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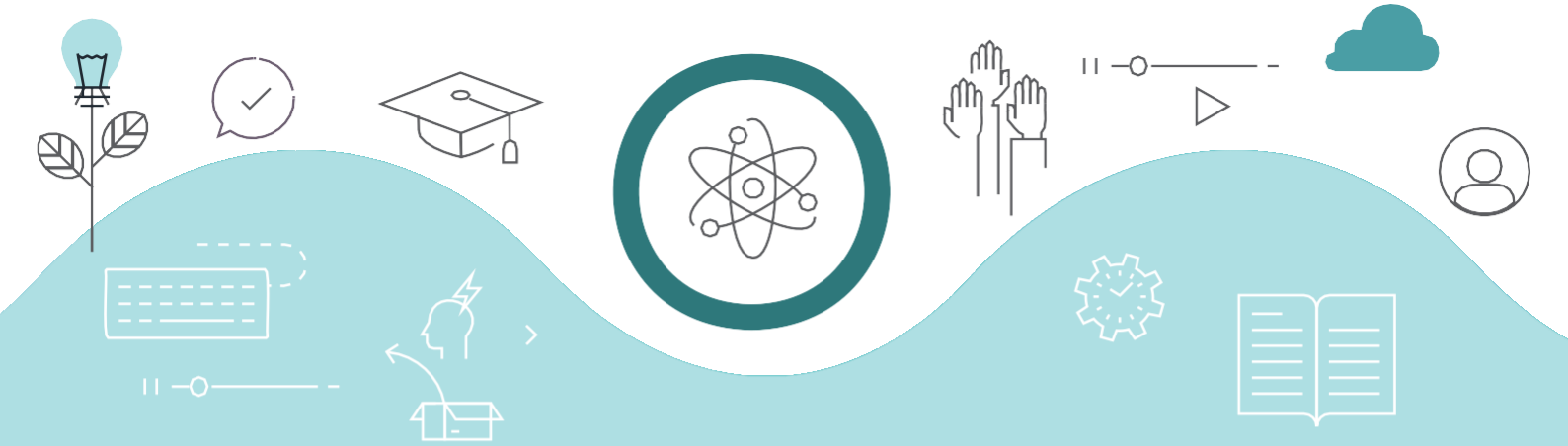
FORESIGHT IN RESEARCH

Case Studies on Future Issues and Methods

Budapest Business University Research Day 2023
Session Proceedings

Edited by
Tamás Gáspár



Foresight in Research –
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Edited by:
Tamás Gáspár

Copy editors:
Tamás Gáspár
David Parker

Layout editor:
László Csonka

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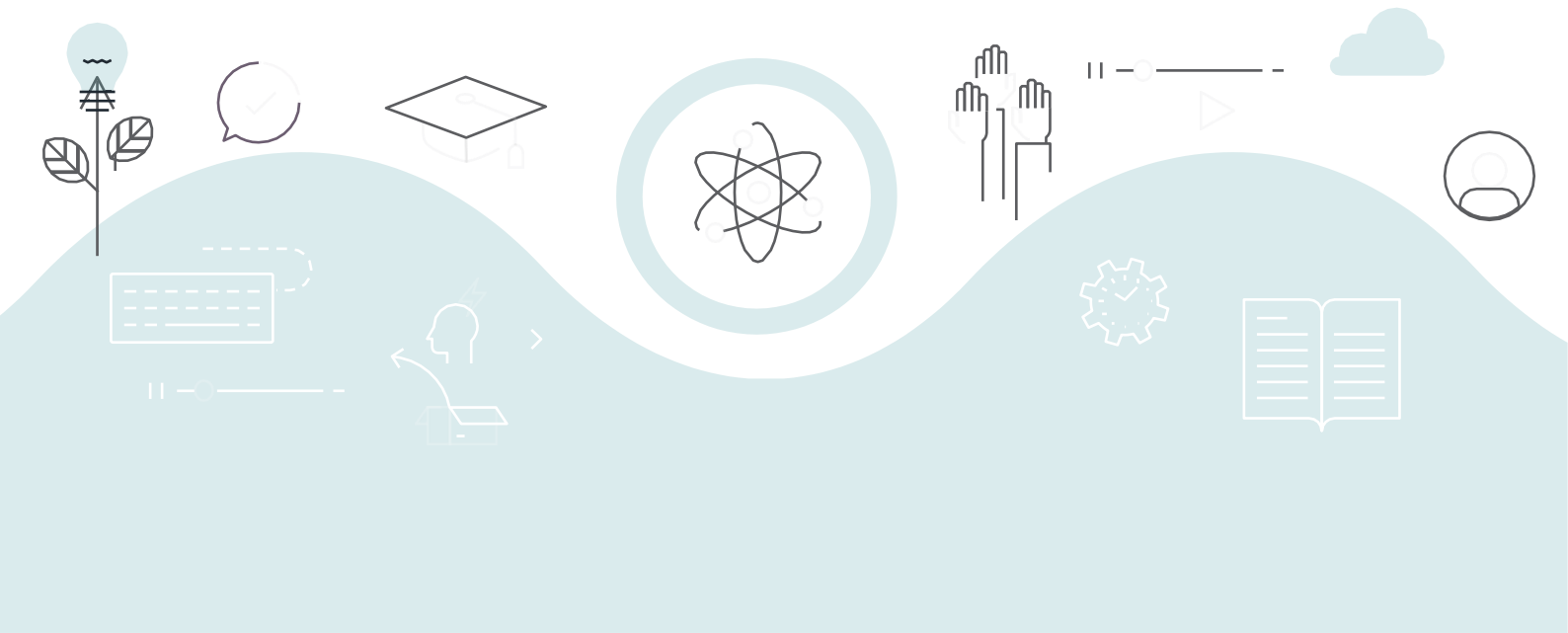

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Literacy for the future! – Lessons from foresight case studies

Tamás Gáspár[1]

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Abstract
Doing foresight is not common sense; neglecting foresight is a loss of a part of reality. Being future literate, using futures consciously for specific purposes is an emerging necessity for people, mainly in business practice and education. This paper shows that the skill to use futures is available and can be developed. Ten case studies on different adaptations of strategic foresight are compared in terms of their topics, use of the future and the methods and techniques to be adapted. The case studies – most of them PhD student research – are apprentice exercises to develop, learn, and experience using futures. The results show that the use of closed and semi-closed Anticipation for the Future (preparing and planning) are still dominant, while the methods and tools get new understandings and very creative combinations to use.
Keywords: futures literacy, strategic foresight, case studies
JEL: A12, A29, O22

INTRODUCTION

Foresight is a mature discipline of social sciences; however, only a little of its capacity has been harnessed until recently. The Future has always been a part of political, social, economic and technological development, either as the embedding environment in which organisations have to adapt to, or as the expecting reality that the trends articulate, or as a plan to be executed. By now this palette has been extended to discovering optional futures in terms of scenarios, identifying wild card events that may threaten changes, or more recently to understand and develop skills of anticipation. Companies, governmental organisations and civil initiations express high interest in foresight perspectives and methods, there is also an increasing number of practitioners and consultants who provide foresight.

