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Innovation Policy and Artificial Intelligence in the Business and Economic Transformation of the European Freight Transport Industry

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Abstract: A knowledge-intensive company is one that employs 20% of its workforce in research and development, having to manage the unique and intellectual property of the company. The latter is part of a growth-oriented business culture, basing its operations on innovation, a factor that permits a series of advantages, including tax reliefs. Moreover, the business would, especially in the actual economic conditions, has to make use of artificial intelligence, with the scope of analysing data, employing learning algorithms for efficiency and effectiveness of operations and strategy, and predicting patterns, correlations and, ultimately, developing models and policy functions. Although, there are some constraints in the world of knowledge-intensive services, especially that of the freight transport industry, as well as in the usage and implementation of AI, consisting of the lack or limited availability of data, infrastructure limitations, data retrieval capacity, computer machine learning software etc., the advantages of using AI in the problem-solving operations of knowledge enterprises determines a client-oriented approach, the strategic concentration on the problem-solving and innovation system creation, with the simple utilization of knowledge for the generation of tangible and intangible values. The research question of the present paper collides between those concepts, and develops on the proposition of a model for the intensive usage of AI in the knowledge-intensive freight transport industry and the related policy decision-making. The article includes a regression analysis on a World Bank database correlating the logistics performance, air freight transport, and railway freight transport to economic, business, social and technology-related variables. The findings are congruent with the basic need for implementation within the freight industry of updated policy, business transformation, knowledge-intensive services and AI algorithms.

Keywords: *Innovation policy and economy, AI, Freight transport industry, Business transformation, Knowledge-intensive companies, KIS.*

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1. Introduction

In 1995, the European Commission released its work on the concept of knowledge intensive business services, stating clearly the position of users, carriers of KIBS, as well as underlining the importance and significance of the latter in the innovation process. Knowledge intensive enterprises are heavily reliant on professional knowledge; the latter is mainly concerned with providing knowledge intensive support for the business processes within the organization [9]. For instance, in the air transport industry, 30% of the workforce has knowledge-intensive occupations, with the scope of supporting the overall operations within the organization and industry. Consequently, within the employment structures of a KIB, one will find scientists, engineers, experts, etc. in different fields of activity, working on either T-KIB services, which are concerned with technological knowledge (i.e. computer science, computer services, engineering, R&D operations), or on P-KIB services, also known as professional knowledge intensive services (i.e. legal, accountancy, management consultancy, marketing services etc.) [19].

The knowledge economy or the experimental economy stems in the promise of change, as an antidote to inequality, with the ultimate scope of enhancing the productivity and growth of the overall system. Nevertheless, this idea has been only narrowly implemented, and momentarily not one developed economy can provide more than the application of some of its products, but not its operations and processes [22]. The main companies coordinating the vanguard knowledge economy, active in niche markets, such as the electric vehicle technologies, hyper-transport, solar-powered housing systems, agricultural technology systems coordinated by geneticists and laboratory workers and high-tech equipment, virtual monetary systems, augmented reality in all fields of expertise, especially medicine and computer science, etc., are confined in a small, quarantined sector, not being able to spread their knowledge and processes across the whole value-chain. Those elements that are part of the tech elite refer to technologies such as artificial intelligence and robotic systems, summing up the alternative future of the economy, as well as the future of economics.

Since 1972, the general economic condition of the developed countries has stagnated or experienced a fluctuation between 1.5 and 2.5 percentage points, with no power to drive a higher growth [18]. From the perspective of employment, 80% of the active workforce at global level has been employed in low-skilled jobs and activities, and the digital world already eroded significantly in this direction, making the collaboration

between humans and machinery/robots fundamental; during the last three decades many jobs have either completely disappeared or they have been wired to automatization processes and operations.

The COVID-19 pandemic has determined the perfect premises for the development of the KIS environment, and for the transition to the knowledge economy at global level. The most affected industry worldwide by the effects of the lockdown has been that of hospitality [4], as more than 90% of the workforce employed was participating in low-skilled activities and operations, and the HORECA companies being able to create less than 10% profit margins (realistically, around 2% margins in full-force seasons). These types of industries, also known as non-essential economy – leisure, hotel, restaurant industry, are not enhancing the economy and the productivity in any way, and are not creating any innovation, meaning that they cannot continue to operate in such a rudimentary way within the premises of the knowledge economy. Moreover, people that are earning less than USD 20000 per year are two times more exposed to unemployment than people earning more than USD 80000 per year, meaning that low-skilled jobs will be made redundant in the new economic order. The safety of the workforce relies in the movement, change and innovation triggered by knowledge. By 2035, more than 1 billion of people will work remotely, as technology is changing the way in which people work, interact, and live. The human cloud industry will be valued at USD 5 billion per year, transforming the labour market into a more efficient and productive element of the economy. The impact of automation, artificial intelligence, robots, etc., will determine, according to the World Economic Forum, a worldwide low-skilled job loss of 75 million by 2022, and an increase in the high-skilled jobs of 133 million by the same year.

