INDUSTRY 4.0 FROM LOGISTICS FIRMS' PERSPECTIVE

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Abstract

In 18th century the first industrial revolution started with water- and steam-powered mechanical manufacturing. Following this era, comes industry 2.0 with the use of electricity and mass production. In 1970's wide spread computerization and automation started the industry 3.0 era. Currently we are talking about a new are, industry 4.0, which enables communication between humans and also things, machines, though Cyber-Physical-Systems (CPS).The concept industry 4.0 although have been brought up in Germany, with the promises of the concept and todays increasing demand in cost effectiveness, flexibility, sustainability draw considerable interest globally. Industry 4.0 era will lead to breakthrough chances in business world. As the technologies of this era enables ubiquitous presence and real time information about each single piece of a process it has been used in many firms in developed countries for some time. With the current and potential benefits of industry 4.0 , especially logistics sector cannot ignore the applications of this era. In this study the perspective of logistics firms in Turkey to the concept industry 4.0 is evaluated. 7 different logistics firms operating in Istanbul Turkey ranging from SMEs to international firms were contacted and their point of view about this new era and their applications were evaluated. A SWOT analysis is conducted according to the firms' evaluations.

Keywords: Industry 4.0, Internet of Things, Logistics

Jel Codes: M10, M11, M31

LOJİSTİK FİRMALARININ ENDÜSTRİ 4.0'A BAKIŞI

Öz

18. yüzyılda buhar gücüyle ve mekanik üretimin ortaya çıkmasıyla başlayan endüstri devrimini, endüstri 1.0 dönemini; elektriğin kullanılması ve seri üretim ile endüstri 2.0 dönemi takip etmiştir. 1970'lerde artan bilgisayar kullanımı ve otomasyon endüstri 3.0'ı karakterize eder. Günümüzde ise siber fiziksel sistemler, nesnelerin interneti ile yeni bir sanayi devriminden endüstri 4.0 döneminden bahsediyoruz. Endüstri 4.0 dönemi gelecekte iş dünyasında köklü değişikliklere sebep olacaktır. Bu dönemin teknolojileri her zaman her yerde var olma ve gerçek zamanlı bilgiye ulaşmaya imkân verdiğinden gelişmiş ülkelerde hali hazırda birçok firma bu teknolojileri kullanmaktadırlar. Sağladığı ve amaçladığı yararlarla özellikle lojistik sektörü için bu dönemin teknolojileri göz ardı edilemez. Bu çalışmada İstanbul'da operasyonlarını sürdüren 7 lojistik firma ile görüşülüp bu yeni döneme bakış açıları incelenmeye çalışılmıştır. Yüz yüze mülakat yöntemiyle yapılan bu çalışmada edinilen görüşler GZFT (SWOT) analiz tablosu ile özetlenmiştir.

Anahtar Kelimeler: Endüstri 4.0, Nesnelerin Interneti, Lojistik

Jel Kodları: L26, O18, R11, B21.

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Introduction

The industrial revolution started with the introduction of water- and steam-powered mechanical manufacturing at the end of the 18th century, named as industry 1.0. The division of labor at the beginning of the 20th century and use of electricity and mass production characterizes the industry 2.0. And during 1970's wide spread computerization and introduction of programmable logic controllers (PLC) for automation started the industry 3.0 era. It is anticipated that in the future products will be managing their own production processes. With such anticipations industry 4.0 is emerging (Lasi, Fettke, & Feld, 2014). Recently we are facing the last industrial revolution, industry 4.0, enabling communication between humans as well as machines in Cyber-Physical-Systems (CPS) which is triggered by the Internet (Brettel, Friederichsen, & Kelle, 2014).

It is apparent that this new era would cause significant changes in our lives. Concepts of this new era such as cyber physical systems and internet of things have already gained considerable interest. Technologies that will be used widespread in the new future offers big opportunities for cost reduction and assainissement of operations. Thus especially for logistics sector the emerging developments in technology are followed closely.

