The Role of Mobile Devices and Applications in Supply Chains

ONUR KURT*
onurkurt7529@gmail.com

GÖKHAN KALEM*
gokhan.kalem@gmail.com

ÖZALP VAYVAY*
ozalp@marmara.edu.tr

ZEYNEP TUĞÇE KALENDER**
tugce.simsit@marmara.edu.tr

*Marmara University
Graduate School of Pure and Applied Sciences
Engineering Management Department
Goztepe Campus, Istanbul
TURKEY

**Marmara University
Faculty of Engineering
Industrial Engineering Department
Goztepe Campus, Istanbul
TURKEY

Abstract: Nowadays, fierce competition remains a major characteristic of today's business environment. The companies have to adopt new technologies in their business processes and especially supply chains to be able to maintain their position and grow. Mobile technologies and their products such as smartphones, tablets, applications etc. are the leading factors which the companies require to follow closely. Dynamic and competitive market drags the companies to the mobile supply chain management (SCM) when redefining their interactions with suppliers, customers and business partners. To understand its benefits, the drivers of mobile supply chain management are explained in detail by giving their use areas in the industry reviewing literature remarkably. In addition, the paper set light to how the firms achieve a sustainable competitive advantage in the marketplace using smartphones and tablets, as well as mobile applications in supply chain management. At the end, new trends and proposals are given in terms of customers' requirements and advances of mobile technologies such as Internet of Things. In this research, it is aimed to understand the role of mobile devices and applications well by explaining characteristics of mobile supply chain management.

Keywords: Mobile supply chain management, mobile devices, mobile applications, mobile technologies

1. Introduction

When mobile phones have been introduced in our lives, they have been used for communication between people either via voice or via text mesagges (SMS). Later, the needs for relaying more information such as images or pictures was emerged thus MMS (Multi Media Services) messages were developed. Because of the need to reach more information by people while mobile, internet connection capability mobile phones were developed. These mobile phones were equiped with either hardware tools such as powerful processors and RAMs to give a faster response what is wanted from itself; bigger and high resolution screens to view better what is wanted to see; WLAN, Bluetooth, NFC (Near Field Communication) devices, digital camera, GNSS Receiver, acceloremeter, magnetometer etc, or software tools such as Microsot Office programmes, Acrobat Reader to view, save, highligth the documents or games etc. These kind of mobile phones are called as "smartphones" in

literature because of their multi tasking features with the operating systems. With the help of these connection capabilities of smartphones, owner of smartphone can stay connect to internet either via mobile operator or via WLAN. After evolution of smartphones, tablets have been introduced to market. Tablets were developed to fill the gap between smartphones and laptops from mobile internet connection point of view. They have bigger screen, better battery life and better processing capability than that of smartphones but they are heavier than smartphones and they do not have phone capability (except via internet connection). While smartphone and tablet technologies are growing, operators are also growing their infrastructures to support faster internet connections such as 2G, 3G and 4G respectively. Furthermore, growing number of entrepreneurs have been developing applications for operation systems used in both smartphones and also tablets.

Multi purpose usage and also stay connected internet capabilities drives the attention of people to buy a smartphone. Trend of owning a smartphone has become a lifestyle [1]. When needed more processing power and extention usage for surfing in the internet, tablets have been chosen instead of smartphones. Because of these trends, smartphone shipments rised by 40 percent in 2013 to exceed the 1 billion unit threshold and $266 billion in value furthermore it is forecasted that smartphone shipments will be 1.89 billion units by 2018 [2]. Also in 2014, it has been seen the increasing of the number of mobile-connected tablets by 1.6 fold to 74 million [3]. In Figure 1 global mobile devices growth are shown. In a result of increasing number of shipments of smartphones and also tablets, it is forecasted that network traffic will also increase. Per month in 2019, 4 GB of data traffic will be generated by the average smartphone, this presents a five-fold increase when compared with the average data usage of 819 MB per month in 2014 [3]. By 2019, nearly double data traffic will be generated by the mobile-connected tablets (including 4G Tablets) when compared with the data traffic in 2014 [3].

