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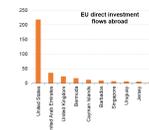


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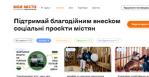


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Article

Foreign Direct Investment and Labour Productivity: Relationship and Interconnection

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Abstract. The article aims to define the interconnection and interdependence of foreign direct investment (FDI) and labour productivity. The contributing factors of economic modernization, R&D spending, and production cost reduction to labour productivity growth are defined. The comparison analysis of FDI inflow, outflow, and labour productivity in the European Union countries is provided. The paper contributes to the empirical explanation of the relationship between labour productivity and FDI outflow and wage growth in certain sectors of the economy. The existence of higher wages in industries with a higher presence of joint venture foreign investments and industries with greater foreign participation was analysed. Greenfield investments are considered a stimulus for economic growth by the supply increase of both national and companies controllable by foreign proprietors. The sources of enhancing investment in R&D released by labour from economic sectors are proposed.

Keywords: labour productivity; labour costs; foreign direct investment; greenfield investment.

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Introduction

The article analyses the interconnection and interdependence of foreign direct investment (FDI) and labour productivity and suggests policy options for improving the country's performance and stimulating labour productivity growth. The inflow of FDI provides the transfer of new technologies, the development of new management techniques, and the creation of additional jobs. Several factors influence the attraction of FDI in the economy including high profit, access to a new market, and availability of low labour costs.

FDI inflows affect and enhance labour productivity increase. The higher wage rates lead to rising aggregate demand. The higher investment with total productivity improvements could reinforce the current account position of the country. The rising technological transparency of the digital economy has contributed to a growing incidence of technology spillovers and external scale economies. Globalization encourages creating an enlarged world supply of a relatively unskilled labour force.

FDI meaning reveals a variety of investment projects and the short-term character of the investment. The rise in the international participation shows that wages grow more quickly for workers in sectors with higher foreign participation. The enhancement of living standards and the formation of an attractive investment climate are the goals of the legislative changes, incentive programs, and new job creation.

The labour market is one of the most important factors for economic growth, which is mainly determined by labour productivity. The existence of the disparity between wage and labour productivity growth impedes economic growth. Despite the radical economic reforms in Eastern Europe, one can still observe a high unemployment rate, low labour productivity, and deterioration of the quality of labour. The creation of new rules and institutions in the labour market aims to strengthen and acceptance of formal rule and promote stable demand and income.

The main approaches to the analysis of the interdependence between FDI and labour productivity show that foreign investment is best seen to extend control for reasons of corporate strategy rather than as a channel for shifting resources from one country to another. Some authors draw more attention to short-term adjustment

problems rather than to long-term possibilities. We can assume that workers in industries with a high presence of joint venture foreign investment are paid higher wages. As the magnitude of the foreign presence increases over time, it will be confirmed that workers in industries with greater foreign participation face faster wage growth.

A government policy to support education and training affects the future opportunities for individuals and the ability of firms to enter new markets and adopt new technologies. It also needs to facilitate the allocation of labour to its most productive use while helping workers to cope with mobility.

Improving the country's investment climate goes hand in hand with enhancing human capital. A skilled workforce is essential for firms to adopt new and more productive technologies, and a better investment climate enhances the returns on investment in education. As firms are offered more opportunities and better access to new technologies, the demand for more skilled workers increases, and the firms have stronger incentives to engage in growth-enhancing activities, which raise both the private and social returns to education.

We could suggest that foreign investment inflow has a positive effect as it increases both labour productivity, export volumes, and spill-over or indirect effect associated with higher performance compared to firms that do not receive.

The number of unskilled workers is growing in East European countries. The problem of the relationship between the quality of labour and labour cost, labour productivity, and FDI has been subjected to a lot of scientific work. The positive wage effect tends to be concentrated among workers that are directly employed by MNEs, but there also appears to be a small positive impact on wages in domestic firms' participation in the supply chains established by MNEs [1]. The latest surveys reveal that most FDI occurs between countries with similar wages. Most low-wage countries have the lowest levels of FDI.

This work is devoted to analysing labour productivity methodologies, designing labour market regulations, and tracking their outcomes. The data for labour productivity in the European Union and across East Asia and the Pacific region demonstrates the future potential for growth. The empirical data support the hypothesis that

there is a connection between FDI outflows and labour productivity per person.

1. Literature Review

The variety of approaches considered different labour assessments in production and service sectors that study requires additional theoretical and practical research. The structural changes in the economy reflected in the labour supply and demand fluctuations and resulted in the appearance of instability and imbalances in the economy. The study of labour market structure, factors, the needs for labour resources, and the possibilities for their coverage demonstrate a slight recovery after COVID-19. The global labour force participation rate, having fallen by close to 2 percentage points between 2019 and 2020, is projected to recover only partially to just below 59.3% by 2022, around 1 percentage point below its 2019 level [2]. The Eastern European countries have maintained their cost competitiveness, despite surging wages and occasional labour shortages, benefiting from considerable productivity improvements.

The definition of labour productivity is based on its determination, and at the level of branches, companies, individual workers, products, etc. The productivity labour estimation is calculated as the volume of production per worker, the volume of net production, or the number of details per worked hour. Hour productivity is calculated based on the gross domestic product (GDP) per hour worked and the total number of worked hours in the entire economy. This indicator eliminates the disadvantages that appear when using the indicator "labour productivity per employee" in the comparison among countries [3]. It measures the efficiency of labour input combined with other factors of production. Bogheana and State [3] argue that high labour productivity is often associated with high levels or types of human capital, indicating priorities for specific education and training policies.

Labour input is defined as the total hours worked by all persons engaged in production [4]. Labour productivity only partially reflects the productivity of labour in terms of the personal capacities of workers or the intensity of their effort. The ratio between the output measure and the labour input depends to a large degree on the presence and/or use of other inputs (e.g., capital, intermediate inputs, technical, organizational, and efficiency change, and economies of scale). This indicator is measured in USD (constant prices 2010 and PPPs) and indices [4].

The main difference in labour productivity measurement in the USA from the East European country's approach deals with inclusion into the analysis of production and service spheres. The labour productivity measurement depends on the internal technological organization of the company and market conditions. Economists assert the interdependence of these two components for the efficient

organization of a company's economic performance. The market fluctuations affect the company's performance which has an average labour productivity index. If labour productivity rises, the role of market factors would be reduced. The acceleration of US productivity in recent years is generally associated with a significant part of the production and use of Information and Communication Technology (ICT), which spurred output per hour worked through significant capital deepening and higher total factor productivity (TFP) growth. The economy of euro area seems to have benefited much less from these factors, reflecting both lower investment in ICT compared with the US and barriers to the diffusion or appropriate use of new technologies, in the services sector [5].

The labour productivity serves to develop and monitor the effects of labour market policies, be used to understand the effects of wage settlements on rates of inflation, or to ensure that such settlements will compensate workers for realized productivity improvements and contribute to the understanding of how labour market performance affects living standards.

Bulkeley and Van Alstyne [6, p.5] define productivity increase as an outward shift of feasible production with the same resources, which is the difference between the rate of growth of real product and the rate of growth of real factor input. The change in labour distribution in different branches and regions in the world summons a shortage of jobs and economic instability.

Grodzicki and Moldzen [7] prove that the improved internationally competitive position of most CEE economies has counterbalanced the institutional change towards more labour market flexibility. In turn, the long-run equilibrium of CEE labour markets has not changed significantly. Kuntze and Mai [8] draw attention to countries Germany, the United Kingdom, France, Italy, and Spain, which accounted for 69.7% of the economic performance of the 28 Member States of the European Union and played a key role in determining their product development in 2018.

The analysis of the recent data on labour productivity per person employed and hour workers discovers the problem of the existence of significant differences in labour productivity between European Union countries (see Table 1). Note the existence of countries with high labour productivity per person employed and hour workers to which Germany, France, and Italy belong, as well as countries with moderate indicators, such as Spain, Estonia, and Lithuania, and low level, including Bulgaria, Latvia, and Poland. According to Eurostat data, between 2003 and 2019 labour productivity increased by an average of 2.6% per year in Estonia, by 3% in Poland, and by 4.5% in Romania. This compares favourably to an average increase of 0.5% per year in Germany or 0.8% in France in the same period. In 2020, the average labour productivity in the European Union amounted to US\$58.5 in GDP per hour worked.

Table 1. Labour Productivity Per Person Employed and Hour Workers (EU27_2020=100). Constructed using Eurostat data [9].

No	Country	2019	2020	2021
1	European Union 27 countries from 2020	100	100	100
2	Euro area	109.2	109.9	109.2
3	Bulgaria	46.2	47.7	49.2
4	Germany	122.8	122.4	123.3
5	Estonia	71.1	73.5	74.2
6	Spain	95.2	92.7	91.2
7	France	125.9	125.9	122.5
8	Italy	100.3	102.2	100.1
9	Latvia	60.2	61.1	65.1
10	Lithuania	67.9	69.6	72.9
11	Poland	64.5	64.8	65.0

Table 2. Nominal Unit Labour Cost Three Years % Change Constructed on the Eurostat data [9]

No	Country	2019	2020	2021
1	Bulgaria	4.8	7.1	5.4
2	Czechia	14.5	18.7	13.9
3	Germany	8.1	18.3	7.4
4	Estonia	15.8	15.7	18.7
5	Spain	5.7	14.3	12.3
6	France	8.9	5.0	4.6
7	Italy	3.2	6.6	4.6
8	Latvia	15.3	16.1	14.5
9	Lithuania	16.6	17.4	19.2
10	Poland	8.0	14.0	9.9

According to data published recently by Eurostat, average hourly labour costs across the EU were an estimated €29.1, slightly more (€32.8) in the eurozone. Most EU member states in Central and Eastern Europe continue to lag, and not by a small margin. The lowest nominal unit labour cost three years percent change in all the EU was recorded in Bulgaria, France, and Italy at €5.4, €4.6, and €4.6 respectively in 2021 (see Table 2).

The labour market in Central and Eastern European countries is more limited compared to Western European countries, with notably lower unemployment and unmet need for employment. It makes employers increase wages and offer better working conditions to attract or retain employees. Wage growth has on average not kept up with inflation across both advanced and emerging markets and developing economies, eroding household purchasing power. Although long-term inflation expectations have been stable in most major economies, they have started to rise according to some measures, including the United States [10].

The Eurozone economy continued to grow at 0.2% in the third quarter of 2022. The growth is based on increased domestic demand following an unexpectedly good tourism season, especially in Italy, France, and Spain. The forecast for a meltdown economy in G7 countries (China's) GDP growth rate of 1 percentage point would lower the aggregate growth in the rest of East Asia and the Pacific (EAP) countries by 0.6 (0.5) percentage points for the next two years [11].

The labour productivity growth is estimated as the average annual growth rate of GDP at constant prices per worker in 2011 purchasing power parities (PPPs). The difference in labour productivity growth across EAP region from 2000 to 2013 demonstrates that labour productivity growth has been the highest in China (9%), India (5.2%), Vietnam (4.4%), Cambodia (4.5%), Sri Lanka (4.1%) and Indonesia (3.5%). The productivity level per person employed per hour in India was the lowest at US\$6.48 during 2013 in comparison to other Asian countries. The highest labour productivity (PPP) (GDP per person employed per hour) was in Singapore (US\$ 59.76) compared to China (US\$ 10.64), and the USA (59.77%) [11].

India's labour productivity improved by 2.91% in December 2021, compared with a growth of 1.41% in the previous year. China has labour productivity growth of 8.71% in 2021 contrasted to 2.76% in 2020 [12].

China's economy slowed down by 4.8% in the first quarter of 2022, but the rest of East Asia and the Pacific (EAP) countries were growing by 5.9% in the second quarter [11]. The moderate growth rate in China is explained by the restrictions related to COVID-19 and tepid consumer demand. The most competitive sectors continue to be information and communication technology, finance, and agriculture. There are the transportation, accommodation, and catering sectors, where the mentioned countries do not reach the pre-

pandemic levels. Data on labour productivity in the European Union and throughout East Asia and the Pacific area demonstrate that there are untapped potentials for future increases in labour productivity.

The labour policy of reduction of labour expenditures per worker is directed to boost labour productivity. Social and economic factors affect labour productivity. They comprise the degree of training, as well as professional knowledge, attitude, and fit for the job. The level of technique is determined by technological progress. The use of innovative techniques, modernization, automatic equipment, new materials, and energy application define labour productivity within the company. The advancement of the production system, new progressive forms of labour application, and the system of labour motivation are among the organizational factors, that characterize the quality of the labour force and equipment. The quality of labour force use, effective technology, and labour organization determine labour productivity reserves.

Regulations to boost labour productivity include a whole number of measures enhancing labour productivity growth. The government provides policies to increase labour productivity in several ways. A rise in public and private investment in infrastructure development leads to higher productivity, stimulates economic growth, improves working conditions, and increases wages in sectors for skilled workers. It results in more rapid changes at the firms' and industries' levels. Improving the business climate goes hand in hand with enhancing human capital. A skilled workforce is essential for firms to adopt new and more productive technologies, and a better business environment raises the returns for investment in education. As firms have more opportunities and better access to new technologies, they demand more skilled workers and have stronger incentives to engage in growth-enhancing activities, raising both the private and social returns to education [13].

The indicators of labour productivity per person employed and hour workers, nominal unit labour cost, and labour productivity growth were moderate and did not reach the margin, according to comparison data for labour productivity in the European Union and throughout East Asia and the Pacific region.

Reform of the labour market includes the liberalization of labour legislation, which expands employment and creates more jobs. Labour market reform is directed to regulate a narrow section of the relationship between employer and employee and provide a balance of interests between employers and employees. The parent company will stimulate FDI outflows and capital transfer to the new place of production. Multinational firms are applying abroad a type of bargaining model they are familiar with. The allocation of a high stock of multinational corporations (MNC's) foreign investment abroad could assume its relocation in case of credible threats.

2. FDI and labour productivity relationship

2.1. Inflows

The scientific debates on the relationship between FDI and labour productivity show the existence of various companies' strategies through technological transfer, management, and marketing proficiency. The increasing intensity of international economic competition and profitable capital markets force the overall production reduction related to employment in practically all countries. Global foreign direct investment flows reached US\$1.58 trillion in 2021, a 64% increase from the level of less than US\$1 trillion during the first year of the COVID-19 epidemic. The strong recovery of growth in 2021 is mostly explained by the expanding M&A industry and MNE retained earnings. The majority of the FDI increase in 2021 was attributable to the reinvested earnings component of FDI, which refers to profits kept in foreign affiliates by multinational corporations (MNEs) [14].

The global capital movement demonstrates the volatile conditions, recent data releases confirm that the global economy is in a broad-based slowdown as downside risks—including risks in 2022. FDI inflows to G20 economies decreased by 7% in H1 2022 compared to the previous half-year. While they were up by 3% in OECD G20 economies, they dropped by 19% in non-OECD G20 economies, driven by decreases in South Africa, Russia, and to a lesser extent China. FDI flows in Russia were negative in both quarters of 2022, reflecting the response to Russia's full-scale invasion of Ukraine. 5 Lower inflows in China largely contributed to the overall decrease of 39% in FDI inflows in non-OECD G20 economies in Q2 2022 [15].

Developing nations continued to pursue policies that were largely intended to liberalize, encourage, or facilitate investment, reiterating the crucial part that FDI plays in their plans for economic recovery. The opening of new activities to FDI (30%), new investment incentives (20%), and investment facilitation measures made up nearly 40% of all measures more favourable to investment (20%) [14].

The assessment of the supply-side and demand-side conditions on the level and the growth rate confirm increasing pressure from the capital and product markets [16, p.315]. Geishecker and Hunya [17, p.12] assert that FDI effect significantly the skill composition of the new EU members against skilled manual workers, where MNE result in more employment of high-skill non-manual workers and low-skill workers. Walkenhorst [18] examines the effect of FDI on wages in transition countries. The author proves that FDI has fostered higher sectoral wage growth. Diverse factors influence foreign investment activities, such as capital cost, industry competitiveness, and access to resources. There is a self-selection effect when firms choose to engage in FDI that is mainly based on their cost-benefit analysis.

A double-difference model examines the relationships among labour protection, labour costs, and China's outward foreign direct investment. Empirical results showed that the law, promoted FDI outflow, significantly increased the probability of Chinese firms, conducting outward FDI [19].

This study analysis supports empirically the dependence between capital influx and wage growth in specific economic sectors. Higher wages are paid to workers in industries with more joint venture foreign investment, and foreign participation, and pay growth is more rapid in these businesses. Bogheana and State [3] prove the connection between FDI and hourly productivity, based on the data available in 2012 for the countries of the European Union, highlighting the existence of a strong connection between the volume of FDI outflows and productivity zones.

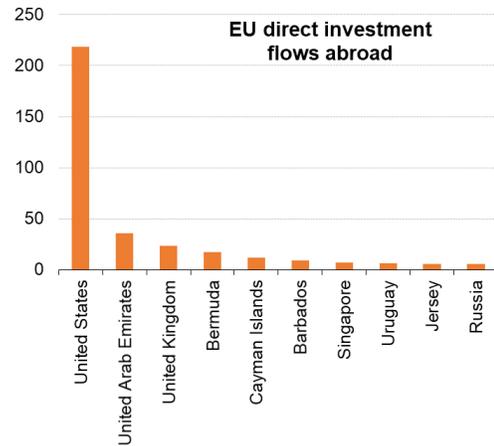


Fig. 1. European Union Direct Investment Flows Abroad (Billion €). Adapted according to Ref.[21].

