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AI - ROBOTIC APPLICATIONS IN LOGISTICS INDUSTRY AND SAVINGS CALCULATION

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ABSTRACT

In this study, we present the development of using artificial intelligence and robotic technologies in the logistics sector and differences of the change created by such technologies. We identified the most correct predictions pertaining to the future of logistics by comparing the results of studies with our findings. To analyze this change, the developments observed in the logistics perspective synthesized by doing research through the conceptual approach and literature review model and then, the impacts experienced in the logistics sector identified with findings obtained from the analyses. Within the framework of the conceptual approach; the types of robotic and developments created with the impact of the industrial revolution, changes experienced in transition from industry 4.0 to industry 5.0 in the logistics and technology-provider specification of the industry 5.0 were investigated. The criteria for the analyses are about the numbers of the use and sales value of the service robots used in the logistics sector in the world by the years, differences of the regional use and savings in the labor costs with the impact of robot investments. In this study, environmental data analyzed; CO_2 emission reduction amounts and diesel savings in highway, intermodal, emission reduction and diesel savings options in 2014 – 2020, and savings calculation tactic is applied. This study allows unique predictions to be obtain through the analysis of the impacts in different stages of the robotic logistics sector in terms of the ability of the robotic technologies to offer important benefits and propose utilization for the future.

Keywords: *Logistics, AI, Robotic, Logistics 4.0/5.0, Intermodal Transportation.*

INTRODUCTION

With the development of artificial intelligence and robotic technologies in the world, the most important way for businesses to increase the logistics service and quality is recognize as the impacts of the fourth industrial revolution covering the cyber-physical systems (CFS) and internet of things (IoT) thanks to the Industry 4.0. Thanks to such technologies, robots are enable to collaborate with each other and people and the service process is facilitate. For the purpose of comprehending this change process, information is given about the utilization process of the technologies included in the scope of the artificial intelligence and logistics robots in the logistics and the differences originating from the utilization of such technologies are presented in this study. In this study, details of the developments in logistics operations in the fields of network design explained, transportation logistics, purchasing logistics, warehousing logistics, in-house logistics and distribution logistics by examining the process of stages realized in the logistics sector primarily with the impact of industrial revolutions.

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Developments falling into the scope of warehousing with human-like continuously operating robots and creating most perfect operations in the global e-trade, together with the new technologies such as unmanned vehicles, drones, a smart industry with the objective of transporting the products to any place needed at minimum costs as soon as possible in the logistics of our present-day included. The utilization opportunities arising from the use of robotic technologies addressed against the adverse impacts caused by the difficulties emerging in the logistics sector, as is in many sectors, due to the quarantine and restrictions implemented for protected from the pandemic particularly in 2020 when COVID-19 pandemic crisis has started and its biggest impacts experienced (Eltayeb, 2020). The requirement increasing in any stage of the logistics in regard meeting the needs of the communities during the pandemic process entails the creation of new solutions for delivering the requested products to the customers at the same time. In conclusion, while the findings obtained within the scope of the impacts of the use of artificial intelligence and robotic technologies in the logistics sector explained, it is emphasize that in fact a better performance will be provide with the utilization of new technologies.

The word “robot" is first mentioned in the play "Universal Robots of Rossum" by the Czech writer Karel Capek, the Czech word for robot means "roboti" or "robota" "slave worker". In fact, Karel wanted to use the word "labor", that is, "worker". Then he did not like this word. In the game, the production purpose of slave workers, that is, robots, is to create worker vehicles without emotions. The great science fiction writer Isaac Asimov named the science of “robotics” used today. Asimov must have predicted that organized robots will overcome weak humanity. He also succeeded in becoming the first roboetician by publishing the law series named "3 Laws of Robots". According to these laws, robots cannot harm people in any way. Perhaps organized robots will change our future and shape it for the better. Perhaps the perception of organized robots is a reflection of the organized artificial intelligence that will drive the industrial revolutions of the future. (Bakirci, 2017).

The compatibility of the technology of an organization with contemporary developments is important for the continuity of the organization's order.

In this study, we focused on the fact that self-managing robots in the logistics of the future will be organize in every sector with the sixth industrial revolution. It foreseen that all organizations aiming to use self-organizing robots should unite and submit recommendations to governments. Among the most important sectors in this regard is the logistics platform after the military defense field.

The study written based on the information obtained because of following the sources announced by official institutions and private logistics companies during the very limited COVID-19 pandemic period, and based on the re-analysis and evaluation of this information. In this study, the archives of the Ministry of Health and the Ministry of Trade of the Republic of Turkey used extensively. The subject has been extensively research based on the materials collected by periodically following the scientific data sources of the world and Turkey. Books and publications of scientists also used in the research. The majority of the data required for academic work obtained according to the sources of the International Robotics Federation.