The mobile big bang will bring radical changes to corporate management styles [5]. As can be seen from these statistics, technology priority will be given to mobile internet connection and devices by companies. So the question is how to implement this mobile technological change into supply chain managements and how do get benefit from these emerging technologies with applying in to our business?

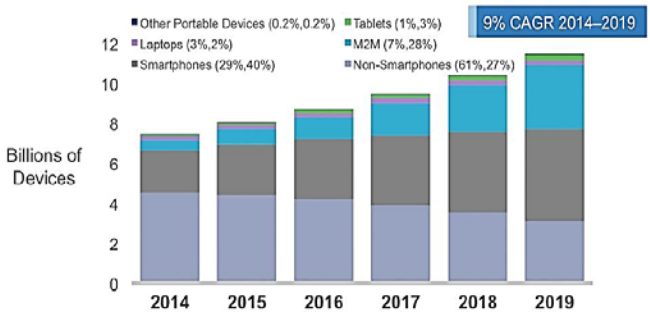

Figure 1: Global mobile devices growth [3]

The aim of this paper is to understand the growing usage trend of mobile internet-connected devices smartphones and tablets, to extract benefits from this trend to use in supply chains and to propose areas of usage in supply chains. Examples of usage are aslo supported to show the improvement of mobile internet-connected devices channel in supply chain. There is no doubt that changes in technology will drive supply chains over the next quarter of a decade in the more uncertain and complex business environment [29]. For that reason, supply chains need to be configured to navigate the future environment and will move ever closer to becoming complex adaptive systems.

2. Background

Early mobile devices came into use in supply chain during the late 1990's as "stand alone" devices. These units were different due to the integrated smartphones in the recent years. It was required to use modems and reading modules to catch and transmit the data whereas an integrated device did not exist to handle different tasks in that time [13].

Multi tasking devices such as handheld PC, PDA (Personal Digital Assistants) and others started to come up with the mid-2000 era. Mobile phones of the time had very limited features like small keyboard, 150x150 pixels resolution and between 4 to 12 lines of text in their screen. Smartphones having more enhanced features enabled bigger screens with higher capabilities in processor power, memory, storage. They were able to operate browsers as well. In the recent years, enormous technological improvements and developments in tablets, smartphones and also the relevant applications have created lots of chances in order to improve business processes [13].

Nowadays mobile computing has provided an important opportunity to enhance greater process by means of Apple iPad. The device enables new chances for the next generation of mobile communication with its internal storage capacity, processing power, size, portability and various connection features. The main advantage of this device is its flexible operability with other smart devices and numerous applications which are reachable from every place when connected to network somehow.

Today, there are many tablets to compete against iPad in the market which are produced by Sony, Samsung, HTC and Motorola. Tablets are also getting higher market share day by day as seen in Figure 1 because it already becomes complementary product to smartphones when the bigger size device and higher processor power are required in especially business environments. In addition, it is not hard to say that the tablets are regarded an equivalent device against laptops and even PCs used as enterprise solutions in the offices.

On the other hand, wireless communication technologies mostly started to be developed at the beginning of 1990s. The first mobile internet came up with GPRS and EDGE systems providing 100 kbps roughly and triggered to develop current smartphones. Especially the launch of iPhone in 2007 and then extension of 3G mobile communication all over the world have remarkably boomed smart devices trend in the individual and business life. Generally speaking, smartphones have been seen the smaller alternative of the tablets. Smartphones and tablets have been carried to provide communication and social interaction for both in business and personal lives.

The trend of mobile business-to-business (B2B), employee-to-business (E2B) and business-to-employee (B2E) solutions has begun to speedily increase by means of the competitive conditions and enhancements in mobile communication and systems [14]. Ultimately, in logistics and transportation area, smartphones and tablets have obtained a significant role to handle supply chain activities for professionals anywhere when connection is available.

