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# Smart Solutions for Logistics and Supply Chain Management

**Hebatallah ElMesmary, Gamal Abd El-Nasser A. Said**

***Abstract—Smart technologies can help to get a clear data of the condition, location, and environment of goods, and processes at anytime, anywhere, also to make intelligent decisions and take corrective actions so that the supply chain can run more efficiently. This work aims at exploring the state of art on the smart solutions such as Big Data Analytics, Cloud Computing, Internet of Things (IoT) and Blockchain in Logistics and Supply Chain Management (SCM). This paper explains the potential applications as well as the impact of smart techniques on SCM. Furthermore, a smart model for supply chain management is proposed.***

***Keywords - Logistics; Supply Chain Management; Cloud Computing; Big Data; Internet of Things; Blockchain.***

## I. INTRODUCTION

Logistics is one of the key elements of supply chain management; the main objective of logistics is revealed in managing the flow of goods, services, and information efficiently and effectively in the right time and right quantity at right place with right devices in order to satisfy customers. According to (CSCMP Supply Chain Management, 2014), logistics management can be defined as a part of supply chain management that involves planning, implementing, and controlling the effective forward and reverse flow of services and goods, as well as the related information flow in order to meet customer requirements.

In general, the definition basically includes planning, customer service, production, transportation, purchasing inventory management, handling, warehousing, processing, packaging, distribution, information processing (Azmia, et al., 2017). Supply chain management can be explained as a network that involves the logistics flow, which starts from a supplier then through a producer, distributor, and wholesaler to the customer. It supports all necessary information for the flow to run effectively (Yoo & Won, 2018). A supply chain comprises many elements of several types, these elements and the interrelationships are substantial for the complexity that occurs in the system.

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This supply chain complexity is revealed by some characteristics as: number of supply chain entities where the supply chain system should consider all the involved different entities of a supply chain, diversity: A supply chain can be categorized according to its homogeneity or heterogeneity, interdependency: Interdependence between products, items and supply chain partners.

Complexity is directly related to interdependence, variety that represents dynamical behavior of a system, and uncertainty in a supply chain that prevails due to the lack of knowledge about the whole system (Awwad et al., 2018).

Thus supply chains face many challenges including complexity, uncertainty, cost, and vulnerable problems. Logistics and Supply Chains should b e smart enough in order to overcome these problems.

Cloud Computing gives users the opportunity to migrate applications and their data towards the cloud. Instead of using expensive applications and resources on a station, users take advantage of cloud delivered on demand applications and resources with minimum cost (Chawkia et. al., 2018). Cloud computing technology offers efficient solutions for companies. The amount of data of organizations increases rapidly. It is becoming more complicated to keep up to speed with smart solutions for companies that want to develop their business instead of spending in technologies.

Big Data Analytics plays a vital role in logistics and supply chain management industry by improving the process of distributing and delivery and sharing the required information and thereby increasing productivity and profit. The data accumulated by supply chains contains information from the key entities such as manufacturing, retail, and logistics. The use of Big Data Analytics on a collection of such data sets can enhance decision making approach for forecasting risks and main opportunities in supply chains (Awwad et al., 2018). The use of Big Data provides a significant value in areas such as market demand predictions, supplying decisions, product development, distribution, customer feedback, and optimization (Awwad et al., 2018). By utilizing Big Data and Big Data Analytics, supply chains should function with the purpose of improving areas such as forecasting customer needs, evaluation of supply chains, efficiency of the overall supply chains, reaction time, risk assessment (Computer World, 2018).

Internet of things (IOT) can establish a huge scale of smart infrastructure to merge products, physical objects, data, information and processes of a supply chain and build a secure and smart system of SCM (Abdel-Basset et al., 2018). Internet of Things is facilitating smart and connected supply chains. The use of cloud-based solutions allows for access anywhere, generates flexibility, and improves efficiency.