The Budapest Business University (BBU) launched a Strategic foresight course in the Doctoral School and is preparing for a management master's programme to be articulated in the near future. The PhD students got deeply involved in futures studies and expressed their enthusiasm to gain a new perspective of research. On the basis of some conceptual and methodological foundations, they had to adapt the futures framework, and students in small groups worked on case studies. An international conference at the university in May 2023 offered the opportunity to present these research results and discuss the messages students had learned from the work.

In addition, it was a good opportunity to open the call to other colleagues at the

[1] Associate Professor, Budapest Business University. Email: gaspar.tamas@uni-bge.hu
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university to add a foresight perspective to their research projects and present their insights. In the framework of the Centre of Excellence for Future Value Chains at BBU we organised a session to detect foresight in research as well as edited conference proceedings to collect and present the results.

This book contains ten different papers, of which seven were written by doctoral students and three by colleagues of different faculties and departments. On the one hand, these are apprentice exercises to use the future and to adapt techniques properly. On the other hand, while doing futures case studies, it raises the awareness of what future to use and how to use it under different circumstances. This latter develops skills and capacities to enhance the potential of future work. Hence we provide some lessons for adapting foresight in academic research.

The aim of this introductory paper is to provide an insight into the rationale of futures studies and to summarise the main experiences of the futures work: to what extent do they show similarities and differences in terms of topics, research questions and methods? What is the way they use the future and what results these approaches produce?

WHY FUTURES LITERACY AND FORESIGHT?

Future consciousness and future orientation are immanent and specific features of the human species. Thomas Lombardo dedicated a thick book to discover the nature and historical development of the human capacity to think about the future (Lombardo, 2008). Loveridge (2009) also gives examples of how foresight has been used in the main cultural eras of our history and concludes that "foresight is not new, only newly rediscovered after one of its periodic sojourns in the intellectual and political wilderness" (ibid, p.8.).

This rediscovery started with the social, economic and political crises of the post-war world in the 1970s, and searched for the risks and consequences of the bipolar-welfare world system as well as for alternative futures that may emerge from the transition starting. The technological and scientific advances, the first computers gave a strong impetus to futures work in terms of world modelling. The Limits to growth, book of the Club of Rome (Meadows, 1972), is a famous example of the rebirth of futures studies. The greater than human and increasing capacity of calculations and feed-back analyses enabled and encouraged scientists to have a better insight into systemic thinking and to detect the potential paths of the complex world.

However, in recent decades we are facing the crisis and the transition of the global world, which depicts the present as a volatile, uncertain, complex and ambiguous world (Johansen-Euchner, 2013; Sombala, 2019). The deconstruction of former social narratives and values and the emergence of the post-modern world, arm-in-arm with the new technological revolution have created a living environment of uncertainty and ambiguity in networks with the speeding up feed-back mechanisms. Hence technological, economic and social networks pass into highly complex systems that perform inconstant futures. In this world one anchor is the ability to navigate in the blows of change by possessing futures consciousness, foresight framework and techniques.

Being aware of what future we use and how we use it in thinking and decision making is what we call: futures literacy (Miller, 2019). Unconsciously, we regularly use futures in planning or expectations, but the navigating power derives from the conscious distinction among aims, types and methods of futures, while knowing the way how the proper aims, types and methods fit each other. *Ipsa scientia potestas est* (knowledge itself is power) – wrote Bacon in his *Meditationes Sacrae* (1597), which today can be interpreted as 'knowledge of the future is power'. Many, for long time try to bridle the future: either to forecast or to plan it. However, epistemologically there is no knowledge of the future; the power is in the navigation by the different uses of the future for present decision making. The VUCA characteristics of our times abreast release the past boundaries of time, open the plausible scope of the future and enable

people to shape their own lives by purposive activities and continuous reflections. Both the ability of permanent adaptation and shaping the future are evolutionary advantages in our global world.

All of the above-mentioned activities we call foresight, the application of future intelligence; no wonder that Loveridge (2009) refers to it as 'the art and science of anticipating the future'. Rohrbeck and and Kum (2018) also highlight that in the corporate field the foresight activities are expected to help companies unbind path dependency, develop a wider and more intensive approach to management as well as enhance company performance.

Bishop and Hines (2012) have created a framework for foresight activity by collecting the experiences of many institutions and companies. These are framing, scanning, forecasting baseline and alternative futures as well as visioning, planning, and acting as parts of the strategic approach. The process detects ongoing trends and emerging issues, reveals the scope of futures in order to have a wider and more intensive sense of the present for decision making and action (Miles and Keenan cited by Saritas et al., 2022). This is the framework that gives the foundation for most of the papers.

OVERVIEW OF THE CASE STUDIES

This volume contains ten very different kinds of paper both in terms of topic and futures use. The structure of the volume follows the time frame the papers adapted: it runs from the distant future to the emerging issues of the present. The following section gives insight into the papers as follows.

Körtvési and Szendrei-Pál (2023) discuss the futures of higher education institutions. Recent social and economic crises, among them the Covid-19 pandemic, opened a new era by challenging the standard education system. The paper traces what transformation to quality education may emerge in the changing world. The authors identified drivers by horizon scanning, define baseline future and consequences by futures wheel, articulate scenarios, and apply PESTEL to test risks and opportunities. Finally, they present the Hybrid mode as preferred future and its implications. This type of education ensures the development of both social and digital competencies, creates effective knowledge transfer and e-learning materials that are easy to update, while the value of a degree does not depreciate.

Scenarios for sustainable mobility in Budapest also face 2030 in the paper of Ács, Ekrami and Mammadova (2023). The changing lifestyle of new generations, the faster way of life and the technological changes demand new infrastructure and urban travel networks. The paper makes a critical foresight view of the Budapest Mobility Plan 2030. The research is based on impact-uncertainty analysis and focus group discussions. Four possible scenarios are created by socio-economic conditions and political support: Green Transformation, Power of the Market, Green PR and Unsustainable city. The authors conclude that scenarios provide insight for policymakers and stakeholders in order to make powerful decisions, develop strategies and to prioritise sustainable transportation for Budapest.