3. Mobile SCM and its Relationship with Smartphones and Tablets

Purpose of the supply chain is the fulfilling a customer demand. Supply chain consists of supplier, manufacturer, transporter, warehouse, retailer and final customer segments. Among these segments there are three flows; information, product and funds. To satisfy the customer request in time depends on efficient and quick information exchange between these segments. If informaton exchange is managed better and faster than before, does this change affect the profit of the company? The answer is yes. When the information exchange between segments are robust, response time to demand in market will be less than ever and all segments of supply chain will get value from it. The problem is how to have efficient and quick information exchange between all segments. If growing usage of mobile internet-connected devices trend is used, supply chains will be more efficient and faster when compared with traditional supply chain systems. This can be occured with using mobile supply chain management (mSCM).

Mobile SCM means that the use of mobile applications and devices to help the execution of supply chain activities and then support firms to obtain cost reductions, supply chain responsiveness and competitive advantage. It can be improved by integrating mobile technology to the existing IT systems and removing dependence on wired systems in the process. This enables firms and users the flexibility to apply wireless technology to any IT-enabled supply chain functions, and extends existing SCM capabilities [15].

To realize the change, mobile SCM system or called as mobile enabling real-time management should be swapped with the existing supply chain management system and then mobile internet-connected devices will be driving force behind the robust mobile SCM. For instance, the operations performed by field service employees are confirmed using the mobile internet-connected device and automatically registered in the company's ERP system furthermore mobile internet-connected devices can also be used to gain access to databases and draw up requests regarding, e.g. orders, inventories, account balance or to download data regarded products sold or serviced [1].

To achieve this flexibility, Bouzayani and Dhiaf used tablets and smartphones to develop the ERP distributed with a decentralized architecture. They developed a total real time supply chain management based on co-modelling of distributed IS (Information System) architecture and complex supply chain management [7]. These kinds of flexible real time SCM architectures should be

implemented into companies to keep pace with the expectations of the customers. Information (communication, monitoring and control) and money exchange between supply chain segments will be done automatically with minimum human error thanks to evolving from traditional supply chain management system to real time management system.

In the field, mobile internet-connected tablets can be used instead of using smartphones by employees because of couple of reasons. Firstly, tablets have bigger screen than smartphones to read easily. This specialty is important when field employees read on the screen. Secondly, tablets have better battery life than smartphones. This specialty is important when the usage of these devices continue throughout entire day. Thirdly, tablets have more processing power than smartphones. This specialty is important while these devices are accessing and draw up the request since all these actions need more processing power. Always should be kept in mind that mobile devices are still only as good as the information that's available [4]. Because mobile devices are only clients of the mobile supply chain management systems, database or information consumed by mobile devices should be kept rich.

Table 1 shows that growth in devices and mobile data traffic according to device types. As mentioned before, the main factor providing tablets with more data consumption than smartphones is the increasing trend of tablets in business areas.

Device Type	Growth in Devices 2014-2019 CAGR	Growth in mobile Data Traffic 2014-2019 CAGR
Smartphone	16,7%	60,1%
Tablet	32.0%	83,4%
Laptop	5,3%	22,3%
M2M Module	45,5%	102,7%

Figure 2: Comparison of global device unit growth and global mobile data traffic growth [3]

4. The Drivers for Mobile SCM

In any business the use of mobile technology including mobile devices and applications has mostly been driven on the way of existing technological opportunities and vision regarding business needs in terms of technological advances. In supply chain management there are many drivers that enable the compliance of various mobile technologies and systems. The increasing necessity to internal and external integration within companies and also between business partners can be the most significant driver in this purpose [23, 24]. Its details and the other remarkable drivers are explained in the following subsections.

4.1. Integration

As mentioned before, internal and external integrations are quite significant factors for compliance of mobile devices and applications in today's business environment. The development of the mobile internet and mobile device based applications has provided a lot of operations that are cross in the functions of the company. The mobile technologies' adoption is usually driven by their capabilities to improve internal and external integration in supply chain management.

Internal integration is improved with the fundamental communication skills like voice calls and push-to-talk services. Furthermore, the internal integration is increased over internet amongst employees by providing them with the access of organizational data anywhere and anytime. Additionally, external integration is improved with mobile apps that provide easy access to related information for final consumers, retailers, transporters etc. For instance, a company can acquire the location and situation of a delivery by using GPS over a mobile device and wireless data services [22].