Blockchain allows faster transaction settlement by processing payments directly with no third-party involvement, automatically updating ledgers, and executing both ends of a transaction instantaneously. Blockchain technology enables to create a decentralized environment, where the data is not under the control of any third party organization.

Any completed transaction is recorded in an unchallengeable ledger in a secure, transparent and permanent way, with a timestamp and other details (Holotescu, 2018). Blockchain can be employed to provide extensive customer value, transparency and enriched service network. Implementing Blockchain in different logistics and supply chains brings visibility, optimization, and forecasting (Lieber, 2017). Examples of applications or efforts that have attempted to streamline the influence of Blockchain on improving supply chains include IBM, Walmart, Maersk, Provenance, etc). Therefore the application of Blockchain can be a good solution for transparency and security for fixing logistics and supply chains (Sivula et al., 2018).

The remainder of this paper is structured as follows: in section II, a brief introduction to smart technologies, Cloud Computing, Big Data Analytics, Internet of Things, and Blockchain is given. Then a brief overview of related work and applications of smart solutions on logistics and supply chain activities is presented in section III. A proposed smart supply chain model is presented in section IV. At last, conclusions and future work are highlighted in section V.

## II. SMART TECHNOLOGIES

One of the most potential areas that have benefited from the innovation of the smart technologies is the supply chain management through smart technologies like sensors, data analytics, and decision-making tools. These tools have the potential to enable the users to share information across the supply chain.

Digitalization in logistics and supply chain management is becoming dynamic due to increasing customer's demand. This digitalization offers easy access to customer needs through effectively sharing the tracking information of the product and service deliveries (Sivula et al., 2018). Digitization makes the supply chain management effective by collaborating complex supplier networks and responsive by sharing information. A digital supply chain is a smart value driven-network that uses new procedures and techniques with information analytics and technology to make value. It has technologies that monitor real-time provider locations, inventory levels, and customer interactions with items. Today, technologies like RFID, wireless sensors networks, and location based information have enabled organizations to switch their existing hybrid supply chain structures into greater collaborative digital models, flexible, open, and agile. (Tahiduzzaman et al., 2017).

### A. Cloud Computing

Cloud Computing is an information technology service model where computing services (software and hardware) are delivered on demand to customers over a self-service independent of device and location (Marston et al., 2011). Cloud Computing is Internet-based computing, where shared information, data, and resources are offered to computers and other devices on demand (Abd El-Nasser, 2016).

Cloud Computing can be classified into; private, public, hybrid, and community cloud. Public cloud is allocated for open use by general public, it can be managed by multiple partners besides a company and it exists externally on the premises of the cloud provider (Mell & Grance, 2011). In public cloud: the end user can get an inexpensive setup since a third party provider covers the application costs. Private cloud is an off or on premises cloud infrastructure that can be accessed by users of diverse business units in a company (Pires & Camargo, 2010). Hybrid cloud: is combination of two or more different cloud infrastructures (Mell & Grance, 2011). In a hybrid cloud, a company can employ its private cloud and it can be scaled out to a public cloud when local capacity is used up (Sujay, 2011). Community cloud is assigned for organizations that share common matters, such as security requirements or regulatory compliance. It can be managed by one or more parties of the community (Mell & Grance, 2011).

Cloud Computing comprises three different models named as follows: Infrastructure as a Service; IaaS, Platform as a Service; PsaS and Software as a Service; SaaS. (IaaS) model is a platform that can benefit equipment's in the form of servers, hardware, storage-space, at pay per use service. In this service model, a cloud provider offers from virtual or physical machines to load balancers, raw storage, networks and firewalls. Users do not control the basic cloud infrastructure but can control, storage, operating systems, and employed applications (Mell & Grance, 2011). In (PaaS), cloud providers host a computing environment including, database, operating system, programming language, and execution environment where users develop and implement applications (Sujay, 2011). (SaaS) model is a software delivery model that provides on demand access to software applications (Garg & Buyya, 2012). Users neither control cloud infrastructure including network, servers, operating systems, storage, nor individual application capabilities (Mell & Grance, 2011). Cloud Computing models are shown in Figure1.

