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Virtual space – source of opportunities and threats for the development of intellectual capital of an enterprise

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***Abstract*— Discussion of the opportunities for growth of intellectual capital (IC) offered by virtualization of business operations is a topic rarely present in literature. Thanks to a modification in a method evaluating the level of intellectual capital in an enterprise it was possible for the author to determine the most important stimulating paths and hindering factors that impact the growth of customer, organizational and human capital. The modification took into account the positive impact on the owner of an enterprise, risks and the necessity to increase net assets. The author discusses the issue of the intellectual capital from the point of view of companies operating within the so called sharing economy and two-sided markets (Internet platforms). Additionally, the author touches upon such modern solutions as BlockChain or the Internet of Things.**

Keywords— intellectual capital, virtual space, growth of intellectual capital (IC)

I. INTRODUCTION

These days more and more enterprises shift a part or even the entirety of their activities into an environment called 'virtual space'. Such a trend is a part of the process of virtualization in which thanks to the usage of ICT technologies it is possible to obtain a virtual object which becomes a counterpart, representation or simulation of the object of the process (Konopka, 2019, p. 76). This object constitutes a part of virtual space perceived as a kind of environment created with ICT technologies and accessed through ICT technologies and systems.

From the business point of view, it is the profitability that accelerates the advancement of virtualization processes. Trade relations have successfully moved online. In Poland, however, e-commerce is still at its early stages. Although, in 2020 the worth of online purchases amounted to more than 15,3 billion Euro, according to a survey by 300RESEARCH, in 2023 online sales in Poland will constitute only 16% of the total retail transactions. Nevertheless, the dynamics of the phenomenon in question is high. The e-commerce market in Poland in 2021 rose by 31,4% when compared to 2019, and it is the best result on the European scale ('Analiza rynku e-commerce w Polsce', 2020).

Virtualization of a company does not only refer to market relations but also to various internal processes. Many companies could not even exist outside the virtual space created by ICT technologies which enable communication, automation of processes or instant access to information. 'Intelligent industry' or 'intelligent production' assumes non-stop connection between machines and between humans and machines (Grodner et al., 2015, p. 9).

In light of the above, it seems useful to research the possibilities offered by virtualization in different areas of corporate activities in order not to compromise its potential and dynamics which may boost the development of global economy. Virtualisation is also worth considering with respect to its validity for growth of intellectual capital of an enterprise.

II. MATERIALS AND METHODS

In order to assure the completeness of the study, the author adopted as a starting point the definition of intellectual capital formulated by L. Edvinsson. Thanks to the definition, which gets to the bottom of the phenomenon, the examination of intellectual capital is not limited to its internal structure alone which as a figure is often wrongly or incompletely described by various authors. The internal structure of virtualization is treated in an auxiliary way – as an element ordering the results of the conducted analysis. With reference to the content based definition of L. Edvinsson, the author of the publication adopted as a surrogate of the market value of an enterprise its valuation

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arrived at by means of income-based method with an assumption that neither the owner nor any other market participant dispose of a better concept for further development of the enterprise as of the date of the valuation. Upon these foundations, the formula for determination of intellectual capital proposed by L. Edvinsson was adapted to serve the purposes of this publication. In this way it was possible to uncover the main factors impacting the intellectual capital (IC) of an enterprise which are closely connected to the virtual space which constitutes the surroundings in which the enterprise operates. The adopted formula allows for a separate indirect evaluation of the impact which the factors resulting from allocation of an enterprise in the virtual space have on its intellectual capital. The present publication, which presents only the initial phase of a more complex study, shows an early classification of vital factors which arose as a consequence of virtualization of various spheres of activities of an enterprise. The evaluation of possible impact of a given factor on IC of an enterprise was conducted under *ceteris paribus* clause which assumes a constant impact of the remaining factors.