4.2. Globalization

In supply chain management globalization is another important driver that enable penetration of smartphones, tablets and apps. Mobile networks such as 2G, 3G and lastly 4G can enable invaluable means for mobile communication especially in remote locations with the lack of fixed landlines to communicate.

With the advances of mobile technologies, mobile communication systems in many countries have already exceeded the land line in terms of geographical coverage and penetration. It means that business environments and people are now tending to involve in entire transactions with other companies easily via mobile communication infrastructures. In addition, today mobility is also practical and beneficial between different countries thanks to global roaming services provided by mobile network operators in almost the entire world whereas it was regarded abnormal to do international calls 15-20 years ago. Therefore, mobile communication has the potential to provide

and improve business operations and transactions with the international firms in the global supply chains [22].

4.3. Mobile Information

Mobile apps are able to remarkably improve the communication velocity [26]. The usage of mobile application while moving eliminates paper-based work flows and can speed up the processes greatly. Furthermore, electronic signature and the information of delivery (time, person, place etc.) via mobile devices enrich supply chain management with more effective and arranged information processes.

In the meanwhile, instantaneous data transfer provides the execution speed throughout the supply chain by means of performing information available in a real-time. Besides it connects different concerned departments or work groups directly with the notifications and alert mechanisms in urgent situations. Finally, order-to-delivery time is shorter and service management responses more quickly with the help of mobile information.

4.4. Novel Processes

Dynamic and competitive environment in the market trigger the companies to use mobile devices and applications in order to handle operational business processes. The firms such as Mc-Donald's are popular worldwide because of their advantageous position in the market and competitive power thanks to novel business processes. Thus, the requirement to maintain advantage in the competition can push companies to innovations and reengineering the business processes utilizing from mobile communication and systems [27].

4.5. Replace Unused Systems

In the last decade the world has come face to face with lots of technological developments especially in mobile communication. For example, it was impossible to send a video or even picture with mobile phones via EDGE technology whereas many mobile opportunties already exist today including delivery of HD movie in a minute over 4G network. Of course there are a lot of examples similarly. Life cycle in the mobile technology makes some systems unused after a while and then companies need to replace them with the new types to pace with competition in the market.

4.6. Cost Reduction

As estimated before this research, efficient cost management is a very significant factor in compliance of any mobile device and application in supply chain management. With the purpose of decreasing operational expenses, managers in SCM always look for new methods to improve operations. Mobile devices and applications can simply supply simultaneous information to SCM systems. Moreover, the complexity of entire supply chain can be decreased by using mobile technologies in the order-to-cash process [28].

5. The Use Areas of Smartphones & Tablets in Mobile SCM

Supply chains cover from manufacturing to customer relationship and include manufacturer, supplier, transporter, warehouse, retailer, and customer segments. Possible usage of mobile internet-connected devices will be explained deeply at this part of the paper.

Customers can use their mobile internet-connected devices, generally smartphones, to buy product via internet instead of buying from physical stores. In a short time, it will be ordinary behaviour to check the product price on internet before visiting a physical store to purchase a product, or check the price of the product on internet using smartphone while in physical store, and purchase the product on the internet if it is cheaper than that in physical store before leaving there. These examples can be extended. With the help of recent technological advances especially in mobile internet connection, boundaries between traditional and internet retailing blurs. This evolution from brick and mortar model to internet model opens up new and limitless dimensions for customers to buy product.

As another expression, technology breaks down the geographical barriers while purchasing, and extends the market area all over the world. This is called as "omnichannel retailing" in literature. Quantum Retail Technology's Retail outlook 2012 defines omni-channel retailing that customers' freedom of choosing interaction channel whichever is convenient to search, get information and purchase the products for improving shopping experience [9].

To keep the pace with technological change, retailers need to adapt their business models to give quick response to market needs. JayashreeRamanan and Ramanakumar analysed growth of Indian retail sector and found

contributing factors as disposable income, urbanization, dominance of the younger generation in spending, nuclear families, advancement in information and communication technology (ICT) furthermore identified the trends in Indian retail as E-tailing, Mobile Internet, F-commerce, Omni-channel retailing, cloud computing, RFID in retail, Augmented reality, Search engine, Drone strike at the retail, and Me-tail [10].