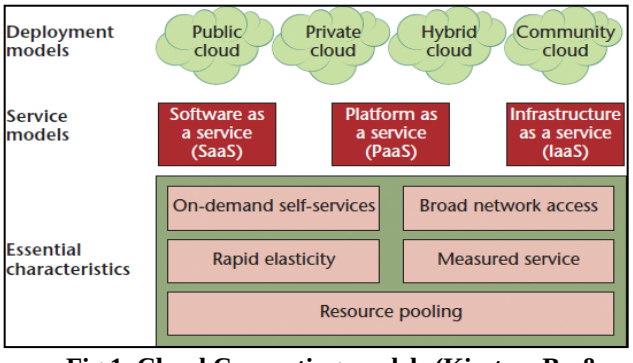


**Fig.1. Cloud Computing models (Kirsten, B., & Aberystwyt, 2011)**

The concept of Cloud Computing can make an effective impact in the area of supply chain management by simplifying the cooperation between the supply chain stakeholders through the integration of supply chain and logistics activities; mainly inventory, warehouse,

transportation, forecasting and planning, and sourcing and procurement. Supply chains that choose to implement Cloud Computing in their operations can realize key benefits as flexibility, cost efficiency, simplicity, system scalability in addition to timely visibility (Agorasti et al., 2013).

Implications of Cloud-based supply chain management allow companies to identify a set of dynamic partners, outline a unique business style, and facilitate the exchange of data and business processes in a non-compulsory way to the weakest links in the chain (Pires & Camargo, 2010).

## B. Big Data Analytics

Big Data has become a matter of great interest, both from the scientific and business sectors. Big Data Analytics show a technique of collecting, managing, and analyzing huge amounts of data. Big Data can be characterized by the five Vs that are defined as velocity, volume, veracity, variety, and value. Velocity describes the large amounts of data generated at an excessive speed. Volume refers to the vast amount of data generated every second. Veracity refers to the truthfulness or accuracy of the data. Variety means Big Data comes from a great variety of sources. Value implies the ability to turn the Big Data into business value (Budhathoki et al., 2018). The five components (Vs) of Big Data are shown in Figure 2.

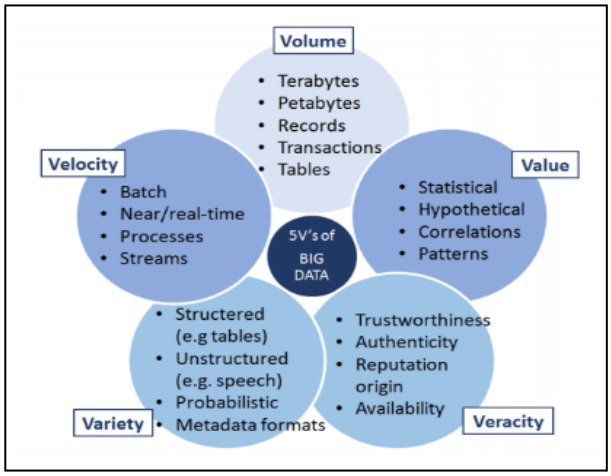


**Fig.2. The 5 components (Vs) of Big Data (Vishwajit et al., 2018)**

Big Data Analytics entail the use of advanced analytics techniques to generate valuable knowledge from massive amounts of data, facilitating data-driven decision-making. Big Data analysis tools help to handle the business challenges by providing solutions for Business Intelligence with dashboards, queries, reports, and predictive analytics like forecasting, optimization, and statistical analysis.