For countries like Romania and Bulgaria, where the level of labour productivity is very low, a decrease in FDI outflows occurs. Furthermore, in Ireland and Luxembourg where labour productivity exceeds 50 euro per hour, the volume of FDI outflows represents over 150% of gross domestic product (GDP). At the same time, it can be noticed the absence of a connection between foreign direct investment inflows and average labour productivity [3].

M&A is a widespread form of company penetration into national markets. Innovations in goods reduce future employment opportunities for unskilled labour. New technological industries require a high level of qualifications of employees. Economic efficiency rises due to M&A, as well as the implementation of the corporate strategy, and market concentration. FDI inflow provides knowledge absorption, cost reduction, and new forms of activities within a company organization. FDI inflow enhances the eagerness of MNCs in the process of internationalizing activity [20]. The biggest recipients of EU direct investment abroad are the United States, United Arab Emirates, and the United Kingdom (see Fig. 1).

These countries are also the biggest investors of direct investment in the European Union in 2021. Desbordes and Franssen [22] find out, that a larger foreign presence tends to have a positive and statistically significant impact on TFP through manufacturing backward FDI linkages and within-industry presence.

Using comparative analysis of data for FDI flows by partner countries in the European Union for the period 2018 to 2020, we could note, the existing tendency to decrease in FDI flows except for Germany, Lithuania, and Latvia (see Table 3). This does not correspond to all analysed EU countries and does not explain the different indicators of labour productivity per person employed and hour workers there.

2.2. Outflows

Further research brought us to the study of FDI outflows from the mentioned countries. The biggest FDI outflows are in Germany, Italy, and Latvia in 2021, which correspond with relatively high labour productivity per person employed and hour workers in Germany and Italy (see Table 4). These data confirm the existence of a relationship between labour productivity per person and FDI outflows. The negative data of FDI outflows for Spain and France were explained by several sizeable divestments of foreign affiliates to

Table 3. Foreign Direct Investment Flows by Partner Countries (Million EUR) Constructed using data of Eurostat [23].

No	Country	2018	2019	2020
1	European Union 27 countries from 2020	15614429.3	16196679.7	15616077.2
2	Bulgaria	2311.6	2533.6	2602.2
3	Germany	1442347.0	1593499.0	1593499.0
4	Estonia	6954.6	9045.6	9011.6
5	Spain	524110.0	552055.0	510265.0
6	France	1309298.0	1273405.0	1261351.0
7	Italy	484629.0	497245.9	478183.6
8	Latvia	2042.0	1928.0	2096.0
9	Lithuania	4223.5	6300.7	8627.8
10	Poland	21517.9	24034.0	23766.5

domestic firms, which led to negative values in net cross-border M&As. For example, the sale in France of *Aviva France* (United Kingdom) to *Aema Groupe* (France) for US\$3.9 billion [14].

Some researchers believe that the US economy is losing its advantages in the manufacture of high-tech items and inventive places in the product life cycle. US assets are more affordable when compared to overseas assets due to the rise in foreign stock prices and the strengthening of the currency. The international production of foreign affiliates of MNEs is still expanding in recent years. The average annual growth rates over the last five years of foreign affiliate sales, value-added, and employment have slowed. The data indicate that international production is a contributing factor behind slower trade expansion [25, p.11].

The literature review shows limited research works on the effects of FDI on the productivity of domestically owned firms for several transition countries. It should be noted that the contribution of FDI to the host economy can have two opposite effects. The positive effect results in job training programs and stimulates further capital inflow into the country. The negative effect deals with differences in average labour productivity in multinationals and domestic firms, leading to incomplete internationalization of benefits from foreign investment [26, p.177].

FDI affects the productivity of local firms via competition between foreign and domestic firms in the host economy. The contributions of a skilled and healthy workforce to a productive and prosperous society under foreign capital inflow in subsidiaries in comparison with domestic companies demonstrate a positive FDI effect on the economy. Non-accession countries' trade agreements with EU preferential or association agreements may affect market size, one of the key determinants of FDI [27, p.136].

MNCs try to locate labour-intensive products in Eastern Europe and Asia, where wages and units of labour costs are cheaper than in Western Europe. Wage pressures are encouraged by increasing capital intensity and the need to increase the volume of R&D. These measures improve the quality of products and force companies to maintain higher prices in world markets. The introduction of new technologies requires skilled workers, as they cope better with tech-

nological change.

This is true for different types of firms and different levels of technological development. Technology transfers by multinational firms and the application of technology by local firms require the use of a minimum of human capital and the training of a skilled workforce. The use of new technologies usually requires significant organisational changes in companies. MNCs are accompanied better by the attraction of a skilled labour force. Lack of employees with higher education can be a deterrent for firms in production and value-added services than for less complex production processes.

The lack of skilled workers is a common problem for firms in MNCs in developing countries. This is especially so for companies that plan to innovate and expand their scale of production. World Bank data [28, p.136-137] shows that firms that consider the shortage of skilled workers to be a "major" or "very serious" constraint are those that improve their production processes. These firms are also more likely to invest in training their workforce. While large firms can organise internal training for their workforce, smaller firms often do not provide such functions.

An attractive investment climate increases the incentive for people to attain a higher level of education. This is the best indication of the large increase in income from education in the former centrally planned economies during their transition to market systems. Similar patterns have emerged in other countries. A high level of formal education is not required for all firms or activities. A lack of employees with higher education can be more of a deterrent for firms in manufacturing and value-added services than for less complex production processes.

The allocation of a large stock of MNC's foreign investment abroad may lead to its relocation in the event of real political and economic threats. The parent company will stimulate FDI outflows and capital transfers to new locations. Multinational firms use a model of negotiation abroad that they are familiar with in terms of international relations (IR) and international business (IB) and reconstituting intellectual boundaries. The importance of retained earnings in 2021 FDI flows reflects the record rise in profit levels

Table 4. Foreign Direct Investment Outflows (Millions of US\$). Constructed on the data of Ref. [14, 24]

No	Country	2018	2019	2020	2021
1	European Union 27 countries from 2020	293 339	368 335	66 412	397 637
2	Bulgaria	249	449	242	150
3	Germany	97 233	137 293	60 624	151 690
4	Estonia	45	1 966	220	1 547
5	Spain	37 546	24 827	23 567	-1 625
6	France	102 042	33 818	46 010	-2 839
7	Italy	31 542	19 787	-1 856	11 759
8	Latvia	207	-103	266	3 361
9	Lithuania	704	1 747	2 874	663
10	Poland	891	1 854	1 295	178

Table 5. Value of Announced Greenfield FDI Projects, by Destination (Millions of US\$). Constructed on the data of Ref.[14].

No	Country	2018	2019	2020	2021
1	European Union 27 countries from 2020	172880	162137	139622	178105
2	Bulgaria	2926	2220	750	1042
3	Germany	22196	21324	25917	40527
4	Estonia	1101	531	614	764
5	Spain	34379	21454	13420	28742
6	France	19116	17847	14964	11964
7	Italy	5514	6951	7109	7594
8	Latvia	1142	934	879	638
9	Lithuania	2034	1931	1094	2076
10	Poland	18220	24462	22757	21871

of MNEs, especially in developed economies, with the release of pent-up demand, low financing costs, and significant government support. The profitability of the largest MNEs doubled to 8.2% [14].

Increasing of labour productivity can be ensured by the minimising of labour costs. Labour productivity is influenced by socio-economic factors, including the level of qualifications and professional knowledge, skills, competence, responsibility, and professional suitability.

The most widespread form of FDI inflow in less developed countries "zero" investments (greenfield investments) act which is made in the form of new enterprises establishment and promotes the expansion of a company's capacities in comparison with the acquisition process of already existing companies - see Table 5. New investments stimulate economic growth by the supply increase of both national and companies controllable by foreign proprietors under liberalization trade conditions in the country.

The data on the value of announced greenfield FDI projects identify countries with increasing amounts in Germany, Italy, and France in 2021 compared to 2018. In other countries, we can mention a slight increase or decrease in their value. It is explained by data on a declining greenfield investment in the power sector in 2021 which remained at less than half the level of 2019. The number of greenfield investment projects in renewable energy remained continued to decline [14].

The impact of FDI on productivity can either be direct or indirect. Inward FDI is associated with the introduction of additional capital and new production and managerial skills that directly affect efficiency. FDI also provides indirect effects by knowledge diffusion [29]. The effects of FDI on host countries' economies are mainly related to increasing labour productivity through technological transfers, and management and marketing proficiency that enables long-term technological progress and economic growth. Blomstrom and Kokko [29] have shown that the effect of privatization is mostly positive in Central Europe, but quantitatively smaller than that to foreign owners and greater in the later than earlier transition period.

The inflow of FDI in R&D provides spillover effects and affects the domestic firms' productivity. The assessment of the spillover effect from FDI in two different sectors namely manufacturing and services demonstrates positive backward spillovers prevail in both sectors [30]. The study of indirect effects of FDI on productivity spillovers from foreign to domestic firms in the Central and Eastern Europe countries indicates the dependence on the number of

industry and firm-level characteristics including the relative technological level *vis-a-vis* foreign firms (absorptive capacity), export orientation, or firm size. M&A represents the widespread form of companies' penetration into the markets of advanced countries.

The paper reveals the existence of interdependence between labour productivity and FDI outflow and wage growth in certain sectors of the economy. Workers in industries with a higher presence of joint venture foreign investments have higher wages, and industries with greater foreign participation have faster wage growth.

Conclusions

1. Analysis reveals how FDI outflows and labour productivity are independent. The degree of economic modernity, R&D expenditure, and cost-cutting in a country influence dependency. The country's FDI shows a variety of investment industries and the transient nature of foreign investments. The increase in MNCs penetration in the country's market demonstrates that workers in industries with higher foreign participation experience faster wage growth.

2. The objectives of the legislative changes, incentive programs, and new job creation improve living standards and create an attractive investment climate. Different profit rates are the result of labour being liberated from some economic sectors in favour of intensive R&D. This leads to structural changes in the economy, since investment goals are chosen only those that promote the increase in labor productivity.

Abbreviations

CEE	-	Central European Economies
EAP	-	East Asia and the Pacific Countries
FDI	-	Foreign Direct Investment
GDP	-	Gross Domestic Product
IB	-	International Business
ICT	-	Information and Communication Technology
IR	-	International Relations
M&A	-	Merges and Acquisitions
MNC	-	Multinational Corporation
MNE	-	Multinational Enterprise
OECD	-	Organization for Economic Cooperation and Development
PPP	-	Purchasing Power Parities
R&D	-	Research and Development
TFP	-	Total Factor Productivity
UNCTAD	-	United Nations Conference on Trade and Development

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Article

Experiences of a virtual think tank. New ways of working, knowledge development and Virtual Reality events

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Abstract. Virtual Reality (VR) as a paradigm for casual communication and socialising is seeing increasingly high adoption rates, but since the pandemic it also sees consideration as an alternative environment for (remote) knowledge work. This study explores VR as it relates to knowledge development at scale (i.e., conferences/events), to identify barriers for adoption. The study consists of observations of a series of VR and videoconferencing events, interviews with organisers and participants, and a survey of participants. Elements of Extended Adaptive Structuration Theory were used to examine results, focusing on technological, social, and performance dimensions. Results show no clear technological obstructions for events' outcome quality compared to conventional forms of remote collaboration. VR provides practical advantages involving non-verbal communication and immersion/presence over conventional alternatives, but lacks in other aspects (e.g., facial expressions). Organisers are still learning to work around the practical limitations of VR. Issues raised primarily relate to technology habituation, or to social interactions and the cultural coordination gaps stemming from a lack of (communication) agreements. Emphasising the advantages of VR while further developing technologies and thoughtful social conventions to alleviate the objections will further open the door to VR as a viable alternative for remote work.

Keywords: virtual collaboration; knowledge work; virtual reality; VR; virtual events; remote work.

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Introduction

The Covid-19 pandemic and worldwide lockdowns have forced employees to adopt to new ways of working, in many cases, leading to more remote work. The European Centre for the Development of Vocational Training [1] says that, according to early evaluations, 40-70% of active workers are affected by remote work compared to 15-17% before the pandemic. This shift has forced organisations to adopt various technological solutions to better accommodate geographically distributed working. Thus, knowledge sharing and -creation moved largely to digital/virtual places. By now, employees are somewhat comfortable using collaboration tools like *Teams*, *Zoom*, and *WebEx* for online meetings, -conferences, and sharing information virtually.

For many employees, remote work led to increased flexibility, better work-life balance, or even increased job satisfaction [1-3], therefore, less willingness to go to the office every day of the working week after the pandemic [5-6]. However, remote work also brought more negative experiences to some. For example, constant videoconferencing reduced the wellbeing of employees leading to an increased emotional exhaustion [7], fatigue [8] or creating higher psychological demands [9]. Moreover, research by Yang et al. [10] shows that collaboration became more siloed and static potentially affecting transfer of knowledge and quality of employees' produced outcomes.

Research also suggests that remote work creates challenges for employees such as work-home interference, ineffective communication, procrastination, and loneliness [11]. Nonetheless, many agree that remote work practices are here to stay, and the attention should move towards making remote work more effective. For example,

Bennett et al. [12] provide an evidence-based list of suggestions on how to improve online meetings whilst Orel [13] suggests looking into alternative technologies, such as extended realities (XR) that could help to overcome those known challenges.

In this article, we explore how people experience fully remote collaboration by using different tools and approaches to remote work. We emphasize the experience with virtual reality (VR) environment due to the lack of research in the field and the potential for further studies. With this study, we aim at (1) better understanding of a potential for virtual reality (VR) technology to be used as a substitute/additional platform for (remote) knowledge work and collaboration, and (2) identifying factors/requirements from user perspective that need to be addressed by organisations in order to implement VR technology for remote work.

1. Theoretical overview

We are living in a world driven by knowledge, information, and innovation capabilities [14]. Innovation is not possible without social interactions, communication, and collaboration which are seen as salient factors affecting organisations' capabilities to successfully innovate [15].

Collaboration becomes even more important when we talk about knowledge work, the type of work that requires manipulating knowledge and information [16]. As it is less structured and more iterative, organisations often expect that teamwork, co-location and knowledge availability can improve collaboration and, consequently, innovation in organisations [16]. Collaboration is defined as "the act of working with another person or group of people to create or produce something" [17] and success of it depends on multiple

Table 1. Determinants of virtual team success. Adapted from Naik and Kim [21].

Structures	Categories	Components
Structural characteristics	Organisational dimension	culture, structure, training
	Task dimension	generation, choose, negotiate
	Technology dimension	immediacy of feedback, social presence, parallelism, multiplicity of cues
	Team dimension	culture, awareness
	Individual dimension	personality, knowledge
Control structure	Mission	complexity
Social interaction	Emergent socio-emotional states	trust, shared understanding, conflict, cohesion
	Decision-processes	communication, coordination, collaboration, conflict management
Outcomes	Performance	solution quality, time
	Satisfaction	solution satisfaction, virtual experience

factors. The common factors affecting collaboration can be divided into contextual factors, support, tasks, interaction processes, *Teams*, individuals and other [18].

Collaboration in management studies is often understood as a process towards a common goal and emerging from the interactions of people with emphasis placed on communication process and interactions [19]. With increasing remote work practices and people not being able to meet face to face, those interactions changed as well. For example, a study by Yang et al. [10] noticed that people changed communication channels (more usage of instant messaging (IM) and emails) and times of communication (more dispersed hours, more asynchronous communication) as well as who they communicate with (less new connections).

Interactions for collaboration can be synchronous (real-time, with simultaneous participation) or asynchronous (time-independent) whilst people can be either located in the same physical place or spread in different places (remote). Based on where and when people interact with each other, Pidel and Ackermann [20] defined four types of collaboration – synchronous and on-site (e.g., in-person meetings), synchronous and remote (video/audio conferencing, VR), asynchronous and remote (messaging, email, shared documents) and asynchronous and on-site (e.g., laboratory work).

Research on virtual collaboration and virtual *Teams* has been growing for the past couple of decades with many articles pointing out different challenges that virtual *Teams* experience. For example, Naik and Kim [21] list previously identified issues relating to communication, collaboration, trust, technology, and design. In a virtual team research review by Powell et al. [22] studied issues were grouped into four general categories: input (design, culture, technical, training) relating to the resources, skills and abilities of the team, socio-emotional processes (relationship building, cohesion, trust) that affect the effectiveness of the team, task processes (communication, coordination, task-technology-structure fit) in order to achieve a common goal, and outputs (performance, satisfaction). Recent research on experiences of virtual work also reports that (e.g.) constant videoconferencing reduced the wellbeing of employees through increased emotional exhaustion [7], fatigue [8] or causing higher psychological demands [9] which might be related to the swift shift from traditional work settings to virtual work. Research also suggests that remote work creates challenges for employees such as work-home interference, ineffective communication, procrastination, and loneliness [11].

Adaptive Structuration Theory (AST) is a theoretical framework often used to study various aspects of virtual *Teams* and virtual work [23]. AST seeks to understand the types of structures technology enables and structures created by people interacting with these technologies. It is “a broad, process-oriented theory and is not necessarily intended for very specific explanation and prediction” [23, pp.

18-19]. Schiller and Madnviwalla [23] also explain that the wide usage of this theory might be related to still unclear constructs in terms of virtual team research. To identify potentially missing factors in the AST, an extensive body of knowledge was studied, and an updated *Extended Adaptive Structuration Theory* (EAST) framework was proposed [21]. According to the authors, EAST captures linkages “between IT, people, tasks, organizations, and processes” [21, p. 2] affecting the success of virtual collaboration. Naik and Kim [21] describe the elements of the framework under the following categories as presented in Table 1.