Global Impacts of AI and Robotics in Logistics Sector

Development is being experience in robotic technologies as a new industrial revolution in the present day. The companies in different sectors are trying to adapt to the developments in

artificial intelligence and robotic technologies in order to both reduce the costs and raise the production level and increase productivity, quality, and competitive power. (Ivanov, 2017). As the use of artificial intelligence is move to the trade circles, the course of the work has started to change particularly in the logistics sector. The advantages like driverless vehicles whose utilization has started to increase in the logistics, robots used in warehousing and shelves, providing the use of many data provide convenience in the logistics process. Revolution changes have occurred until the present day as industrial revolutions in the logistics field. (Wang, 2016);

- The first revolution is the process by which transportation is mechanize. In this process, transportation with human and animal power has ended. Trains, ships and trucks have started to be use in railways, seaways and highways. It started in the second half of the 19th century.
- The second revolution started in the 1960s, partially mechanized with logistic equipment that performs storage and inventory
- The third revolution started in the 1980s when logistics management was systematize. Information technologies are being used extensively in logistics management
- The fourth revolution continues to evolve with the digitalization of logistics processes since 2000
- The fifth revolution is under development. In this system, robots can do anything a human can do. Robots can record the data they obtain in the cloud system. They can communicate with each other.

Two important factors are increasing the need for autonomous logistics solutions. (IFR, 2019);

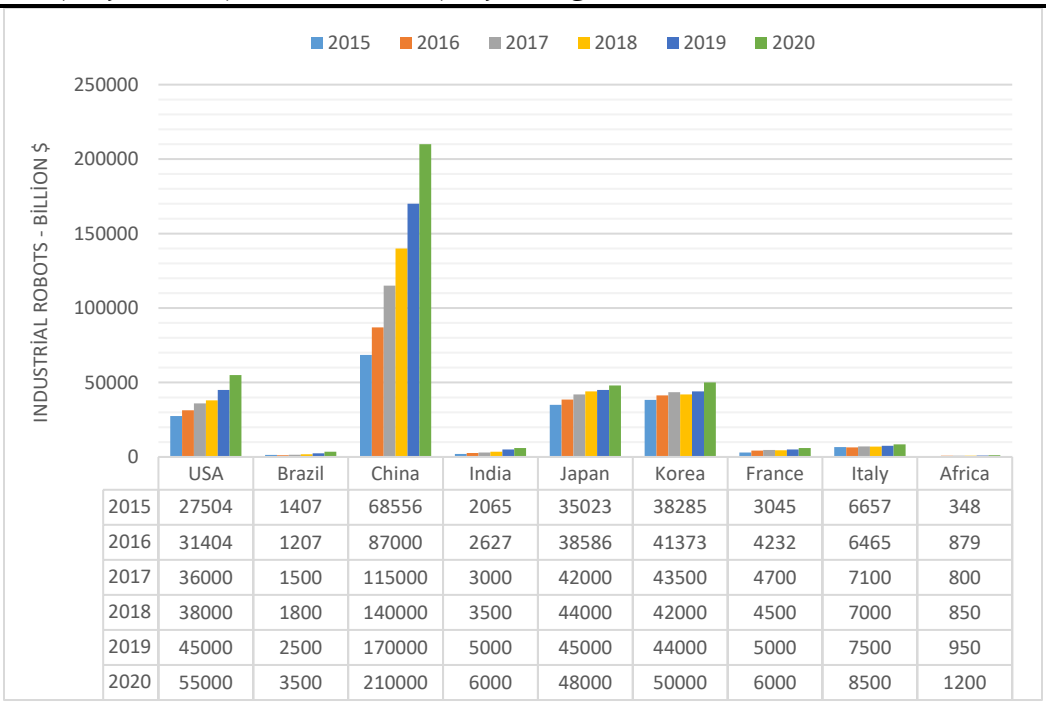
- Growth of E-trade – Product distribution has highly changed and increased in the last ten years. Currently, the products are package one by one and sent to the customers. In this field, the distribution rate of the dispatches is extraordinarily increasing in the stage of different packaging requirements and selling of heavier products in the businesses.
- Lack of existing labor – The increase of the need for the skill exceeding the labor in the logistics accounts for the support of the robot technology in the production and robot is a solution tool in the logistics sector during the COVID-19 pandemic process, which we are witnessing.