For any business, logistics and supply chains represent a crucial part. Big Data greatly helps in the fields of manufacturing, distribution, warehousing, transportation, packaging, tracking etc. of products. Big Data helps in solving problems in a diversity of business fields, but operations and sales are on the top (Ghosh, 2015). Big Data can be applied in two distinct approaches; it can either promote current processes by concentrating on contemporary business needs and challenges, or data can be investigated to develop products and services as new value propositions. Besides manufacturing companies; service providers, retailers, professionals, and governments, can realize the potential of big data (Brinch et al., 2017).

Today, advanced analytics and Big Data are applied in several ways to activate digital supply chains and make it a reality such as real-time monitoring, supplier sourcing, customer segmentation, knowledge sharing, forecasting demand, and simplifying distribution (Tahiduzzaman et al., 2017).

## C. Internet of Things (IoT)

Internet of Things (IoT) refers to internetworked devices such as radio frequency identification (RFID) tags, actuators, sensors, mobile phones…etc., each with the ability to gather information from, and even perform actions in the real world. An IoT system is a network of networks that connects a huge number of things, objects, devices, and sensors through communications and information infrastructure to stipulate value-added services through intelligent data processing and management for diversified applications (Bhuvaneswari & Porkodi, 2014). The Internet of Things Ecosystem is shown in Figure 3.

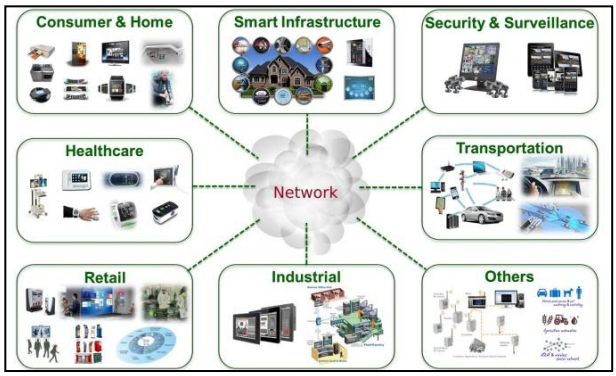


**Fig.3. IoT Ecosystem (Vivante Corporation , 2013)**

Implementation of IoT helps organizations to enhance their capabilities to integrate the suppliers, customers and intra-organizational logistics processes (De Vass et al., 2018). The growing IoT paradigm, may play a considerable role in the retail industry to manage supply networks in response to customer demands (Yu et al., 2015).

## D. Blockchain Technology (BCT)

Blockchain enables transparency and trust across businesses; it opens up new opportunities for business and economic environments with secure transactions. Blockchain bridges the trust gap in business networks. The elements of the Blockchain technology drive this disruption are transparency, immutability, security, consensus, and smart contracts. Figure 4 shows the processes of creating transactions, creating, verifying blocks, and transferring blocks to the Blockchain.

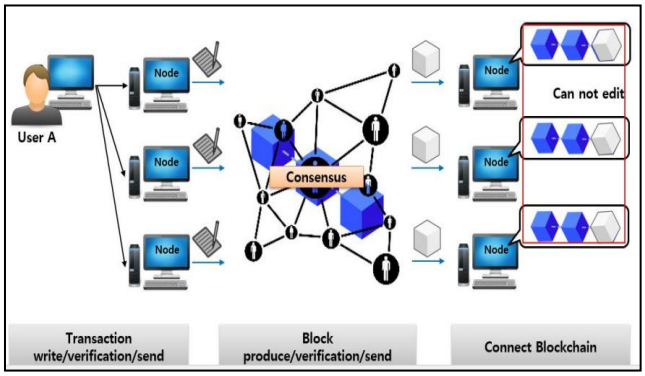


**Fig.4. Blockchain Operation (Yoo, M. & Won, Y., 2018)**

Blockchain Technology could be implemented in supply chain management in three compelling aspects: disintermediation, smart contracts and as a solution to information asymmetries (Chang et al., 2018). The benefits that businesses can reap from BCT include privacy immutability of data, public accessibility of records, dealing with supply chain information more efficiently without being excessively concerned about securing them appropriately, and access for various populations and locations. For government, it can obtain more trusted information for better and intensive inspections. For customers, BCT would guarantee public security of personal data (Tribis et al., 2018).