Virtual reality (VR) is the topic to discuss from a foresight point of view in the paper of Shi, Tian and Wu (2023). What they search for is what factors influence the successful adoption of VR technology in tourism marketing and what optional future implications of VR utilisation may emerge in tourism marketing for Chinese tourists. Virtual reality is an emerging technology that leads to a new interpretation of reality and the environment embedding strategic decisions. Tourism in China is one major area where the adaptation of the new technology may have an outstanding influence. The research is based on a wide range of methods, including quantitative and qualitative techniques, which result in tendency forecasts and optional scenarios. The authors find that virtual reality in marketing can increase brand recognition, foster innovation and enhance immersion.

Artificial intelligence (AI) and ChatGPT is a hot topic that challenges many social institutions and activities. Balla, Csiba and Simon (2023), as PhD students were mainly interested in the impact of AI on academic work. AI is rapidly changing, and societies have no experience yet of how to live together with intelligent technologies, how it changes the information, learning and decision-making processes. The aim of their research is partly to unfold plausible scenarios on the impact of ChatGPT in the academic field, and partly to identify the wild cards in the scope of the AI future. In terms of the scenarios, the authors link the possible-plausible options with opportunities and threats, and clearly distinguish positive and negative futures within the scenarios. These findings serve the easier navigation in the emerging future of artificial intelligence by making the most of the benefits, while mitigating the risks.

Chen, Cai, Fu and Wei (2023) also chose modern technology for the foresight work in terms of new energy vehicles in China. Renewable energy and electric cars are ongoing discourses and have a wide range of literature as new trends in energy transformation. The paper is based on quantitative data to discover the Chinese market for new energy vehicles, and hence give a comprehensive view on the past and present. In terms of the futures the authors use the past experience to forecast the tendencies of the market, which they find very promising, and to be in line with China's 14th five year plan in terms of economic transformation. However, to be able to navigate in this emerging field, they also detect risks and wild card futures as well as articulate policy suggestions in terms of taxation, production support and infrastructure development. They consider the main contribution of the paper that it gives a competitive evaluation of new energy vehicles and forecasts the comprehensive competitiveness of the market for new energy vehicles based on the current situation.

ChatGPT is so challenging that Forman, Papashvili, Szántó and Tóth (2023) also chose to discuss its future in higher education, more specifically on bachelor programmes. One of the main areas of ChatGPT is to revolutionise teaching and learning processes as well as methodologies. The authors have traced the experience and perspectives of teachers by interviews to detect what potential impact of ChatGPT may have on higher education. These results were combined with media outlet analysis and Z-number cognitive mapping. The authors find that ChatGPT has the potential to significantly impact higher education in the coming years; however, it is multifaceted. It may enhance personalisation, improve engagement, increase efficiency; it could revolutionise course delivery, student assessment, and learning outcomes, while raises ethical concerns and pedagogical challenges when AI is integrated in the classroom. As a conclusion they state that AI researchers, educators and policymakers need to collaborate closely to make the most of the potential of ChatGPT.

Sustainable mobility in Budapest is also a returning topic for research. However, while Ács et al. (2023) seek for optional future scenarios, Tran, Sithole and Amakwah (2023) take the perspective of students in terms of the baseline future. The embedding environment is similar, it highlights Industry 4.0, new urbanisation, high density of the population and environmental concerns. The future of transportation has a crucial role owing to its controversial impacts on society and the environment. The authors also take the vision for 2030 as an orientation point, but critically discuss if the ongoing transition meets the preferred future. They do so by using impact-certainty analysis from a PESTEL framework, focus group discussions and futures wheel. They find that the accessibility of public transport increases mainly by underground infrastructure, while road congestion is worsening. Governmental policy supports low-to-zero emission vehicles and provides them by extended fuel stations.

The last three papers of the research focus on the transformation of the present. Fekete and Divéki (2023) detect how quality courses can be redesigned for the future by the characteristics and needs of Generation Z. The background of the research is again the technological change that determines the capabilities, habits, behaviour and social relations of young people. The basis of the analysis is the expectations of 21st century skills, and the authors

seek to understand how redesigned courses can contribute to the possession and development of these skills. They made an experiment with Gen Z students in study skills courses. Surveys, student reflections and interviews provided data to evaluate the ongoing structures and to prepare a dynamic and interactive syllabus. The results support that students are partners in and they are satisfied with redesigning courses, and the action research they participated in has contributed to skills development.

Ábel, Hegedűs, Nagy and Tóth (2023) search for new understandings of and futures reasons for inflation. They claim that recent economic theories and policies are not capable to explain completely the present changes of prices. In that perspective discussing the future also means finding new contents for well-known concepts. The research takes new approaches in inflation research, and finds increasing profit margins of companies as an influential factor that emerges from the restructuring of the world economy in transition. The behaviour of the participants of global value chains seems to be more sensitive to reply to market shocks with changing the prices rather than attacking market shares. The conclusions are supported by a wide range of company data analyses.