However, research on virtual collaboration and virtual *Teams* often does not place emphasis on the technology or virtual environment used to accommodate that teamwork. For example, Powell et al. [22] provide an extensive definition of virtual *Teams* and their tasks whilst Naik and Kim [21] discuss technology dimension in relation to the richness of media and its fundamental characteristics. Often studies related to online work and communication describe settings that are related to “traditional” videoconferencing tools (such as *Zoom*) or even asynchronous digital communication tools (document sharing platforms, wikis, etc.). For example, several studies examined lack of engagement, presence, and fatigue leading to reduced efficiency of online meetings (e.g., [24-25]). Thus, a concept of ‘*Zoom* fatigue’ has appeared as explained in relation to issues with non-verbal communication, close-up eye gaze, cognitive load, self-evaluation, and lack of physical mobility (e.g., [26,24,27]). However, as early as 1996, Reynard and Benford [28] pointed out that a VR environment could provide advantages in comparison to traditional videoconferencing by providing a space for users to engage with the surrounding environment and communicate in non-verbal ways to supplement verbal communication. Additionally, research shows that current VR technology can enable deeper understanding, better sensory experiences, and enhanced sense of ‘presence’ [29-30].

Here, presence describes a feeling of ‘being there’ and should indicate that people experience VR environment just as they would experience reality. Experiences of participants and a stronger sense of presence could indicate that cognitive and emotional responses in VR are similar to real-world responses and, thus, could be comparable [31]. High presence is also associated with overall experience of the virtual environment [32] as a combination of multiple constructs including presence (immersion and engagement), flow (usability, skill, emotion) and experience consequence (judgment and technology adoption) [33].

Moreover, that sense of presence can be linked to the effectiveness of virtual environments (e.g., [34]). Casanueva and Blake [35] divide presence into personal presence and co-presence, a feeling of ‘being there’ and the feeling of being in the same place with others. A study by Salnäs [36] showed that presence and performance dif-

ferred in different virtual environments – with text-chat media showing the lowest perceived social presence and performance and video-conference showing the highest presence.

As we believe that remote work and virtual collaboration are here to stay, we posit there is a need to understand the potential for virtual collaboration better. Especially, to understand how different tools can be used for more successful virtual collaborative practices. The aforementioned Extended Adaptive Structuration Theory framework is used to structure the results of this study.

2. Research approach and methodology

The paper is based on a case study of a global hospitality industry think tank. This think tank is an annual gathering of (primarily) executive-level professionals to ideate and envision the future of their industry. During the think tank, experts follow the design process from research and knowledge sharing, to inspiration, ideating and concept development. The final concepts are then demonstrated in a conference setting together with inspirational speeches from the industry. This think tank had started in 2004–2006, experienced a break but was revived during the Covid-19 pandemic. The year before this global think tank was organized using videoconferencing for collaboration. However, for the 2021 edition, they used a virtual world platform (*AltspaceVR* [37]), a broadly used videoconferencing platform (*Zoom*) and an online collaboration platform (*Batterii* [38]), to enable both synchronous and asynchronous collaboration.

The novel approach to knowledge sharing and creation by using solely virtual tools dictated the choice of exploratory approach. Two researchers took part in the think tank as passive participants, observing the events and participant interactions. The data was collected through unstructured notes of facilitated workshops during *Zoom* sessions, recordings and unstructured notes of social events, and the conference in VR to capture the process of the workshop and participant behaviour. Unstructured approach allowed researchers to collect a rich set of data and identify behaviours and situations specific to the virtual setting.

Additional data was collected through semi-structured interviews with participants including their experiences with virtual environments, and the participant experience survey to capture other aspects of experience of the VR. Observations and VR recordings were performed using *Oculus Quest* or *Meta Quest 2* headsets. The participant experience survey was developed based on a previous study by Tcha-Tokey et al. [33] with the aim at capturing user experience in virtual environments. The survey was shortened from 84 to 19 questions because, based on participants' profiles, they were not expected to complete a lengthier questionnaire. The survey included questions about familiarity with technology, attitude, engagement, immersion, skills, emotions, consequences, judgement, and technology adoption. The survey was deployed through *Qualtrics* and sent out by think tank organizers to the list of participants. By the end of March 2022, 55 responses were collected.

The notes from observations and interviews were coded using a two-tiered coding system with open codes grouped into themes. The survey was analysed to provide descriptive information and search for associations that were indicated in the previous research. However, due to the limited data set, these associations can be considered only indicative.

3. Results and discussion

The results of this research are presented by following the EAST framework [21] for categorisation: introducing structural character-

istics, social interactions, and outcomes.

3.1. Organisational dimension

The global think tank was initiated by a single corporation by inviting representatives of other organisations through their network. The aim of the think tank was known to participating organisations and some participated in previous editions. However, people representing those organisations often were not familiar with the event. Also, some participants invited additional people/organisations they thought to be relevant for the event organisers. Moreover, a team running the organisation of the think tank was also newly established for this specific purpose, thus, organisational culture was not yet fully established whilst starting to work together.

The organisers offered training sessions for the new virtual team members to familiarise with the tools and virtual environments that were used for the project. Professional facilitators were hired to help the members of the team to navigate within the systems.

3.2. Mission

The aim of the team was to imagine what the future of the hospitality industry would look like. As the task itself did not have any stated limitations - meaning that there were no criteria or stipulated stakeholder set - the complexity of the task was low. However, the process of arriving at final prototypes could be considered complex as it involved multiple steps and continuously diverging and converging processes.

3.3. Task dimension

The virtual team was partially divided into two separate groups. Most team members participated in idea generation steps to a certain level of consolidation of those ideas. The final (conceptual) prototype development and visualisations were created by a selection of team members.

In total, eleven video conferencing sessions and four VR sessions for synchronous collaboration, email and an online platform for asynchronous collaboration were used for the duration of six months in 2021–2022.

3.4. Team dimension

The virtual team consisted of representatives from different organisations related to hospitality sector, from international hotel chains to design and architecture firms. Members of the team were also diverse in their geographical locations with most based in North America, with minorities in Europe, Asia, and Australia.

In total, there were approximately 100 participants in the team. During the process, these participants were divided into seven sub-Teams working on a more concrete topic. After the end of the project, a survey was sent out to which received 55 responses in total, though 10 of those were incomplete to the point of not being usable, leaving 45 viable responses.

3.5. Individual dimension

Individual level of knowledge in terms of the topic was not revealed or discussed in the process. Although team members were not very aware of each other's individual levels of knowledge, the majority of participants were in middle/upper management and/or executive

Table 2. Technological tools and their usage in the think tank

Technological tool	Purpose & way of usage
Email	Asynchronous communication with project team members. Informing about upcoming events of the project, sharing information that should be accessible later such as meeting invitations, links to virtual project spaces, experience survey. Communication was often one-directional, meaning that information went from the coordinating team towards project team members. Also, smaller sub-team members communicated via email within their teams. This tool allows written communication only and the feedback immediacy varies depending on how fast (if at all) recipients reply.
Batterii	Asynchronous communication for team members to share their insights and inspiration from various sources, organize files and documents into categories, find information easily, and provide collaborative analytics. Synchronous communication during workshops to ideate and converge ideas into structured concepts. As this tool was new to many participants, a short training was provided during the kick-off session. The tool allowed sharing several types of information, from websites to videos in a structured and visual manner. The collaborative whiteboard allowed to work on the task synchronously, meaning at the same time with the team and seeing the document being modified. However, no direct communication is available via the tool itself more than leaving written comments.
Zoom videoconferencing	Synchronous communication moments to kick-off the project and then work in groups. During these group work sessions, Batterii platform was used simultaneously as a database and a whiteboard to capture the discussions and knowledge. Zoom sessions were facilitated by a professional company, specialising in virtual collaboration. This allowed more seamless experience whilst transitioning between common meeting and work in groups during the session. Also, presentation slides were shared during the session as well as presenter's screen with Batterii environment to make sure that everyone sees the same information on screen. This tool enabled more cues to receive and transfer information as most of the team members were visible on screen, enabling partial visual/verbal communication as well. Visual setup and people's environment also transferred additional knowledge about people's experience with technology and confidence in using different platforms and tools and sent messages about their personalities by the way they communicated via these tools (e.g., muting/unmuting, waiting for their turn to speak or speaking up). The widespread problem with the tool was the quality of sound which varied highly depending on the hardware that was used by the team members.
AltSpace VR environment	AltSpace VR environment was used to for synchronous communication, social group interaction and knowledge sharing. Two sessions were organized for the team members to familiarize themselves with the equipment and the environment. Additionally, written instructions were sent out for registering and entering the VR environment. Even though no real people were visible, but more cues were communicated through the avatars (virtual representations) of participants – their body language, facial expressions, the looks of avatars. The quality of synchronous communication varied based on the quality of internet connection and experience of the participant. The results of the project were demonstrated in the environment and the feedback was immediate through the reactions (e.g., using emoticons to demonstrate their emotions). The VR environment tried to replicate the conference setup in the real life.
Access Platform	Multiple platforms could be used to access to the AltSpace VR environment: consumer market VR sets including Valve Index, HTC Vive, and Oculus Rift, but the Meta Quest platform was presumably used by most (VR) participants as it has held >65% also access the VR environment through their desktop computer, which was presumably used by a small portion of participants (easily recognisable through their lack of body motion and fixed posture). The organisers of the event sent out instructions to participants to help them set up the most commonly used VR platforms (mentioned above), and for desktop access (PC/Mac). Additionally, open Zoom sessions were scheduled beforehand in which participants could get support in their access to AltSpace VR using their preferred platform, including setting up accounts to allow for access (depending on the chosen platform). First-time users would also be recommended to 'play around' with the platform to become familiar with the handheld controls of their platform and to get past the initial disorientation which can come with the use of a VR set. Desktop users would use conventional PC game controls based on movement using a combination of the mouse and the WASD-keys on the keyboard.

level positions at their respective organisations, thus suggesting a sufficient knowledge of the industry.

However, during the teamwork process, individual levels of technological knowledge were observed as well as collected through the survey at the end of the project. Team members were sufficiently confident in their usage of videoconferencing platform *Zoom* and email but unfamiliar with asynchronous collaboration platform *Batterii* and virtual reality environment *AltSpaceVR*.

3.6. Technology dimension

As mentioned, different tools were used for different activities: email, *Batterii* (collaboration), *Zoom* (videoconferencing), *AltSpaceVR* (VR software), and the platform to access the VR environment (*Oculus Quest* and/or *Meta Quest 2*). The technology dimension describes how these tools (see Table 2) were used also in relation to the immediacy of feedback and multiplicity of cues.

The project coordination team decided to use different channels for different purposes – informing about the project and steps via asynchronous email communication which requires less feedback or social presence, gathering knowledge, ideating, and converging

ideas both in synchronous and asynchronous ways via *Batterii* and *Zoom* sessions due to the nature of tasks and requirements for social presence and immediate feedback at times. Whilst socialising and sharing the outcomes via *AltSpaceVR* environment allowed more visual cues as well as more appropriate group social interactions compared to *Zoom* videoconferencing.

3.7. Social interaction

Social interaction (communication, collaboration, shared understanding) was observed by researchers during synchronous collaboration moments in *Zoom* and *AltSpaceVR* environments.

The VR environment allowed for more tacit knowledge capture in comparison to *Zoom* sessions mostly due to the body movements as well as the usage of (virtual) space, e.g., choosing to stand in different areas of the space which also mimicked the setting of a physical conference. Whilst waiting for the conferences to start, participants were able to socialize and communicate in groups, however, they were muted during the main event. In these moments, participants were able to communicate only via direct messaging (chat). Typing on a virtual keyboard using VR controllers took longer time than on

a physical keyboard and required more focus on the process, indicating lapsed attention to an event itself. However, non-verbal cues like gestures and head movements enabled some additional information transfer.

Group interaction and dynamics also varied with using different tools. In *Zoom* sessions, the quality of interactions in groups highly depended on the facilitator who asked questions or encouraged the conversation, or people who were more outspoken themselves. Turning the camera on during the *Zoom* session in most cases indicated stronger involvement in the discussion and attention to the meeting. The role of the facilitator became more prevalent to control the group dynamics and share the speaking time amongst participants. In VR sessions group dynamics felt more natural since multiple people could talk at the same time imitating the natural setting. Once in the VR environment, a participant could create their own ‘sound bubble’ which meant their voice can only be heard within a certain distance, and once a talking avatar moves away, their volume would drop-off much more severely than it would in the physical world.

The biggest changes in interpersonal dynamics in the VR environment related to the avatars and their appearance. Participants with diverse backgrounds (e.g., students and CEOs) experienced less social distance and more interaction possibilities. The role of social/cultural status commonly felt in real-life events was less prevalent in the virtual world. People were also able to familiarise with avatar appearances that led to participants recognising other avatars in following events and creating a social bond. The social gathering feeling in VR environment was more natural, allowing groups of avatars to communicate without interference from other attendees.

Project team members reported that the feeling of proximity of other avatars to their own avatar corresponded to real-life proximity and this led to the uncomfortable feeling at times. Also, this close distance then could lead to (unwanted) small talk, which would not happen in a *Zoom* setting and could be more easily avoided in a physical setting. Both observations and interviews suggested it may be more difficult to ‘hide’ or ‘blend’ in the VR environment in comparison to physical or even *Zoom* events.

On the other hand, in VR sessions, one could observe non-typical behaviour and surmise lack of awareness of the duality of their environments, and lack of established norms for events in VR. For example, interactions with the real-life environment such as adjusting the VR headset (which does not make sense in the postures of the avatar), changing positions between standing and seated (leading to avatars ‘sinking’ into the floor or floating above other avatars), or taking off the headset and putting it down (leaving the avatar in a ‘hanging’ marionet-like posture).

Additionally, the VR setup did not create many sound issues (which is typical in *Zoom* and other videoconferencing platforms). However, visual clarity issues occurred. For example, presenters’ slides required less crowding and bigger fonts to be visible from further away. Hardware issues, bandwidth quality and lack of prior experience also affected response times from other avatars. For example, longer pauses in conversation were needed to make sure people do not interrupt each other. Or a wave of emotes (raising hands, clapping, etc.) in reaction to the presenter appeared several seconds later.

Whilst more social interaction was possible in VR environment, it was not suitable for taking notes and doing any other activities, especially in comparison to *Zoom* videoconferencing platform. However, the setup of the overall project supported different activities for developing more complex set of knowledge. The ideas that were dis-

cussed in group brainstorming sessions in *Zoom*, shared on the collaboration platform Batterii and then transformed into visual representations that were demonstrated in the virtual exhibition and presented during VR events.

3.8. Outcomes: Performance

As the aim of the studied think-tank was to generate innovative ideas, inspire further innovations in the industry and collaboration between different stakeholders, performance quality or quantity was not in the focus. However, the organisers were satisfied with the outcome and collaboration throughout the process. The think-tank generated over 800 ideas through virtual facilitated workshops. In total, seven innovative concepts were developed and shared at a (virtual) conference on AltSpaceVR. It is important to note that the direct implementation of these concepts might not be possible any time soon or attractive to the industry now, thus, potential for implementation was also not a criterion in this exercise.

In comparison, the same think-tank generated 79 ideas and developed five concepts in 2020. However, we are not aware of the process of idea-generation, nor are we familiar with the toolset used in that edition and, thus, are not able to compare the outcomes. Nonetheless, in Ref. [22] note that previous research did not indicate significant differences between traditional and virtual *Teams* in terms of effectiveness of *Teams*, the quality of the outcome or number of ideas generated. However, the time taken to reach a decision has been longer within virtual *Teams*. Our interviews also revealed that due to the lack of experience or comfort with digital tools, some participants felt like they needed more time than others to adjust to virtual settings or learn how to use different tools.

Powell et al. [22] also provided factors potentially contributing to the success of performance, including training, goal setting, team cohesiveness, communication, and appropriate task-technology fit. In this study, different tools were used for different steps in the design process as well as instructions and training were provided to participants. Also, professional facilitators were used in each of the meeting, making meetings more structured and productive.

3.9. Satisfaction

For this study, we focused on the satisfaction with the process, especially in terms of experiences in the VR environment which was captured through interviews with participants as well as a survey with focused on the experience in the event’s VR environment (AltSpaceVR). We did not focus on the experience of using other tools outside of observations or participants mentioning other tools themselves.

The experience survey demonstrated that most of the participants enjoyed (VR) events with no significant difference between genders and/or their experience with the technology. The results are however different from the previous research that suggested differences between genders or experience levels in terms of satisfaction within virtual *Teams* [22]. Nonetheless, a slight significant correlation ($r = 0.362$, $p = 0.017$) was noticed between the satisfaction with the events and the level of support received, which is in line with the study of Tan et al. [40].

From interviews and observations researchers noticed that lack of experience with the VR related to more physical discomfort and those participants were also more aware of their physical environment, with that correlation also found from survey respondents ($r = 0.352$, $p = 0.044$). This could also be observed in avatar behaviours

where avatars were looking at their hands, stretching, or otherwise lacking spatial awareness.

Familiarity with the VR environment also shone through from participants' behaviour related to social conventions like the use of emotes, with some either emoting with several seconds of delay or using (presumably) 'incorrect' emotes (e.g., raising a hand while the crowd is applauding the end of a presentation). Approximately half of all participants experienced physical discomfort during VR sessions which were related to (1) prolonged wearing of heavier headsets (e.g., Valve Index weighs 809g while vs Meta Quest 2's 503g per [41]) causing pressure points; (2) eye strains possibly due to differences in distance and strength of vision; (3) possibly differences between experiences and expected motion. This 'VR sickness' is widely described in literature and is said to improve with more time (experience) in virtual environments [42].