The notion of IC has its origin in observations of the differences between market value of an enterprise operating as an organized whole and the value of its all net assets. The term *intellectual capital* was used for the first time in 1958 when stock exchange analysts commenting on good results achieved by small public companies, observed that these results constitute the intellectual bonus of these companies (Kasiewicz and Kicinska, 2006, p. 65). As the growth of such understood IC translates into faster growth of wealth for the owner of the enterprise, with respect to the necessary investments frozen into the company's assets, each and every owner should be keen to pursue the notion of IC in order to boost their wealth which outgrows the entirety of financial contribution invested to achieve this growth. Allocation of business operations in the virtual space opens many doors for growth of IC, therefore it may be a good idea to get a closer look at the opportunities and consequences the virtualization processes offer.

Despite the unquestionable significance of IC, recent years have not brought about uniform standards of its evaluation (Skrzypek, 2017, p. 100). Nevertheless, a number of companies listed on stock exchange markets address the IC phenomenon in their annual reports in about 59% - 70% of its constituents. A study conducted on 20 companies shows that the most frequently re-occurring IC factors are: clearly formulated strategy (19/20), innovativeness (16/20), competences of executives (19/20), good relations with investors (18/20), cooperation with other enterprises (18/20) and the development of distribution channels (Bagieńska and Burchart, 2018, p. 35).

A considerable contribution into studies on intellectual capital was made by L. Edvinsson who was the first to describe the notion of intellectual capital and made an effort to explain its internal structure (Edvinsson and Malone, 2001, p. 39). Using the outcomes of Edvinsson's work it may be proven that total value of intellectual capital of an enterprise may be expressed by the following formula:

$$IC = M_{VE} - A_{net} \qquad (1)$$

Where :
Mve – market value of an enterprise as an organized whole,
A net – assets less liabilities.

If one adopts the income-based method of evaluation as the one which is the closest to the market value of an enterprise being an organized whole, and the evaluation assumes the development scenario seen from the point of view of the present owner but also of a potential buyer, formula (1) will be as follows:

$$IC = M_{VE} - A_{net} = \sum_{i=1}^{n} \frac{NCF_i}{(1+r)^i} - A_{net} \qquad (2)$$

Where:
NCFi – net cash flow due for the owner of the enterprise in i-year,
n – assumed number of years of functioning of an enterprise,
r – discount rate including the bonus for risk that burdens NCFi,
Anet – assets less liabilities.

Obviously, depending on various conditioning there will be different rules for *NCFi* calculation, nonetheless, the main constituent of the cash flows are net incomes generated by an enterprise (Szczepankowski, 2012, pp. 66–71). In this way, formula (2) may be treated as a criterion which helps to determine the impact of various factors that stimulate or hinder the growth of IC in an enterprise: everything that increases or delays in time *NCFi* for the nearest years after the calculation was made (e.g. the profits) boosts growth of a company's IC. Furthermore, everything that eliminates the risk of failure to obtain the forecasted *NCFi* on time and all that reduces net assets necessary to obtain the *NCFi* positively impact the intellectual capital.

To put it simply, everything that lastingly increases income of an enterprise, reduces the risk of loss of forecasted profits or reduces net assets needed for fulfillment of a company's development scenario, has a positive impact on the IC of an enterprise.

The relevant factors here may be considered in at least three dimensions – customer capital, organizational capital and human capital (Edvinsson and Malone, 2001, p. 45).

III. RESULTS AND DISCUSSION

According to data provided by the Polish Chamber of Electronic Economy, in 2020 the percentage of Internet users shopping online amounted to 72%. It is estimated that the worth of Polish e-commerce market will rise to 162 billion PLN in 2026 which shows a huge potential of customer capital present in the virtual space (the Polish Chamber of Electronic Economy, 2022).

In case of ***customer capital***, and, to be more specific, possibilities of its expansion in the virtual space, its potential cannot be overestimated. Due to its nature, virtual space allows for considerable cost reduction and growth of scale of operations in the following areas:

- cheaper and faster access to a vast base of potential clients;
- efficient cooperation with potential clients;

- increased efficiency of *up-selling* and *cross-selling*;
- application of more effective tools of penetration and awakening of hidden needs of buyers;
- delivery time/access time – especially in conditions of dematerialization of goods – thanks to the Internet which provides immediate delivery/access.