2. Problem Statement

People have lived, especially in the close history that we are taught, in a system connected and controlled by and through fear, brute force and deceit, a Machiavellian infrastructure of the ends that justify the means. Nevertheless, the introduction of the doctrine of the rights of the masses triggered individuals in concerted action against governmental and/or religious tyranny, confirming Skinner's statement that the natural inclination of a human being is that of fighting the selfish control, and re-establish the good purpose and direction of the humankind through the concept of democracy (that more in a philosophical and poetic way, rather than political).

Consistently, every moment of the economic history was marked by a most advanced production practice, which at the beginning of its introduction on the market was far from being an efficient process. Nevertheless, with the passing of time, and with the increase of knowledge on its potential, usage, and framework, it becomes productive, and achieves the greatest output from a given, limited input, but most importantly, it becomes an incentive for change across the economy, for innovation [1], including the advantages of versatility and efficiency. Smith and Marx have attained the truth of economics, which resumes to the best and most advanced practice of production (as it was the case of industrialization, for instance), a concept that can only achieve its higher status by being disseminated throughout the economy, by testing it in different circumstances and sectors, by understanding its opportunities and limitations. This is the reason why knowledge economy can showcase its greatest potential only when it is released to basically all levels and sectors of the economy [18]. The distinction and the advantage of over-mechanized manufacturing and industrial mass production relies in the fact that while the former two concepts can be attributed to specific sectors of the economy, the knowledge intensive economy can exist, be developed and implemented, and bring growth to every sector, transforming the business world in a KIS, precision-based, scientific, and high-tech machinery, that promises a socially inclusive, persistent and sustainable growth [16].

The products and services of the knowledge economy are accessed today, in their incipient form, via platforms and networks, to ultimately work more efficiently intertwining hardware (including gadgets) and software to construct and deploy complex information and data [3]. The general trend is comprising of vast wealth accumulating in the niche market of already huge technology companies, underlining the ever-growing gap between the new world and the old world. The small enterprises across the world have felt hard core the changes that emerged in the last decades, and with the pandemic crisis the inequality of the systems was pictured more clearly as ever. Even with the after-effect corrective measures of the governments worldwide, the problems arising, especially in the entertainment and leisure industry, are far from over, leaving the supply and demand arrangements out of balance [21]. Although huge financial resources have been delivered towards resuscitating an economy that was long overdue, there is no stopping the damage already inflicted. This means that a new era will breakthrough, reshaping the institutions, the culture of business, the education system, the social and legal frameworks, and the politics, all through the concept of innovation and socially inclusive economic growth. In other words, the knowledge economy would create a world in which each

entity, being it individuals, enterprises, governments, are equally working towards the same goal, that of continuous innovation and generalized efficiency within a perfected system [17].

Within the European space, there is a debate concerning the policy implications for businesses inclined toward sustainability-oriented innovation strategies. According to a 2019 research [15], there is a consistent business community that acknowledges the importance of SOI, and the boost effect it has on the performance and productivity indexes, being referred to as one of the competitive advantages of the enterprises driven to use sustainable technologies and innovations as a main strategy focus. Nevertheless, the capacity of enterprises to adhere to SOI principles is highly linked to the national system of innovation performance [15], which sets up a standard for each EU country in relation to its position relatively to other member states. This is consistent with differentiation of SOI adoption across the EU economic area, an effect triggered partially from the lack of investment and financial aid capabilities for innovation and technology system implementation within the given member state. Consistently, the direction in which the funds are used within an enterprise in the European Union depends on the compatibility of the business model to the innovation framework scheme, and on the degree of skills and knowledge acquired by the given company [15]. This phenomenon suggests that the EU enterprises are fully aware of the importance concepts such as SOI and KIS have on the future structure of the private industry, but those companies present misalignment intra- and inter-business strategy and orientation. The European enterprises are not part of a fully-grown industry, and they are, in majority, incompatible to knowledge economy, high-performance business models.