## III. RELATED WORK

There are many challenges in the global logistics and supply chain network such as transparency and monitoring. (Azmia et al., 2017) discussed the relationship between and strategic business processes and logistics activities; leading to effective performance in supply chains.

Cloud supply chain can be defined as a complex system to provide, host, manage, monitor, develop, and use cloud services. A cloud supply chain includes five main elements illustrated as follows: Cloud Service Provider (CSP): The CSP is the entity that makes a cloud service available to the customer; Hosting Infrastructure: The hosting infrastructure includes the physical resources (firewalls, servers, power, and hardware systems), and platform layers of the cloud architecture; Delivery Platform: Cloud services are accessed through servers, laptops and mobile devices; Control Systems: In dynamic supply chain, there is a high tendency that the several moving parts associated with the delivery of the cloud service may spiral out of control of the provider. Cloud Customer: a cloud customer is an entity responsible for maintaining a business relationship with a cloud provider and using its services (Akinrolabu et al., 2018). The five key elements of a cloud supply chain are shown in Figure 5.

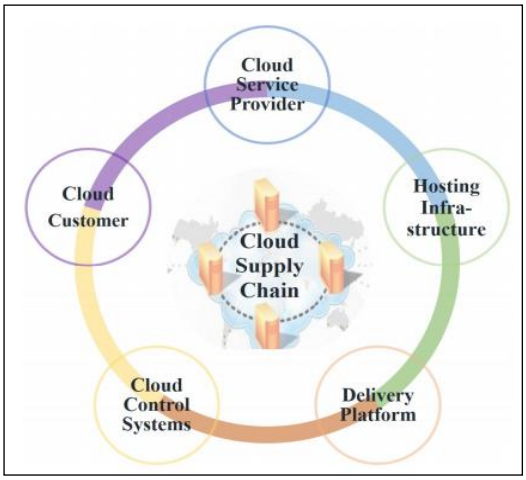


**Fig.5. The Cloud Supply Chain (Akinrolabu et al., 2018)**

The significance of Big Data Analytics in the context of supply chain management for managing end to end supply chains for achieving business excellence and a generic cloud-based architecture for the Big Data-centric supply chain operations have been proposed (Biswas & Sen, 2016). IoT enables companies to update inventories on real time according to replenishment orders, promoting efficient inventory management practices (Eldridge & Chapin, 2015). (Govindan et al., 2018) presented and analyzed a variety of applications of Big Data Analytics in logistics and supply chain management through exploring technology based tracking strategies, implementation concerns and supply chain capability maturity with Big Data. (Wang et al., 2016) proposed a maturity framework of Supply Chain Analytics (SCA) to evaluate the extent to which SCA is utilized within logistics and supply chain management. The proposed framework is based on five levels of capability: process-based, functional, collaborative, sustainable SCA, and agile SCA.

The current innovation in the IoT enables to collect, analyze information related to product supply and demand (Prinsloo & Malekian, 2016). This led to optimized logistics systems and enable both the suppliers and the customers to track and share real time information on the movement of products along the supply chain. (Parthasarathi, R., & Yongsheng, M., 2018) proposed a framework which includes manufacturers, suppliers, logistics and clients that can track the movement of the product along the supply chain. The framework demonstrates how IoT could enhance SCM, which improve the overall performance through enhanced information sharing, efficient resources utilization and reduced loss of merchandise along the supply chain.

Blockchain Technology extended customer value, transparency and enhanced service network. This technology works through Cloud integration, which offers a cost-effective business model for digital supply chains. BCT can help to achieve disruptive transformation in digital supply chain networks through extended visibility. Such visibility articulates continuous monitoring to ensure improved supply chain performance (Sivula et al., 2018).

