Working paper

**Digital convergence or divergence**

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# Abstract

This paper is focused on literature review related to relevant indicators for assessing digital convergence and divergence of national economies in Europe, Literature collection and review; Collection and exploitation of existing data collection for measuring economic growth, digital development like DESI- The Digital Economy and Society Index, Employment rate, GDP per capita, Global Innovation Index

Introduction

The integration of digital technologies into economic systems has sparked a dual narrative of convergence and divergence among global economies. On one hand, digital convergence is evident as technology enables greater connectivity, knowledge sharing, and access to global markets. Economies that effectively leverage digital tools can bridge gaps in productivity, innovation, and global competitiveness, fostering an inclusive growth trajectory. For instance, digital platforms allow small and medium enterprises (SMEs) in developing countries to participate in international trade, leveling the playing field with larger, more established players. On the other hand, digital divergence arises from unequal access to digital infrastructure, skills, and resources. Advanced economies with robust technological ecosystems continue to outpace less developed nations, exacerbating economic disparities. Factors such as limited internet penetration, digital literacy, and insufficient policy frameworks in many regions impede equitable participation in the digital economy. Therefore, while digital technologies have the potential to unify global markets, their uneven adoption risks widening the divide between technologically advanced and lagging economies, necessitating coordinated efforts to promote inclusive digital transformation.

1. Literature review

## Middle-Income Trap

The findings presented in study (Timothy Yaw Acheampong, 2020) are consistent with the positive correlation between MIT, higher incomes, higher socio-economic development, and higher percentage of people with access to the internet as well as higher technological progress. Furthermore, this study highlighted the necessity for benefiting from the 4th industrial revolution only in case of higher technological progress, while the various “digital divides” are major concerns that needs to be addressed by policy makers to overcome differences between different economical categories, age categories etc.

The issue of the 4th industrial revolution is also addressed by (Linda Glawea, Helmut Wagner, 2020) from the aspect of middle-income trap (MIT) concept and its relation to modern technological concept (like artificial intelligence, automation, etc.). Due to its attractiveness, and expected contribution to future technological advancements, the authors called this automation-augmented concept as “MIT 2.0”. Presented study showed potential higher persistence of the trap which is identified after the initial growth of developing countries, which consequently results with rising wages and higher requirements for human capital.

As fundamentally different research on MIT, study presented in (Palma, Pincus, 2022) was focused on analysing problems of economic growth in middle-income countries. The problem of slow productivity growth is recommended to be overcome by strengthening competitiveness in sectors that are technologically sophisticated, which is necessary to encourage with development strategies, the liberalization of investments as well as the focused human development. Furthermore, study in (Dóra Győrffy, 2022) also analysed the MIT for period between two major crises—the 2009–2013 financial crisis and the COVID-19 pandemic. The increasing productivity is also identified as a key element that should support growth in order to avoid attracting additional labour and capital to the region, which further contrasts greatly with the new technological revolution and may cause new trap. The paper also underlined the significance of institutions, especially the rule of law in making the transition from cost-based to quality-based growth.

Finally, research in (Magdolna Csath, 2022) also examined the indicators relevant for measuring the development path and growth model of countries and further to a understand the factors for avoiding the middle-income trap. Author highlights the necessity for considering the whole system and understand imbalances, which might be rooted in the level of knowledge and health (further inked to the level of competitiveness and innovation-based values), the capacity of the economic structure to create and use knowledge, the level of productivity and efficiency, etc. Those factors are also considered as crucial for the society’s resilience and adaptability to crisis, as key lessons learnt after recent crises.

## Digitalization and convergence

The study in (Andreia et al., 2023) showed the digitization convergence within countries with a higher level of economic development, in terms of higher tendency to digitalise faster, due to the higher number of large firms as well as shown impact of economic factors for resolving disparities, as opposed to that of educational development.

On the other side, authors in (Kuzior et al., 2022) analysed the convergence factors illustrating the digitization of countries, taking into account the number of Internet users, digital skills of citizens, digital infrastructure availability, accessibility as well as technical and other barriers for digital development. However, as a key results of presented study, the integral model for determination of digitization trend was created, based on the following group of socio-economic factors: the national cybersecurity level, ease of doing business, and the anti-money laundering index on the country’s digital development level. The model can be used as a starting point for understanding the difference between economic transformation and digital convergence as well as risks factors for negative impacts of digitization, like legalizing criminal income and many others.