1. Literature Review

Industry 4.0, come in view in official documents and foreshadowed an industrial revolution. (MacDougall, 2014). German government positioned industry as a national strategic initiative in 2011. The main purpose of this initiative is to encourage digital production through internet of things and value chain and business models (Commission, 2017). After 2011, this concept and view of point spread globally and as of 2016 became a main subject line in World Economic Forum (Forum, 2016).

Mrugalska and Wyrwicka (2017) defined industry 4.0 as the integration of complex physical tools and machines to network, sensors and software for the purpose of forecasting, controlling and planning trade and societal outcomes (Mrugalska & Wyrwicka, 2017) . According to Hermann et al (2016), industry 4.0 can be analyzed under 4 main components; cyber physical systems, internet of things, internet of services and smart factories (Hermann, Pentek, & Otto, 2016). Industry 4.0 involves numerous technologies and related paradigms (Thames & Schaefer, 2016). Some of these paradigms are; radio frequency identification (RFID), enterprise resource planning (ERP), internet of things (IoT), Cyber Physical Systems, cloud based manufacturing, smart factories (Kagnicioglu & Ozdemir, 2017; Lu, 2017; Yıldız, 2018)

Some of these paradigms are summarized below.

1.1 Cyber-Physical Systems

All structures involved in the communication and coordination of physical and cyber worlds are named as Cyber-Physical Systems (CPS). It is the integration of physical processes and computation (Hofmann & Rüsch, 2017).

1.2 Internet of Things (IoT)

Structures enabling the communication of things, objects are named as internet of things. It is seen as a promising, destructive technology. At first stages things were labelled and tracked with low cost sensor technologies such as RFID tools.

1.3 Cloud based Manufacturing (CBM)

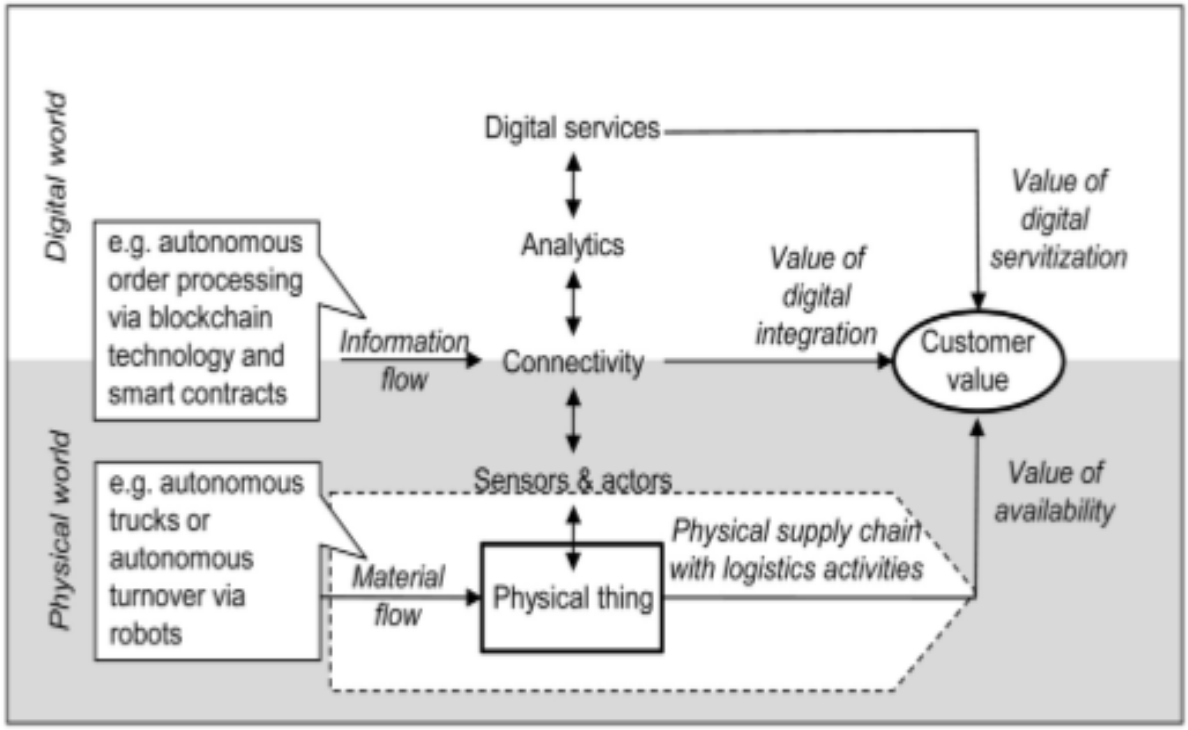
It is "a form of is a computing and service-oriented manufacturing model developed from existing advanced manufacturing models (e.g., application service providers, agile manufacturing, networked manufacturing, manufacturing grids) and enterprise information technologies under the