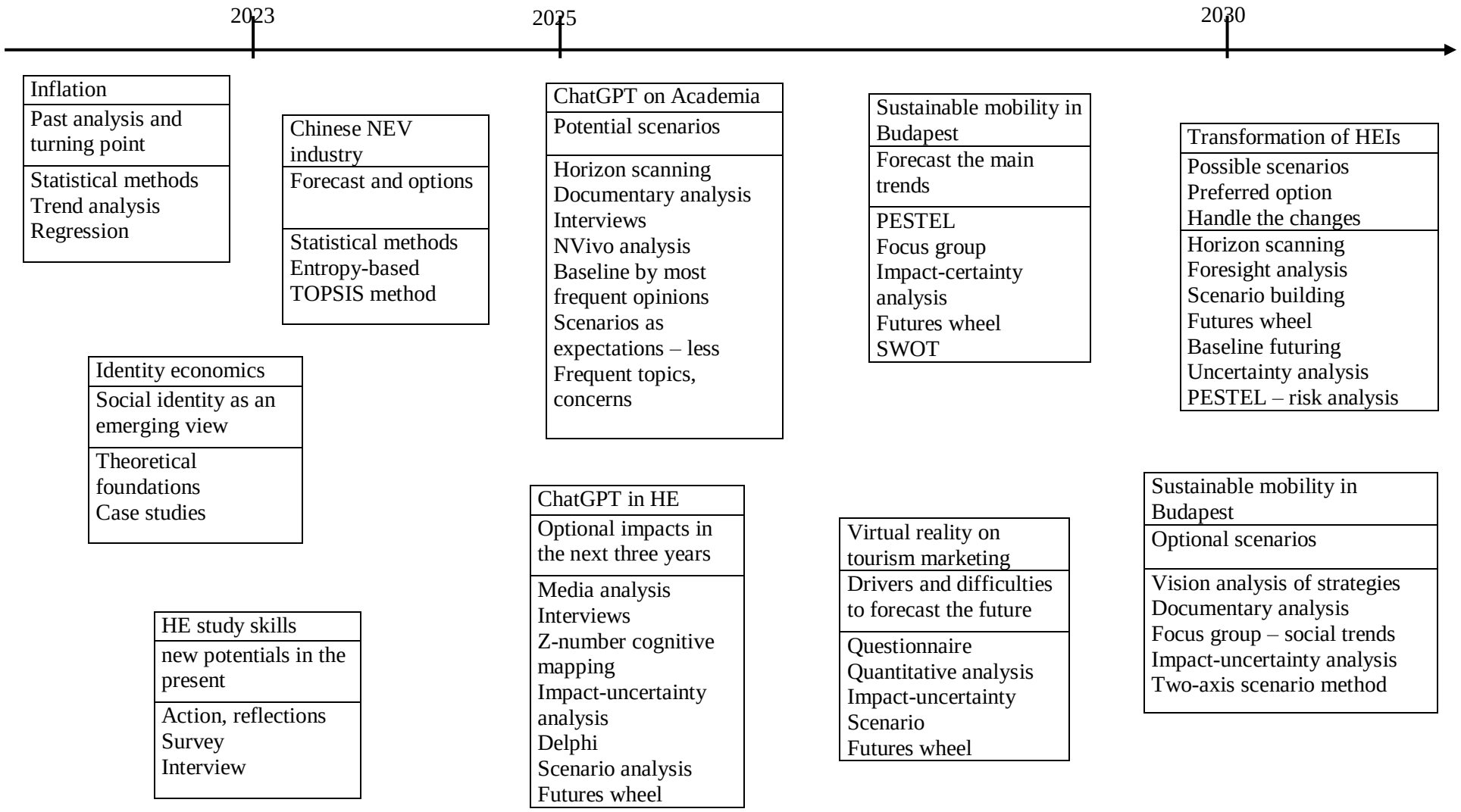
The paper of Tóth and Rados (2023) returns to the starting problem of the collection and hence completes the framework of the case studies on futures. While the transformation of higher education discusses how the technological infrastructure and human need can meet, this paper challenges the rational-individual decision making. Future thinking does not calculate all possible and accessible information but rather follows motivations and attitudes that are socially determined. Identity economics, as an emerging branch of behavioural economics, takes social identity to be the foundation of expectations and decision making. Using a wide range of literature the authors give a comprehensive view of identity, which is a part of the individual's utility function, the basis of conflicts, the basis of morality, appears as relationship, and which is embedded in the social individual. The paper collects case studies as empirical evidence for social identity and conclude that the present lack of unified theory and methodology offers a "future opportunity to achieve the often-coveted goal of unifying social scientific approaches to economic transactions by recognizing their embedded nature into social interactions, and the individual's and social groups' emotional and deterministic look of the future as factors".

USE OF THE FUTURES – WHATS AND HOWS

Figure 1 summarises all papers of this volume along a timeline by the topic they chose, what future and how they used it, and the technique the authors adapted. This structuring provides an insight into the different usage of the futures that the case studies present.

All chosen topics are hot issues in the present world, both in terms of the subject and the technology linked to it. China is an emerging power of the world, where not only the leadership but also the perspective of development is challenged. The operation of the economy, price stability is raised to question with tourism and marketing as core areas of present economic growth. Higher education and academic research have a crucial role in the transformation of social-economic systems. These issues are linked with the most challenging human and technological potentials: ChatGPT, virtual reality, electric vehicles on the one side, and 21st century soft skills, social identity and sustainability on the other side.

1. Figure Topics, the use of future and methods of the papers in terms of time horizon



Source: Compiled by the author

The time horizon is not too wide. The figure shows that most of the case studies are grouped around 2025, with some prospects to 2030. One reason is definitely the chosen topic: the authors clearly state that in terms of artificial intelligence it is unreliable to articulate any statement for more than just a few years. Another reason is the aim: in terms of inflation or identity economics the papers make a past evaluation and seek for emerging issues of the present, which otherwise may become influential or dominant for the long run future. In addition, our learned automatisms in terms of the use of the future, prefer controlling the future either by foreseeing or by handling it.

A group of the case studies focus on detecting the present in terms of turning points, emerging view or new potentials. Another group aims at tracing main trends and forecasting as well as unfolding the drivers of these changes and their consequences. A third group focuses on potential scenarios of the future. Certainly, these groups and aims overlap; moreover, the understanding and the intention behind 'forecasts' or 'scenarios' are quite different.

Baseline futures are part of the research in almost all cases. This is understandable and correct since the PhD course used the Bishop-Hines (2012) foresight framework where baseline forecast is an essential element of the foresight activity. However, in addition to the methodology, authors' research questions in terms of the future are also more linked to the discovery of the future than to its invention.

One can trace this characteristic by investigating the scenarios. Following the foresight framework, the majority of the papers turn to unfolding the potential futures, and define three, four or even more scenarios. These options sometimes appear as varieties of baseline conclusions. Sometimes they are rather optional consequences of the ongoing tendencies with definite positive or negative evaluations of the authors. In one case scenarios become the basis of articulating the preferred future. However, the reverse tendency is also available. In the case studies, forecasts are never single futures. Even by quantitative methods authors detect optional outcomes of the expected futures.

The overlapping of the baseline and alternative uses of the futures can be discovered by linking the case studies to the timeline. It is worth noticing that the very short run and longer horizon research do not necessarily match the forecast – scenario types of using the future, as it regularly happens. Authors deal with 'scenarios' even in the projection type of papers, though in different interpretations, and baseline futures are highly influential in longer perspective types of research.

In terms of the methods and techniques applied to different futures, one can experience a wide scope that partly follows the foresight framework, and partly suits the topic in question. The PhD students were very much open to experiment with new techniques and to match them with other types of research methods. All case studies were based on mixed methods, combinations or sequences of different approaches, either in the quantitative or qualitative fields. Sometimes authors adapted techniques from their own narrow field of research, such as TOPSIS, NVivo or Z-number cognitive mapping, and used them for foresight purpose.

Most striking is the creativity of newcomers in the futures field, and how they adapt and use methods in a 'non-standard' way. For instance, futures wheel embedded in scenario analysis completes the research by detecting what complex and controversial consequences an optional future might have. Uncertainty analysis is regularly the basis of scenario research, since the drivers that have several, qualitatively different optional outcomes can differentiate future scenarios. However, in some cases of this volume uncertainty analysis either appears as a monitoring tool to test the stability and reliability of the foresight activity, or rather the certainty (instead of uncertainty) of the drivers the authors measured and adapted.