Authors in (Samsami, 2022) analysed different trend in digitization if compared period between and during COVID-19 pandemic. Before the pandemic, the capital was a key driver for digitization, significantly dominant to any other even education, business opportunities, and cultural values. On the other side, the pandemic pushed all others, those even being far away of at low stage of digitization, to foster development of digital solutions, but however larger digital divide between high- and low- income countries is expected in near future. The authors also identified new phenomena of ‘born digital’ referring to new companies established during the pandemic are fully digitized and mainly create fully digitized business opportunities.

## Digitalization and welfare

Study presented in (Dienlin, 2020) was focused on presentation of effects of digital technology use on adolescent well-being. The results clearly show that the effects (either positive or negative) are linked to the nature of technology use and only by moderate usage, the positive well-being effects are achieved. However, researchers agree that the effects of adolescents and adults are comparable, while there is still a lack of empirical findings on the effects of digital technologies on the state of well-being, whether it has fostering or threatening effects.

More specifically, the recent study in (Canale et al., 2021) examined the effects of digital technologies usage for individual and social wellbeing during the COVID-19 pandemic, and showed that digital technologies (especially e-support services and online emotions) can be identified as critical resources for assisting individuals to overcome difficulties (like posttraumatic growth, positive mental health) raised during the pandemic.

## Labour market and digitalization

The macroeconomic and microeconomic effects of rapid increase of IT businesses are also analysed in (Lacova et al., 2022) with special focus on digital exclusion and low level of digital literacy and resilience. The findings show that recent rapid exploitation of digital technologies (especially during COVID-19 pandemic) made significant impact on the labour market, by changing working environments and enterprises, imposing additional efforts of managers to ensure employees well-being, while at the same time declining the digital competences of highly skilled individuals. However, during the pandemic the use of digital technologies by Internet non-users was catalysed, with simultaneous increase of unemployment rate as the negative negative aspect of labour market evolution.

On the other side, in (Didier, 2022) the 4th industrial revolution is considered as „knowledge-to-digital economy transition“, further implying several issues, such like: the stocks of developed human capital and changes configuration of the labour market, educational mismatch, labour market polarisation, etc.

Technologies are changing the way of working and the labour market by itself on the fundamental way, and one of critical societal challenges can be found in growing (digital) skill gap, as reported in (Stephany, 2022). Being fully in line with recent European Commission’s 2022 Data Act, the reuse of online user-generated data for the purpose of monitoring and understanding of skills requirements and training implications is proposed. It is foreseen to be used mainly by reskilling institutions, creation of official occupational and skill taxonomies, while additional efforts should be done for ensuring the highest level of privacy protection and cyber security of collected dana.

## Digitalisation and COVID-19

The global pandemic was clearly identified as the accelerator of modern technologies exploitation which was significantly which was previously lagging behind and with slower dynamics (Andreia et al., 2023). Even the COVID-19 made radical changes in labour markets and societies, researchers identified fiscal uncertainty and lack of transparency as key persisting factors affecting the business environment.

Authors in (Kryshtanovych et al, 2022) examined on changes of the labour market caused by digitization of the economies, as especially fostered during COVID-19. The following findings are elaborated, naming just the most dominant: new social and labour structures, increased level of competition, innovative forms of employment, changed hiring practices, higher educational requirements, as well as liberalized labour laws in several countries. However, firms are those with the most important lessons learnt during the pandemic related to integration of innovations as a key market advantage as well as urgent transformation of business models.

The aspects of COVID-19 lessons for firms are also analysed in (Lixu Li, et al., 2022). Even the prior literature identified the following triangle of relations between digitalization capabilities, agility, and firm performance, the pandemic positioned digitally enhanced agility as a key prerequisite for increased competitive advantage benefiting from the COVID-19 uncertainty of market demands.

