARE to be the foremost innovative.

Tabel 3: Patent-intensive organisations in the domain of Industrial IoT

Applicant	Patent	Share
Strong Force IOT portfolio 2016, LCC	185	71.98
Telefonaktiebolaget LM Ericsson (PUBL)	10	3.89
Intel Corporation	7	2.72
International Business Machines Corporation	6	2.33
ウフル Co., Ltd.	5	1.95
Boe Technology Group Co., Ltd	5	1.95
LG Electronics Inc.	4	1.56
Siemens Aktiengesellschaft	4	1.56
Apple Inc.	3	1.17
Bao Tran	2	.78
Convida Wireless, LLC	2	.78
Deutsche Telekom AG	2	.78
Newsouth Innovations PTY Limited	2	.78
Perinet GMBH	2	.78
Shanghai Weilian Information Technology Co., Ltd	2	.78

Table 4: Patent-intensive organisations in the domain of Cloud computing

Applicant	Patent	Share
International Business Machines Corporation	615	35.12
Microsoft Technology Licensing, LLC	181	10.34
VMWARE, Inc.	120	6.85
Salesforce. Com, Inc.	84	4.8
Kyndryl, Inc.	79	4.51
Intel Corporation	52	2.97
Oracle International Corporation	51	2.91
The Bank of New York Mellon Trust Company, Na.	48	2.74
SAP SE	46	2.63
Servicenow, Inc.	43	2.46
Amazon Technologies, Inc.	41	2.34
Capital One Services, LCC	36	2.06
Accenture Global Solution Limited	34	1.94
Telefonaktiebolaget LM Ericsson	34	1.94
Red Hat, Inc.	32	1.83

From Tables 3-6, it's interesting to notice that within the field of industrial IoT analysis, strong force is dominated by corporations with a share of 71.98% of us patent offices. On the opposite hand, the cloud computing domains represent an oversized a part of the innovation effort, maybe as a result of there's presently intense competition among IT houses in developing numerous cloud solutions. Indeed, the effort seems to be fairly distributed, with IBM (35%) of the US office being the foremost patent-intensive company. Overall, IBM looks to be a number one company in digital technology development as a result of it owns patents in each domain. This is demonstrated by IBM's, Intel Corporation and Telefonaktiebolaget effort to developing comprehensive digital solutions, as demonstrated by the creation of significant data analytics solutions tailored to its cloud offerings. Nonetheless, it appears that other corporations, such as Microsoft and Intel, may take a more pragmatic approach. This may be due to IBM's strategy of building technology that closely conforms with its own standards and regulations, thus making it less appealing as a fundamental platform for future technological improvements by other firms.

It may support integration between differing kinds of technologies, thereby reducing the price of digitization. In particular, those with high and mid-level patent intensity may be thought-about as corporations that are possible to guide the digitization process, also as developers of most digital technologies (e.g. IBM, Intel Corporation and Telefonaktiebolaget). On the opposite hand, though less heterogeneous and patent-intensive companies can tend to push ability between technologies and therefore the transition to industry 4.0, they will still play a key role. Role if they concentrate on developing cutting-edge digital solutions, as in the case of strong force, Microsoft, VMware Inc and other.

Table 5: Summery: Patent-intensive organization

Firm	Total Patents	Technological domains	Industrial IoT patents (%)	Cloud Computing Patents (%)
IBM Corporation	621	2	0,97	99,03
Strong Force IoT	185	1	100	0,00
Microsoft.	181	1	0,00	100
VMWARE, Inc.	120	1	0,00	100
Salesforce. Com, Inc.	84	1	0,00	100
Kyndryl, Inc.	79	1	0,00	100
Intel Corporation	59	2	11,84	88,14
Oracle International	51	1	0,00	100
The Bank of New York	48	1	0,00	100
SAP SE	46	1	0,00	100
Servicenow, Inc.	43	1	0,00	100
Amazon	41	1	0,00	100
Technologies,Inc.	36	1	0,00	100
Capital One Service,	34	1	0,00	100
LCC	44	2	22,73	77,27
Accenture Global	32	1	0,00	100
Solution				
Telefonaktiebolaget				
Red Hat, Inc.				

Table 5 focuses on organizations that have filed patents in multiple technology domains, providing data on their total patent count (column 1), the number of domains in which they have patents (column 2), and the proportion of patents attributed to each domain relative to the total number of patents (column 3 and 4). we will consider the foremost patent-intensive and diversified corporations as rivals to each different as a result of all of them have the resources and technological competency to create a comprehensive IT system, therefore competitive to build a dominant IT network to integrate SCM and marketing function. Similarly, a corporation that's extremely targeted on one technology domain will function support for giant players, surely IT applications that need relevant data of a selected domain.

4.3 Discussion

The research aims to provide a thorough understanding of the digital technologies that enable the integration of supply chain management (SCM) and marketing (M). especially in network-oriented business models, the need to effectively coordinate strategic choices across the network, from customer-oriented to supplier-related, is a difficult and critical issue. It is best understood as a combination of marketing and supply chain strategies. (Jüttner et al., 2010). The first stage is to identify a set of digital solutions that can improve the implementation of the mechanisms required for effective SCM-M integration, such as cloud computing and Industrial IoT, starting with the array of enabling technologies discovered within the domain of Industry 4.0. Following that, a patent analysis is performed to highlight the broad technological and organizational trends that characterize the technology portfolio under consideration. This analysis throws light on their innovation processes and the possible applications for SCM-M integration. To do this, a dataset of current and unique patents awarded by six different countries was obtained and examined from IPTech.cc. Furthermore, real-world scenarios from management practice have been added to the patent data.