Even though the respondents ($n = 32$) showed no significant differences in terms of satisfaction levels with different experience levels ($r = 0.055$, $p = 0.766$), it might also indicate that there are other aspects at play. For example, those participants who do have experience with VR may not experience much discomfort or habituation issues, but they might also have higher expectations/standards for the quality of VR environments and the organisation of events than those for whom it is still novel.

3.10. Presence

Presence in VR is often measured through indicators of objective immersion and/or subjective engagement (e.g., [43]). Our experience survey included in total five questions regarding immersion and engagement. The majority of respondents ($n = 45$) expressed that they had a feeling of being together with other people (75% somewhat or strongly agree) and having good conversations with others (56.8% somewhat or strongly agree). Majority of respondents also expressed sense of being at the event (63.7% somewhat or strongly agree) and were able to focus on what was happening in the VR environment (84.1% somewhat or strongly agree). Awareness of real-world surroundings such as sounds, room temperature, other people and similar aspects was neutral in a large portion of cases (29.5% neither agree nor disagree) yet did not demonstrate any relationships with other variables. This could indicate that there might have been issues with the semantics of the question as one of the reasons for slightly different outcome than the rest of engagement/immersion questions.

The experience survey responses also showed that there was no significant relationship between feeling of presence and the experience with technology but there was one with post-event satisfaction ($r = 0.431$, $p = 0.004$), meaning that the more 'there' respondents were, the more they were satisfied and willing to experience it again ($n = 42$). No relationship between presence and experience with technology goes, e.g., the opposite from De Leo et al. [44] research that demonstrated higher levels of presence from participants who had experienced VR gaming. However, in this survey we did not ask specifically about gaming experience but rather general experience with the VR.

Similarly, researchers' observations and interviews demonstrated that the VR setup had multiple benefits compared to, e.g., traditional videoconferencing tools specifically for these types of social events. First, social interactions between participants' avatars were the most described elements of participant experiences. Interviewees used descriptions such as 'more real', 'real conference', 'being at the same place', etc. However, differences were noticed in terms of the equipment used by participants. Participants who used VR headsets

to connect to the VR environment were perceived as more responsive and provided quicker feedback (e.g., in using emotes) compared to participants who used AltSpace VR via desktop PC/Mac and were more static in posture and slow in their responses.

Interestingly, interviews showed that presenters in the VR conference experienced less anxiety to present on stage when compared to the real-life setting because they were avatars talking to avatars: they felt less pressure in terms of making mistakes or forgetting something as participant reactions are less expressive. They suggested this may have to do with the lack of facial expressions of avatars, which as a technology is progressing but not close to (consumer) market-ready (e.g., [45]) On the other hand, interviewees noted that presenting to avatars felt more 'real' than presenting in a videoconferencing app, where visual support materials typically 'hide' the audience from the presenter (though when visible these allow the presenter to see the audience's facial expressions).

4. Limitations

As could be expected beforehand, participants in the event had many characteristics in common like work and industry profiles, but also were mainly joining from North America and Europe, thus limiting the representativeness of the population for other contexts. The selection of tools and applications used for this study is also not representative of the wealth of options available to the market: participants used to *Zoom* for videoconferencing may have been more comfortable collaborating than those used to *MS Teams*, *Slack*, or *Discord*, and the *AltSpaceVR* platform is one of a multitude of VR event platforms available including *Meta Horizons*, *VRChat*, and *vSpatial* (among others).

The original survey used to model the participant survey was aggressively shortened, intended to decrease the chance of non-completion, especially because we expected a relatively small sample. This puts into question whether the items used are as reliable as in their original publications without more checks and balances in place. Though the study design somewhat accounted for this through triangulation, this is not a guarantee for the reliability of the results.

This paper presents merely a single case study based on observations, and thus it is potentially affected by researchers' biases. Furthermore, researchers' fatigue and other circumstantial factors may have inadvertently impacted the observations as the events were planned within the United States CST zone (UTC-6) during office hours while the researchers observed from The Netherlands (UTC+1).

5. Relevance and conclusions

This study aimed to improve the understanding of the VR technology's potential to substitute physical environment (space) for knowledge work and collaboration and identify factors that affect user experience of remote work tools. It showed there is potential for fully remote collaboration by using a multitude of tools to reach the planned goal, one among them being VR technology. We did not observe or record any significant shortcomings that would prevent these different tools as an effective alternative in the context of professional meetings/events specifically. However, that would imply the 'threshold' lies more with the lack of familiarity with and habituation to VR technology, which could be related to the (present) state of development of VR as a social/cultural paradigm.

Although VR technology enables more social interactions and seems to provide a more 'immersive' setting than videoconferenc-

ing, VR's behavioural conventions are still developing. Current users are setting the stage and shaping the culture of interactions in VR environments, and the rapid developments in the field – both in VR hardware and -software – means attained mechanical/social comfort levels could rapidly become obsolete without continuous use. VR can then become more viable if its rapid development curve will flatten to a more stable state – as it has done for other communication/collaboration paradigms like the world-wide web and email in the past [45].

With VR adoption gradually increasing, VR's social and practical conventions will also gradually develop while trying to keep pace with technological leaps. As a context for knowledge work, there are clear and distinct (practical) advantages which come with VR, but also many unknowns which make it impractical or even infeasible to see it as more than a mere alternative or complement at present. VR as a context for knowledge work has potential but alleviating the aforementioned issues will presumably only allow us to uncover more and different 'obstacles' to effectively collaborate on knowledge work in a VR space. Thus, they will only bring us marginally closer to 'working in the Matrix' at this moment.

Thus, there is a further need to study how social interactions and collaboration happens (or can happen) in the VR environment and how we can identify the success factors for it in specific contexts. This would allow practitioners to determine requirements for communication and collaboration, and see which integrations are possible for them to compose a toolset meeting those requirements to improve their remote working practices.

If VR is to develop into that viable alternative environment for knowledge work and -exchange at a larger scale, we need to understand how to organise events and what is needed from organisational point of view to accommodate these activities. Paradoxically, this can only happen if more events take place and are studied to identify critical success factors for organizers, which is most likely to happen if the platform is proven to be a viable alternative or complement first.

As such, it is imperative that researchers keep exploring this developing paradigm for work, and that early adopters keep experimenting and recording their experiences to ensure we can learn as much as we can in a rapidly developing subsection of technology. Though exploration like in this study can be very useful, steps should be made to also create methods/frameworks which allow us to think more systematically and structurally about VR to effectively develop standards which the next batch of adopters can then learn from.

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A wider adoption of VR technology for remote work could eventually create bigger shifts in organisations, as it would require organisational transformations – from IT to personnel and space management, new leadership styles, etc. At a wider scale, more immersive and/or widely accepted virtual work might lead to more emphasis on further technological development, cyber security aspects, and the creation of new businesses. However, at the same time it might worsen economic inequality and even create bigger gaps in the workforce. Therefore, more research into remote/virtual knowledge work is required to understand the potential consequences of this ongoing change in how we think about work.

Abbreviations

AST	-	Adaptive Structuration Theory
EAST	-	Extended Adaptive Structuration Theory
IM	-	Instant Messaging
PC	-	Personal Computer
VR	-	Virtual Reality
WASD	-	WASD keys, a set of four keys on a keyboard used as directions to control players in video games
XR	-	Extended Realities

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Authors' contributions

Vitalija Danivska initiated research concept and design, together with Wouter van Tankeren collected and analysed observation and interview data, Wouter van Tankeren analysed survey data. Both authors interpreted data and prepared the manuscript. Vitalija Danivska wrote the theoretical overview whilst both authors prepared other parts of the manuscript. Wouter van Tankeren reviewed the initial draft of the manuscript. Both authors reviewed and approved the final manuscript.

Conflicts of interest

All authors declare that they have no conflicts of interest.

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Implementation of Smart City Technologies in Odessa

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Abstract. The article deals with the practical application of the *Smart City* concept in the city of Odessa. It has been established that the main directions of development of the *Smart City* in Odessa are "smart" road infrastructure and mobile applications for convenient use of city transport, use of the latest housing management systems, electronic governance and online platforms for socially active citizens, "smart" lighting technologies *Jooby Smart City Lighting*, application of the Internet of Things (IoT) within the framework of the Odessa *Smart City* program. The article also describes the application of a system of efficient collection and sorting of garbage in the form of autonomous platforms, some of which work on solar energy. An element of the *Smart City* system in Odessa is the *Precious Plastic Odessa* organization, which has "rethought" plastic exits and partially solves the problem of their recycling. The considered online platforms solve the problems of establishing feedback and interaction of citizens with local authorities. Important questions and tasks are carried out on the platforms *Socially active citizen*, *Smart City*, *Electronic city*. All these technologies ensure a high quality of life for citizens, safe, ecological and economic functioning of all branches of the city's activities. It was established that the concept of *Smart City* combines the introduction of innovative technologies into the municipal and transport infrastructure of the city, thereby significantly increasing their efficiency, and also creates transparent relations between the city government, business structures and the public.

JEL: O31, Q42, R22, R49.

Keywords: Smart City; automation; video surveillance; IoT; modernization; lighting.

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Introduction

Cities in modern realities are the dominant form of socio-economic organization and the so-called engines of the country's economic growth. The world's population is actively growing, especially the number of city dwellers. The consequences of this can already be seen not only abroad, but also in Ukraine: regional centers are growing, the number of cars on the roads is increasing, and the number of people on city streets is increasing. Therefore, such complex mechanisms as modern cities must be managed with the help of modern smart technologies, and in all directions: from the introduction of smart traffic lights and road signs to the construction of a global system of "smart" technologies in education, medicine, etc. This should really be one of the priority directions for the development of any *Smart City*, since the streets of this type of city should be comfortable, both due to the large number of technologies that make life easier, and due to absolute confidence of citizens and tourists in their safety. And despite Ukraine's population decline, urbanization continues. This determines the relevance of research and implementation of the "smart-city" concept in Ukrainian cities, especially in Odessa.

The concept of the smart city has attracted world interest, including governments, companies, universities, and institutes. Different stakeholders have tried to understand and explain the smart city from their different viewpoints [1]. The generally accepted definition of the concept of *Smart City* has not been established yet. Based on an integrated approach, *Smart City* is defined as an integrated and multifactorial municipal ecosystem that includes attracting human capital and full use of information and communication technologies by integrating physical, digital and human subsystems

in an artificial environment to solve current problems of the city balanced development in the economic, institutional, and environmental spheres to ensure the safety, comfort and quality of life of citizens in the future [2]. Smart cities have attracted great attention since 2008, with the launch of IBM's Smarter Planet project [3].

Today is the time of an active digital globalization, considerable technical progress, and the development of the Internet. The transformation of the entire infrastructure of each region of Ukraine with a focus on its existing potential is an important aspect that determines the attractiveness of Ukraine in the global space.

The most progressive regions of Ukraine are the Black Sea region and the Slobozhansky region. The attractiveness of an export activity in the Black Sea region was due to the development of industry and to the length of the maritime border, which makes it possible to receive and ship cargo from all the countries. Therefore, the city of Odessa in Ukraine is flexible enough to make changes and introduce innovations, which, as a result, contributes to Odessa residents' well-being and improve the quality of recreation and comfort of tourists in the city.

The purpose of this article is to determine the available elements of Smart City technology in Odessa and analyse the prerequisites for their implementation. The specified goal involves the following tasks:

- 1) determine the prerequisites for the introduction of Smart City technologies in Odessa;
- 2) consider the aspect of the development of the transport system on the way to the modernization of the city;
- 3) specify the available technologies that ensure the safety of city residents and guests;
- 4) consider the principle of operation of the *My City* platform

- and the advantages of its use;
- 5) analysis the "Socially Active Citizen" platform in terms of the Smart City concept in Odessa;
 - 6) reveal the problem of street lighting and the use of new technologies in this area;
 - 7) analyse the role of the *Smart City* program in ensuring the development of the city;
 - 8) consider examples of the use of IoT technologies;
 - 9) determine the possibility of electronic management of the city;
 - 10) consider technologies of the Smart City concept in the field of ecology.

1. Concept of the *Smart City*

Considering the importance of the role of forming a high-quality integrated system to meet the interests and needs of the municipal city residents, a number of scientists, including foreign ones, paid attention to the problems of defining the concept of *Smart City* and *Smart City Management*. Thus, the many domestic and foreign authors dedicated their works to this topic. D. Gibson, G. Kozmet-sky, R. Smilor [1] reveal the conceptual framework of a technopolis wheel from studying the dynamics of high-technology development and economic growth. The papers point to new institutional relationships among the segments of the technopolis wheel. E. Muraev [2] devoted his work to solving an important scientific problem formation of organizational and information support for strategy development smart cities of Ukraine in the conditions of the digital economy. S. Palmisano [3] considered the aspect of the global development of the world, including the role of smart cities in the development of the planet. V. Soto, E. Frias-Martinez [4] investigated the role of mobile devices in sensing the urban environment and described a method to automatically identify land uses from call detail record databases. I. Zhukovych [5] studied the interpretation of the concept of *Smart City*, also systematized all definitions according to the criterion of participation of certain interested parties. Chukut S., Dmytrenko V. [6] studied modern approaches to understanding the essence of the concepts *Smart City* and electronic city in the context of the development of electronic governance at the local level. Besides, the main problems that inhibit the development of e-government at the local level in Ukraine are identified, and the possibilities for overcoming them are indicated.

These scientists studied the theoretical part of the *Smart City* concept, systematized the existing concepts, and considered the conceptual foundations of the implementation of this strategy at various levels.

2. Modernization of the transport system

The transport system has a significant impact on the overall modernization of the city and this aspect must be considered in the Smart city concept. At his presentation on March 9, 2021, the director of the Department of Transport, Communications and Traffic Management of the Odessa City Council, Serhiy Tetyukhin spoke about the plans for the development of the road and transport infrastructure of the city of Odessa. The main areas of work were the development of pedestrian and bicycle traffic, fight against traffic jams and overloading of parking lots, as well as modernization of electric transport. Today in Odessa there are tools and technologies to solve these problems.

At the end of 2019, a free app "Public Transport — Odessa" appeared in application services [7]. It locates each tram and trolley-

bus in real time. Thanks to the application, you can find out the waiting time for a certain tram or trolleybus. Also, you can track the change in the electric transport route after the streets are closed, view all its stops and the inventory number of a vehicle and the number of seats.

This program was developed by employees of the *Provectus IT* company. Data on the location of transport is downloaded from the municipal website *Odessa Transport* [7]. But the site is not adapted and not suitable for use on a smartphone, so Provectus decided to create a mobile application. Today, the application is used by more than 3 600 Odessa residents and guests of the city, and its biggest advantage is the ability to work in offline mode.

In the future, the developers of *Public Transport — Odessa* are going to add the function of tracking minibuses. However, the main problem on the way to solving this issue is that the owners of route transport in most cases are private entrepreneurs. Therefore, there is a need to coordinate with each of them and install sensors in buses that will be maintained and constantly updated.

Regarding the development of electric transport in Odessa, the possibility of cashless payment in transport is important according to the Smart city concept. Since October 2020, this opportunity has appeared in Odessa trams and trolleybuses thanks to the joint actions of ME *Odesmiskelektrotrans*, *Transpod* and *EasyPay* companies. To do this, it was necessary to connect a payment card to the *Transpod* application and purchase a ticket by selecting the option "payment for travel".

The cashless payment system developed further and at the beginning of October 2021, PrivatBank launched cashless payment for travel in city transport. Payment can be made via the Privat24 application, where you can scan a QR code. In Odessa, for public transport passengers who buy tickets using a QR code, the price of a ticket is UAH 7 instead of the standard tariff of UAH 8, which is active from November 1, 2021.

In modern developed countries, traffic lights do not just play the role of an element within the transport system, they are equipped with a camera, Wi-Fi, a car, and license plate recognition system and the like. In 2018, a smart traffic light also appeared in Odessa at the intersection of Nebesnaya Avenue and Levitan St. It is equipped with video sensors and can adapt to the intensity of traffic flows. The traffic light decides automatically when to turn on the red or green light, according to the number of cars.

Another type of "smart" traffic light, which allows trams to pass, was installed in Odessa at the intersection of General Petrov and Yitzhak Rabin streets in 2019. The new traffic light object is equipped with LED lamps, a countdown timer, and its controller has a system that spots the approach of a tram: if the car approaches crossroads, the traffic light turns on a green signal for it and the tram does not stop at the crossroads. Today about 370 ordinary traffic lights are operating in Odessa, half of them do not comply with the legislation at all, and the effectiveness of smart traffic lights is still being monitored and new ones are not being installed [8].

The development of modern technologies in the transport system has led to the fact that many residents of Odessa, switch from cars and public transport to bicycles, segways, unicycles - their own or rented ones, whenever it is possible. And in 2020, an automated rental of electric scooters appeared in Odessa. Scooter rental was created to combat inefficient city transport, traffic jams, and the problem of air pollution in the city.

KIWI was the first company to launch scooter rental in Odessa in 2020. The price of using this company's electric scooter is UAH 10. Each minute of use will cost UAH 3.

The next company that introduced automated scooter rental in

Odessa was Bolt company. The first scooters appeared on the city streets in April 2021. The price of the service includes the price for unlocking the vehicle and the time of its use. Unlocking an electric scooter in Odessa will cost UAH 9, a minute of travel from Monday to Thursday — UAH 1.9, and from Friday to Sunday — UAH 2.5.