Improving customer experience is another important topic for retailers. Customers want to collect information about product before purchasing so retailers should support their touch points to customers especially websites. Bughin, Chui, and Manyika proposed that executives should examine the touch points to customers of their companies and try to improve these points to increase customer satisfaction [11]. Physical Stores (Pros: able to walk in store, touch, feel the products, try on if it is we are able to find the correct size etc. Cons: product types availability depends on store size and region, business expenditure of store etc.) and Digital Stores (Pros: no regional boundries to find the product demanded, easily reachable since customer-retailer connection will be through internet, relatively more product types than Physical Stores, less business expenditure than Physica Stores etc. Cons: not able to walk instore, touch, feel the products, try on if it is wearable to find the correct size etc.). From retailer point of view, retailers should open up internet sites and also their internet sites should be adapted to mobile internet-connected devices' processes.

Scanning the barcode is other type of usage of mobile internet-connected devices. With scanning barcode, it is searched for the availability and the price of exactly the same product on internet. For instance, RedLaser application on smartphones can be used to scan the barcodes and search the price of this product. The main point of this type of retailing is that internet retailers should develop their applications to search for a product, give an information about that product, supply customer reviews about that product, purchase this product, if this product not available take backorder or suggest similar product to customer. For example, EPCIS (Electronic Product Code Information Services) is used in meat supply chains to provide tracking and tracing information about meats to supply chain partners, customers and authorities such as date of slaughtering, place of birth, location of slaughterhouse, certificates etc. [6].

Another usage of scanning barcodes is to buy a product. Bughin, Chui, and Manyika explained that advertisement displays have been placed in South Korean and Belgian subway stations by Tesco and Delhaize respectively. With the help of these advertisement displays, the products can be ordered and purchased from physical stores via the usage of smartphones by customers [11].

Demand and search information of customers, and customer reviews about products via company specific application provide valuable information to manufacturers, suppliers, transporter, warehouse, and retailer segments to asses their process on products.

From manufacturer, supplier, transporter, warehouse, and retailer point of view; scanning the barcodes of the products by mobile internet-connected devices can be used to record transportation information (real time) of the product from retailers to customers (delivery tracking). With the help of this information customer can be informed about the status of his or her order. In addition to scanning labels, RFID (Radio Frequency Identification) tags can be used by transportation companies to provide information automatically about the product. Bughin, Chui, and Manyika explained that FedEx's SenseAware Program uses devices included a GPS system, temperature, ligth, humidity, and barometric pressure sensors and these devices placed to sensitive packages to provide location and atmosferic information of the packages [11].

Mobile internet-connected devices can also be used to send proof of delivery. This process can be done either recipient can put his or her signature using a stylus on the screen or recipient's signature on the paper can be scanned for further interrogations [1]. This usage is useful in transportation segment of the supply chains. With this usage, paper work of tranportation processes is lessen, automatized (real time transportation information is provided) and availability of this information is increased.

Mobile internet-connected devices, especially smartphones can be used as mobile-payment devices among supply chain segments from customers to transportation segment. Bughin, Chui, and Manyika exemplified growing trend of mobile-payment service in developing countries that with the help of these services in ten month, more than a million mobile-payment subscribers have gained by Dutch-Bangla Bank Limited (DBBL) in Bangladesh [11]. Starbucks have used instant photo verification of buyers via Smartphone for

payments [8]. Smartphones or tablets can also be used in credit card transsactions if they have contactless technology to capture the credit card information. However, in this type of usage, there can be security issues. To address these issues, transactions can be done via official applications on the credit card owner's smartphone or tablet.

Furthermore, Apple utilizes EasyPay system in its own stores instead of traditional POS devices. iPhone users can easily complete their buying through an iOS application after scanning the product bar code. The other customers can request help from Apple staff for purchase. Apple use this system since 2009 in the stores by making purchase process much easier for customers and also its employees. Therefore, customers do not need to wait in the queue to buy product and can handle this in any place of the store thanks to mobile device. Besides the customers can sign the transaction with their fingers or e-pencil and then get the receipt via e-mail directly without any waste of hard-copy. In the following years this system is expected to become more popular in the world.