support of cloud computing, the Internet of things (IoT), virtualization and service-oriented technologies, and advanced computing technologies" (Li et al, 2010).

1.4 Smart Factories

It is based on the idea of a decentralized production system in which people, machine and resources can communicate over a social network. Smart factories can detect the business need through sensors, communicate with other production tools through internet and capture the production information from the Big Data in cloud systems (Alçın, 2016) ; (Hofmann & Rüsch, 2017). As the current and potential industry 4.0 applications would improve the efficiency and effectiveness of the logistics sector, it became a current, important issue for this sector specifically. As seen in figure 1, industry 4.0 applications provides decentralization, self-regulation and productivity in logistics (Hofmann & Rüsch, 2017).

Figure 1: Industry 4.0 in Logistics Sector



Source: *Fleisch et al (2014)*

3. Methodolgy

In research methodology of this study is exploratory, in-depth interview technique is utilized. Qualitative research analyses the understanding of concepts and viewpoint of people about situations and concepts (Dey, 1993). Storey (2007) suggested that since qualitative research aims to explore the subjective stance of people, it prevail against quantitative research. In-depth interview enables deeper understanding of concepts and consistency between complexities and individual experiences. According to Granot et al (2012) for applied sciences like management and marketing qualitative methods provides a deeper understanding to the researcher.

In this study in-depth interviews were conducted with managers (ranging from middle line manager to general manager) of 7 logistics firms during January-April 2018 period. The respondents were asked firstly about the industry 4.0 applications that is already being adopted to their firm. Then the advantages and disadvantages of industry 4.0 is articulated considering their firm and the opportunities and threats of the new era is asked. Then the SWOT of industry 4.0 from the logistics sector perspective is asked.

4. Findings & Discussion

All firms in the study find industry 4.0 useful and in a way regard it as a necessity regardless of their current utilization situation. Due to confidentiality issues the names of the firms are not given but the companies are defined based on their employee numbers in the SWOT analysis. The respondents analyzed industry and explained the firm specific industry 4.0 applications, the employee acceptance of these new applications and SWOT analysis.

Table 1 : SWOT Analysis

	Applications	**Employee Acceptance**	**Strength**	**Weakness**	**Opportunity**	**Threat**
Firm A Large Scale Company >500 employees	Pilot IoT applications	Higly motivated	Increased transparency Real time customer communication	Not Mentioned	Create competitive advantage	Security problem hackers
Large Scale Company 300-499 employees	IoT, Sensors, Artificial Intelligence, cyber security, cloud	Willing to accept and adopt	Faster decision process, cost reduction, increase in customer satisfaction	Insufficient financing alternatives Not enough incentive	Growth International market integration.	Not mentioned
Large Scale Company >500 employees	Digitalization	Rejection at first	Increase in employee productivity, cost reduction, increase in customer satisfaction	Not all stakeholders at the same level of industry 4.0 technology utilization High initial investments	Availability of new business models	Need for integration of all stakeholders` systems. High initial investment
SME < 99 employees	Not yet	NA			Advanced control in all processes	Possible HR insufficiency
Middle size 100-299 employees	Not yet	NA				Possibility of human resource need diminishment . IT integration problems
Large Scale Company 300-499 employees	Tracking systems- ERP integrations	Rejection at first. Need a leader for the process	Productiveness- Mistake minimization	High initial investment. Employee rejection at first	Increase market share through blockchain applications	International competition harm if the new technologies are adapted.