Because of the comparison performed in the retrospective studies searching the contribution of the robots into the annual labor productivity increase in the world. (Muro and Andes, 2015);

> "It is announced that the contribution of the use of steam engines into the annual increase of the labor productivity was at a rate of 0, 34% between 1850 and 1910. On the other hand, the use of the robots in the manufacturing increased the annual increase of the labor productivity at a rate of 0,36% as a result of the analysis of the use of the industrial robots in 14 industries in 17 countries between 1993 and 2007, they have about the same amounts. This rate does not seem high; however, it represents 10% of the total. In the same research, it was demonstrated that CT revolution (computer technology) supported 0,60% of the labor productivity increase in Europe, USA and Japan between 1995 and 2005 and this is twofold of the amount provided by robotics".

Consequently, it shown that the use of robots has a positive impact on labor productivity.

Once the main application sectors in the world are examine by years within the scope of the impacts of artificial intelligence and robotic technologies in logistics on the global economy, it seen that the site where they are mostly used is logistic systems. The logistic sector followed by the defense industry and site robots, respectively. (Automation Magazine, IFR, 2020). Sales of field robots were 27,800 units and defense sales were 46,700 units in the 2018 -2020 period. A vast increase in the utilization of robots in the logistics sector in recent years and elevation of sales, while it was 19.000 in 2015 increased to 189.700 in the period between 2018 and 2020 accepted as an indicator of the requirement increase in the logistics sector. (IFR, 2020).
The robotic systems only used in the covered storage sites in the previous years replaced by faster technologies equipped with high technology and high safety and this is effective on these outcomes. While the applications of Artificial Intelligence (AI) emerged in any field in the world, the cooperation process of robots and labor started once the robots called collaborative robots had been start to be use in recent years. It is expect that the market value of the robots will further increase in the next years and it is estimate that the increasing requirement of faster production and delivery of products at competitive prices the most important incentives provided by artificial intelligence and robotic technologies.
Because of the studies where the use of multi-purpose industrial robots is regionally investigate; it is see that the highest values were realize in the Asian countries notably China, Japan and Korea in the world between 2015 and 2017. In the same period, Deutschland is rank at the top in the use of robotic technologies among the USA and European countries.
It is see that the number of industrial robot shipments in China between 2015 and 2017 is 270.556 billion dollars **(Figure 1)**. According to the industrial strategy put into practice by the Chinese government in 2007, it is estimate that the robotic market in the country will reach a level of 1 million industrial robots in 2025 and it will have such a volume of 70 billion dollars. (IFR, 2020). It is see that the shipment figures of the industrial robots in the other regions and countries have not reached the expected levels yet.



	USA	Brazil	China	India	Japan	Korea	France	Italy	Africa
2015	27504	1407	68556	2065	35023	38285	3045	6657	348
2016	31404	1207	87000	2627	38586	41373	4232	6465	879
2017	36000	1500	115000	3000	42000	43500	4700	7100	800
2018	38000	1800	140000	3500	44000	42000	4500	7000	850
2019	45000	2500	170000	5000	45000	44000	5000	7500	950
2020	55000	3500	210000	6000	48000	50000	6000	8500	1200

Figure 1. Regional Distribution of Industrial Robots. (IFR, 2020)

It is expected that the potential of the logistic sector will increase in the global economy following the loosening of the restrictions experienced in the global trade due to the COVID-19 pandemic (Eltayeb, *et al.*, 2020). In some researches based on estimations particularly for the future, the following opinions announced regarding that because of the acceptance of the use of Industry 5.0 developed robots in the sector. It will increase the productivity up to 30 percent in many sectors notably logistic sector, notably developed Asian countries, and will reduce the total labor costs up to 18 percent or more until 2025.

For example, if it is assume that robots will perform 25% of all works in 25 exporter countries in 2025, it will expected that a decrease at a rate of 16% in average would be created in the labor costs globally (BCG, 2019);

A labor cost saving is expected to occur in South Korea at a rate of 33%, in Japan at 25% and in China at 18% because of the robot investments **(Figure 2)**. It is estimate that the rate of saving in the labor costs will be lower than 10 percent in the European countries excluding Deutschland due to the robot investments, this rate will be below 1 percent in the developing countries like India or Indonesia.