Generally, the access to a wider circle of recipients in real time is made possible thanks to the tools of contextual advertising (Strzelecki Artur, 2015) and behavioral advertising (IAB Association Europe, 2014). Nowadays, commercial campaigns frequently use *Performance Marketing* solutions such as Internet search engines (entering a search phrase) or a partner network possessing a huge number of websites on the Internet (even 2 million). Matching the content of advertisements to the preference profile of a potential buyer takes place according to various criteria such as: localization of the user, their gender or age, the key word entered, subject matter of visited websites, destinations on the Internet or orientation towards a specific device e.g. a smartphone of a particular manufacturer. To promote commercial contents the advertisers use various platforms (e.g. YouTube, Facebook, Instagram). An important role here is played by *remarketing* strategies which convince the unconvinced to buy products of the website they have just left, or contextual display of goods with prices offered by different sellers and links to online retailers ('Kampanie Google Ads', 2022). One may not miss here the so called *affiliate marketing* (a model of promoting goods and services where Internet users sell products of external companies on their websites and chargé a commission) or activities based on *programmatic* which is a fully automated system of buying and selling of advertising space on the Internet. All these solutions exist thanks to opportunities offered by virtual space, especially thanks to the possibility of communicating with an enormous base of potential clients in real time at relatively low cost. Another useful tool here is the automated thus, economical mechanism of matching marketing contents to users' profiles. There are also random practices for creation of customer databases for specific companies offering specific products or services (e.g. installation of photovoltaic panels). Such companies use the services of telemarketers or just AI automats who call randomly selected phone numbers and artificially create demand through information about an alleged government subsidy for their product. Following the initial interview, a list of persons who expressed a certain degree of interest in a given product or service is made and is later sold to the company actually offering the service or product. Such activity in itself may be positively assessed as it streamlines the market and boosts economic development. However, the information passed to prospective customers must be accurate which is not always the case and that the frequency of phone calls does not come near to harassment.

The modes of communication within virtual space allow for passive and active contact with the client at the very low cost and makes it possible to use *up-selling* and *cross-selling* tools which automatically display information about products the customers browsing through a given commercial platform bought in the past. Electronic retailers may contact their customers on regular bases each time they introduce an innovation/modification in their products or services, they may also request feedback on how to further improve their trade offer. A special tool which measures customer satisfaction levels triggers constant verification of the quality of the online offer and allows for constant correction of its representation. In return for their feedback, customers are usually offered a small form of gratification e.g. a gift, discount or loyalty points.

Leaving aside the above mentioned features, it must be pointed out that in case of dematerialized goods the virtual space does not only serve as a platform getting together sellers and buyers but also becomes a vehicle that efficiently and practically free of charge delivers the product to the end user in real time. Virtual space may become the focal point of a company's activities and the distribution centre for the entire country. Online companies do not need to maintain subsidiaries and they are still able to offer a full product portfolio nationwide at minimum costs with the advantage of immediate sale. If a product cannot be dematerialized there is still space for cutting costs as a company may reduce the number of retail outlets to one in a given country or even in a given region of the world and continue sales through worldwide networks of courier companies, Parcel Lockers, parcel collection points in brick and mortar retail outlets etc. High efficiency and low cost of delivery options offered by highly specialized postal firms undoubtedly guarantees constant and sufficient incomes for retailers who virtualized the sales segment of their activities. In this sense the virtual space opens huge possibilities in terms of development of intellectual capital as compared to traditional economy because the companies who shifted their sales-related operations to the digital environment benefit from considerably increased market value (as an organized whole) which becomes much higher than the owner's current capital invested in the company.

It goes without saying that virtualization of an enterprise's operations related to the customer capital brings both benefits such as development of IC but also serious barriers and threats. The most important barrier is the digital exclusion of a part of the society, impossibility to view a product in a physical, three-dimensional form, dishonest practices of buyers who buy a product in order to only use it once and then return it to the seller, or dishonest practices on the part of online retailers. However, due to huge advantages for businesses conducting their activities from the virtual space, one may observe a number of initiatives undertaken to eliminate the drawbacks. There are specialized training courses aimed at reducing the scope of digital exclusion, legal regulations which guarantee free return of goods purchased online, possibility to withdraw from collection of purchased goods, wide choice of collection possibilities, warnings on Internet forums against dishonest websites etc.