5. Conclusion and Limitations

In this study a general view of industry 4.0 perspective of logistics firms in Turkey is analyzed. Most of the research in this area are based in Germany, China and other industrially advanced countries. Also industry 4.0 has been mainly analyzed from engineering perspective, there are very few studies examining the concept from social sciences viewpoint (Sosyal & Pamuk, 2018). This study suggests that logistics firms are aware of advancements the new industrial era is bringing. Large scale firms are already applying or are in the process of adaption of new technologies such

as IoT, big data and ERP integrations. All of the firms in this study perceives industry 4.0 technologies to be necessary for keeping up with competition especially for international competition. For further studies the data should be enlarged which would improve the validity.

REFERENCES

ALÇIN, S. (2016). "Üretim İçin Yeni Bir İzlek: Sanayi 4.0". *Journal of Life Economics*: 19-30.

BRETTEL, M., FRIEDERICHSEN, N., and KELLE, M. (2014). "How Virtualization, Decentralization and Network Building Change the Manufacturing Landscape: An Industry 4.0 Perspective". *International Journal of Information and Communication Engineering*: 37-44.

COMMISSION, E. (2017, January). Germany: Industry 4.0. https://ec.europa.eu/growth/tools-databases/dem/monitor/sites/default/files/DTM_Industrie%204.0.pdf

DEY, I., (1993). Qualitative Data Analysis: A User-Friendly Guide for Social Scientists, Routledge Publications, London

FORUM, W. E., (2016). The Fourth Insutrial Revolution What It Means and How to Respond. https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond.

GRANOT, E., BRASHEAR, T. G., and MOTTA, P. C., (2012). A structural guide to in-depth interviewing in business and industrial marketing research. Journal of Business & Industrial Marketing, 547-553.

HERMANN, M., PENTEK, T., and OTTO, B., (2016). Design Principles for Industrie 4.0 Scenarios. System Sciences (HICSS) 49th Hawaii International Conference (s. 3928-3937). IEEE.

HOFMANN, E., and RUSCH, M., (2017). "Industry 4.0 and the Currenct Status as well as Future Prospects on Logistics". *Computers in Industry*: 24-34.

KAGNICIOGLU, C. H., ve OZDEMIR, E. (2017). Evaluation of SMEs in Eskişehir within the Context of Industry 4.0. Procedia (s. 900-908). PressAcademia. İstanbul

KAGNICIOĞLU, C., ve OZDEMIR, E. (2017). Evaluation of SMEs in Eskisehir within the context of industry 4.0. Procedia (s. 900-908). Press Academia. İstanbul

LASI, H., FETTKE, P., ve FELD, T., (2014). "Industry 4.0.". *Business &Information System Engineering*: 239-242.

LI, B. H., ZHANG, L., WANG, S. L., TAO, F., CAO, J., JIANG, X. D., and CHAI, X. D., (2010). "Cloud Manufacturing: A New Service-Oriented Networked Manufacturing Model". *Computer Integrated Manufacturing Systems*: 1-7.

LU, Y., (2017). "Industry 4.0: A Survey on Technologies, Applications and Open Research Issues". *Journal of Industrial Information Integration*: 1-10.

MACDOUGALL, W., (2014). Industrie 4.0 Smart Manufacturing for the Future. Mechanical & Electronic Technologies. Germany Trade & Invest,, 40.

MRUGALSKA, B., and WYRWICKA, M. K., (2017). "Towards lean production in industry 4.0". *Procedia Engineering*: 466-473.

THAMES, L., and SCHAEFER, D. (2016). "Software-Defined Cloud Manufacturing for Industry 4.0". *Procedia CIRP*: 12-17.

YILDIZ, A. (2018). "Endüstri 4.0 ve Akıllı Fabrikalar". *Sakarya University Journal of Science*, 548-558.