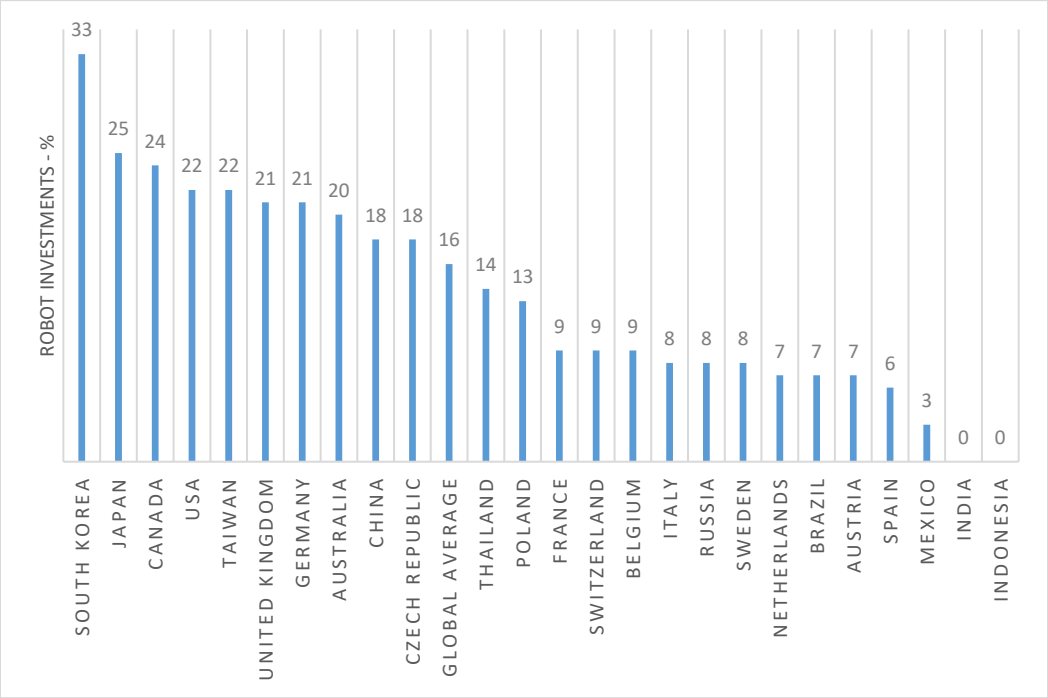


Figure 2. Saving in Labor Costs because of Robot Investments. (BCG, 2019)

The innovations such as drone deliveries are on the onset and it seems that robotics will continue to grow within logistic applications. Industry 5.0 revolution considered as the commencement of the equality potential in the global trade and it is define as Society 5.0 in the sense of unmanned technologies or super-smart society.

In this system, robots can both repair, control and reprogram on their own. The robots working in collaboration with people are the "collaborative robots" supporting the man workmanship by accelerating labor excellence.

The stages change in the logistics. Changes encountered in transition from Industry 4.0 to Industry 5.0 in Logistics. Once the impacts created by the industrial revolutions in logistic operations are evaluate in different fields of logistics, the features and importance of the Industry 5.0 process arise **(Table 1)**.

The new stage, called the fifth stage in the industrial field, also defined as "Society 5.0" or "Super Smart Society". (Frost and Sullivan Company, 2020).

Table 1. Detailed Impacts of Industrial on Logistic Operations

Industrial Revolution	Network Design	Transport Logistics	Purchasing Logistics	Storage Logistics	In-house Logistics	Distribution Logistics
Industry 1.0	Local applied structures	Decentralized fleets	Push delivery process	Lack of automation	Manual controlled wagon	Time delivery process
Industry 2.0	Global applied structures	Central or predictive central fleets	Pull delivery process or supplier-	Automatic warehouse system or	Manual trolley or automatic	Order-based delivery process or active delivery

			managed inventory	warehouse network	guided vehicles	
Industry 3.0	Partial or complete global ERP	Real-time and navigation routing	Autonomous inventory management	Supply chain warehouse network	Ground AGVs	Automatic delivery process
Industry 4.0	Open and flexible working area	Autonomous lorries	Predictive supply logistics management (Big data)	Lack of storage in the supply chain	AGVs controlled by production machinery	Predictive delivery management
Industry 5.0	Existence of products at right time at right costs in the needed location	Unmanned vehicles, drones	Customer-oriented routing of the supply chain together with smart society	Storage with Human-like and continuously operating robots	Self-adjusting, self-controlling robots	Receiving product in one day following order in e-trade, trust in shopping and delivery having information about how the delivery will be made

Source: Unity Consulting & Innovation. (Frost and Sullivan Company, 2020).

The most important features of this stage explained as aiming to bring the human factor back to the sector and being society-oriented technologies. As a prediction, it is expect to increase the knowledge and skills for digitalization of the block-chain in order for the societies constituting Society 5.0 to adapt to the change and to make use of the advantages proposed in the best manner.