Nevertheless, the European Union has been working on the construct and concept of KI(B)S [2] since the 90's, recognizing that the economy, especially that of the member states, could only step into the next era if it were aligned to innovation. While assessing the situation after the last financial crisis from 2008-2009, the policy makers wanted to make sure that the next time things will be under control. Unfortunately, that did not happen, but, nevertheless, the policy has been adjusted to better face the cyclical economic climate, and to better profit from the opportunities to transform the latter. Generally, the main theme of the transport policy reform in the European Union has revolved around practicing sustainable and environment-friendly activities [7], with the inclusion of innovation and digital technologies, for the scope of becoming a contender on the international/global scene [8]. Taking on the principles of knowledge economy and KIS, the public policy in the EU would basically enhance the

conditions and opportunities of inclusive growth, transforming or rebuilding the European social cohesion, and, specific for the transport sector, to transition to zero-carbon emissions. The August 2020 adopted policy [13], included in the Mobility Packages of 2017, 2018 and 2019, is slowly tracking down those measures in order to accelerate the business transformation of the freight market, in particular, and of the mobile workforce, in general.

As a significant part of the European economy, the transport market supports and promotes the other sectors, but also stands as an extra cost among the activities on the value chain. There is a constant battle to keep in certain limits the costs associated with the transportation of goods across the EU, for the opportunity of becoming more competitive. Economically speaking, all low value-added, high-volume goods, such as construction materials, or liquid products, have a high share in the transport related costs. The logistics and transportation services represent approximately 10% of the revenue across the majority of economic sectors; those costs comprise of warehousing, administration, and carrying of inventories services [14]. The efficiency of this sector of the industry would have a significant general impact on the economy, and the business transformation of the transport market could, among others, reduce timeframes, enhance the viability of the just-in-time management system, only by introducing simple but effective measures, which refer to technology application, and also to business innovation and transformation. Moreover, the transport sector of the EU-28 employs more than 5% of the total available labour force in the union [14], and stands tall over other economic sectors, situating the picture within the frame of competitiveness development, better cost control, and consistent stimulus towards European integration through the enhancement of the Single European Market (SEM).

There is, nevertheless, a distinguishable discontinuity in the legislation of the member states, furthering the ununiform transport networks across the EU, and signalling the necessity of transforming this economic sector into an efficient, concentrated machine through both transport policy reform and overall business transformation and innovation. The discrepancies are clearly observable on site, with Central and Eastern European countries failing to upgrade at least their transport infrastructure, in order to align with the TEN-T. At the same time, protectionist public policies have hindered the market liberalisation, which would, in the end, benefit not only carriers, but the improvement and performance of the European transport network.

Decisively, the transport European policy, although feeding the transport system through social, economic cohesion and regional development programmes, lingers in the quantum of public health, energy

consumption and environment protection limits, sometimes altering the integrity of the SEM with potentially protectionist decisions and measures.

3. Aims of the research

For the last three decades, the European Union, through their legislative and executive bodies, has relentlessly worked towards realizing and instituting complex and cumulative policies for the freight market, aiming at greening the transport system, transforming the business within the SEM based on principles of liberalization, open-access, transparency, growth and innovation. The *greening* movement [5], has been all about protecting the environment and the health of the EU nationals, and creating a system with perspectives for the future, where only the most efficient measures, technologies, policies, strategies emerge and are vastly used.

Moreover, in the last decades the emphasis was directed towards enhancing and modernizing the infrastructure, particularly discussed in relation to the freight sector, for the scope of the paper. From introducing and using on almost all motorways of an automatic tolling system, to the extensive agenda of the *Europe on the move* action [11], where cross-border information exchanges between member states and non-member states was at heart, the public policies of the freight industry have gradually and consistently introduced the extensive usage of technology, modern systems for control and enactment, as well as that of innovations, and digital aiding means.

Nevertheless, it is very well known that the application of the European legislation is not always uniform, and that there are still countries, and regions across Europe, where this new imagined and, to some extent, applied world is nowhere to be seen. Ideally, this paper considers the environment that will be created in the next few decades, as the EU is preparing for the ultimate transformation started by the digital revolution, the slow, but steady transition to zero-carbon emissions [10], and the rebuilding of the old continent through social cohesion [12]. The latter are, such as we prefer to call them, the soft means for a truly sustainable and inclusive growth, one that is promoted through the hard means – innovation, digitalisation, business transformation, extensive R&D investment, transitioning towards a knowledge economy, a perspective that should start to vaguely expand in the next 30 to 50 years.