The enterprises which utilize virtual space for communication and cooperation with their clients may also become victims of digital crime. The existing statistics show that the most common attacks (57%) are conducted by *bad bots* who are used to take over customers' accounts, to steal loyalty

points and to conduct other offences related to credit cards or gift vouchers. The second group of common crimes are the so called *DDOS* (Distributed Denial of Service) – these are attacks on a service or account by means of a single connection of a dozen thousands of computers which block the access to commercial platforms of online sellers. This offence generates considerable losses for owners of blocked services due to disruption of business and loss of customers who drift away towards other retail providers. In order to lift the block on their service online sellers are forced to pay a ransom. A similar threat for virtual business activity is called *Ransomware.* It is a software created by hackers which reduces the access to a computer system and in order to remove the bottleneck retailers must pay a ransom (the Polish Chamber of Electronic Economy, 2022).

The existence of dangers and barriers in the virtual space increases the risk for the customer capital which calls for a higher risk premium, which in turn requires the adjustment of the discount rate in formula (2) presented in the beginning of the publication. Thus, the intellectual capital of an enterprise decreases and reduces the wealth of the owner (the wealth expressed by the excess of the enterprise's value over own equity).

Allocation of the entirety of operations or just a part of them in the virtual space creates a number of chances for IC growth in the sphere of **organizational** capital understood as 'investments in management systems and in philosophy which accelerates the flow of knowledge in an organization within and outside to the suppliers and distribution channels' (Edvinsson and Malone, 2001, p. 34).

In the light of Edvinsson's definition quoted above, the key role in the sphere of communication of things may be played by solutions such as *Industrial Internet of Things* (IioT). Thanks to such solutions it becomes possible to eliminate the human factor in signaling the demand for various deliveries and management of these deliveries. Current automation of production processes which takes into account changing conditions of the production process and initial optimization of the decision area, leads to increase in efficiency and reduction of costs. In a modern plant it is necessary to integrate the Industrial Internet of Things with Artificial Intelligence and with the machine learning. The rest is taken care of by the 'digital twin' technology which by means of computer simulation shows results of implementation of new solutions thanks to data collected in various places from various devices connected to virtual space. 'Digital twin" is a valuable source of information not only for a potential client of a product but also a chance for machine producers who want to match their products to the needs and expectations of potential buyers (Poreda, 2020). A recent research shows that 66,4% of enterprises benefiting from the application of *the Internet of Things* declares increase in productivity, 64,7% observed the reduction of production time and stoppages, while 49,9% declares reduction of costs (Gumiński *et al.*, 2020, p. 64).

Apart from traditional enterprises who have virtualized certain spheres of their operations, there are companies born into the world wide web. These are companies which cannot exist and function in an offline environment (Hartman et al., 2001, p. XIII), there are for example *sharing economy* companies such as Uber, BlaBlaCar, Bolt, Airbnb which connect buyers and sellers. In case of *Uber,* persons who dispose of assets such as a vehicle, time and the capacity to take on passengers are connected to persons who need to get somewhere. It is all possible thanks to an electronic application which works in line with the idea of openness and cooperation (Toroń and Wiese, 2017, p. 20). BlaBlaCar operates on a slightly different basis – the application connects a driver of a pool ride with a passenger of a pool ride (BlaBlaCar, 2022). Airbnb platform connects private individuals offering accommodation with private individual seeking accommodation. As an alternative for hotels and Bed and Breakfasts, Airbnb offers much wider choice of options – the subject of the rent may be a stilt house, loft in the centre of a metropolis, villa with a swimming pool, rooms on a boat or even a castle (Airbnb oferta, 2022). Of course all platforms connecting bidders and users apply solutions which assure security and comfort for both sides of the agreement (Airbnb, Inc, 2022).