Literature Research

The synthesis and research conducted by using the conceptual approach and literature review method in this study. The analyses providing the comparison with the findings in the literature and supporting the observed synthesis in the perspective of logistics performed along with the analyses performed with criteria selected in this subject.

After general information given about the development of artificial intelligence and robotic technologies, the development stages of the industrial revolutions in the logistics sector examined. The social, business and technology trends described in the logistics trends by giving information about the types of logistics. The technology providers of Industry 5.0 clarified to obtain an opinion about the future by identifying the changes experienced in the transition from Industry 4.0 to Industry 5.0 in the logistics sector within the framework of the technological developments.

DHL Logistics explains 29 main trends, which will affect the logistics sector in the next years. The report covers the findings obtained from a wide partner network including research institutes, technology players, beginners and customers, as well as an extensive analysis of macro and micro-trends. Trends that will shape the logistics in the future such as artificial intelligence, robotic, quantum calculation, sustainability and global mobility explained. Trends with low impact involve evolutionary changes with incremental improvements. Trends with high impact have revolutionary applications that are potentially disruptive. High-impact trends include social & business trends and technology trends. (DHL Logistics, 2016);

- Social & Business Trends – 4th Edition; Super Grid Logistics, Next-Generation Security, Smart Containerization, Sustainable Logistics, Logistics Marketplaces, Future of Work, Multi-Sourcing, Sharing Economy, Rethinking Packaging, Omni Channel Logistics, Mass Personalization, Fresh Chain, Silver Economy.
- Technology Trends – 5th Edition; Self-Driving Vehicles, Artificial İntelligence, 3D Printing, Robotics & Automation, Block-chain, Unmanned Aerial Vehicles, Internet of Things, Cloud & APIs, Generation Wireless, Quantum Computing, Digital Twins, Augmented& Virtual Reality, Bionic Enhancement, Big Data Analytics.
- Data obtained because of the study conducted by DHL demonstrate that the COVID-19 pandemic has facilitated the future of digital and automation in the logistics sector and the following future predictions explained. (DHL and Wilding, 2020);
- The leaders of the supply chain are shifting from the supply era for the cost to the supply period for durability,
- Changes in the consumer behavior require adjustments in the transportation flow and warehouse networks,
- New working styles will impair the traditional processes and will bring a new acceleration in digitalization and automation attempts.

The findings obtained in the literature related to robot applications used in the logistics sector shown in **Table 2.**

Table 2. Literature about Robot Applications in Logistics Sector

Authors	Year	Method	Title of the Study	Predictions
J. Wang, M. K. Lim, Y. Zhan, X. Wang	2020	Conceptual Approach	Smart Logistic Service System for Developing Transfer Operations in IoT Environment	In this study, it is show that the coordination of operations with IoT technology would be productive for increasing customer satisfaction. It is propose that better performance displayed with IoT-based logistic distribution providing connection between customers, order-taking robots and cloud technology.

O.H. Chi, G. Denton and D. Gursoy	2020	Conceptual Approach and Literature Review	Use of Artificial Intelligence Device in Service Delivery: A Systematic Review, Synthesis and Research Agenda	In the study, the publications related to the use of subjects such as AI technology, system planning of this technology, algorithms, voice recognition, and psychological information in different fields reviewed. It is emphasize that the previous AI is the starting stage.
Frost & Sullivan The Growth Pipeline Company	2020	Conceptual Approach	Industry 5.0 Bringing Empowered Humans Back to the Shop Floor Industry 5.0 - Starts the process of using trained manpower in the field of production with humanoid robots doing heavy work	It is note that industry 5.0 presented as society-oriented unmanned Technologies and this stage aims to take the human factor to the production site. Through Industry 4.0, it was only provide to collect the usage data of products, to follow the usage models and transmit to observer. However, there was built-in limited actionable intelligence for these. Industry 5.0 products supported by fast connection cam optimize their performances and provide maximum productivity throughout the lifetime of the product. Roles such as machinery maintenance and quality assurance will combine in the plant operations and will become a single work. This will require employees to be train in numerous and various work roles. Industry 5.0 is a model of the next industrialization level characterized by smart supply chains and hyper-privatization where a qualified labor force used in production in plants once human-like robots take the place of labor in heavy works.

Once the different impacts observed in transportation, purchasing, warehousing, and in house and distribution logistic stages of the industrial revolutions oriented the use of artificial intelligence and robotic technologies in the logistic sector in the world. Literature about the development of the logistic operations between 2019 and 2020 findings obtained from these studies examined, the correct predictions for the future emerge.