All in all, the collected set of papers reflect that the formal education of foresight and applied case studies contribute to develop individual futures literacy. The authors are all aware of what type of future they use regarding the topic to research, and what methodologies and methods

they adapt to do so. Using Riel Miller's ontological and epistemological framework for futures literacy (Miller, 2019), these papers belong to the closed and semi-closed Anticipation for the Future categories with the final aims of foreseeing what may come and emerge, or expecting what should come. This is in line with Miller's finding that most of the use of futures belong to these categories, mainly this is so in the business and economics fields.

CONCLUSION

Foresight is an increasingly important field in the business world in order that companies, industries and their researchers may safely navigate. Futures literacy as the conscious way to use futures for specific purposes is becoming a fundamental soft skill for entrepreneurs and analysts. The case studies of this volume prove that adapting foresight perspectives and methods to regular business strategy analyses widens the scope of understanding, enriches the space of orientation for management, and provides new perspectives to ask the most adequate questions.

The similarities and differences of adapting strategic foresight reflect that all topics and problems are open to futures studies. The methodology offers several ways to design the research, and the methods and techniques are also open to creativity - how to use and to combine them. The results and conclusions of the papers highlight that the foresight approach unfolded understandings, optional futures or risks that were out of regular thinking and images, even in the case of classical forecasts.

Enhancing futures literacy, becoming an expert in using the future the most appropriate way in different cases, is utmost important in higher business education. Fortunately, the Budapest Business University is open and supportive to adapt futures courses to help students and colleagues develop futures literacy.

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The transformation of HEIs and quality education

Dorina Körtvési[2], Eszter Szendrei-Pál[3]
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Abstract
Universities and higher education institutions are critical to societal improvement and have been severely harmed by the Covid-19 pandemic, which has hampered educational advancement owing to educational institution closures and the subsequent economic crisis. In the case of higher education, it is a question of stakeholders recognizing that it has a continuous and critical role to play in promoting socio-economic mobility, innovation, and economic recovery, as well as a significant role in providing financial assistance to the most vulnerable students, regardless of the sector, as well as strengthening distance learning, technology use, health care, and overall well-being. To delve deeper into the subject, the PESTEL model was used to analyze and assess the causes, hazards, and opportunities in HEI transformation, and a scenario was built to evaluate and strategically think about the data gained through horizon scanning. The findings show how higher education institutions may endure major transformations in the most effective way for stakeholders.
Keywords: higher education, HEIs transformation, COVID-19, foresight

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INTRODUCTION

Universities and higher education institutions are vital to society's progression and have been badly hurt by the Covid-19 pandemic, which has impeded educational advancement due to the closure of educational institutions and the resulting economic depression. School closures result in a loss of learning, an increase in school dropouts, and more disparity if considerable efforts are not made to address its effects. The health crisis has resulted in a huge shutdown of face-to-face activities at educational institutions as a result of home economic difficulties, and the impact on learning will be considerably worse. In the case of higher education, it is a question of stakeholders recognizing that it has a continuous and critical role to play in promoting socio-economic mobility, innovation, and economic recovery, as well as a significant role in providing financial assistance to the most vulnerable students, regardless of the sector, public or private, in which they are enrolled, as well as strengthening distance learning, technology

[2] BBS Doctoral School Entrepreneurship and Business, körtvesi.dorina@uni-bge.hu
[3] BBS Doctoral School Entrepreneurship and Business, szendrei-pal.eszter@uni-bge.hu

use, health care, and overall well-being. To investigate the topic in more detail, the PESTEL model was used to analyse and determine causes, risks, and opportunities in higher education institutions (henceforth: HEIs) transformation and a scenario was created to evaluate and strategically further think the data obtained through horizon scanning.

In this paper, we are going to introduce the methodology which we applied for creating the scenarios. After that, we present the domain analysation, where we determine and clarify the focus of our research. Later, the results of an earlier performed horizon scanning research will be presented. Based on these results, we will perform our scenario analysis and create basic future wheels, so the PESTEL model can be used for interpreting and analyse deeper the results. Finally, we will present what we see as the preferred future, and the future implications.

1.1. METHODOLOGY

The goal of current research is to identify possible scenarios for HEIs after Covid-19. As a result of it, the authors intend to highlight the future options for HEIs leaders related to teaching modes, provide support to decide which is the best way to continue their tasks, and help them to prepare themselves for it. To do so, we will build and analyse future scenarios to provide them some options. In this section, we will go over our research technique in detail.

There are two types of scenarios: exploratory and anticipatory. The current research will use the first one, as it is observing past and present trends and tries to indicate the likely futures (Godet et al., 1999).

The currently applied framework is based on the foresight of Bishop and Hines (2012) and the Strategia Sapiens article of Gáspár (2015).

First of all, we applied domain analysis in order to introduce the focus of the research, the key issues, and other important elements, like geography, timeline, etc. Based on these we could create our main research question: What format of education would be appropriate to enable HEIs transformation ensuring quality education?

After that, we applied the Foresight Analysis process of Pherson (2018). As a first step we identified the key drivers with the help of Horizon Scanning. During the second step, we could generate 3 scenarios and perform the scenario analysis, which involves baseline forecasting and basic future wheels methods. The third step was developing and tracking indicators. Finally, in order to develop an action plan, we applied the PESTEL model to highlight the risks and opportunities related to the macro environment of HEIs. Based on the results we could present the implication of the preferred future.

During the forecast analysis we focused on the criteria of a good scenario (Glenn, The Futures Group International; 2009):

- Credibility – To demonstrate the reliability of our research, we solely used credible sources. Publications from high-quality journals with an impact factor, websites and reports from international organizations, and so on.
- Novelty: research on the transition to higher education has been a hot topic since 2021, but it is still at an initial level. Long-term conclusions and mostly predictions and assumptions can be read in academic papers, thus, research on online quality education possibly involving a whole university is quite new.
- Likelihood – It will change the future of HEIs and stakeholders as well.
- Impact – It can cause a big change due to social, economic, and environmental transformation.
- Relevance – To the issue is vital because inappropriate reforms and lack of preparation can lead to the decline of higher education.
- Timeliness (awareness) – When Covid-19 began, it was mostly considered as a short break, no one expected to be in a more severe situation even after years causing huge

damages and shifts. After a long-period of time, people have not tended to return to their average life, hence, real and long-perspective transformation for HEIs will start just now.