Another company that provided Odessa residents and guests with electric scooters was the JET company in September 2021. Unlike its competitors, Jet does not require an unlocking fee. You need to pay only for the time of the trip, the price is UAH 2.50 per minute.

To use the rental car, you only need to download the application of the relevant company to your phone, in which you can see where the scooters are parked. To set the scooter in motion, you need to link your bank card and scan the QR code. The maximum speed of the scooter is 25 km/h. The battery charge lasts for 2-4 hour of active use. In Odessa, scooters are located throughout the city, but mostly in the central part of the city. These are popular locations, such as Mysksad, Primorskyi Boulevard, Deribasivska st., Soborna Ploshcha, Oleksandrivskyi Prospekt and others.

Speaking about electric vehicles, we should mention electric cars. They are gaining increased popularity in Odessa because most of the electric cars supplied to Ukraine were imported through the port of Odessa. Therefore, the creation of charging stations, which are now represented in Odessa by network complexes of popular gas stations, recharging stations in parking lots and parking lots of hotels, restaurants, cafes, shopping, and dealership centres, has become an urgent issue.

In 2019, the first location where you can charge an electric car at a fast electric gas station appeared in Odessa. It contains 3 stations, which are installed near the Odessa CLEAN UP dry cleaner at Rozkidailivska st. 3. The first station charges cars with a 50-kW direct current and has a CHAdeMO connector, which allows you to charge the popular Nissan Leaf car in 30 minutes. The second station (EFS AC-32MSB), AC 22 kW, has a Type2 connector (Mennekes) and charges a Renault ZOE in 50 minutes. The third AC station (EFS AC-32J2M1SB) has two Type1 ports (J1772) and one Type2 port (Mennekes), and can simultaneously charge three cars with a capacity of up to 7 kW, for example, the same Nissan Leaf will be charged in 3 hours [9].

Today, the city of Odessa has about 30 charging stations for cars running on electricity. Most of them are in the central part of the city, three devices are in Tairov borough, two near the industrial market "7th kilometre", four of them are located in Kotovsky and Fontanka boroughs.

3. The role of the video surveillance system

Another important component of a modern city developing according to the "smart city" concept is smart technologies that provide the safety of residents and visitors of the city on its streets [5]. Odessa does not stand aside of this direction of development.

In 2017, the city authorities initiated the launch of the *Safe City* automated video surveillance system [10]. Due to this technology, it became possible to confront various offences, to read registration plates and identify faces, to measure the speed of traffic on the roads and to look for criminals, missing people, stolen cars and other vehicles, suspected people. The system works round the clock in real time, therefore, all the information is accurate and operational.

Odessa is the cultural capital of the southern region of Ukraine. Nowadays it is one of the biggest cities in Ukraine, with over a million inhabitants, the fourth after Kiev, Kharkov and Dnipro in terms of population. And for this city several dozens of cameras of the National Police of Ukraine and municipal enterprises are crucially

insufficient. But that was the reality before 2017. However, the city authorities have decided to change it, first of all, by creating a new department – the Centre of integrated video surveillance system and video analytics of Odessa (*Center-077*) [10].

According to Boris Magazinnik, head of the organizational and analytical support of the Department of Municipal Security, Odessa became one of the first Ukrainian cities which implemented a similar video surveillance system, that can automatically monitor the maintenance of order in the city and carry out necessary analysis.

"We were inspired by the experience of the city of Kyiv. It was their video surveillance that we liked most because of its excellent results of work. Our hardware specialists recorded the necessary data, and then worked on the development of this project," said Boris Magazinnik [10].

Once the project was approved, 30 million UAH were allocated by the local authorities for its realization. With this money, monitor rooms with large screens were equipped, and video surveillance cameras were also installed throughout the city. In these modern monitor rooms, 81 images can be displayed on the screen at the same time. This greatly facilitates the work of guards and increases performance.

If we talk about the modern scales of the video surveillance system, in today's Odessa we have already had more than 1000 such cameras installed. There are such kinds of the cameras: overview cameras, with license plate recognition, cameras with face recognition function, controlled cameras, panoramic cameras. There are also more than 200 cameras of the Specialized Installation and Maintenance Department and the Main Department of the National Police in Odessa region that work in the system [10].

The largest number of such cameras is inserted in the most popular district of residents and tourists of Odessa – in the Primorskyi district. It was here where many incidents involving theft, criminal offences, and so on were recorded.

Most of the offenses were recorded on the *Health Route* – a pedestrian zone 6 km long. It was before the introduction of an automated video surveillance system.

Maintenance of one camera with a communication service costs the city budget about 650 UAH per month. Kyiv spends more than 1200 UAH for the same purposes, Dnipro - about 1000 UAH [10]. Today, the results of the authorities' activities in this direction can already be felt. According to the *Center-077*, with the advent of cameras, the crime rate in areas where large crowds gather has dropped significantly.

During the Centre's work reported cars and motorcycles theft cases decreased by more than 72%. Moreover, with a video surveillance system, it was possible to catch lots of groups of car thieves, to find about 250 missing cars and more than 20 missing children. However, there are certain nuances in the system operation. Consequently, it is important to understand them.

These have been described by Boris Magazinnik: "It is important to understand that our database has not got contacts with any other database. We can't identify each person by an image. The system does it only for those people who were put on a wanted list officially, and information about them is open." [10].

This video surveillance system also works for the development of transportation logistics in Odessa, as well as the control and managing the individual city's objects.

For example, at the request of the Tourist Centre, a huge amount of visual information about those who visited a certain type of beaches in the summer is collected by cameras. In addition, *Center-077* evaluated a program to identify violations of parking in the city, however, the results of this work have not been made public yet.

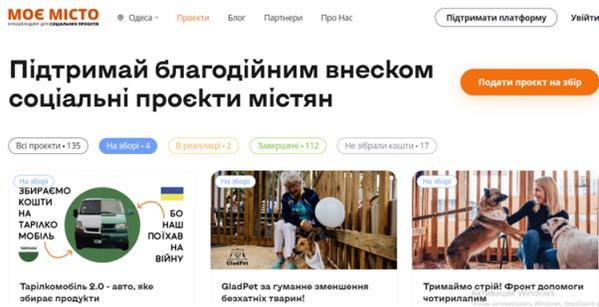


Fig. 1. Online platform *My City* [11].

About 50 people with access to the system currently work in *Center-077*. They monitor everything that happens on the screen and look for information at the request of citizens and organizations. Access to the municipal video surveillance system is also granted to the following subjects: the National Police Headquarters in Odessa region, the Office of the patrol police in Odessa, the Ukrainian Security Service, the Specialized Installation and Maintenance Department, the State Emergency Service of Odessa region [10]. Footage can also be purchased by those who have special permission at the appropriate rates.

4. Online platform *My City* and *Socially Active Citizen*

It should also be said that in the modern world the townspeople very often independently initiate the introduction of certain innovations for full development of their city [6]. Odessans are no exception. Thus, *My City* online platform was created by a few active citizens - see Fig. 1. With its help, everyone can collect the necessary resources for the implementation of their project. Only non-political, non-religious projects that can be of substantial public benefit and to resolve or mitigate some specific problem in the city can be submitted to the platform [11].

On the site, you can review the city's existing projects, as well as post your project for public consideration. You can also support any project and spread the experience of implementing some projects.

The main way to attract resources on this platform is crowdfunding, that is, collective financing. As described on their website, it deals with the collaboration of people who bring together money and other resources to support the efforts of other people or organizations to implement their ideas [11].

For maximum efficiency in promoting your project or idea, you should follow a certain algorithm of actions, that are clearly indicated on the website of the *My City* platform. Once the author has had an idea of his project, they should submit an application to the platform, choose the most appropriate title, describe their project, and also choose the duration of the fundraising and the required amount.

Philanthropists who like the purpose of the project support it financially. Thanks to this, the author raises the necessary amount for the implementation of the project and brings it to life. If the project does not raise the required amount, after checking with the author, *My City* team will transfer the received funds to another project [11].

The interface on the platform's website is very convenient, and all projects are classified into the following groups: roads and transport, ecology, improvement, sports and health, charity, tourism, economy, education and assistance to the military. Thanks to this platform,

more than 110 projects have already been implemented and more than 6 million UAH have been collected.

Once again, it was found that both the government and even citizens of Odessa are interested in funding such projects. Thus, with the joint efforts, the full implementation of the *Smart City* concept in Odessa will be much more efficient and faster.

Since April 19, 2017, there has been an online platform *Socially Active Citizen* - see Fig. 2. This is a unified electronic system that combines three areas: submission of projects, registration of petitions and participation of Odessa citizens in public discussions.

On the website, you can submit collective petitions, provide your idea regarding the use of budget articles, and also consider the discussions of citizens that are relevant and important.

Every Odessa resident can register on the platform using a bank ID (bank card), electronic digital signature, social networks with a copy of the passport and identification code.

The first direction of this system is *Public Budget*. It gives every Odessa citizen the opportunity to submit his idea in an electronic version, having previously issued it in the form of a project. By means of electronic voting, the citizens of Odessa vote for the projects, and the city government pays for the implementation of the chosen ideas from the city budget.

The second direction is the electronic petition submission service. This is an opportunity to submit collective appeals to executive authorities on any occasion.

The third direction called *Public discussion* is working according to the principle of conducting public hearings, but only in electronic form. This allows to cover a greater number of opinions of Odessa citizens [12].

On December 7, 2021, the Odessa Public Budget Commission completed consideration of projects submitted by Odessa residents for implementation in 2022. 97 projects submitted to the online platform [13] of the Odessa City Council *Socially Active Citizen* were considered. According to the results of the meetings, the Commission supported 70 projects that were submitted for online voting, including 23 small projects. The total amount of expenditures for 2022, which was planned to be directed to the implementation of the winning projects, was UAH 50 million [14].

5. Operation of smart meters

Next on the list of smart city technologies are smart meters and Jooby RDC radio modules for remote reading. They take the readings automatically and send them independently to the relevant companies. Jooby sensors are created to measure water, gas, heat and electricity meter readings. Such Jooby RDC systems are used in several cities of Ukraine, and in general their users are more than 15 thousand subscribers.

The second smart technology is *Jooby Smart Lighting* systems. Depending on the time of day, the lamps automatically adjust the brightness of the light. Also, the operation of the lighting system can be adjusted to the presence of a person [15]. For example, if

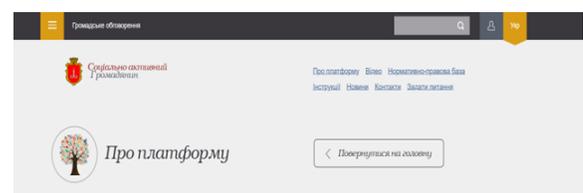


Fig. 2. Online platform *Socially Active Citizen* [12].

there is no movement on the street, then the lighting is reduced to the minimum level. This significantly reduces the level of electricity consumption. Accordingly, when the motion sensor is triggered, the brightness increases. *Jooby Smart Lighting* systems are used in Ukraine and other countries, and also meet the highest environmental standards.

Another application of the *Jooby Smart Street Lighting* technology in Odessa is street lighting system which is managed by the *Jooby CMS* cloud service, developed in Switzerland. This solution is easily applied both to one object and to the entire network of the city. The lamps can be adjusted for time and brightness, they turn on and turn off accordingly to the astronomical calendar. The process of controlling the lighting intensity according to the schedule allows you to set up to 8 points of daily brightness change [15]. And the *Jooby CMS* cloud system reads and visualizes data on consumed energy, current energy capacity, brightness level of lamps and the number of activations of motion sensors — reports are available for 26 parameters of the system.

And, of course, there is an example of the use of this technology in Odessa. It is the lighting of the entrance to the "City Centre" shopping centre. These devices can be managed both by list and by map. It is easy to group objects and choose different management programs.

Also, there is the third technology — *Jooby RDC Dashboard*. It is a service for collecting and processing data on the consumption of all types of resources and the status of devices [16]. This allows the resource company, developer, etc to receive accurate readings just in time. Using the service, consumers have access to data on the status of devices and the network, as well as receive graphic reports on resource consumption.

6. State program *Smart City*

We can also highlight the *Smart City* program in the Odessa Regional State Administration, which was presented by IoT Ukraine. A *Smart City* is a developed urban area that generates sustainable economic development and high quality of life, focusing on improvements in the economy, mobility, environment, as well as improving the living conditions of people and the government. Success in these areas can be achieved through strong human and social capital.

According to the developers, the main problems of cities today are as follows:

- a) up to 30% of cars on central roads look for a parking space;
- b) up to 40% of all public spending is spent on street lighting;
- c) urban waste is expected to increase by 100% in the period 2010-2025;
- d) occupying 2% of the total area of the Earth, cities emit 80% of carbon dioxide [17].

The *Smart City* project will help to correct this situation in such areas as industry, logistics, agriculture, environment, transport and traffic, parking, waste management, smart lighting, protection and safety of residents. This platform is driven by useful and resource-saving applications to improve cities and keep citizens informed. The project describes functions such as air quality checks, assessment of café sanitary conditions, inspection of current buildings and legislation to be implemented should be easily accessible.

One of the key elements that connects all the components of a smart city is sensor IoT devices [6]. By extracting information from the sensors and integrating it, social networks help members of society to be closer to each other, leaving the city government to deal with more serious security issues. In Singapore, thanks to the Inter-

net of Things technologies, just one computer warns of traffic jams, directs additional public transport to congested routes, and monitors the state of utility networks in real time. Meanwhile, in most Ukrainian cities, people still pay cash for travel in buses, and utilities learn about accidents from calls from outraged users. Today, the window of opportunity for Ukrainian cities is open: innovative ideas are waiting to be finally accepted and applied.

There is a vivid example of the use of IoT technologies, which gives an advantage to utilities when there are constant accidents in the place. After all, IoT technologies allow real-time automatic monitoring of all systems [5]. For example, a water utility can equip metering devices in homes and even infrastructure facilities with such sensors. Through a SIM card in each sensor, the utility will automatically, without collecting data manually, receive up-to-date information about the state of the networks, in particular: how much resources a house or entrance consumes, where an accident occurred, and prevent disasters by responding to events in a timely manner. The mobile operator will provide not only SIM cards for continuous monitoring, but also a special online platform for management and control - the IoT Control Centre.

Thus, in the *Smart City* it will be easier to obtain information directly from specially installed sensors or "indirectly" - thanks to sensors installed for another purpose, but which have useful information. The *Smart City* contains intelligent sensors in every corner, facilitating the management of urban economy through a system of intelligent video analytics. Video data is integrated through wired and wireless networks, creating an urban public safety platform [17].

7. Electronic (Open) City platform

Another element of the *Smart City* program in Odessa is the Electronic (Open) City platform. It is defined as a system of electronic city management on the one hand and a service for receiving applications from citizens on the other. This program was first presented in Odessa in 2015. Its main task is the maximum openness of the authorities, control of city services and demonstration of the work of officials. Within the framework of the program, a single centre for citizens' appeals has already been created, thanks to which Odessa residents can report any city problem and get a result without leaving their homes.

The main element of the program is the system of processing citizens' appeals. For the first time, all appeals are consolidated into a single database with control over their implementation. Electronic document management allows to connect all departments, municipal institutions and make them fully function. The current system of citizens' appeals is not so effective. And within the framework of the project, the following scheme works: a person publishes an appeal on the site (it is equivalent to a written one), and in a few minutes this message is already with the executor. It becomes possible to speed up the processing of appeals, as well as to avoid paperwork. By the way, in the future, the mayor will also have his own office, where he will be able to see at any time how this or that service works, at what stage of execution the work is, etc.

Operators collect applications from all possible city channels (citizens' appeals department, hotlines, district and city receptions, reception departments at district administrations, social networks) and include them in the Unified Electronic Register. Appeals come to the relevant deputy mayors or to him and are redistributed to the direct executors. Thus, appeals are under bilateral control - by Odessa citizens and the city leadership. In general, the priority directions of the city management system are housing and communal services,

social direction, medicine, education, tourism, transport, administrative direction and urban planning [18].

In addition, other portals are being created. Thus, on the investment portal Odessa residents will be able to place their proposals for investment, on the tourist portal - it will be possible to view a directory of all attractions and the mobile application *Guide to Odessa*. Separately, it is planned to create an electronic directory on housing and communal services with passports of all houses, as well as a map for GPS tracking of public and technical transport (for example, snow removal equipment) [19].

It is impossible not to pay attention to the addition to the city program *Electronic City*, where Odessa residents can use the service *Open City Budget*. According to the authors, the purpose of the project is to launch a unified information infrastructure of the executive bodies of the municipality. Thus, Odessa residents will see how a transaction is included in a particular department or, conversely, how part of the money goes to certain needs. That is, all financial flows can be tracked and analysed.

According to the Director of the Department of Information and Public Relations Andriy Syvash, the key changes that will be made to the project include:

- a) creation of a comprehensive city information protection system;
- b) introduction of an information system for property management of the territorial community;
- c) development of an electronic archive of technical inventory and evaluation of real estate objects [20].

Creation of a *Personal Account of Odessa Citizen* is another change to the program. According to the project, it should be a unified system of identification and authentication, which will provide authorized access of participants of information interaction - citizens-applicants and officials of the authorities to the information contained in local information systems. As well as integration into the main portal of the city and providing unified access to numerous services, portals and systems of the city council.