MATERIALS AND METHODS

In the study, a sampling design and more specifically purposeful sampling were use.
An example of saving with the use of artificial intelligence in the logistics industry - Savings Calculation in Intermodal Transportation. (Ekol Logistics, 2021);
Savings Calculation Method: The intermodal transportation solution offered by the logistics company developed to provide an environment-friendly alternative. The utilization of this mode

of transportation directs the majority of cargoes to maritime and railway transportation from the usual heavy lifter, road transportation.

The fuel consumed and CO_2 emitted for each trip on sea and railway transportation compared with the figures to identify the using time of road transportation, and the savings achieved reported. The calculations to determine savings based on the emission figures of trucks compliant with Euro 5 standards. Within this framework, the average fuel consumption figure for Logistics Company's vehicles are 0.32 liters of diesel and 1.1 kg of CO_2 emission per kilometer covered with a full trailer.

Calculation Formula

$$\begin{aligned}\text{Savings } (CO_2; \text{Diesel}) &= [\text{Consumption Road } (CO_2; \text{Diesel}) - \text{Consumption Intermodal } (CO_2; \text{Diesel})] \\ &= [\text{Number of Trips}_{\text{Int.}} \times \text{Trip Distance} \times \text{Average Consumption per km } (CO_2; \text{Diesel})] - \\ &\quad [\text{Number of Trips}_{\text{Int.}} \times \text{per Trip } (CO_2; \text{Diesel})]\end{aligned} \quad (1)$$

Environmental Data; The logistics company, reduces the mileage on road with its intermodal solution created by combining railroad, land and maritime transportation and minimizes the carbon dioxide, hydrocarbon, particle and nitrogen emission. This is an important environmentalist approach. It is aim to leave a better world for the next generations the energy-saving measurement results are announced by the logistics company with the artificial intelligence meter used.

CO_2 emission reduction and diesel savings in January 2020;

- CO_2 emission reduction (Kg): road – 16.750.992 kg, intermodal – 11.512.667 kg and emission reduction – 5.238.326 kg,
- Diesel savings (Liter): road – 6.575.171 liter, intermodal – 2.605.777 liter and emission reduction – 3.969.394 liter.

The logistics company announces the energy-saving measurement results with the artificial intelligence meter used in **Table 3**.

Table 3. Carbon Dioxide Emission Reduction (Kg) and Diesel Savings (Liter) in 2014 – 2019

Carbon Dioxide Emission Reduction in 2014 – 2019 (Kg)									
YIL	2019			2018			2017		
Months	Road	Intermodal	Emission Reduction	Road	Intermodal	Emission Reduction	Road	Intermodal	Emission Reduction
January	17.343.431	12.127.373	5.216.059	19.905.521	13.246.722	6.658.799	20.071.617	13.269.784	6.801.833

Nov.	Oct.	Sept.	Aug.	July	June	May	April	March	Feb.
15.818.182	17.019.231	16.506.436	14.627.545	18.057.712	15.622.239	18.811.014	16.949.855	18.761.133	16.948.016
10.864.246	11.474.944	11.017.839	10.488.412	12.310.489	10.531.766	12.835.257	11.870.617	13.221.830	12.067.506
4.953.937	5.544.288	5.488.598	4.139.134	5.747.224	5.090.474	5.975.758	5.079.239	5.539.303	4.880.511
18.012.833	19.153.427	18.554.475	15.900.938	19.797.334	20.542.841	20.645.999	20.233.996	22.694.054	19.905.274
12.384.801	12.810.181	12.438.819	10.894.276	13.766.464	13.921.603	13.911.320	13.654.809	15.574.355	13.384.493
5.628.032	-	-	-	6.030.870	6.621.239	6.731.681	6.579.188	7.119.699	6.520.782
22.128.788	21.862.871	19.665.701	19.615.886	18.729.903	20.620.120	21.711.737	20.236.282	23.187.003	20.646.842
14.859.493	14.597.320	13.150.130	13.187.895	12.496.212	13.771.205	14.598.583	13.365.138	15.529.084	13.811.764
7.269.296	7.265.552	6.515.572	-	6.233.691	-	7.113.155	6.871.144	7.657.920	6.835.078