- Timeliness (time to prepare) – Actions are temporary and mostly changing.

1.2. DOMAIN ANALYSIS

This research, based on the tribulations of higher education institutions over the last three years, presents the challenges facing universities, the expectations of stakeholders and tries to find answers to the question of what form of education might be the most effective in the future. It also important to investigate which form will guarantee the training of high quality and effective professionals, without compromising the interests of stakeholders, while preserving the image and value of the university, and meeting economic and social expectations, considering the political regime in which it operates. In this section, research framework and the research question are discussed.

1.2.1. TIME HORIZON AND GEOGRAPHY

First, we will introduce the time horizon and geography of the research. This part will answer the question *'How far into the future is one intending to look in time and space?'*.

Time horizon

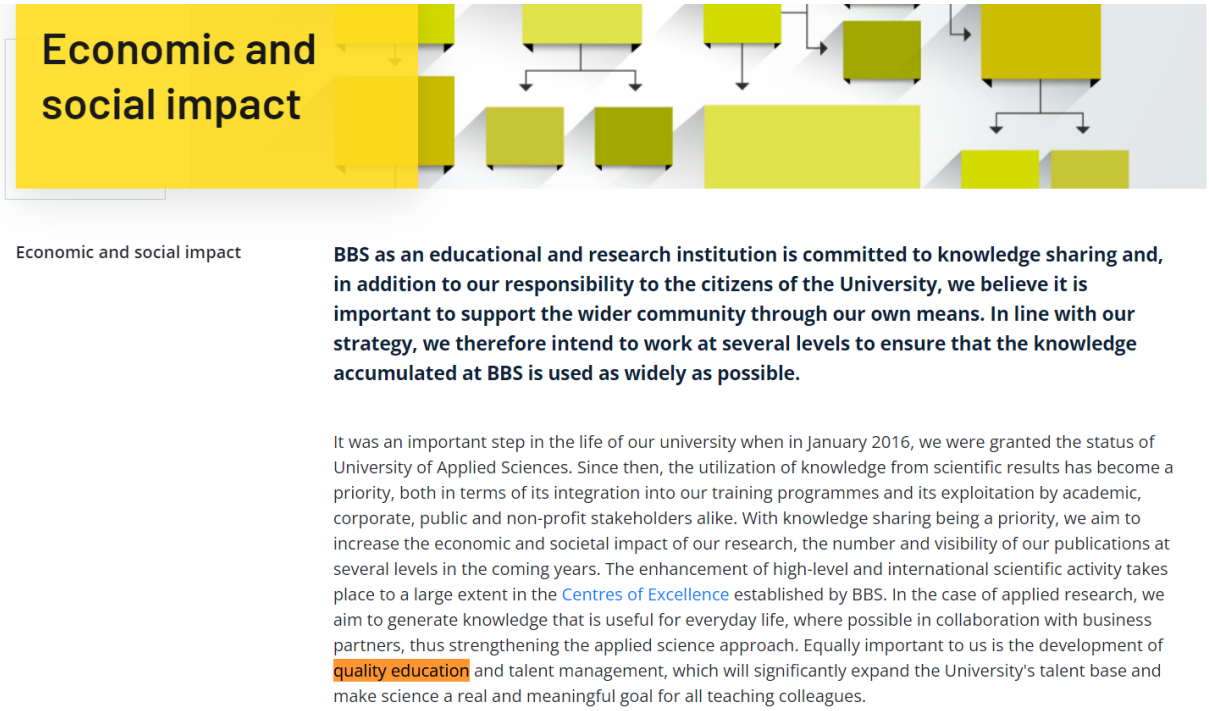
Related to the time horizon, the consequences of Covid-19 will have a major impact on the future of universities and forced them to act quickly. The emphasis is on the word 'forced' rather than a well thought out, structured and planned shift.

In order to ensure that in the future (even if only partially) an online and quality of university education that is economically and socially acceptable in terms of infrastructure, technology, and so on will be achieved, well-considered decisions are needed, both at governmental and institutional levels. At this point, we considered that sustainability was not a negligible consideration. Most universities already have a specific sub-section and strategic objective on their profiles to deliver quality education in a sustainable framework (e.g.: Budapest Business School, Figure 1).

In this context, we have taken as a basis the largest current global consensus, the United Nations Sustainable Development Goals (SDGs), which set out the achievement of quality education as a specific goal (Goal No. 4).

The UN SDGs were adopted as part of the 2030 Agenda in 2015, and as the name implies, Member States must accomplish these goals by 2030. This means that, taking into account the rapid technological change, the almost daily technological revolution and the consequences of Covid-19, we would give only 7 years for universities to develop a solution, without compromising the interests of stakeholders and attaining a truly high-quality education. (United Nations, 2015)

1. Figure: Budapest Business School example on quality education



Source: www.uni-bge.hu

Geography

In this case, the geography is interesting. COVID-19 has affected the whole world, so closure and online university education has been implemented overnight in almost all parts of the world. The research we have used shows that there are no geographical boundaries to this problem, we have found reports and accounts from universities in Europe, the US, Asia, and Africa that are still maintaining a hybrid or online form of education (European University Association, European Commission, 2022); (AAUA, eLearnAfrica, and WILEY Education Services, 2022); (Harvard Business Review, 2021), (International Institute for Asian Studies, 2021). However, Covid is global, so we will focus only on universities in CEE during this research otherwise the focus would be too wide, and it would be almost impossible to cover all relevant segments.

1.2.2. KEY ISSUES AND KEY QUESTIONS

Based on Heng, Kao, Muong and Lor (2021) and Barrot, Llenares and Rosario (2021) the research highlights the main issues with the transition to online higher education institutions and we summarised them in the following points:

- *Lack of students' motivation:* Online learning was supposed to be the next engaging and immersive approach for teaching the next generation of pupils. Students in online classrooms complain about a lack of motivation due to the lack of human contact and interaction between the students and the lecturers. Physical interaction between students is also necessary for maintaining engagement, and this is something that the online learning system partly or does not yet address. Educational institutions must provide students with compelling instruction. Students are unable to turn off webcams or doze off during in-person classes and physical classrooms also allow teachers to pay more attention to the individual needs of each student.