This program also involves the creation of a system of informing Odessa citizens. Residents of the city will be able to receive up-to-date information about the events of the city, the work of public utilities. The service of sending electronic and free SMS messages for the city residents regarding emergencies, changes in traffic, road closures, urgent search for blood donors, scheduled power outages, water cut-offs, etc.

In addition, the amendments provide for the creation of online registration for Odessa residents to make an appointment with deputies or officials.

8. Ecological aspect in the *Smart City* concept

One of the most critical issues that must be addressed with a sense of urgency is the environmental issue [4]. Among other things, the various pollution problems and the problems of secondary use of waste are also solved by the smart city concept. So, there are several notable examples of solving these issues in Odessa.

In the period from 2020 to 2021, 27 underground containers for collection and sorting of domestic solid waste were installed in Odessa. A total of 9 complexes with containers of waste disposal with a volume of 1.1 cubic meters, the special monitoring system that determines the degree of their fullness, the warning system and the remote control have been installed.

An aboveground part includes three garbage containers with LED lighting, with information stickers telling people what can be thrown in and what cannot, with 4 solar panels and with Wi-Fi system.

These containers are autonomous. When the container is full, the LED light changes from green to red and the lid is locked.

A garbage truck driver can empty the container simply by pressing one button on the remote control. Then, he needs to manage the system through the special program on his phone.

After receiving a signal, the platform with the container, located underground, will rise up and after unloading of containers, it will set in place, and will be lowered in the underground chamber by pressing a button. Such a system can help to reduce the time for emptying containers and, as a result, improve logistics of waste disposal organizations.

Another innovation is the solar panels that are located beside waste collection systems. Charge the batteries for at least 50 descents and ascents of the platform. Thanks to the installation works on cable laying into containers were removed [22].

This system helps to sort waste conveniently and send it for further processing. In addition to this, the implementation of the *Solar City* project was started in the beginning of 2020 with the assistance of the Odessa City Hall. The project calls for installation of solar panels on the roofs of apartment buildings. The project is implemented by funds of the companies that have the appropriate license. These solar panels are intended solely for the generation of electric current that will be directed to the power grid according to the "green tariff".

"As for the residents of apartment buildings, the benefit is obvious for them. They will have a repaired roof and they will subsequently receive 25% of the profits from the electricity produced. According to preliminary calculations, this profit will be about UAH 80000 per year for one house. Residents will be able to spend these funds on the improvement and repair of their own home," said Genady Trukhanov.

He also emphasized the benefits of this activity for Odessa. It consists of attraction of investments for the repair of housing stock and reducing the consumption of traditional energy sources. This innovation will contribute to lower annual CO2 emission levels and implementation of the Covenant of Mayors for a reduction of carbon dioxide emissions which Odessa joined in 2015 [23].

Also in Odessa, was developed «Precious Plastic Odessa» project. In short, this is a plastic waste collection point. The workers of this centre accept all sorts of plastic and create different household objects from it, for example, dishes, toys, jewellery, lamps, and many other things which we use in daily life.

The prices of these products are based on the cost of the plastic bottle caps per kilogram. Now it is about UAH 20 per kilogram. In addition, employees of the centre systematically carry out educational activities, talk about the peculiarities of plastic material, organize theoretical and practical events. The founders say the workers of the *Precious Plastic Odessa* project are always ready to cooperate with organizations and carry out even very urgent and large orders in exchange for receiving plastic raw materials for further work [24]. Examples of such projects include bicycle parking, tables, chairs and even the technology for creating paving slabs from recycled plastic has been developed.

Conclusions

The article reveals the nature of the existing elements of *Smart City* technology in Odessa and reflects the prerequisites for their implementation.

1. Prerequisites for the introduction of *Smart City* technologies in Odessa and the prospects of this region are described. The

aspect of the development of the transport system on the way to the modernization of the city is considered.

2. Existing technologies that ensure the safety of city residents and guests were considered and technologies were analysed in the future.
3. The principle of operation of the *My City* platform and the advantages of its use are described. The *Socially Active Citizen* platform was analysed from the point of view of the *Smart City* concept in Odessa. The role of the *Smart City* program in ensuring the development of the city was analysed.
4. The problem of street lighting and the use of new technologies in this area is revealed.
5. Examples of the use of IoT technologies are considered. The possibility of electronic management of the city is determined.
6. Technologies of the *Smart City* concept in the field of ecology are considered.

Every year Odessa gets closer to the concept of the *Smart City*, introducing the latest technologies for the infrastructure potential create good perspectives for the attractiveness of the Black Sea region of Ukraine in the world. The acceleration of the modernization of this region offers many new innovative solutions for the development of the city, including the development of the city's transport model, the creation of platforms for the development and implementation of projects that ensure people's comfort. In addition, the city of Odessa takes care of security by installing automated video surveillance systems and implementing smart lighting technology. And some resources, such as IoT technologies, even help to automate household tasks, facilitating the work and functioning of the city. In addition to the government, citizens also participate in im-

proving the city. They actively propose and finance projects, express their opinions in the form of petitions and public discussions, and create eco-initiatives to save the environment.

Abbreviations

IBM	-	International Business Machines
IoT	-	Internet of Things
IT	-	Information Technology
LED	-	Light Emitting Diode
UAH	-	Ukrainian Hryvnia

Authors' contributions

Larysa Ivashko chose the topic of the article and the aspects that should be covered in it, developed the methodology of its writing.

Maria Filatova created the final version of article, designed it according to the requirements, reviewed the literature devoted to this topic and analysed the technologies in the transport system.

Nataliia Shkurateniuk considered the relevance of this topic and research perspectives, highlighted the problem of security in the modern city.

Kateryna Petrenko systematized the terminology of this article and considered the latest innovations in implementing the *Smart City* concept.

Emilia Tashchy conducted an analysis of online platforms that ensure the development of modern cities and determined their role in the general concept of a *Smart City*.

Anastasia Bogachova considered the ecological aspect of the *Smart City* and drew general conclusions.

All authors read and approved the final manuscript.

Conflicts of interest

There are no conflicts to declare.

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24. Precious Plastic Odessa - <https://Odessa.name/ru/articles/2209-studiya-plastika-v-odesse-precious-plastic-odessa>

Article

Technology Trends in Banking System and its Impact on Population of Different Ages

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Abstract. The paperwork aims to analyse the rapid advances in technology trends implemented in the banking system and how it affects the population of different ages, because, as it is known, we assist in a massive changing of demographics and lifestyle of people. To achieve this aim, the main points to be discussed are the traditional branch banking, which is giving place to electronic banking and, even more recently, to mobile banking and, how people are adapting to these ascending trends. The empirical research was done using Quantitative Method – Survey and Qualitative Method – Structured Interviews and provides important information on accessibility to mobile banking, relationships between age and usage of credit cards, going to traditional banks or going online and forecasts for the future of banking system. This study helped to understand the impact of digital banking on customers.

Keywords: E-technology; banking system; demographics; impacts; financial system.

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Introduction

Financial institutions serve as financial intermediaries between primary saving and borrowing sectors. In the current environment it has become critical for financial institutions to evolve strategies for competitiveness in the context of rapid changes with technological, economic, social, demographic, and regulatory environments. Also, globalization, regulatory compliance, risk management, technological innovation and demographics are the major transformative issues that determine and will determine soon the growth of global financial sector.

Consolidation and cross-border mergers and acquisitions (M&A) in the context of easing cross-border investment regulations are also visible trends observed in the financial sector [1]. Another key point is the technology that has transformed services offered by financial institutions into commodities. Information and communication technology (ICT) developments and trends in recent years have had great impact on the banking sector worldwide, increasing market scope and reducing transaction costs. In the main, banking institutions seek to gain competitive advantage by using ICT, including Internet technologies, to provide value added services to meet consumer needs at lower cost or as part of their corporate value proposition [2].

This topic is to highlight which are the most important changes in banking system due to new technology in some developed countries, like the United States, the United Kingdom, China, France, Germany and how these changes were adopted by people of different ages. Online banking is becoming one of the most popular payment methods in Europe, allowing customers of a bank or other financial institution to develop a wide range of financial transactions through their websites. Over time, Europeans' confidence in this electronic payment system has increased. Meanwhile, the use of physical cash is experiencing a significant reduction in some countries, such as Germany or Austria [3].

According to a survey in November 2019, 73% of respondents in

Singapore, aged between 18 and 24 years claimed their interest in virtual banking. In recent years, there has been a growing proportion of the population in Singapore who use digital banking to pay bills or shop online [4]. While technology becomes more and more pervasive, an age-related underutilization of IT remains observable. For instance, elderly people (65 years of age and older) are significantly less likely to use the Internet than the average population [5]. This age-related digital divide prevents many elderly people from using IT to enhance their quality of life through tools, such as Internet-based service delivery [6].

Due to the era of digitalization, a lot of trends in banking sector were changed, for example the use of internet banking among the population of different states. In 2020, it was found that 96th strongest internet banking penetration in Europe, followed by Norway and Denmark [3].

This work underlines the novelties that arose in the banking sector and how the population reacts in accordance with age, mentality, and beliefs.

Increasing number of technologies, platforms and applications for the banking system may be a good alternative for certain population groups, while for others it could cause confusion and impossible to managed. Some problems (such as necessity to establish how these innovations have entered the banking sector in different countries and how different age groups of population reacted to the new changes and what should be done by financial institutions to satisfy peoples' needs) are under question.

The main aim is to analyse the online banking penetration in European market and how people reacted to it. To achieve this aim, the following tasks will be done.

- 1) to determine the most favourable countries for innovation in the banking sector;
- 2) to analyse the technology trends in the banking system;
- 3) to comment on the new technology trends;
- 4) to analyse population's behaviour towards changes.

1. Banking sector: *pro* and *contra*

1.1. Strategic trends in banking sector

Banking sector has always needed strategies to deal with different circumstances occurring in the world. With the imposition of more stringent capital adequacy and risk management, banks require to find the best solutions according to that specific issue.

Despite global challenges, the banking industry provides immense opportunities through expansion in new markets, technologies, and personalization to enhance customer relationship. For instance, the changing demographic profile has made it imperative for banks to develop specialized products and advisory services aimed for the older population.

The concept of banc assurance has huge potential to address the needs of older consumers. Insurance with its annuity features and tax advantages is well established in European regions because the trend observed is that the responsibility for retirement security is increasingly shifting toward the individual and away from government and employers [1, p.6].

Driven by the open banking revolution, retail banking has become an ultra-competitive sector. There is a huge demand for digital, easy-to-use services and fast processing of important documents like mortgage applications. People are more than willing to turn to other services if they feel they aren't getting the best service from their bank - for example, possibilities of Embedded Finance [7]. According to Finextra [8], the trends that are shaping the banking sector in 2021 are the following.

1. A renewed trend on customer experience. People want easy ways to manage their money, they want different apps, personalized services and banks that are approachable. The best way to do this is to start thinking in a "customer first" way. One is about selling a product; the other is about becoming part of a customer's journey through life.

2. The competition in the banking sector. Banks need to fight to attract and retain customers. With the advent of open banking, the rise of digital-native challenger banks and tech companies getting in on the payments business, traditional banks are operating in an increasingly competitive environment. Banks that introduce technology to make financial management easier across the board will find themselves in a good position to keep pace with these challengers.

3. Drive digital innovation. It is not just technological innovation that is important – banks also need human talent to get value from technology. They need brilliant people who can interpret and apply the insights derived from the massive amounts of data banks hold on their customers. There will continue to be an intense battle for talent, especially in technology departments.

4. Increase revenue. The retail banking sector has flatlined since the massive crash of 2008-2010. They have gone through the cost-cutting process, but most have been less focused on how to grow their top line. They need more customers, but they also need to earn more money from existing ones. The challenge is how to do this without alienating people. One way to do this is by personalizing products, understanding the individual customer's goals and how the bank can help them get there.

According to Celent [9], a leading research and advisory firm focused on technology for financial institutions globally retail banks should be considering their priorities across three horizons.

1. When it comes to digital customer engagement, efficient operations, or robust fraud management, banks should identify and close key gaps in capabilities immediately.

2. Banks need to make sure they have a clear strategy, such as cloud adoption, or how they will participate in the increasingly open ecosystem.
3. Banks should keep an eye on issues that are not yet urgent but are starting to receive a lot of industry attention, such as central bank digital currencies.

1.2. Technology trends

Business Intelligence and Digital Banking. Global technology trends indicate increased focus on next-generation remote banking solutions, business intelligence (BI) and analytics in transaction monitoring.

Internet and mobile applications have made next-generation remote-banking solutions a critical priority for banks. Banks could improve their personalized services for customers the use of online banking sites. Other technological innovations, such as cloud computing and virtualization, could improve the productivity and usability of web-based banking applications.

Digital banking can also be used as a tool to collect data and to facilitate the cross-selling of products and services. Many experts point out that the competitive position of banks could be further enhanced by their adoption of technology trends. Successful banks should need to have a system architecture that enables customers to have a full view of their banking services.

The role of BI and analytics is becoming more relevant in providing customized rewards, products, and investment solutions to customers. BI encompasses a comprehensive suite of dashboards, visualizations, and scorecards. New technologies like visualization, in-memory analytics, and service-oriented architecture (SOA) are facilitating the development and use of BI applications.

Smartphones became the dominant access point for online banking, but as consumers spend more time on their mobile devices than on computers, online banking is transforming into mobile banking. The mobile platform acts as a catalyst to electronic person-to-person (P2P) payments. Companies are making massive investments in P2P payment methods that enable to pay each other electronically.

Social media, including *LinkedIn* and *Facebook*, are now emerging as leading marketing channels used by banks to announce new products, services, or events and to receive personal feedback. In the era of increased use of technologies, it has become imperative for banks to make adequate investments in analytics and dashboards whereby meaningful analysis on real-time data gives bankers the opportunity to make daily decisions that influence their business.

In the context of increasing bank losses from cybercrime, banks must manage and have strong partners to handle security concerns across channels and devices. It has become vital for banks to use integrated systems to increase the ease and efficiency of streamlining delivery processes. Efforts ought to be aimed at streamlining channel systems consisting of branch systems, ATMs, credit cards, Internet banking and mobile systems into one cohesive process [7, p.8-10].

Another innovation is Savvy Banks, that are already looking at ways to use automation and AI to improve the customer and employee experience. They're starting to use automated services to help customers self-serve, while freeing up their teams to concentrate on where their skills can add the most value to the customer (in areas that need an empathetic and creative touch) [8].

Increasing Online Banking Penetration in Europe. In 2020, it was found that 96% of the Icelandic population access online banking sites, making Iceland the country with the strongest internet banking penetration in Europe, followed by Norway and Denmark.

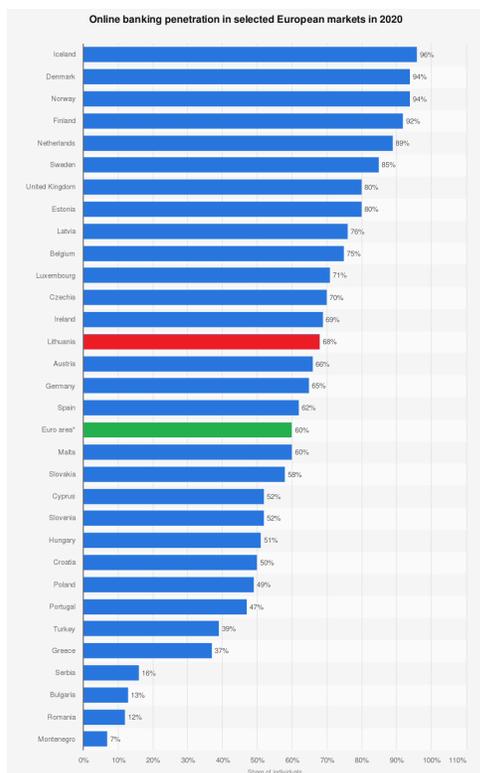


Fig. 1. Online Banking Penetration in European Market, 2020. EU - green, Lithuania - red. Adapted according to Ref. [3].

Online banking is becoming one of the most popular payment methods in Europe, allowing customers of a bank or other financial institution to develop a wide range of financial transactions through their websites. Over time, Europeans' confidence in this electronic payment system has increased. Meanwhile, the use of physical cash is experiencing a significant reduction in some countries, such as Germany or Austria [10].

Mobile banking model and services. The mobile banking platform combines payments, banking, and real-time, two-way data transmission for ubiquitous access to financial information and services. Mobile banking is the financial service innovation offered using Information and Communications Technology (ICT).

There are two ways in which people can access the services provided by mobile banking. The first way is when only customers of a bank can avail the mobile banking service from the bank and perform various banking activities. While, in the second one, unbanked customers can also perform banking transactions through their mobile service provider. Mobile banking services can be classified into SMS Banking, Application (Software) oriented, Browser (Internet) based model and Mobile Apps. The common activities which can be performed through mobile banking are balance enquiry, mini statement, money transfer, payment of bills and others [11].

1.3. Demographics: two opposite sides

Effect of demographics on usage of mobile banking. It is usual to include demographics characteristics in models about technology use and their adoption. The impact of demographics on the adoption

of various electronic devices has been extensively studied. Howcroft et al. [12] revealed that younger consumers value the convenience or time saving potential of online and mobile banking more than older consumers.