The aim of the current research is partly born out of a utopic dream, but mostly it is based on the realisation that, after observing the world slowing down, taking in the bigger picture, all that is today of significance has been bluntly destroyed by a single, general decision. The visionaries of

our world understood that the present is no longer today, that this moment in time is already asking for the future, and that entire systems can be reborn simply through transformation and out-of-the-box perspectives.

The culture of the artificial intelligence, intertwined with the knowledge intensive businesses, and the modern, sustainable policy represents that dream of future, an image that is given billions of Euro in investments, but still stands behind the extensive attention that the same freight sector has enjoyed in American or Asian economies. Therefore, the present paper will address the significant impact such implemented measures would have on the European economy, starting with an observation of correlation between the logistics performance and the freight services on railroad and in air, and a number of technology-, emissions-, social-, population-, business-, economy-related variables. Based on the findings, which are either significant or not, showcase the point made by the current research, which is understanding that the basic need of the freight industry comprises of updated policies, an extensively transformed business model, and the introduction across all types of freight transport means of the knowledge economy and the AI algorithms.

4. Research Methods

The main research method used for the obtaining of results in this particular case has been the regression analysis, which basically is defined by its purpose of explaining or describing potential relationships that exist between certain variables [20]. The functioning mechanism behind this type of statistical model is represented by one variable being dependent or response to a set of variables, namely the explanatory or independent variables.

Consequently, the variables used as response in this particular study are related to the amount of goods in million tonnes per kilometre transported through air and railroad freight, and the logistics performance index – overall, and in terms of quality of trade and transport-related infrastructure. The regressors or the independent variables have been divided into four groups – technology and emission related variables (including CO2 emission from transport, total green gas emissions, air pollution, R&D expenditure, secure internet servers per million people), business-related variables (new business density, procedures to build a warehouse, procedures to register a property, self-employed, start-up procedures, time required to start a business), social, population and labour related variables (current education expenditure, current health expenditure, employment in services, labour force, unemployment with advanced

education, urban population), and economic and financial related variables (GDP, high-technology exports, ICT service exports, industry, listed domestic companies, new business density, profit tax, pump price for diesel fuel, service imports, service exports, service value added). The database has been assembled from World Bank org, the information being consistent with the statistical data for the European Union between 2010 and 2019. Not all variables have the same number of observations, being mentioned as the results can be influenced by the lack of equal data.

The testing was not based on validating specific hypotheses, it has been constructed in order to understand if there is any connection whatsoever between the selected variables. The main scope of the research is to underline the importance of forward thinking and application of technology and innovation to the freight transport sector, which would enhance the probability of an efficient business transformation for the realization of the ideal – the knowledge economy.

When interpreting the results, there were particular elements that have been assessed, such as the magnitude of the correlation – namely the size of the coefficient (if the independent variable x would increase by 1, would the dependent variable increase or decrease and by what amount), and the significance of the estimated coefficient – basically observed by the values of t-statistic and p-value.

It should be mentioned that the results are expected to not showcase significant correlation between the variables, a pattern consistent with the current economic system – one that presented in many occasions considerable flaws, a system that asks for change and update into the new and growth-sustainable knowledge economy. Nevertheless, the next chapter will discuss extensively the results of the study, and the interpretation of the prediction as a parallel to the principles of the knowledge economy, business transformation, the knowledge intensive freight industry, and the technology and innovation of the AI algorithms for statistics retrieval and enhancement of the freight transport industry in the European Union.

5. Findings

As mentioned previously, there have been four dependent variables – air transport, freight (million ton-km), logistics performance index: overall, logistics performance index: quality of trade and transport-related infrastructure, railways, goods transported (million ton-km), tested against four classes of independent variables, the latter being included in the technology and emissions category, business category, social, population and

labour category, and economic and financial category. The next subchapters will extensively discuss each category of results.