This research has yielded some intriguing results. Several organizations, like Amazon, Wal-Mart, and Zipcar, have launched projects to digitize their processes by leveraging existing technologies. The example described here emphasizes the important and mutually reinforcing role that technology plays in the integration of supply chain management (SCM) and marketing (M). In reality, each form of technology is crucial to the integrative component of SCM-M. When it comes to sensors and data acquisition systems, for example, Industrial IoT plays an important role in obtaining raw data pertaining to the influx and outflow of commodities across the supply chain, as well as interactions between products and customers. Cloud computing, on the other hand, is dedicated to the storage of this raw data in an organized and structured fashion.

Such information can be retrieved and transferred between supply chain management (SCM) and marketing. This structured information is then used as input for data analysis and client profiling tools. Both the structured data in the cloud and the data generated may be shared with supply chain participants on a continual basis, allowing them to better coordinate supply-and-demand-focused processes. This paradigm, similar to the DIKW model, provides further insights into SCM-M integration by emphasizing the need for data conversion into information and knowledge in multiple forms. This transformation is made feasible by the application of various digital technologies (Rowley, 2007). It is worth emphasizing that industrial IoT solutions are more common in terms of applications, stakeholders involved, and data types handled. Distributors, merchants, and manufacturers use these systems to collect certain sorts of information, such as component/product location, production/assembly deadlines, and consumer data.

The cloud service also processes many sorts of raw data, but its primary goal is to store structured information that can be useful to supply chain members. This information is then used to derive more relevant insights. As a result, the flow of data acquired by the underlying IoT sector is primarily one-way, from the supply chain/market to the cloud. Cloud services, on the other hand, not only receive real-time data from tags and sensors, but also communicate data to SCM and marketing functions. They store the produced data and make it easier for supply chain members to access information in the cloud, thereby managing bidirectional data and information flows. These services serve several functions.

The marketing and SCM functions work together to provide information. The cloud acts as a repository of information accessible to all supply chain players in the context of the SCM function. This improves interaction among members and increases understanding of each stage of the supply chain. Furthermore, cloud computing allows for continuing market and operational data analysis and integration in order to efficiently manage the SCM-M interface.

Regarding the trend of patent activity, the innovation efforts underlying the four classes analyzed gift a growing trend. This reveals a growing interest in these solutions, presumably because of a variety of state initiatives geared toward digitizing enterprise processes (e.g. Calenda, 2016; Kagermann et al., 2013, Ardito et al., 2018). Relatedly, organizational-level analysis shows that organizations that are technology leaders in terms of productivity and patent diversification (e.g. IBM, Microsoft, Intel, AT&T, Bank of New York and JPMorgan), are possible to guide the digitization method during this fourth industrial revolution. However, the organization should still be supported by different corporations additional dedicated to developing newest or specialized solutions during an explicit technology space (e.g. strong Force and VMware Inc.).

5. Conclusion and policy implications

While much has been said about the integration of marketing and SCM tasks, there is still a lack of clarity about the precise digital technologies that can be used to achieve this aim, as well as their respective roles (e.g., Pero and Lamberti, 2013). As a result, by shining light on the enabling technologies associated with Industry 4.0, this research adds to the current body of literature on SCM-M integration (Jüttner et al., 2007 and Ardito et al., 2018). These technologies are especially positioned to assist SCM-M interface management, particularly from an information processing standpoint.

In this regard, (Ardito et al., 2018) give a thorough framework that highlights the benefits of various digital technologies in the context of SCM-M integration. Furthermore, we contribute to the existing research by offering insights into the critical role that organizations play in the development of these technologies. This knowledge can help shape the digitization process within businesses.

It should be noted that the integrated picture of the enabling technologies supporting SCM-M integration has been relatively hazy, with little information accessible on the technology landscape in this domain, its evolving patterns, and the influence it has. This lack of clarity eventually impedes the ability to construct a clear picture of the best answers. These findings are also applicable to adoption (Deloitte, 2015; McKinsey & Company, 2015; Ardito et al., 2018). Furthermore, given the lack of a well-defined picture of emerging solutions in the Industry 4.0 domain (e.g., Theorin et al., 2017 and Ardito et al., 2018), this patent analysis can contribute to the literature that investigates how to drive the fourth industrial revolution from a technological standpoint.

5.1 Implication Managerial

We make two significant recommendations from a management standpoint. To begin, we highly advise managers to ensure that their organizations embrace digital solutions that are aligned with the nature of their business processes, such as Industrial IoT and cloud computing. Second, and in keeping with the previous advice, enterprises must create an internal competence that allows them to fully realize the promise of each digital technology.

Companies, for example, should have the expertise to build IoT implementations and cloud-based solutions across the whole supply chain. This allows SCM and marketing units to acquire and share essential market and operational data and information. Furthermore, firms should hire data scientists who are skilled at selecting and analyzing relevant data, changing it into actionable knowledge. Senior management should gain a holistic awareness of digital technology utilization in order to better capitalize on existing and future opportunities afforded by the intricate data flows emerging from the digitization of demand and supply-focused business operations.

This study has many limitations that have to be acknowledged. First, patent knowledge to review the dynamics of innovation has been published, there are several weaknesses. The analysis is refined by incorporating secondary or supplementary data (e.g. current publications and research and up-to-date trade projects) or primary data through in-depth interviews with specialists concerning the field. Second, most of our attention has been dedicated to the growing trend of sanctioning technologies. Future research should additionally better analyze its implementation and use. Related, the impact of the impact of the applying of those technologies is directly connected to the related disciplines.

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