Finally, the most recent study published in (Maximilian Klöckner et al., 2023) analysed digitisation responses of firms as one of positively reported COVID-19 crisis response type. The authors reported that firms were motivated to leverage visibility by fostering digitization as a key mean to position themselves in the business community. Additionally, inter-institutional competitiveness is more attracted by usage of blockchain technologies, which can be also considered as one of technological advancements quickly widened during the pandemic, but with the aim to increase cyber security of digitally shared data.

# Measurement and methods

## DESI - The Digital Economy and Society Index

We reduce 7 years’ (2016-2022) DESI data into a single variable. In order to reduce the number of variables and to explore the latent factors in the background, one factor was created based on the 7 variables by principal component analysis. The value of the Kaiser - Meyer - Olkin criterion is excellent (0.877), the result of the Bartlett test is significant (p <0.001). The single factor explains 98.61% of the variance, which is a high ratio, also taking into account that the procedure significantly reduced the number of variables.

## Employment rate

We used Employment Rate data of 7 years (from 2016 to 2022). In order to reduce the number of variables and to explore the influencing factors in the background, one factor was created based on the 7 variables by principal component analysis. The value of the Kaiser - Meyer - Olkin criterion is excellent (0.870), the result of the Bartlett test is significant (p <0.001). The developed factor explains 96.40% of the variance.

## GDP per capita, social welfare

In our analysis, we examined the GDP data per capita of the last 7 years (from 2016 to 2022). In order to reduce the number of variables and to explore the influencing factors behind, one factor was created based on the 7 variables by principal component analysis. The value of the Kaiser - Meyer - Olkin criterion is excellent (0.868), the result of the Bartlett test is significant (p <0.001). The developed factor explains 99.03% of the variance, which is an excellent ratio.

## Quality of Life (QoL)

In our analysis, we examined the social welfare indicator (QoL) of the last 7 years (from 2016 to 2022). In order to reduce the number of variables and to explore the influencing factors in the background, one factor was created based on the 7 variables by principal component analysis. The value of the Kaiser - Meyer - Olkin criterion is excellent (0.898), the result of the Bartlett test is significant (p <0.001). The developed factor explains 90.870% of the variance, which, taking into account that the procedure significantly reduced the number of variables, is an excellent ratio.

## Human Development

We examined the social welfare indicator of the last 6 years (from 2016 to 2021). In order to reduce the number of variables and to explore other influencing factors related to the variable, one factor was created based on the 6 variables by principal component analysis. The value of the Kaiser - Meyer - Olkin criterion is excellent (0.899), the result of the Bartlett test is significant (p <0.001). The developed factor explains % of the variance.

# Research result

Table 1. The correlation table of the observed variables

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | Digital development | Quality of life | Employment rate | Human development | GDP per capita |
| Digital development | Pearson-correlation | 1 | ,849\*\* | ,248 | ,784\*\* | ,558\*\* |
| Significance |  | ,000 | ,212 | ,000 | ,002 |
| Number of observed variables | 27 | 20 | 27 | 27 | 27 |
| Quality of life | Pearson-correlation | ,849\*\* | 1 | ,244 | ,734\*\* | ,537\*\* |
| Significance | ,000 |  | ,299 | ,000 | ,015 |
| Number of observed variables | 20 | 20 | 20 | 20 | 20 |
| Employment rate | Pearson-correlation | ,248 | ,244 | 1 | ,186 | ,141 |
| Significance | ,212 | ,299 |  | ,354 | ,484 |
| Number of observed variables | 27 | 20 | 27 | 27 | 27 |
| Human development | Pearson-correlation | ,784\*\* | ,734\*\* | ,186 | 1 | ,664\*\* |
| Significance | ,000 | ,000 | ,354 |  | ,000 |
| Number of observed variables | 27 | 20 | 27 | 27 | 27 |
| GDP per capita | Pearson-correlation | ,558\*\* | ,537\* | ,141 | ,664\*\* | 1 |
| Significance | ,002 | ,015 | ,484 | ,000 |  |
| Number of observed variables | 27 | 20 | 27 | 27 | 27 |
| \*\*. Correlation is significant at a 0.01 level. | | | | | | |