In the meanwhile, it is obvious that social media usage has been growing, and people are sharing their needs, choices and pros/cons of products through these media channels. This kind of shared information can be used to create knowledge repositories by companies because the end user is dictating mobile consumption and driving the market [4].

6. Mobile Applications in SCM

Mobile applications have remarkably grown especially with the uptrend of smartphones and tablets in the market. Applications which are compatible with operate just like computer programs to handle some specific jobs in the mobile devices. Nowadays apps continue to extend their usage areas for individual users and also lots of companies from various industries. The adoption of the applications is really significant for the firms to keep up-to-date and follow trends in the market.

Firstly, the most prominent advantage of these apps in SCM is having feature of location independence via mobile communication networks such as 3G and 4G anywhere as an important opportunity of mobility [17]. Moreover, mobile applications seem very useful for each level in the supply chain management. It means that mobile apps can be utilized by the managers, workers, engineers, drivers, and technicians etc. who are involved in this chain covering high, middle and low level employees in the companies [19].

In addition, mobile SCM apps enable information flow between different business functions throughout the supply chain. So, product flow is healthier when reaching to the final consumer in this way [15].

According to Umney (2011), mobile technologies and applications provide companies many advantages with the help of speedy decision making, increasing productivity and reasonable costs. Besides, new generation of mobile communication helps SCM apps to enhance their usage by improving mobile or WiFi coverage.

Mobile SCM applications are classified as given in a matrix by Ruhi and Turel (2005). Bearer technologies and their relevant value chain activites can be seen in Appendix A. They classifies the activities as logistics, operations, marketing & sales and service and then list mobile SCM applications in the table with respect to their bearer technologies. It seems one of the most prominent taxonomies given in the literature so far.

According to Jenkins (2013), mobile SCM applications enable employees to be snychronized with the help of real time flow in the supply chain management. It seems an important factor to track all the process at the right time.

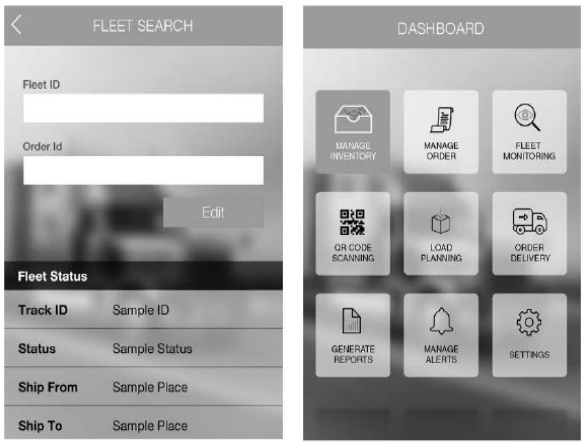

Figure 3: Supply chain management mobile app [21]

A sample mobile SCM application is pointed out in the Figure 3. It can be seen that many business functions are already accessible in the dashboard of application. Fleet monitoring, order delivery and inventory management are basic features of the application.

Nowadays, numerous supply chains have simply accepted the significance of mobile SCM and the

accurate information in real time thanks to applications. Thus, they have already implemented mobile technology in supply chain management.

7. Conclusion

When usage areas of mobile internet-connected devices are investigated, it can be concluded that tablets are more suitable than smartphones to be used in supply chains especially from company employees because they need bigger screen, better battery life and better processing capability than that of smartphones however both of them are fragile. Fragility of tablets is the biggest problem in front of the usage in industrial environment of supply chains. To overcome this problem, ruggedized versions of tablets should be developed to protect the tablet against fall, also water and dust.

Using mobile internet-connected devices, such as smartphones and tablets, is useful for all segments of supply chain to pick up real time information about products to response quickly to the demand. However, companies' supply chain management systems should be support input-output data traffic of the mobile internet-connected devices.