A vital element of functioning of electronic platforms is that within the *sharing economy*, individuals who are users of various goods for their own private purposes may be temporarily transformed into entrepreneurs who offer these goods to others for money. When the transformation occurs, the goods offered are already the owner's property which means that initial investment is not required because the asset is already there. What is more, if the assets in question are subject to economic exploitation (e.g. a private PC used for *gig economy* must be replaced because it does not support the updated software used for commercial purposes to play computer games) the actual cost of depreciation of a private device used as a driver to make profit becomes problematic. The device was bought in the first place for consumption purposes and it would be exchanged for a newer model anyway due to obsolescence. In case of BlaBlaCar platform, drivers of the car pools offering transport services for passengers would use their vehicles in the same journeys anyway for their own purposes. Transport of additional persons does not require any initial investment, and any additional fuel consumption and wear and tear is insignificant. Observing the processes from the perspective of intellectual capital with zero initial investment, there is a considerable reduction of net assets for an enterprise operating within *gig economy* what facilitates the growth of IC of 'business entities' temporarily extracted from households. In case of companies born online, the economical dimension characteristic for *gig economy* consists of:

3) connecting service providers and service recipients is automatic and humanless – no costs involved;
4) fixed assets needed to render the service are already at the provider's disposal, from the economic point of view if the asset is withdrawn from exploitation not because of loss of technical parameters but due to technological advancement – in *sharing economy* depreciation costs do not occur or are significantly lower;
5) some other costs of rendering the service are negligible

thanks to virtualization what considerably raises the worth of IC of such a 'temporary' enterprise.

Another technology which becomes important for enterprises operating in the virtual space is *block-chain* technology. There are four main areas of application of *block-chain* solutions: financial services (accounting, audit and bank transfers), activities on two-sided market, supply chains and social welfare (Weking *et al.*, 2020, p. 287). *Block-chain* in the field of financial services thanks to the elimination of a trusted third party guarantees low transaction costs and assures short time of the financial operation. A similar effect can be achieved on two-sided markets where the trusted third party is also eliminated by such platforms as Uber or Google. As the result, such drawbacks as centralized risk, low efficiency and high transaction costs are neutralized. Application of *block-chain* in supply chains thanks to the formal register of the chain of blocks grants identification to each member of the system and allows tracking of the item in the turnover along the whole supply chain (Grewal, Motyka and Levy, 2018; Xu *et al.*, 2018). Moreover, thanks to the *Internet of Things* it is possible to reliably track the condition of the item along the whole supply chain e.g. maintaining of appropriate temperature of the item and getting assurance that all health standards have been upheld along the supply chain. As the result, cost effective and reliable tracking of a delivery is assured as well as the optimum conditions for the items moving along the chain. Similar improvements may be obtained in the field of social welfare where *block-chain* technology provides authentication, security and reduction of asymmetry of information as well as secure implementation of health care IDs (Weking *et al.*, 2020, p. 288).

Summing up, the companies using the *block-chain* technology must adopt a different organization of internal processes which usually results in lower transactional costs, lower risk of losses for the participants of the processes, higher cost and time efficiency. In accordance with formula (2) all these elements have a positive impact on the intellectual capital of enterprises participating in *block-chain.* Reduction of costs and increase of efficiency brings about the growth of forecasted cash flows *NCFi* due to the owner, while the reduction of risk causes the reduction of risk premium *r*, what leads to a greater worth of the enterprise as an organized whole.

Other changes that may be implemented in the processes of an organization thanks to virtualization refer to the policy of offering a portfolio of payment methods specifically tailored for particular customers. The portfolio includes BLIK, online and traditional payment methods e.g. cash on delivery. The diversity of payment options increases the attractiveness and accessibility of the online offer for the vast circle of customers and extends the customer capital due to the reduction of subjectively felt risk related to the payment for delivery. The assurance of customers is also addressed thanks to another software which includes highly developed processes which keep the customers up to date with the status of their orders and the course of the delivery. What's more, the customers may alter the form or place of collection of the delivery what enhances the trust of buyers to the sellers and the fear that the transaction will not be successfully completed is reduced. Online retailers, on the other hand, are confident that their base of potential buyers will not be depleted.

Local and global internet platforms are available internationally, in local languages and are able to ship their products all over the world (e.g. AliExpress). Highly specialised supply networks with collection points located in retail chains, courier companies, Parcel Lockers allow for centralisation of operations and liquidation of local structures of distribution. The economy of scale helps to reduce the fixed costs of business activity. It would not be possible without introduction of changes into organization and at least a partial virtualization.