- *Students with special needs*: Students with special needs are a group of students who have been neglected or have had difficulty handling the past two years. Students with special needs require a more individualized and hands-on approach to learning. Though technology has advanced significantly, it still relies primarily on the presence of a full-time professional to help the student through the tasks.
- *Infrastructural issues:* Though online learning does not necessitate large buildings, large classrooms, or further equipment such as chairs, tables, and so on, this does not reflect the need for infrastructure. Rather technological devices, such as a computer, software, electricity, and internet connection are more essential. If a student or a lecturer cannot purchase this type of infrastructure, it is provided to them through public libraries in most industrialized countries. However, in developing countries this level of infrastructure and assets is only accessible to a small percentage of the population.
- *Digital literacy:* Although the new generation is good at technology and its daily usage, this does not directly lead to digital literacy. Understanding the workings of many software programs is required to learn well through an online system, which presents a steep learning procedure. In an online learning environment, students must also comprehend online communication etiquette and be aware of their rights and obligations as students. The continual technical challenges that both professors and students confront on these platforms is a major issue. These issues frequently necessitate technical assistance, producing repeated disruptions in the learning process.
- *Course structure and quality*: Even the course curriculum and structure were thought to be modernized as a result of the shift to web-based learning and other modern teaching tools. Unfortunately, this has not been the case. Even after going online, institutions have maintained their outdated course material and structure. Students are rethinking education as a whole, and the corporate sector seems to be doing the same. For example, Google and Tesla have chosen to skip college as a requirement for employment. YouTube, Google, Udemy, and other online platforms provide excellent content on many subjects for less money or even for free. These platforms also allow them to pick and select their studies, allowing for a highly flexible learning structure. This should prompt educational institutions to reconsider their entire way of teaching.
- *Lack of universities with accredited online degrees:* It matters more where you studied than what you studied. In such a market where the brand is a huge factor, the online learning sphere is yet to convince prestigious higher learning institutions to offer their courses through online/ distance learning modes. The problem is that online degree programs are frequently unaccredited and so are unrecognized by employers or other institutions. Though schools have welcomed online learning, higher education institutions and authorities have yet to acknowledge it as a valid way to achieve a professional degree.
- *Distraction issues paired with the lack of discipline:* Due to technical challenges, internet struggles, and sometimes boring lectures, online attendance has decreased significantly, especially if attendance is not checked or compulsory. Most students find online learning tedious and frequently complain about the lack of driving factors to complete a course. Even professors frequently lament a lack of resources to make classes more engaging, resulting in a loss of interest on both sides. Quality education is frequently harmed due to the absence of accountability and transparency in the online teaching technique. Distractions have multiplied as a result of the unlimited use of laptops and cell phones during class, frequently at the expense of paying attention in class.

The research key questions are the followings:

- How HEIs will handle the changes?

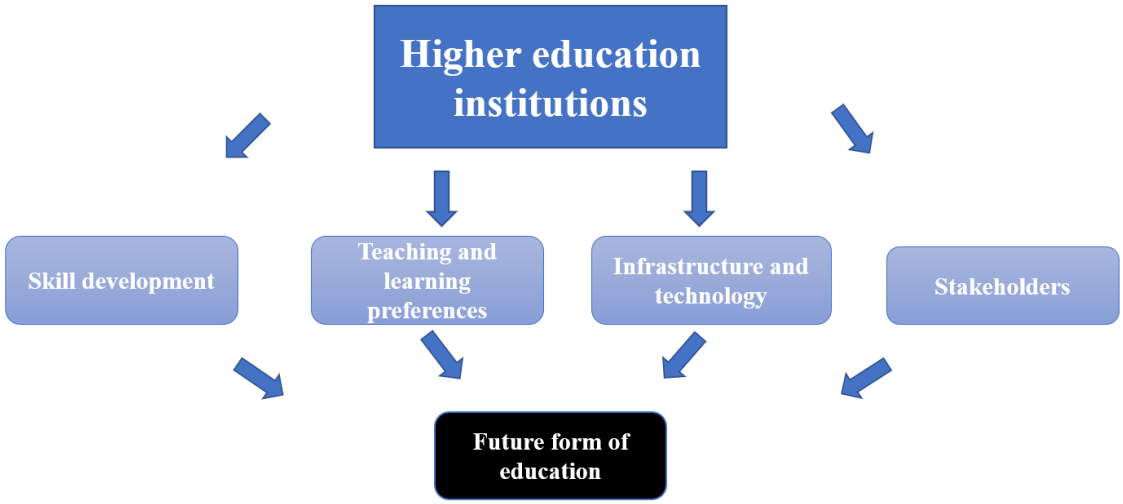
- Which changes would be the most beneficial for stakeholders?
- How will technology influence the HEIs existence?
- How financially, will the technological development be feasible?
- What kind of new teaching and learning skills will appear?

Based on these, the main research question is the next one: What format of education would be appropriate to enable HEIs transformation ensuring quality education?

1.2.3. DOMAIN MAP

The foregoing brief summary shows that the range of issues is very broad. In terms of grouping and reducing the scope of the research, we concentrate on higher education institutions rather than students. Of course, this includes taking stakeholders into account, but this research focuses on how higher education institutions can provide quality education in accordance with the economic, social, political, technological, and environmental conditions and expectations of their stakeholders, rather than how to motivate students or ensure universal access to online education. Furthermore, we are investigating which format (online, hybrid, or face-to-face) might be most suited for this purpose. The domain map is shown in Figure 2.

2. Figure: Domain map of the research



Source: own elaboration

1.3. ENVIRONMENT ANALYSIS

The environment analysis of HEIs and their current situation resulted in a lot of materials, from different perspective. We specifically focus on those points that can be further elaborated on.

The impact of the epidemic on students seeking higher education is largely unknown. We know that the digital divide, housing insecurity, and food insecurity affect disadvantaged student groups. It's difficult to deny that higher education is becoming more corporate. Worryingly, the monetization of higher education institutions compromises our ability to foster knowledge as a public benefit. This creates an environment that pushes us further away from inclusive and equitable structures, which are important elements in determining educational results and satisfying the requirements of students for continuous admission and retention. Academic leaders warn of the long-term dangers of academic capitalism and HEIs working as an export industry, and they question the future role of higher education. Predictions of declining enrolment and the closure of additional HEIs are serious trends that urge stakeholders

to rethink the HEIs priorities and goals (DasGupta, 2018), (Slaughter and Rhoades, 2010), (Qi, 2016).

It is clearer than ever that important societal shifts are taking place, and that alternative educational paradigms are required. Developing leaders for social transformation, committed to fairness and social justice, and aligning with the Sustainable Development Goals can all help us build our capacity to overcome today's difficulties. The complexity of the COVID-19 epidemic necessitates a complicated collection of interconnected views for determining the best course of action. The Sustainable Development Goals (SDGs) are set to assist such ambitions, laying out a clear roadmap to putting a paradigm shift in education and leadership into practice. Universities, according to the *United Nations' Higher Education Sustainability Initiative (HESI),* are "essential drivers for achieving the Sustainable Development Goals" through "sustainability initiatives, research, teaching, pedagogy, and campus behaviours." (Global University Network for Innovation, 2021).