Barcodes on products should have standard types and give information about that product via the scanning label by using cameras of the smartphones or tablets.Companies should develop their own applications to search for a product, give information about that product, supply customer reviews about that product, and purchase this product. Furthermore, if this product is not available, backorder or similar product should be proposed to customer by applications.
Companies' fliers or ads on the shopping walls should have barcodes and when this label is scanned by using applications on the smartphones or tablets, customers can purchase these products on internet and these products should be sent to the customer. With a label scanner application, fliers should not be color since via application customers can check the product images, its specifications and if it is available its reviews. If applications can be personalized, e.g. with the help of credit card information, customers' searching products can be identified and special discounts on these products can be proposed to customers. This results in collecting demand with less cost and less uncertainity in demand when it is compared to traditional systems thanks to collection of real time information about products via mobile applications.

Furthermore, in coming years, technology will help to raise the internet of things approach. According to Mattern and Floerkemeier, "Internet of Things" was explained that changing system approach of remote identification of objects to smart objects have ability to communicate among each other, with internet or users [12]. Products having Internet of Things capability will use wireless interfaces such as NFC, Bluetooth, WLAN etc. With the help of Internet of Things capable products, companies' can tie costumers to their services and program updates. As a result of that, company will have close relationship with customers more than ever. This close relationship can be used in decreasing uncertainity in demand and increasing customer satisfaction through creating innovative products with less cost. In the near future, evolution of internet of things and its usage in mobile supply chain management should be considered carefully by companies.

References

[1] Maciej Szymczak, Using Smartphones in Supply Chains, *Management*, ISSN 1429-9321, 2013, pp. 218-232

[2] CCS Insight Report, June 2014

[3] Cisco Visual Networking Index: Global Mobile Data TrafficForecast Update, 2014–2019, February 3rd 2015,

[4] Bridget Mccrea, Wireless & Mobility:8 Trends taking us closer to visibility, *Logistics Management*, 2013

[5] Minhyung Kang, The Mobile Big Bang, *SERI Quarterly*-October 2010.

[6] Huub Scholten, Tim Bartram, Ayalew Kassahun, Sabine Kläser, Ralph Tröger, Rob J.M. Hartog, Angela Schillings, Sandra Meier, Robert Reiche, Enabling Transparency in Meat Supply Chains: tracking & tracing for supply chain partners, consumers and authorities, *IT-Standards in der Agrar- und Ernährungswirtschaft* 2014

[7] Walid Bouzayani, Dr. Mohamed Mahjoub Dhiaf, Real Time Supply Chain Management, Co-Modelling of totally Supply Chain Solution, *IEEE*, 2013

[8] Jacques Bughin, Michael Chui, and James Manyika, Ten IT-enabled business trends for the decade ahead, May 2013.

[9] Quantum Retail Technology Inc Retail Outlook 2012

[10]CMA Jayashree Ramanan, K.P.V. Ramanakumar, Trends in Retail, International *Journal of Business and Management Invention*, Vol. 3, Issue 1, 2014, pp.31-34

[11] Jacques Bughin, Michael Chui, and James Manyika, Ten IT-enabled business trends for the decade ahead, *McKinsey Quarterly*, May 2013

[12] K. Sachs, I. Petrov, and P. Guerrero (Eds.): Buchmann Festschrift, LNCS 6462, *Springer*-Verlag Berlin Heidelberg, 2010, pp. 242–259

[13] Clemens, B., Cata, T. and Hackbarth, G. Mobile Device Considerations for Supply Chain and ERP Related Systems, *Communications of the IBIMA*, 2012, pp. 1-16,

[14] Kurbel, K., Jankowska, A. M. and Nowakowski, K., A mobile user interface for an ERP system, *Issues in Information Systems*, VII(2), 2006, pp. 146-151,

[15] Eng, T. , Mobile supply chain management: Challenges for implementation, *Technovation*, vol.26, 2006 , pp. 682-686

[16] Partridge, A.R. Mobile Communications: Managing Supply Chains on the Go, Retrieved from http://www .inboundlogistics.com/cms/article /mobile-communications-managing-supply-chains-on-the-go/ , 2011

[17] Car, T., Pilepic, L. and Simunic, M., Mobile Technologies and Supply Chain Management – Lessons for the Hospitality Industry, *Tourism and Hospitality Management*, vol. 20, 2014, pp. 207-219.