Yet another manifestation of virtualization of various spheres of a company's activities related to changes in organizational capital is the creation of internal databases and making them available online for employees in real time. It helps to streamline the operations of an enterprise, increases its worth as an organized whole and positively impacts the intellectual capital.

The last constituent of IC analyzed in professional literature is **human capital** which should be understood as the entirety of skills, knowledge and experience of employees (Edvinsson and Malone, 2001, p. 34).

In virtual space it is possible to use this capital remotely, without the need for mobility of employees. Therefore, the cost of labour of a highly qualified human factor located in different parts of the world is reduced as it is no longer necessary to transport and accommodate workers. People with unique competences may offer their services (e.g. within the *gig economy)* to many businesses often in different countries or on different continents and thus diversify their income sources. At the same time the competences may be ideally matched to the type of work or commission. From the point of view of intellectual capital, utilization of distant work opportunities offered by the virtual space results on one hand in lower cost of obtaining a human factor (the relocation and accommodation costs are ruled out), and boost of efficiency on the other due to a better match of competences to the current requirements and tasks of the recruiting companies. On the global scale, the efficiency of utilization of labour resources is significantly improved.

The possibility of provision of work remotely offered by the Internet allows for activation of additional labour resources which would otherwise lay inactive for various reasons e.g. limited availability of potential workers. As the result, the human capital deployed in their own households thanks to the Internet and electronic platforms may be utilised to manufacture goods and render services. The labour market is boosted by additional resources and increased supply of labour services and the costs of employing a person with the right skillset is much lower.

The possibilities of virtualisation of different aspects of rendering labour services mentioned above do not exhaust the impact on the quality and cost of the available human capital in a company as vital components of its intellectual capital. The usage of the virtual space may play an important role in the development of the components. Thanks to popular meeting

platforms (*ZOOM, Microsoft Teams*) employees may remotely master their competences without the need to travel to training venues. Remote training courses mean lower costs for the company and less disruption of the working day as the employee may return to work after the session is finished and does not waste time on the return journey. Virtualisation may also prove invaluable in the process of self-education of employees. When faced with a problem, employees often find a solution online or just a clue that inspires them to find the right solution. For example, if one needs to program a computer, let's say in *Visual Basic,* it is very probable that relevant information will be provided by YouTube. The authors of clues or tutorials are also motivated by financial incentive as their podcasts are accompanied by commercials which are a source of income for them. The more people will watch their content (and the accompanying commercial or at least its part) the more money they get from the advertiser. Of course, it is necessary to always validate the accuracy of a given clue as it may be misleading at times but the mere opportunity of a 'free' counselling offered online reduces the time of arrival at a solution to a problem which translates in higher efficiency of a worker. and reduction of a labour cost allocated to a given task. This, in turn, boosts the *NCFi* in formula (2), and, as the result, the IC of an enterprise.

Virtualisation of a company's operations in the sphere of activating human capital, allows for significant reduction of costs (including material costs) but also net assets. The principle of remote work assumes that employees use their own homes as offices that is why companies are able to give up a lot of office space for which they previously paid rent. Many employees work on their own private equipment (laptops, PCs, smartphones scanners, printers, modems connected to domestic wireless system, domestic Ethernet). Expenses made to equip the at-home working station may be voluntary in return for the option of not having to commute to the office every day. Companies which use the virtual space for communication with and between employees considerably reduce the costs of maintaining office space and other surfaces indispensable for the provision of work. There are huge savings on heating. lightning, maintenance workers, security workers and others. In consequence, it may be said, that virtualization of contacts between a company and employees leads to the transfer of company's costs on shoulders of employees who must bear the costs as the costs of providing work. A positive aspect of this phenomenon is that form the point of view of the employee, the balance brought about by virtualization between reduced costs (no commuting costs) and the newly arisen costs of rendering work (purchase of ergonomic furniture) may turn out to be positive. Thus, in this case virtualization creates premises for a more efficient utilisation of resources in the scale of a given community.