5.1. Air freight transport

Testing the quantity of air transported goods against CO2 emissions from transport, air pollution, total green gas emissions

In terms of magnitude, the quantity of goods transported via air means presents a strong effect in relation to the carbon emission from transport – a 1% increase in the CO2 emissions from transport, determines a 2229 million ton/km growth in the quantity of air freight transported goods. The same effect is registered also in relation to the air pollution, but this time there is a smaller impact on the dependent variable, while the total green gas emissions in kt of CO2 influences only by 0.8% the increases in the transported goods by air.

In terms of significance, it can be assessed that the effect of CO2 emission from transport has the most statistical precision of the estimate. The t-statistic is significant at 90% level, allowing for the conclusion that the CO2 emissions will indeed influence the quantity of transported goods by air borne means. The other independent variables do not present the same statistically significant effect, although it can be underlined that they influence to some extent the dependent variable.

Testing the quantity of air transported goods against R&D expenditure and modern technology

The magnitude of the effect of the research and development investments in correlation to the quantity of air freight goods is negative and very strong. Therefore, a 1% increase in the R&D expenditure (as % of the GDP) determines a drop of 18645 million ton/km in air transported goods. This is consistent with the school of thought of the knowledge economy, where the development of technology and extensive technology use would determine efficient decision-making, thus finding a better solution for the clean transport of freight goods. If the number of secured internet servers (used in the knowledge intensive business services sector of the freight transport industry) increases by 1 for every million people, the quantity of goods transported by air means increases by 1.3 million ton/km goods.

Testing the quantity of air transported goods against business related variables

The magnitude of the correlation is negative in relation to the new business density, the number of procedures to build a warehouse, and to the time required to start a business. This highlights the fact that allowing technology to optimize the management system of the freight transport industry, and aid on the business-related activities, the general advancements

in this particular sector of the economy would become more knowledge intensive, and perfectly fit within the new economic system imagined by the European Union. There are also some positive correlations, namely with the number of procedures to register property, the percentage of self-employed people from the total labour force, and the start-up procedures to register a business, which underlines the fact that more businesses are being created, more people move towards an entrepreneurial career, and that determines a further effect on the consumption market. These are also observations consistent with the transformation into a knowledge economy.

The significance of the test cannot be validated, explaining that if it were to hypothesize in relation to the effect on the dependent variable, the null hypothesis could not be rejected, showcasing no clear correlation between the variables. Nevertheless, this can also be a result of the limited number of observations.

Testing the quantity of air transported goods against social, population and labour related variables

Overall, the statistical significance of the test can be confirmed with a 95% confidence level, showcasing that the percentage of expenditure in education has a positive effect on the air freight market, while the expenditure in tertiary education has a negative effect on the latter. This is consistent with the initial stage of the business transformation process and movement towards knowledge economy, showing that the freight industry still employs low-skilled workers. The increase of 1% in the health expenditure would determine an almost 2 million ton/km increase in the quantity of air transported goods, while the impact of employment in services generates a staggering growth of 1638 million ton/km air freight goods, confirming that the air freight industry gravitates towards KIS. Moreover, the unemployment with advanced education determines a drop in the quantity of air transported goods, showing the need for high-skilled workers in the freight industry.

Testing the quantity of air transported goods against economic and financial variables

The p-value of the regression readout is significant at 95% level, with 62% of the variance explained. Particularly, the adjusted net national income has a significant effect on the quantity of air transported goods in the European Union, the other estimates, expense as percentage of GDP, exports of goods and services, and foreign direct investment, having a negative impact on the dependent variable, typical for a consumption economy. This also underlines the need for a shift in perspective, to generate sustainable economic growth. Consequently, the influence of GDP, high-technology exports, and ICT service exports is confirmed at 95% confidence

level. Nevertheless, there is a negative impact from the high-technology exports, showcasing that the freight industry is still to adopt advanced technology-based systems, and to be enhanced by the extensive usage of high-technology, such as artificial intelligence algorithms, knowledge systems, and high-skilled workers.

5.2. Railway freight transport

The railroad freight transport is not correlated to the variables from the technology and emissions category.

Testing the quantity of railroad transported goods against business variables

The magnitude of the impact business variables have on the railroad transported goods (million ton/km) is positive in connection to the density of new businesses, and to the procedures to start a new business, while it has a negative impact in relation to self-employment, procedures to build a warehouse and to register property, and to the timeframe required to open a new business. This situation is normal, as the railway freight market is eating into the road freight market, and as more businesses are entering the freight market (self-employment in the road freight business), the less goods are transported via railways. Nevertheless, the road freight market is not as knowledge intensive as the rail and air freight industry, and also it does produce higher carbon emissions compared to the rail freight industry.