(Chang et al., 2018) studied the innovative blockchain technology, its impact on supply chain performance, and its optimal design. The firm attempts to maximize the total expected discounted profit by managing Blockchain design, production, and ordering decision jointly. (Chen et al., 2017) proposed a framework for Blockchain driven supply chain quality management. (Westerkamp et al., 2018) used smart contracts to propose a Blockchain-based supply chain traceability system.

(Yoo & Won, 2018) proposed a system by applying Blockchain to the price tracking part of supply chain management systems in order to guarantee the transparency of product distribution. This system enables companies to trace their trades by enriching transparency in the supply chain management.

## IV. SMART SUPPLY CHAIN MODEL

A smart supply chain model that integrates Cloud Computing, Big Data Analytics, Internet of Things (IoT), and Blockchain for supply chain management is considered in this research, the proposed smart supply chain model is shown in Figure 6.

The integrated smart solutions will improve the supply chain management efficiency as follows:

Cloud Computing: Improves the overall performance through efficient resources utilization, cost efficiency; simplicity, flexibility, and system scalability.

Big Bata Analytics: Abstract valuable knowledge from massive amounts of data; facilitate data-driven decision-making, predict key opportunities and risks in supply chain.

IoT: Enables tracking and sharing real time information on the products' motion along the supply chain.

Blockchain Technology: Creates a decentralized ledger of all transactions in a supply chain network to increase security and transparency, minimize cost, and lessen transaction time.

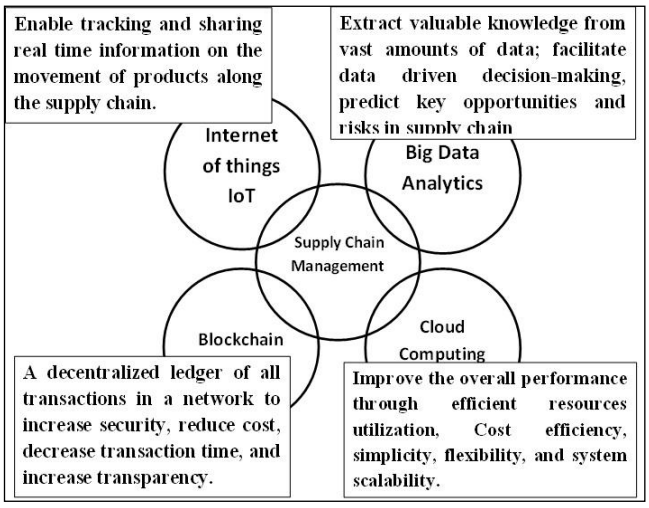


**Fig.6. A Proposed Smart Supply Chain Model**

## V. CONCLUSION AND FUTURE WORK

This paper surveyed the applications of smart technologies; Cloud Computing, Big Data Analytics, Internet of Things (IoT), and Blockchain on supply chain management and logistics. Smart solutions offers effective share of tracking information such as condition, location, and environment of goods, and processes at anytime, anywhere, it helps to obtain valuable knowledge from enormous amounts of data, facilitating data-driven decision-making, also helps to provide extended customer value, transparency, cost reduction, acceleration of transactions and enhanced service network in SCM. A smart supply chain model that integrates Cloud Computing, Big Data Analytics, Internet of Things (IoT), and Blockchain for supply chain management is considered in this research.

Future research will focus on developing a framework for supply chain management using smart solutions.