The reduction of net assets (formula 2) and growth of intellectual capital of an enterprise which can be achieved through virtualisation of operations may be further enhanced thanks to liquidation of the in-house computing equipment when the computing services become outsourced to e-cloud or computer farms. Then the costs related to construction, modernisation and maintenance of a server room become non-existent as well as costs of labour of IT team or specialist equipment. The only costs incurred in this respect are the cost of computing services rendered by external companies which are usually lower so many businesses decide to outsource this part of operations hence the current boom of cloud computing industry.

IV. Conclusions

The above analysis of the possible impact of virtualisation of particular areas of activities of a company on the growth of IC shows a promising potential which can be observed in all classical aspects if IC (client capital, organisational capital and human capital). Other benefits from virtualisation related to intellectual capital include increase in *NCFi* due to the owner of the enterprise, reduction of net assets which are normally financed from the owner's equity and which are essential for a smooth functioning of the business and elimination of risk which is always a burden for a company.

Virtualisation of an enterprise may have an external dimension as a form of space which allows communication between this enterprise and other entities operating in its surroundings and as a rule boosts IC within organisational and human capital. In the external dimension virtualization of certain aspects of business activity means moving these aspects on the Internet. Virtual space is used here to communicate with customers and suppliers and also as a medium which delivers in real time goods which can be dematerialized.

The main drivers for IC growth may be found in cost-effective solutions for the development of customer capital which translates in higher sales volumes and in customer surveys which provide vital information on how to improve offered goods and services and how to adjust them better to the needs and expectations of consumers. The access to the external virtual space makes it also possible to reduce the cost of maintaining local retail outlets by shifting the sales operations online. The reduction of costs and increase in the volume of production will certainly have a positive effect on *NCFi,* and at the same time on the intellectual capital. On the other end, the risks related to dishonest online practices and the presence of malicious software may have a negative effect on IC.

In the internal dimension of virtualisation, the virtual space connects things within the company with other things (Industrial Internet of Things), people with other people and people with things.

The basic areas of growth of intellectual capital in the sphere of communication come down to the reduction of costs thanks to the elimination of the human factor, increase in efficiency thanks to the acceleration in data processing and standard data handling and for simulation of future processes creating decision fields which are accurate and helpful in the decision-taking process which is the domain of humans. Utilisation of digital technologies reduces the risk of human errors committed in data gathering and then data processing. In this way, the premises for growth in the value of an enterprise are made. Of course, one must also take into account the factors that hinder

intellectual capital such as the need to make additional investments which increase the volume of net assets and costs of exploitation of these assets.

Internal virtual space which connects people to people surely streamlines business operations: employees are in constant touch with one another and can circulate electronic documentation around the company without even leaving their desk. In the past, the necessity of physical movement between offices or parts of a building did constitute a problem. For example, a well-known footwear producer living in the first half of the 20th century, A. Bata arranged his office in the elevator in order not to waste time on walking between floors while managing the company (Czech Convention Bureau, 2022). However, in the view of the author of the publication, the most significant opportunities for increase in intellectual capital of an enterprise can be found in the fact that the internal virtual space connects employees working remotely form home. This brings such benefits as lower costs of labour and a wider pool of employees with the most appropriate competences and qualifications looked for by employers which in turn boost the flow of *NCFi* thanks to increased efficiency and reduction in labour costs. One mustn't however forget about various risks (e.g. an employee who remotely provides work services for a number of businesses may transfer know-how from one company to another) or related to home office necessity to invest in net assets (e.g. purchase of hardware and software).

At the same time, virtual space offers huge IC opportunities for businesses operating within the so called sharing economy where a lot of business ventures may be undertaken on the basis of irrelevant (non-decision) cost and irrelevant investments which are expenses in principle safeguarding the expected level of consumption.

All in all, it must be emphasized that all dimensions of virtualisation require a certain amount of investment for instance in specialist software and computer equipment what usually forces an increase in the net assets. Nowadays, the companies which offer merchandise necessary for virtualization of business operations experience a period of sudden growth, also computer farms offering highly specialized computing environments lowering the TCO coefficient (Total Cost of Ownership) of IT infrastructure in a company are blooming. Undoubtedly, the processes presented above will translate into reduction of net assets and automatically into increase in intellectual capital of an enterprise.

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II. Author Contributions

Does not apply – one author.

III. Conflicts of Interest

"The author declare no conflict of interest."

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