July	June	May	April	March	Feb.	January	Months	YIL	Dec.
19.336.876	24.343.124	23.076.965	24.036.787	24.042.036	21.422.296	19.029.098	Road	2016	12.732.992
12.389.871	15.662.742	14.941.821	15.634.230	15.122.151	13.424.230	11.778.648	Intermodal		8.826.075
6.947.006	8.680.382	8.135.144	8.402.557	8.919.885	7.998.067	7.250.451	Emission Reduction		3.906.918
18.856.416	19.719.361	17.588.944	17.588.944	17.991.275	16.379.463	15.666.312	Road	2015	14.559.656
11.467.876	12.207.667	10.752.826	10.752.826	11.162.701	10.084.625	9.652.190	Intermodal		9.826.520
7.388.540	7.511.695	6.836.118	6.836.118	6.828.574	6.294.838	6.014.122	Emission Reduction		4.733.136
14.313.036	14.512.509	14.689.761	14.645.791	14.808.014	13.037.005	13.124.531	Road	2014	18.379.281
8.581.310	8.871.625	8.949.215	8.702.242	8.812.043	7.875.462	7.722.190	Intermodal		12.066.688
5.731.726	5.640.884	5.740.546	5.943.549	5.995.970	5.161.543	5.402.342	Emission Reduction		6.312.594

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Aug.	21.259.887	13.301.531	7.958.356	17.793.592	10.889.557	6.904.035	13.056.683	7.856.161	5.200.522
Sept.	21.725.289	13.657.559	8.067.729	19.960.683	12.677.964	7.282.719	16.393.211	10.090.258	6.302.953
Oct.	22.518.631	14.266.027	8.252.604	21.642.676	13.613.430	8.029.247	15.804.116	9.763.265	6.040.852
Nov.	22.306.192	14.247.216	8.058.975	21.142.880	13.188.957	7.953.923	15.933.487	9.647.050	6.286.437
Dec.	18.881.976	12.309.487	6.572.489	19.934.463	12.367.600	7.566.863	14.686.427	8.981.389	5.705.038

Diesel Savings in 2014 – 2019 (Liter)

YIL	2019			2018			2017		
Months	Road	Intermodal	Diesel Savings	Road	Intermodal	Diesel Savings	Road	Intermodal	Diesel Savings
January	6.607.022	2.634.089	3.972.934	7.583.056	2.927.929	4.655.128	7.646.331	3.019.106	4.627.224
Feb.	6.456.387	2.641.575		7.582.962	2.991.936	4.591.027	7.865.464	3.229.226	4.636.238
March	7.147.099	2.853.270	4.293.830	8.645.355	3.531.191	5.114.164	8.783.145	3.579.499	5.203.646

Months	YIL	Dec.	Nov.	Oct.	Sept.	Aug.	July	June	May	April
Road		4.850.664	6.025.975	6.483.517	6.288.167	55.572.398	6.879.129	5.951.330	7.166.101	6.457.088
Intermodal	2016	2.093.931	2.501.753	2.558.970	2.419.344	2.704.986	2.806.287	2.307.426	2.767.858	2.575.539
Diesel Savings		2.756.734	3.524.222	3.924.548	3.868.823	2.867.413	4.072.843	3.643.904	4.398.244	3.881.550
Road		5.546.536	6.862.032	7.296.268	7.068.372	6.057.501	7.541.842	7.825.845	7.865.143	7.708.190
Intermodal	2015	2.050.805	2.538.103	2.638.268	2.576.338	2.282.554	2.958.852	2.993.458	3.018.883	3.037.012
Diesel Savings		3.495.731	4.323.930	4.658.277	4.492.034	3.774.947	4.582.990	4.832.388	4.846.261	4.671.012
Road		7.001.632	8.430.015	8.238.714	7.491.696	7.472.719	7.135.202	7.855.284	8.271.138	7.709.060
Intermodal	2014	2.658.034	3.356.989	3.275.046	2.998.088	3.065.399	2.860.041	3.158.640	3.370.038	3.060.181
Diesel Savings		4.343.598	5.073.027	5.053.668	4.493.609		4.275.162	4.696.645	4.901.100	4.648.879

Nov.	Oct.	Sept.	Aug.	July	June	May	April	March	Feb.	January
8.337.377	8.340.235	8.046.403	7.874.032	7.161.806	9.015.972	8.547.024	8.902.514	8.904.458	7.934.184	7.047.739
3.244.841	3.230.202	3.070.170	3.069.237	2.876.443	3.645.769	3.534.880	3.708.403	3.394.861	2.970.421	2.589.995
5.092.536	5.110.033	4.976.233	4.804.796	4.285.364	5.370.203	5.012.144	5.194.112	5.509.598	4.963.764	4.457.744
7.830.696	8.015.806	7.392.845	6.590.219	6.983.858	7.303.467	6.514.424	6.663.435	7.083.925	6.066.468	5.802.338
2.924.257	3.026.362	2.877.832	2.358.550	2.443.769	2.628.884	2.268.427	2.428.516	2.654.450	2.225.702	2.130.019
4.906.440	4.989.445	4.515.013	4.231.669	4.540.089	4.674.583	4.245.997	4.234.919	4.429.475	3.840.766	3.672.319
5.901.291	5.853.376	6.071.560	4.835.809	5.301.125	5.375.003	5.440.652	5.424.367	5.484.450	4.828.520	4.860.938
2.038.326	2.146.538	2.210.977	1.772.578	1.892.706	1.973.364	1.970.245	1.833.172	1.868.475	1.675.796	1.597.543
3.862.965	3.706.839	3.860.583	3.063.231	3.408.419	3.401.639	3.470.408	3.591.195	3.615.975	3.152.724	3.263.395