## REFERENCES

1. Abdel-Basset, M., Manogaran, G. & Mohamed, M. (2018). "Internet of Things (IoT) and its Impact on Supply Chain: A Framework for Building Smart, Secure and Efficient Systems", Future Generation Computer Systems, 86(1), 614-628.
2. Agorast,i T., Eirini, A., Antonios, A. & Konstantinos, D. (2013). "Cloud Computing in Supply Chain Management: An Overview", IGI-Global, E-Logistics and E-Supply Chain Management: Applications for Evolving Business, 218-231.
3. Akinrolabu, O., New, S. & Martin, A. (2018). "Cyber Supply Chain Risks in Cloud Computing – Bridging the Risk Assessment Gap", Open Journal of Cloud Computing (OJCC), 5(1), 1-19.
4. Awwad, M., Kulkarni, P., Bapna, R. & Marathe, A. (2018). "Big Data Analytics in Supply Chain: A Literature Review". Proceedings of International Conference on Industrial Engineering and Operations Management, Washington DC, USA.
5. Azmia , I., Hamid , Hussin , N. & Ibtishamiah, N. (2017). "Logistics and Supply Chain Management: The Importance of Integration for Business Processes", Journal of Emerging Economies & Islamic Research 5(4), 73 – 80.
6. Bhuvaneswari, V. & Porkodi, R. (2014). "The Internet of Things (IoT) Applications and Communication Enabling Technology Standards: An Overview", Proceedings of 2014 International Conference on Intelligent Computing Applications, 324-329.
7. Biswas, S. & Sen, J. (2016). "A Proposed Architecture for Big Data Driven Supply Chain Analytics", Journal of Supply Chain Management, 23(3), 7-34.
8. Bowersox, J., Closs, J., Cooper, B. & Bowersox, C. (2013), Supply Chain Logistics Management, 4th ed., McGraw-Hill Higher Education, New York, NY.
9. Brinch, M., Stentoft, J. & Jensen, J. (2017). "Big Data and its Applications in Supply Chain Management: Findings from a Delphi Study", Proceedings of the 50th Hawaii International Conference on System Sciences.
10. Budhathoki, D., Dasgupta, D. & Jain, P. (2018). "Big Data Framework for Finding Patterns in Multi-market Trading Data", Big Data 2018 Lecture Notes in Computer Science, Springer, Cham, 10968(1), 237-250.
11. Chang, J., Katehakis, M., Melamed, B. & Shi, j. (2018). "Blockchain Design for Supply Chain Management", SSRN Electronic Journal. 10.2139/ssrn.3295440.
12. Chawkia, E., Ahmeda, A. & Zakariaea, T. (2018). "IaaS Cloud Model Security Issues on Behalf Cloud Provider and User Security Behaviors", Proceeding of The 2nd International Workshop on Big Data and Networks Technologies (BDNT'2018), 328-333.
13. Chen, S., Shi, R., Ren, Z., Yan, J., Shi, Y. & Zhang, J. (2017). "A Blockchain-based Supply Chain Quality Management Framework", The Fourteenth IEEE International Conference on e-Business Engineering, DOI: 10.1109/ICEBE.2017.34
14. ComputerWorld. (2018). "Overcoming 5 Major Supply Chain Challenges with Big Data Analytics".
15. CSCMP Supply Chain Management, Council of Supply Chain Management Professioanls (2014), [available at: http://cscmp.org/about-us/supply-chain-management-definitions]
16. De Vass, T., Shee, H. & Miah, S. (2018). "The Effect of Internet of Things on Supply Chain Integration and Performance: An Organisational Capability Perspective", Australasian Journal of Information Systems, 22