These authors further found the educational levels of respondents did not affect the use of telephone or online banking. According to Crabbe [13], demographic factors play a significant role in adoption decisions. He found that social and cultural factors, such as perceived credibility, facilitating conditions, perceived elitism, and demographic factors, significantly affect adoption decisions for mobile banking. Also, both demographic and psychographic variables affect the adoption of new innovations such as m-banking – in particular, age, gender, personal income, and education. Mobile-savvy college students, who are using their mobile devices for services beyond calling and sending messages, will drive adoption of innovative mobility services, including mobile banking. If to think about mobile phone users aged between 16 and 34, they are most comfortable using mobile phones for financial transactions, while, for example, majority of people having 65 and above years will not be at all comfortable [11].

Customer's adoption of technology in banking sector There are various studies which highlight the customer adoption of technology in banking and map their satisfaction levels thereof. A study done by Polatoglu [14] indicates that early adopters and heavy users of internet banking were more satisfied with this service compared to other customers. Efficiency, convenience, and safety were viewed as desired end-state goals when using mobile banking. System and information quality significantly influenced customer satisfaction, while information presentation did not significantly influence customer satisfaction. Also, trust can play a crucial intervening role in the relationship between perceived value (system and information quality) and customer satisfaction [11].

Perceived usefulness has been found to have a significant positive effect on both attitude and usage intention toward use of Mobile Banking Services. Also, mobile interface usability (quick response time and easy navigation) and service has a positive effect on customer satisfaction. It is known that loyalty of m-banking customers was directly affected by satisfaction from m-banking services. Moreover, a positive relationship exists between attitude towards m-banking and intention to adopt m-banking, as consumers who enjoy wireless banking transactions and those who find mobile-banking services easy to use, display a positive attitude towards usage of mobile banking. Once service providers can deliver user friendly, and consumer-satisfying services, then Mobile Banking will be adopted by consumers [11].

Teenagers in using new technology of banking system It is instinctively known that mobile is a key channel for any number of things: from communications to gaming, on to navigation through to payments.

Existing studies covering a mix of demographics have shown that the use of mobile devices to bank is universally on the rise. According to the UK's Office of National Statistics, half of adults and more than three-quarters of 25-34 years old now manage their money online. With about one in five having made payments via their mobile phone and a quarter using it to check bank balances.

A strong enthusiasm is expected as teenagers are the first generation to have opened their bank accounts with tried and tested mobile banking applications already in place. Unlike their older siblings or parents, they have been able to dive straight into this platform without the need for a huge instruction, because teenagers are so familiar and intuitive then it comes to mobile applications [15].

Table 1. Onliners in the population of 65+ years in different countries. Adapted according to Ref. [21].

Country	Share of age group 65+ in population, %	Onliners in population, %	Onliners in age group 65+ in population, %
Japan	23.2	79	NA
Germany	20.7	82	43
Italy	20.2	54	12
Greece	18.9	46	4
Sweden	18.1	92	61
Portugal	17.9	53	11
Austria	17.6	75	29
Bulgaria	17.5	46	4
Latvia	17.4	68	12
Belgium	17.2	79	36

Research in the United Kingdom has shown that online and mobile banking among bank customers aged 11 to 18 has increased by 40% in just two years. The research also identified teenagers as now being far more likely to ask for a bank transfer from their parents for a trip or to go to the cinema than asking for cash. Half (52%) of under 18s who use current account are now doing most of the transactions online. On average teenagers' bank online 12 times per month – with 90% of log-ons coming via mobile phone. Just 10% of log-ons are made via iPads, tablets, or desktop. Russell Galley, Managing Director of Halifax said: “Today’s children and teenagers have grown up with the convenience of the internet at their fingertips and so for many online banking is just part and parcel of how they expect to be able to manage their money.” [16].

Elderly people and internet adoption for daily commodity usage Information technology (IT) allows members of the growing elderly population to remain independent longer. However, while technology becomes more and more pervasive, an age-related underutilization of IT remains observable. For instance, elderly people (65 years of age and older) are significantly less likely to use the Internet than the average population. This age-related digital division prevents many elderly people from using IT to enhance their quality of life through tools, such as Internet-based service delivery [6].

Among other groups, the elderly lag in using and benefiting from IT in general and the Internet in specific. Despite these benefits, a conspicuous age-related digital divide remains [17-20]. This digital divide means that despite all potential advantages, the elderly are less likely to have access to and to exploit the potential of Internet usage and IT in general.

As a result of demographic transitions, especially Europe is facing ageing-related challenges in creating an inclusive information society. Currently, nine of the world’s 10 ‘oldest’ countries (in terms of percentage of people aged 65 or over) are in Europe. While Japan leads this ranking with 23.2%, more than 20% of the population in Germany and Italy is 65 years of age and older.

The same age group constitutes more than 18% of the population in Greece and Sweden and more than 17% in all other European countries. Both Japan and Europe currently have so many elderly people and so few newborn babies that the ageing population has established a long-term trend that will continue for generations, see Table 1 [21].

While varying degrees of Internet adoption among the elderly populations of these countries exist (ranging from 4% in Greece and Bulgaria to as high as 61% in Sweden), we can observe an age-related digital divide in all of them. Notably, lower general Internet adoption is closely related to a stronger age divide. For example, in countries with low population – wide Internet adoption, such as Greece and Bulgaria, people aged 65 and older are more than 11 times less likely to be online than the overall population. Accord-

ingly, ageing populations and age-related e-Inclusion constitute fundamental European challenges.

2. Methodology

2.1. Data collection methods

The research purpose is to analyse the spread of online banking in Europe and how people of different ages tend to react to it. Whether the population is adapting their behaviour fast to the new changes in banking strategies or find the innovation suspicious, what is most important to the analysed population when it comes to banks’ services, in which direction is used the online banking among people.

The aim of the research paper is to identify the main influential factors towards adoption of online banking: the age (if the teenagers are more sensitive than the elders or vice-versa), the preferences (if the customers prefer to go to a real bank rather than accessing the online version of the bank), actions done using online banking (what are the areas where people use their debit/credit cards) and important aspects (what is the most important thing when customers are thinking about banks).

To collect data, researchers make use of different data collection strategies. For surveys, using structured questionnaires are an important instrument for collecting primary data and typically involves collecting data on many variables from a large and representative sample of respondents. Also, within a qualitative research design, the data collection typically involves collecting a large amount of data on rather small, purposive sample, using techniques such as in-depth interviews, participant observation or focus groups [22].

Data can be obtained from primary and secondary sources and in this research, following primary and secondary types of methods are used to achieve the research purpose:

Primary Data. Primary data are data that are collected for the specific research problem at hand, using procedures that fit the research problem best [22]. Sources of Primary data are individual or focus groups, panels of respondents specifically set up by the researcher and whose opinions may be sought on specific issue or study. Collection of primary data is quite difficult as compared to secondary data, but it is quite reliable and accurate. For this research, the author has collected primary data using two different methods: Structured Interview and Survey.

Secondary Data. Secondary data are data collected earlier by other researchers or for other purposes than research, such as official statistics, administrative records or other accounts kept routinely by organizations [22]. For this research, the author has used an existing survey to be compared with the one conducted by the author.

2.2. Research Data Instruments

An important thing was to conduct literature review to create research data instruments suitable for the research topic and problem. With the information gained from reading and analysing the information from books, articles, statistics, blogs and websites, the survey questionnaire and the questions for the interview were designed. The survey was then distributed by an online tool – Google forms, and the interview was conducted via e-mail and Zoom platform.

Survey Data Instrument (Quantitative Method). A well-established primary data collection strategy is the survey. In a survey, a large and representative sample of an explicitly defined target population is interviewed. Characteristically, many standardized questions are asked, and the respondents are coded in different answer categories. A survey is carried out when researchers are interested in collecting data on the observations, attitudes, feelings, behaviour, experience, or opinions of the population [22].

The questionnaire was designed with seven questions according to the following technique: the gender of the respondent, the age (five categories of age groups), the fact if the respondent has or not a bank account and a credit card, the preference of the respondent towards online or real banks, actions done using online banking and important aspects when the respondent is thinking about banks. All the questions helped the author to solve the research questions about the usage of online banking among different age groups.

Interview Data Instrument (Qualitative Method). A popular method of data collection is the interview in which interviewees are given the floor to talk about their experiences, views, opinions and so on. This instrument is flexible and sensitive to social context [22].

For this research, structured interview was used to collect data from people having an economic background. The idea behind choosing this instrument was to collect information from interviewees with different age on the topic of Banking Technology Trends and how this sample of population sees the effects of technology in the banking sector.

A total of four questions were asked in a document sent via e-mail and then the respondents had to think of the answers and send it back to the researcher or to connect to Zoom platform and talk to the author. The starting question was about the selected population background and the field of activity. The second one was about the opinion on the new technology trend and especially online banking. The third question tried to highlight the point of view on the accessibility young and old people have to this facility. The last question collected ideas on possible new technology trends in the banking sector.

2.3. Sample Selection Strategy

For successful research, a researcher should understand the importance of selecting the suitable people, who have the required knowledge, experience, and ability to answer the questions in a right way. The survey is the data collection instrument that involves several respondents with different or similar backgrounds. The respondents were invited to complete the survey on the platform Google Forms, and it was available for a period of 10 days, starting from the 10th of November 2021 and ending on the 20th of November 2021. A total number of 71 respondents participated in this survey.

Structured Interviews are a method to gain maximum accountability and a clear point of view because the author focuses on targeted people with the right background to answer the questions. A brief introduction of the respondents is presented to validate that the respondents are reliable and have the knowledge and skills within

the subject that author has chosen for the research paper.

The author believed that it is important for the reader to get feelings about the respondents that were interviewed, especially their studies and activity. The selection for the interviewees was based on very high knowledge and experience, i.e., teachers with a great academic achievements and students with high grades and activities in the academic community.

3. RESULTS

3.1. Results of Interview (qualitative)

For the empirical part of the research, the author used non-anonymous structured qualitative interviews. Such an interview method is advantageous, because it helps the researcher get the needed information from a primary source, which makes it easy to be implemented. On the other hand, the prominent disadvantage is that the respondents could not have the necessary background to answer the questions, or they can talk too much about the concepts they are trying to explain. The author considered this method the best to be implemented, because the author is in an economic environment and this made easy the process of finding suitable people, who have the experience needed for answering the questions so that the findings would be useful for the research.

A diverse range of people were interviewed, with different economic backgrounds and coming from different countries (Republic of Moldova, Romania, and Lithuania). Following findings were discovered by the author after analysing the answers of the four respondents:

3.2. Results of Survey (quantitative)

The survey was conducted for 10 days through the platform Google Forms and the author is going to describe the key findings from it.

As shown in the Fig. 2, having a bank account has a visible relationship with the age of the respondent. People aged between 19 and 25 are the ones having the highest percentage of owning a bank account (54.93%), being followed by people having between 31 and 45 years (12.68%), while the age group 45+ are having a bank account in proportion of 1.41%. almost half of the teenagers that answered the questionnaire have a bank account (9.86%) and the ones not having are of 8.45%.

As underlined in the Fig. 3, the relationship between the age and having a credit card is like the one between the age and having a bank account shown in the Figure, the age group trends being quite the same. The leading position of having a credit card is occupied by people having between 19-25 years (53.52%), being followed by the group of 31-45 years (14.08%) and 16-18 years (12.68%).

According to the Fig. 4, there are high differences of preferences between young and old people. Teenagers and young people, mainly tend to want to solve their issue online, being more open-minded to technology and comfort. On the other side, are the people having 45+ years, which surprisingly, would also prefer to do everything online and are not conservative as all the theories state.

The sixth question of the survey was with multiple choice to see what the most important aspects of a bank's perception are. The participants prioritized them the following, as shown in the Fig. 5: the most important things are Trust with 66.2% and Customer Service with 60.6%, being followed by Terms and Conditions with 50.7% and on the last positions are Digital Services (38%) and Financial Advice (32.4%)

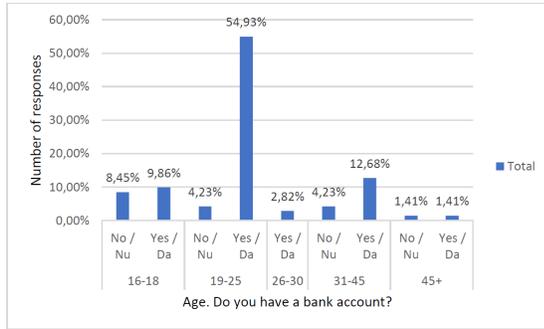


Fig. 2. The relationship between the age and having a bank account.

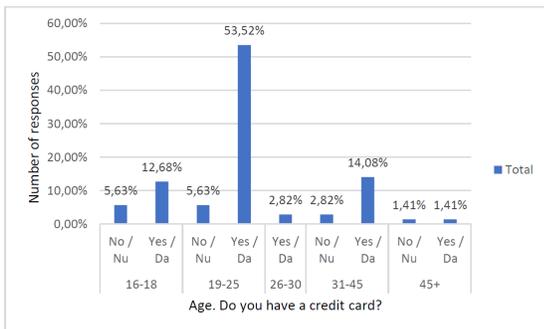


Fig. 3. The relationship between the age and having a credit card.

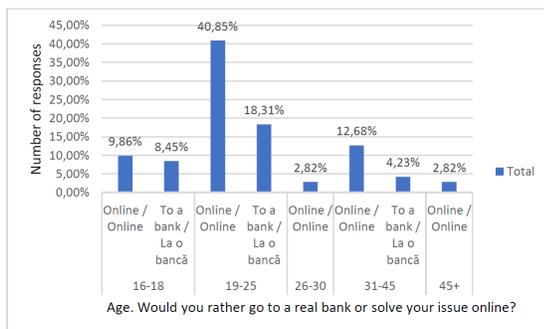


Fig. 4. The relationship between age and preference for online or traditional bank.

A similar question was asked in a survey conducted in 28 countries from across the globe and for them the priorities are shown in Fig. 6. There can be observed that Trust is on the first place for both surveys, as well as Financial Advice being on the last place. In the worldwide survey, Terms and Conditions are on the second place with 18%, followed by Digital Services with 17% and Customers Service with 14%.

The last question in the survey was about the actions done using Online Banking and it was also a multiple-choice question. As stated in the Fig. 6, it can be underlined that the population uses Online Banking the most for Shopping (81.7%) and for Transactions to other people (74.6%), being followed by the action of paying bills with 64.8%. Only a few respondents use Online Banking for other purposes (8.5%) or don't use it (4.2%).

Conclusions

The age influences the fact if a person is having a bank account or not, as from the survey, people aged between 19 and 25 are the ones having the highest percentage of owning a bank account (54.93%), being followed by people having between 31 and 45 years (12.68%). The age also influences if a person is owning a credit card or not, the proportions being similar to those from having a bank account. There are high differences of preferences regarding solving the issue online or by going to a traditional bank between young and old people. For this aspect, an interesting thing was observed by the author, especially the thing that all the respondents having 45+ years answered that they would prefer it online. The population analysed prioritize the most the trustfulness and the customer service at a bank. The actions done using online banking are mostly shopping and transactions to other people.

1. One of the aims of the study was to determine the countries where it is favourable to innovate the banking system. The United States, the United Kingdom, China and developed states from the European Union, like France or Germany are the ones where banking innovation is overtaking in the first place. Also, Europeans' confidence in the electronic payment system has increased, showing how the use of physical cash is experiencing a significant reduction in some countries, such as Germany or Austria.

2. The study provided the guidelines of technological development which is entering more and more spheres of our lives. The banking sector is not an exception and here are underlined some technology trends that all the banks are trying to follow and to align their policies with the requirements of people towards technology.

First, technology made everything easy and comfortable for people. Now, customers will look for those banks that provide electronic services and pay attention to their satisfaction through

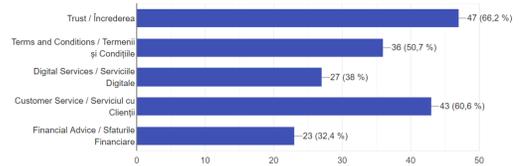


Fig. 5. What is most important to you when you think of a bank?

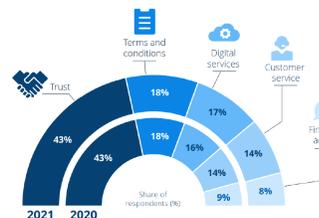


Fig. 6. What is most important to you when you think of a bank? Adapted according to Ref. [10].

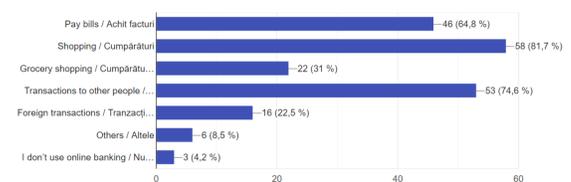


Fig. 7. What actions do you do in online banking?

different apps, feedback forms or even small talks with them. Banks have already implemented online and digital banking, artificial intelligence during peoples' transactions, as well as the opportunity to open a bank account online.

Secondly, the competition in the banking sector is now determined by the level of digitalization and will win those banks who invested in their technical development.

Thirdly, banks will need talented people to work in their IT department, where they will create the user-friendly apps and websites, will take care of customers' cybersecurity, and will solve every problem regarding technical issues.

Finally, it is also important to have revenue and to keep old customers, as well as to attract new ones. For this, banks have already thought about personalized services.

3. This study helped to understand the impact of online and mobile banking, which can be specified as digital banking. For the customers it is of a great importance to have good experience with the usage of banking apps and websites and to accomplish this, the banks have introduced technological innovations, such as cloud computing and virtualization. Besides the experience with the online banks, customers should trust the banks and that their money are safe during the transaction or in the savings account.

For this, the administration of banks is concerned with cybercrime and innovate the security of data storage, intercountry transactions and keep an eye at the issues with ATM machines. Another innovation is Savvy Banks, that use automation and AI to improve the customer and employee experience, especially through automated services to help customers self-serve.