Dec.	7.199.905	2.789.325	4.410.580	7.383.135	2.745.013	4.638.122	5.439.418	1.936.232	3.503.185

Resource: Created by the author, with data disclosed by the logistics company. (Ekol Logistics, 2020)

RESULTS AND DISCUSSION

- According to the energy saving measurement results with the artificial intelligence meter used, it is determined that the level of saving is higher in intermodal applications.
- The calculations to determine savings based on the emission figures of trucks compliant with Euro 5 standards. Within this framework, average fuel consumption for Ekol's vehicles is 0.32 liters of diesel and 1.1 kg of CO_2 emission per kilometer covered with a full trailer. The counter on the home page provides the reflection of the instant amount in the current year calculated in proportion to the previous years.
- Primarily, the use of automation systems in the world finds more areas of application in the logistics sector every passing day. It is understand that the use of artificial intelligence and robotic technologies only in the storage areas is not adequate in the logistic operations during Industry 4.0 process.
- The requirement of making the logistics operations in production departments traceable and manageable is becoming prevalent. It is see that logistics have become the main usage site in the use of service robots and AGV systems constitute the most important share.
- AGV systems are used a digital application field in the plant logistics in Industry 4.0 process. The use of AGV systems combining the strategies, which have higher technological specifications, are secured, fast and have high maneuver capability, is accelerated.
- The goals of making the operations interconnected for which separate solutions were previously implement only in logistic and production sites and achieving a fully automatic intralogistics process, become compulsory for businesses.
- It is foreseen that the expectations of making the logistic operations best may be covered by the systems managed with fleet traffic management and navigation software, supported by drones, human-like collaborative robots and 5G technologies where it is shifted from supply chain to developed block-chain.

CONCLUSION

In this study, the developments provided by artificial intelligence and robotic processes in logistic operations were primarily described by giving information about the stages up to the present day starting from the changes experienced in the logistics sector with the impact of the industrial revolutions. For this purpose, types of artificial intelligence applications used and types of robots introduced. Because, of the synthesis, the analyses clarifying the state of the logistics in the past, present and future were conducted for the purpose of assessing the impacts observed in the perspective of logistics. Through these analyses, it is attempt to identify the utilization opportunities created in the logistic operations. Information shortly given about the status of the logistic industry presented in a faster way due to the COVID-19 pandemic crisis being experience in the world. In conclusion, it is see that super-smart society process started and the

fact that the requirement felt for the artificial intelligence support has increased insofar as it never used in robotic technology. It is understand that Industry 5.0 has entered process depending on the fact that societies have to provide their all needs with digital possibilities starting from the basic needs after the restrictions was being implemented due to pandemic in this field. It is foresee that the concerns regarding the elimination of labor and some professions removed with proper strategies in the process of using artificial intelligence and robotic technologies in the industry. It is seen that while the removal of the need for labor is not expected as well as the reduction of costs in terms of businesses, on the contrary, the way of providing production that is more productive and service by means of "robot power – manpower" collaboration will be paved. It is envisage that the industrial revolutions where it is target to employ people in easier works like only pushing a button and providing the necessary monitoring and control required being support because there are both heavy and risky works for the human workers among the disappearing professions. With an exemplary analysis; Energy-saving measurement results are announce by the logistics company with the artificial intelligence meter used. Thus revealing the benefit of using artificial intelligence. According to the energy saving measurement results with the artificial intelligence meter used, it is determined that the level of saving is higher in intermodal applications. The fact that it is aimed to offer the human workers the working opportunities under more humanistic conditions thanks to the self-controlling more developed robot technology which is consistently operating, is able to perform any work which people perform, is emphasized. In this process, it was concluded that the use of human-like robots has almost become compulsory and the objectives of Industry 6.0 should be identified in the future depending on fast adaptation to the conditions of the present day.

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