[18] Umney, C. , Supply chain execution goes mobile, Retrieved from http://www.supply chaindigital.com/ logistics/2695/Supply-chain-execution-goesmobile# ,2011

[19] European Commission, Business opportunities: Mobility, Retrieved from http://ec.europa.eu/enterprise/dem/sites/default/files/page-files/mobility_v1.1.pdf , 2013

[20] Jenkins, J., Mobile Trends Shaping Supply Chain Management, Retrieved from http://www.smallbizclub.com/technology-sections/software/item/760-mobile-trendsshapingsupply-chain-management?Itemid=731 , 2013

[21] Softweb Solutions, Mobile supply chain management solutions, Retrieved from http://www.softwebsolutions.com/mobile-supply-chain-management-solutions.html, 2014

[22] Umar Ruhi and Ofir Turel, Driving Visibility, Velocity and Versatility: The Role of Mobile Technologies in Supply Chain Management, *Journal of Internet Commerce*, 4:3, 2005, pp. 95-117

[23] Holten, R., Dreiling, A., Muehlen, M. Z., & Becker, J., Enabling Technologies for supply chain process management, *Proceedings of the Information Resources Management Association International Conference*, 2002, Seattle

[24] Poirier, C. C., & Bauer, M. J., E-Supply Chain: Using the Internet to Revolutionize Your Business, 2000, San Francisco: Berrett-Koehler Publishers Inc.

[25] Ruhi, U., Turel, O., Driving Visibility, Velocity and Versatility: The Role of Mobile Technologies in Supply Chain Management, *Journal of Internet Commerce*, vol. 4(3), 2005, pp. 95-117.

[26] Gebauer, J., Shaw, M., & Zhao, K., The efficacy of mobile e-procurement: A pilot study, *Proceedings of the Hawaii Conference on Systems Sciences*, 2002, Los Alamitos, CA.

[27] Barney, J., Firm resources and sustained competitive advantage, *Journal of Management*, 17, 1995, pp.99-120.

[28] Kalakota, R., Robinson, M.,& Gundepudi, P. Mobile applications for adaptive supply chains: A landscape analysis. In K. Siau & E.-P. Lim (Eds.), *Advances in Mobile Commerce Technologies*, 2003, Hershey PA: Idea Group Inc.

[29] Graham C. Stevens Mark Johnson, Integrating the Supply Chain… 25 years on, *International Journal of Physical Distribution & Logistics Management*, Vol. 46, Iss 1, 2016, pp. 19 - 42

APPENDIX A:

The classification of mobile SCM applications [22]

Value Chain Activities

Bearer Technologies	Logistics	Operations	Marketing & Sales	Service
GPS	☐ Load Verification ☐ Vehicle Dispatching ☐ Package Tracking ☐ Asset Tracking ☐ Telematics		☐ Location-based Information Access ☐ Consumer Sales Promotion Campaigns	☐ Telemetry
WWAN	☐ Advance Shipping Notifications ☐ Manifest Reconciliation	☐ Inter-office Integration	☐ Back-office Information Access	
Cellular	☐ Delivery Confirmation ☐ Manifest Reconciliation ☐ Electronic Signature Capture ☐ Exception Notification ☐ Driver Contact	☐ Approval Workflows ☐ Managerial Contact ☐ Employee Contact	☐ Sales Promotion ☐ ATP/CTP Channel ☐ Reverse Logistics ☐ Location-based Push Services ☐ Sales Contact	☐ Service Contact ☐ Telemetry
P2T	☐ Delivery Confirmation ☐ Exception Notification	☐ Employee Contact		☐ Employee Contact
RFID	☐ Asset Tracking ☐ Barcode Scanning	☐ Barcode Scanning ☐ Telemetry	☐ Retail Space Replenishment	
WLAN (Wi-Fi/ Bluetooth)	☐ Back-office Updates	☐ Telemetry ☐ Manifest Reconciliation ☐ Receiving & Payment Workflows		

Mobile SCM Applications

Acronyms Glossary:
ATP/CTP: Available-to-Promise/Capable-to-Promise
GPS: Global Positioning System
P2T: Push-to-Talk
RFID: Radio Frequency Identification
WLAN: Wireless Local Area Network
WWAN: Wireless Wide Area Network