4. Research analysed population's behaviour towards technologies and banking system. Interviews and survey data pointed the main aspects of different age groups and their beliefs according to banks.

Recomendations

It is considered that a lot of functions of traditional banks will disappear and there would be fewer employees. It is considered that

banks should prepare for changes regarding cryptocurrencies. The banks should work a lot in the sphere of cybersecurity. Several recommendations could be formulated.

1. It is recommended for the banks to develop their apps and websites in a several number of different languages, to be accessible to a lot of people from different countries.

2. It is recommended for the banks to increase the level of trust by doing the update of customers' data once in several months or by having campaigns involving the cybersecurity department.

3. The banks should observe the trends of interest rates at different alternatives of financial institutions.

4. Regarding the old people, the employees at banks can develop some informational sessions for them, aimed to explain and help with the usage of new changes in the technological way.

5. Also, for young people, especially for teenagers, banks can organize sessions where to explain the main features, how to protect their account or what are the benefits of different banking instruments.

Abbreviations

BI	-	Business Intelligence
P2P	-	Person-to-Person
SOA	-	Service-Oriented Architecture

Authors' contributions

Keisha LaRaine Ingram chose the article's topic, methodology, formulated a strategic idea, analyzed existing technologies. Anastasija Ciubotaru reviewed the literature, presented the analysis, collected the data, evaluated the obtained results and formulated general conclusions. All authors read and approved the final manuscript.

Conflicts of interest

There are no conflicts to declare.

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Article

Modern learning, teaching, and assessment methods of education, based on Team academy method at Vilnius Business College

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Abstract. The need to integrate theory and practice, to connect them into the real entrepreneurial world is the most important aim of education. To equip students with the skills so that they would be able to solve problems and provide solutions. Within the framework of the 21st century learning paradigm, the mission of Vilnius Business College (VBC) is to offer students new approaches to learning experiences by employing active methods of student involvement into their learning processes. It is possible to achieve all this only through a student's active engagement into business reality, applying simulations, employing shared effort and active teamwork while searching for links among different phenomena of applied business. The main idea is how to facilitate the acquisition of hands-on experience in business organization and project management in the studies. *Team academy* methodology as educational innovation helps to implement entrepreneurial skills align personal and develop team experience in reflection to with market needs.

Keywords: team academy; coaching; team; entrepreneurship; action-based learning.

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Introduction

Within the framework of the “21st century learning paradigm”, the mission of Vilnius Business College (VBC) is to offer students new approaches to learning experiences by employing active methods of student involvement into their learning processes. In practice this means the following: the VBC takes the matters of quality of studies very seriously and provides opportunities to students to actively participate in collectively creating the content of professional education. This allows students to feel greater responsibility for the progress made in studies as well as for their success in business. All this is possible to achieve only through a student's active engagement while searching for links among different phenomena of reality, shared effort, and active teamwork.

Team academy (or *Tiimiakatemia*) is an international brand and a learning community of over 6000 users of the learning methods, and currently there are approximately 850 teampreneurs studying in different Team Academies in Finland, Spain, Hungary, United Kingdom, Netherlands, France, and Brazil [1]. *Tiimiakatemia Learning Network* was established in 2012 as a network for *Tiimiakatemia* coaches around the world. The internationalization has most cases simply started by visiting *Tiimiakatemia* in Jyväskylä, which was launched by Johannes Partanen in 1993 with a bulletin board message in Jyväskylä University of Applied Sciences: “Do you want to go on a trip around the world and learn some marketing on the side? Come to class 147 at 3 p.m. to hear more!” [1]

Team academy found its way to VBC in 2019 and it was first tried out in the study programme of *Business Management and Marketing*. The advantage of the *Team academy* methodology as an educational innovation is that it facilitates the acquisition of hands-on experience in business organization and project management; thus, the students' capability of adjusting their practical steps in business to the ever-changing reality becomes smoother and less painful. Besides, this methodology empowers students as they get ready to work in a team and evaluate their peers as well as their own role and input into the jointly produced product and, what is even more important, accept responsibility for the outcomes of their teamwork. This kind

of approach signals the cardinal change from student as a passive recipient of knowledge to an active agent in the processes of studies.

This work is devoted to: i) presenting management education in the context of learning in the team setting and principles; ii) applying new way of assessment and learning in the formal education; iii) showing the diversity of approaches that exist within the *Team academy* method.

1. *Team academy* – innovative learning

More modern approaches assume that entrepreneurship can only be achieved by trying, experimenting, and learning about one's own experience [1]. This is because according to newer approaches motivating students to become and / or think as entrepreneurs is key [2].

Action-based learning is based on real life experience [3, p.35]. The *Team academy* model is based on a fundamental belief that management is learnt by being in business. In contrast to many educational institutions' attempts to simulate workplaces to render the student experience more 'real', the *Team academy* turns the institution into a workplace where education is an integral output. To realize this, learners create and run real businesses. The fact that these are fully owned and controlled by the students themselves [4].

Methodology came to the VBC due to partnership links with our foreign colleagues, namely, in Finland. This is how they described their experience with this new methodology from the very beginning. The starting point of a small-size revolution in higher education began in 1993 with the invitation placed on the noticeboard: “Would you like to go on a round-the-world trip and learn some marketing on the way?” It happened at the Jyväskylä University of Applied Sciences (JAMK), in a small town in central Finland. The chief protagonist of the note was Johannes Partanen, a maverick marketing lecturer with a passion for making difference, who was driven by the need for a new learning model to better engage his students in the processes of university education. The model of education started then, and is still being used today, turned the traditional bachelor studies model on its head [5]. Without habitual

classrooms, neither strictly scheduled lectures nor exams the programme started with replacing classrooms by open offices, and lecturing teachers by mentors and team coaches. The students of the programme had to start with practical work from the very start: they were to create and take up managing real companies, which they afterwards supplemented by theory in their educational 'journey'.

The educational process itself entirely adopted the experiential learning model based upon David Kolb's theory of experiential learning [6, p.48] and thus combined the two separate worlds of business and education. The model, institutionally developed and adapted by Partanen, was based upon the tenet that 'experiences obtained through practice and experimentation nourish our thoughts and specify the issues we read about in books, resulting in more effective learning' [4]. This has become the basis for the creation of the *Team academy* methodology, a three-and-a-half-year bachelor programme of 210 ECTS. [7]

By operating as a tertiary degree, the central component of *Team academy* is the Teamcompany which is the most important learning tool. Students create their company in the second semester and spend the rest of their time in the university working to make the company a success. "Teampreneurship is a new international trend in growth entrepreneurship", - the founder of Tiimiakatemia, teaching councilor Joannes Partanen said [5].

2. The Method

The focus is placed on team learning and team coaching. Team – together everyone achieves more. The Team consists of 15-25 members with long term relationships (three years of studies) and is split into sub-groups that do projects (project groups). Each team has its own team coach who works with the team on long term basis. Coaching is needed mainly in team's training sessions. Generally, the teams could be titled as the vehicle for learning together [8]. It is a combination of doing (applying theory into practice) and acquiring knowledge (reading).

Team academy as a method is divided into three areas: 1) training – team learning; 2) reading learning by reading; submitting the written book reflection; 3) practice – learning by doing. It happens in project work – from social project to business case.

One of the most outstanding elements of the *Team academy* case is the rigour that underpins the education process, with detailed processes and methodologies supporting the learning pathways of Teampreneurs. Three mechanisms support the Teampreneurs along their "learning path": 1) training sessions; 2) reading; 3) projects.

Training sessions. They take place two times per week, 90 minutes per session. Mainly it is dialogue and open conversations. The topics are the issues important to the team: projects, planning, brainstorming, problems, etc. They can be pre-planned, or the session can be run with open-ended agenda. Team coach facilitates the session. Every session starts with check in (opening setting) and finishes with check out (feedback on session).

Reading. At *Team academy* an important part of personal development is conditioned by reading books. We value book reading as it is a well-known and proved competent habit for successful entrepreneurs.

Reading is a part of the leaning culture for an individual and team development. It helps to better express themselves, reflect and find solutions to their ideas. Reflection essays play an important role as they are done in writing and allows the student to express

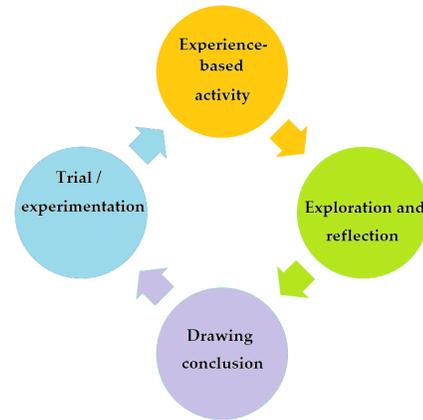


Fig. 1. Kolb's circle of experiential learning. Adapted according to Ref.[6, p.128].

oneself individually on paper. For example: "Who moved my Cheese" by Spencer Johnson [9]. A parable about two little people and two mice in a maze, searching for cheese, where each character represents a different attitude towards change, with cheese being what we consider success. Students read the book, come to the coaching session, and give his or her review and main ideas that others may apply. Next time reading a book he or she writes an essay, a personal reflection on the book – the insight, the learning, the practical side, and conclusions.

Projects. Projects are presented for two purposes: to create the learning environment (for studies and developing individual's competency) as well as to create the ways of making business (for team companies). Teampreneurs undertake work through their Teamcompanies by acquiring clients, negotiating project details, and signing contracts followed by executing the project themselves. The proceeds from their projects can be utilized by Teamcompanies in a manner they see fit from reinvesting the income to paying out salaries [10].

In projects, the Experiential Learning (expressed in terms of Cycle of Kolb [6], see Fig. 1) is applied through following factors: i) a concrete experience; ii) a reflective observation; iii) abstract conceptualization which is reflection that promotes a new idea, or a modification of an existing abstract concept; iv) active experimentation whereby the learner applies the new knowledge.

A 24-hrs challenge is all about solving a problem from a real client within 24 hours. It is a team effort in which you work for 24 hours on the challenge presented, come up with the best solution possible and present this to the client and the community.

3. Coaching

Coaching takes place in team training sessions, not lectures. It must be combined with doing (applying theory in practice) and acquiring knowledge (reading). Coaching is the art of facilitating the performance, learning and development of another (Downey's definition of Coach) [10].

Tiimiakatemia Global's definition of a Professional team coach is an expert professional who has the knowledge, skills, mindset, and experience to the development of individuals, teams, and communities. Coach is a training and learning development specialist who can build and guide teams both for working and learning purposes [11].

Table 1. Principal questions of learning contract according to Cuningagham [13] and *Motorola* [14] formulations..

Cuningagham formulations		<i>Motorola</i> formulations	
1.	Where have I been (History)?	1.	What went well?
2.	Where am I now (Present)?	2.	What didn't go so well?
3.	Where do I want to get to (Future)?	3.	What did I (or we) learn?
4.	How shall I get there (Methods)?	4.	What will I (or we) do better next time?
5.	How shall I know if I've arrived (Measures)?		

Therefore, lecturers at the VBC are called coaches as they hold the space, facilitate learning of a coaching session. Each session starts with check in (to set the ground for the session) and finishes with check out (to sum up the session to act, to reflect, to commit, to review, etc.) questions.

Key areas of input propelling the *Team academy* methodology [12] include team coaches and spirit.

Team coaches. The team coaches perform the role of mentors who support student teams and individuals through their educational pathway as well as their practical stages of concept development. Their salary is paid by the College. The coaches have entrepreneurship and business experience.

The Spirit. The *Team academy* spirit is a much-valued commodity and involves special characteristics built during the time spent on the *Team academy* programme. Some of the key characteristics are presented as follows: a strong sense of community, appreciation of learning by doing and a firm trust in the value of the process itself during chaos. One could say that the spirit of *Team academy* is a value 'code' for 'teampreneurs'. It is also a description of a positive, excited, and youthful atmosphere prevailing among the team members.

4. Learning contract and agreements

Learning contract is committing, personal learning plan [12]. By using it the learner explores his/her learning path from the perspectives of past, current moment and future. These explorations are crafted into an action plan with goals and means to get to them. The principal questions of a learning contract are presented in Table 1. Two formulations are possible: Cuningagham formulation [13, p.345] as well as *Motorola* formulation [14].

The studies at the VBC are conducted on the co-operative basis between the student and coach. The coach will provide with guidance on the subject studied (the content, structure of the course, and feedback on progress made).

Agreements are the shared ground rules and comes as the team contract. Students agree on the important things together such as: responsibilities, leadership, working hours, assistance, resolving conflicts, breaking the rules, reward. [15, p.64-65]

Knowing yourself is the basis of management and feedback process helps to make improvement and grow. In *Team academy* it has been called as *Motorola* principle [14] which consists of four questions reflected after major project, case or task accomplished - see Table 1.

USA company *Motorola* used these questions in its project reports. *Motorola*-style feedback is used daily at *Team academy* process. The questions are simple and work in all kinds of situations: in the end of a training session, in the end of a project, in the end of the academic year, etc.

Strategic session. One of the specialties of this study programme is that newly joined students gather for the strategic session outside the campus at the beginning of every month of a semester. The content is provided by the coaches and second year students. Logistics,

venue, and organizational matters are delegated to manage to the first-year students. In this way they start to access the team development stages, learn to communicate, plan, execute and manage the event. During the session they start to reflect on their skillset, get to know each other and establish the bond.

Team roles and profiles. A simple questionnaire is used to define each individual team role and working preference. Every *Team academy*'s student test him/herself by using Belbin's team role test [15, p.43].

5. Realization of *Team academy* at VBC

Open Office Space. It is a 100 m² open space on the VBC premises in Vilnius. Facilities and equipment include the provision of internal furniture and educational equipment as well as other materials that are made available by the VBC.

Student teams. Suitable size for the coach to hold a coaching space and learning is for minimal of 20 students. Students form teams of 4-6 persons to establish a legal entity, called *Small partnership* (lith. *Mažoji bendrija*, MB). They meet each other regularly and coaching sessions are held twice per week with duration of 90 minutes.

Ideas for team activity. Strategic session at the beginning of a first year, goals setting, learning contract formulation, social project initiatives, innovation or other thematic day, book discussions, 24 hours challenge, marketing projects, reviews on ongoing key activities, presentation and pitches, mentoring of others, presenting self outside the campus, assessment on company progress, evaluation of the personal, team and company development, company visits, quest lectures and hands on experience, shadowing, fundraising campaigns.

Implementation and realization of ideas. A coach keeps track on student progress during the coaching session. The deliverable and goals are presented at the beginning of each semester. Goals are targeted to develop competences not limited to: a) ability to act as a team member in learning; b) team leadership skills; c) team entrepreneurial spirit. Assessment is held and based: number of books the student has read, team activities and roles taken, money earned per team. Every semester has different amount to be earned starting from €500 per team and number of clients served.

Issues for team and for coaches. Setting the rules for teams lies under students' belt, therefore, to keep commitments for their agreements requires constant review. Facing time management and priorities challenges need to be addressed and learnt most of the times. Motivation being a key for continuous development is crucial. Therefore, attendance to each coaching session is mandatory, it helps to track progress, facilitate learning dialogues, brainstorm ideas, find solutions when everyone is on the same page. A coach shall be flexible, adaptable, problem and conflict facilitator. It requires open and bold approach towards students' behaviour and attitudes. Coaches are here to develop students team spirit entrepreneurial mindset.

6. Assessment

There is a further assessment done on the individual basis which has the teampreneurs reflect on their own learning journey and their own personal mastery achieved. This process takes place between the teampreneur (student) and the team coach every six months and is exercised through the following tools: reflection on the Learning contract, the Learning log, the Reading literature programme and ‘the ‘Skill Profile’ [16]

Every semester 360-degree evaluation is performed due to the assessments of the student, the coach, and the peers. European Qualifications Framework (EQF) [17] sets certain learning outcomes to all bachelor’s programs in the European Union, including “advanced knowledge” and “demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study” [16]. It also includes competence-based learning outcomes, such as “taking responsibility for decision-making” and “managing complex technical or professional activities” [16]. And the curriculum with *Team academy* method, despite being competence-based, encompasses all that and more.

7. Future potential

The success of the programme helps to ensure its sustainability. This is evidenced by high employment rates of students who study via the *Team academy* methodology, by high rates of teampreneurs who go onto starting their own companies, and by high international recognition and expansion of the *Team academy* programme.

The rapid change in the global job landscape means that the con-

cept of work is also changing to a similar degree. As noted by the *Team academy* management staff, increasingly, workers require the ability to navigate their own employment path necessitating the development of entrepreneurial thinking and acting.

Conclusions

Conclusion that is reminded to *Team academy* student: “You don’t take action; action takes you” – The Silent Coach. [18] Therefore, “if you really want to see the future of management education, you should see *Team academy*”, Peter Senge said [19].

To sum up, the objective of the present was how to facilitate the acquisition of hands-on experience in business organization and project management in the studies using *Team academy* method.

First, management education in the context of learning in the team setting and principles is possible and needed for the formal education. Second, competence based learning and hands-on experience using specific tools such as check in, check out principles, *Motorola* techniques, entrepreneurial, problem-solving thinking, lead to guide towards real business company approach. Third, assessment is based on the results including reviews from self, peers (team goal) and coaches helps to be included in the process, to share accountability and foster engagement.

Abbreviations

VBC	-	Vilnius Business College
EQF	-	European Qualifications Framework
JAMK	-	Jyväskylä University of Applied Sciences

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