17. Eldridge, R. & Chapin, L. (2015). "The Internet of Things: An overview". The Internet Society (ISOC), 1-50.
18. Gamal Abd El-Nasser, S. (2016). "Nature Inspired Algorithms in Cloud Computing: A Survey", International Journal of Intelligent Information Systems, 5(5): 60-64.
19. Garg, S. & Buyya, R. (2012). "Green Cloud Computing and Environmental Sustainability", Harnessing Green IT- Principles and Practices, London, UK, Wiley Press, 315–340.
20. Ghosh, D. (2015). "Big Data in Logistics and Supply Chain Management" - A Rethinking Step, International Symposium on Advanced Computing and Communication (ISACC).
21. Govindan, K., Cheng, T., Mishra, N. & Shukla, N. (2018). "Big Data Analytics and Application for Logistics and Supply Chain Management", Transportation Research Part E, 114(1), 343-349.
22. Holotescu, C. (2018). "Understanding Blockchain Technology and How to Get Involved", Proceedings of The 14th International Scientific Conference eLearning and Software for Education Bucharest, April 19-20, 2018.
23. http://www.vivantecorp.com/index.php/en/products/internet-of-things.html
24. Kirsten, B. & & Aberystwyth. (2011). "Cloud Computing: A Records and Information Management Perspective", IEEE Security & Privacy, 9(1), 63-66.
25. Lieber, A. (2017). Trust in Trade: Announcing a New Blockchain Partner. IBM. [available at: https://www.ibm.com/blogs/blockchain/2017/03/].
26. Marston, S., Bandyopadhyay, S., Li, Z., Zhang, J. & Ghalsasi, A. (2011). "Cloud Computing - The Business Perspective". Decision Support Systems Journal, 51(1), 176–189.
27. Mell, P., & Grance, T. (2011). "The NIST Definition of Cloud Computing". National Institution of Standards and Technology.
28. Parthasarathi, R. & Yongsheng, M. (2018). "Adaptive Supply Chain Systems – Conceptual Framework using Internet of Things (IOT)", Proceedings of TMCE 2018, 7-11 May, Las Palmas de Gran Canaria, Spain.
29. Pires, S. & Camargo, B. (2010). "Using Cloud Computing to Integrate Processes in Supply Chain", Proceedings of the POMS 21st Conference. Vancouver, Canada.
30. Prinsloo, J. & Malekian, R. (2016). "Accurate Vehicle Location System Using RFID", Internet of Things Approach. Sensors, 16 (6), 825.
31. Sivula, A., Shamsuzzoha A. & Helo, P. (2018). "Blockchain in Logistics: Mapping the Opportunities in Construction Industry", Proceedings of the International Conference on Industrial Engineering and Operations Management Washington DC, USA, September 27-29, 2018.
32. Sujay, R. (2011). "Hybrid cloud: A New Era". International Journal of Computer Science and Technology, 2(2), 323–326.
33. Tahiduzzaman, M., Rahman, M., Dey, S; Rahman, S. & Akash, S. (2017). "Big Data and its Impact on Digitized Supply Chain Management", Journal of Business Management, 3(9), 196-208.
34. Tribis, Y., El Bouchti. A. & Bouayad, H. (2018). "Supply Chain Management based on Blockchain: A Systematic Mapping Study", MATEC Web of Conferences 200, 00020
35. Vishwajit, R., Subrina, N, Noureen Stephen, B., Argenis, B. & Michael, G. (2018)." Event Detection from PMU Generated Big Data Using R Programming", 6th IEEE Conference on Technologies for Sustainability, Long Beach, CA.
36. Wang, G., Gunasekaran, A., Ngai, E. & Papadopoulos, H. (2016). "Big Data Analytics in Logistics and Supply Chain Management: Certain Investigations for Research and Applications", International Journal of Production Economics, 176, 98–110.
37. Westerkamp, M., Victor, F. & Kupper, A. (2018). "Blockchain-based Supply Chain Traceability: Token Recipes model Manufacturing Processes", IEEE International Conference on Blockchain, Halifax, Canada. OI:10.1109/Cybermatics_2018.2018.00267.
38. Yoo, M. & Won, Y. (2018). "A Study on the Transparent Price Tracing System in Supply Chain Management Based on Blockchain". Sustainability. 10. 4037. 10.3390/su10114037.
39. Yu, J., Subramanian, N., Ning, K., & Edwards, D. (2015). "Product Delivery Service Provider Selection and Customer Satisfaction in the Era of Internet of Things: A Chinese E-retailers' Perspective", International Journal of Production Economics, 159(1), 104-116.


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