Testing the quantity of railroad transported goods against social, population and labour variables

The railways freight transport market does not rely on intensive labour services, it is mostly automated, which is showcased by the results of the regression. The hypothesis where the railroad freight market is influenced by the social, population or labour related variables can be rejected. This situation highlights the fact that the intermodal systems for goods haulage across the European Union, which gained considerable market in the last decade, represent a forward movement towards the KIS and the knowledge economy. The business transformation of the freight market would eventually draw on a profound effect on the other means of transport for goods on the SEM.

Testing the quantity of railroad transported goods against economic and financial variables

The freight market of railroad transported goods is negatively influenced by the expenses as percentage of the GDP, with a strong magnitude, and a t-statistic value significant at the 95% level – as the expenses increase by 1%, the quantity of goods transported via railroad drops by 465 million ton/km, underlining that this type of transport has a

number of disadvantages, such as the delivery timeframe, limited railroads, limited access.

At the same time, the profit tax (percentage of commercial profits) positively influences the quantity of goods transported via railroad, at 90% significance level. The 1 percentage point increase in the profit tax will determine a 1174 million ton/km growth in the quantity of railway transported goods. The profit margins of manufacturers and suppliers will be higher when the chosen transport mean is the rail. This underlines the main advantage of the railroad transport system, but it is not enough to shadow on the disadvantages.

5.3. Logistics performance index

The logistics performance index will showcase results that are the most in line with KIS principles, underlining the need for change, for updates in the system, and, mostly, for the introduction of high-technology and innovations in the freight transport and the logistics industry. The social, population and labour variables do not have any impact on the logistics performance index, implying that the data lacks the necessary information to draw on significant explanations.

Testing the logistics performance index against CO2 emissions from transport, air pollution, total green gas emissions, R&D expenditure

The magnitude of the influence of CO2 emissions on the logistics performance index is significant at the 95% level, with a 1% increase in CO2 emissions triggering a 5% increase in the performance of the logistics industry. The impact of air pollution on the logistics performance index is negative, determining a drop in the latter of 5%, the same being true also for the influence of the total green gas emissions.

The expenditure as percentage of the GDP directed towards R&D influences the quality of the logistics' infrastructure, determining a 47-point increase in the logistics performance index.

Testing the logistics performance index against business variables

The size of the effect of the new business density, of the procedures to build a warehouse and to register property is significant at 95% level, with 99% of the variance explained. The procedures to register property are negatively impacting the logistics performance index, while the other two are positively influencing the dependent variable. For every new business registration, the logistics performance index increases by 26 points.

Moreover, the start-up procedures to register a business and the timeframe for a business registration impact negatively the logistics

performance index, determining drops in the latter as the number and duration of procedures to start a business increase.

Testing the logistics performance index against economic and financial variables

The statistical significance of the correlation between service exports/imports and the services value added is precise at 90% level. The service exports and the service value added have a negative influence on the logistics performance, while the service imports positively impact the logistics performance index.

6. Discussion and Conclusion

The European Union has analysed in 2020, at the end of another decade of measures and directives destined to create a consistent message and implementation across all member states, to operationalize the international relations, and to fight for the right causes, the current situation of the system, radically observing the policy issues of fair competitiveness on behalf of the European enterprises, of social cohesion, and of climate change movement. The digital revolution, a central theme for any discussion regardless of the industry, through the extensive use of the Internet of Things, and other digital technologies, have altered the means by which we live, we work, and we are entertained. Adding to the equation the health crisis, which in turn startled the economic and financial system, and brought it to another abrupt fall, there is not much that we can recognize around us.

After 20 years of continuous investments in technology companies (among which Apple Inc., Microsoft, Amazon Inc., Alphabet Inc., Facebook, Alibaba Group, Tencent, TSMC, Samsung, Nvidia making the top ten), the latter are part of the most valuable group of entities in the world, some even more powerful than governments and states. The main business activities of those companies are software and hardware manufacturing, AI, engineering, e-commerce, cloud computing, R&D, biotechnology, video games, consumer electronics, and information technology. All those concepts are part of the future world of knowledge economy.

The group of technology entities will be converted in a global phenomenon, with the inclusion of many other industries, including the freight sector, considering the fact that the productivity growth has slowed down even in the advanced economies of the world. Every sector of the economy has to be in line with technological progress, innovation, digitalization, high-skilled jobs, and a completely rewired financial and investment system.

Among the world economies, the European Union stands behind China and the USA in terms of technology companies, and KIBS, although, paradoxically, the latter was a concept first given attention to, in 1995, by an entity of the EU. Nevertheless, from 2014 to 2020, there have been made available by the European Regional Development Fund, only for the development of Information and Communication Technologies (ICT), over 20 billion EUR. Romania managed to allocate 2.4% of the total sum. This shows that the public policies are gravitating around the idea of massive investments in research and development, in technologies, in the digitalization process, and not only towards challenging the productivity of a particular economic sector, but to have a significant effect on all the corners of the latter.

The freight industry is one of those sectors where one can identify an area highly technologized (e.g. air freight transport – as validated in the present study), and pertinent to KIS, and other areas where the activities are based on low-skilled jobs (e.g. railway freight transport). The present research was meant to offer a glimpse into that disproportion of the freight market, by performing a regression analysis on the EU air freight transport, the railway freight transport and the logistics performance index, on the gathered data from the World Bank, over the period between 2010-2020. The aim of the research was to only highlight the fact that there is stringent need for allocation of resources, through the development and implementation of public policies, directed towards increasing the productivity of the freight industry by the means of technology, AI algorithms, business transformation, and KI(B)S.

The results of the regression analysis in relation to the air freight transport determined a correlation between the quantity of air transported goods and the emissions of CO2, as well as the R&D expenditure as percentage of the GDP. Therefore, this particular sector of the European freight industry, although still not in line with state-of-the-art environmentally-friendly technologies, is incentivised by the extensive investments in R&D, complying to the characteristics of a KIBS. When assessing the impact of the business-related variables on the quantity of air transported goods, it was clear that the air freight transport of the EU pertains to the sector of knowledge intensive services, fact underlined by impact of expenditure in education, and the unemployment with advanced education. Considering the economic and financial variables, it was validated that the air freight transport industry needs to generate sustainable productivity growth, through the adoption of advanced technology systems, AI algorithms, and high-skilled workers.

In the railway freight industry, the results were consistent with insignificant air pollution and CO2 emissions, but determined drops in the quantity of goods transported via rail with the proliferation of new businesses, self-employment, and the diminishing of procedures for opening a new business. The railroad freight transport does not employ intensive labour services, thus there was no impact on the quantity of goods transported on railroads from the social, population and labour-related variables. Moreover, the impact of expenses as percentage of the GDP negatively influence the quantity of goods shipped via railways, probably a determinant of the limitations of this mean of transport, although it still is one of the least expensive freight transport channels, upping the profit margins of the other participants on the value chain.

Generally, the logistics performance index was to draw the closest significance and benefits of the KIBS and knowledge economy. The air pollution and green gas emissions had a negative impact on the logistics performance index, which means that the system, pushed by the EU greening public policy, is improving its positive impact on the freight market. Moreover, R&D expenditure increases significantly the logistics performance index, concluding that the industry receives incentives for better productivity and overall performance of the infrastructure. The phenomenon of new business registration determines the growth of the logistics performance index, while the number of procedures to start a business will block the system and drop the performance index. There are no significant and important influences on the logistics performance index from the economic and financial variables.

Conclusively, it is clear that the EU enterprises are missing some skills, especially those related to investment and technology adoption. The freight industry is part of the same story, and it makes the whole system vulnerable, due to the limited technological adoption. Moreover, even though there are signs that at least parts of the freight market are more inclined towards KIS, innovative, digital and dynamic entities are still to appear. The EU has directed considerable amounts of funds towards developing and implementing a wide range of technology and knowledge intensive services, but the speed to which those funds are effectively utilized by freight companies is limited, disproportionate and it showcases a lack of skills. Congruently, the new wave of demand for high-skilled workers will definitely leave a gap in the employment market, more so in the freight industry where the KIS and digital technologies are to be adopted via the enforcement of the public policies (see the Mobility Package). The education system will play a major role in the diffusion of the learning gap, and will represent the first step in the implementation of learning opportunities

across all the sectors of the freight industry. With a still far away perspective for complete realization, the freight industry has been able, to some extent, to add on principles, strategies, directions of the knowledge economy and of the knowledge intensive services, but innovation, extensive usage of AI algorithms, and business transformation are elements that will pertain to the next stage of the European history, one that is already streamlined into the public policies.

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