It's also worth noting that higher education has lagged behind other businesses in adopting a more digitally driven, outcomes-oriented business model. One indicator of this is that IT spending accounts for less than 5% of college budgets. Now, it appears that investing in IT is important in the first place in order to assure the continuation of programs and campus life to the greatest extent possible (Harvard Business Review, 2021).

1.4. HORIZON SCANNING

In the following part, we will introduce the methodology and the results of an earlier performed Horizon Scanning research.

1.4.1. THE PROCESS

The goal of Horizon Scanning is to identify and categorize for example trends, topics, stakeholders, and expectations related to a selected phenomenon (Géring et al., 2021). As this method is focusing on a wide range of information and data, the identification of unusual phenomena (e.g.: weak signals and unexpected themes) becomes possible (Könnöla et al., 2012). The future-orientation of this method makes possible the formulation of different scenarios based on the discovered expectations, challenges, and possibilities (Kuusi et al., 2015).

The selected articles were collected as a part of a research project called ‘“The future of business education”. The goal of this project is to investigate the main trends which can affect the future of higher education in general (Géring et al., 2020). As the expectations of stakeholders are culturally embedded (Géring et al., 2021) we investigate articles only from Central-Eastern Europe. One part of the collection of the articles was before the pandemic (2020), the other part of the process was in the middle of the pandemic (2021), which is a so-called wild-card event.

The collection process resulted in a database with a wide variety of materials (e.g.: academic journal articles, higher education-related articles, CEE-specific initiatives, university surveys, etc.). After that, the identification of stakeholders and their expectations followed. Thanks to the 2 phases article collection process, the comparison of stakeholders’ expectations before and in the middle of the Covid became possible. (Fűzi et al., 2022)

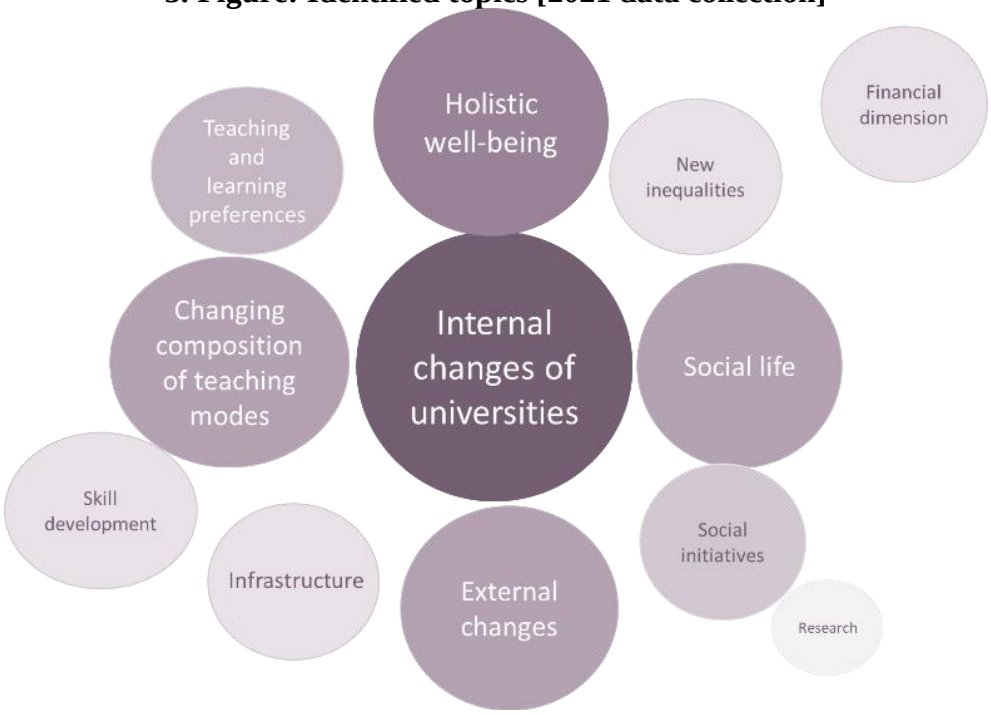
1.4.2. DATA OBTAINED FROM HORIZON SCANNING

In the following, we are going to discuss the identified topics and stakeholders. This part will also cover the most important expectations of each stakeholder before and after the pandemic.

Identified topics

As a result of the information collection, a huge database was created with the main ideas, approaches, and results of the selected articles. After that, the identification of key topics can be started. The most relevant topics and the emphasis of them compared to each other can be seen in the figure below.

3. Figure: Identified topics [2021 data collection]



Source: Fűzi et al., 2022, p. 11

As the diagram shows, the 'internal changes of universities' category is in the middle, which means most of the articles highlighted that Covid-19 has affected the usual working of the internal processes of universities. Holistic well-being is the second biggest category. It covered problems like mental health, work-life balance, and physical health of students, teachers, and other employees of higher education institutions caused by the pandemic. The changing composition of teaching modes covered the topics related to the new (or rarely used) techniques, which came into the limelight throughout online teaching. The social life was decreased as the restrictions were affected the opening of campuses and banned the option of offline teaching for a while. The topic of decreasing (or disappearing) social life was also popular in the discourses. The external changes mean e.g.: the changes in the labour market or in teaching-related regulations. The remaining categories also appeared in the discourses, but they were not really emphasized. Teaching and learning preferences have changed, as the students and teachers have gained experience with online teaching tools and techniques. Skill development was also discussed, as it was more challenging via online teaching platforms. The (sometimes) outdated infrastructure of universities caused problems when they had to switch to online, and this challenge also appeared in the selected articles. New inequalities appeared, as not everyone could afford the tools, which are a must-have to be able to participate in online education. The financial dimension was also important, as the resources of the higher education institutions could have been changed due to the pandemic. Finally, the challenges related to research were the least discussed topic.

Identified Stakeholders and their main expectations (before and after Covid)

During the analysis of the articles, 7 stakeholders were identified in the higher education

institutions. There are two groups of stakeholders: the internal actors and the external actors. The internal actors are the university students and teachers. The external actors are society, the IT sector, employers, and other educators. In this part, the most important expectations of the stakeholders will be introduced, and the changes in their priorities and in their power will also be covered. (Fűzi et al., 2022)

First, it is important to note that the expectations of stakeholders are usually controversial. Sometimes these differences can appear not only between the stakeholder groups, but the preferences within one stakeholder group can also be controversial depending on the situation. On the one hand, Covid has strengthened some of the actors' voices, on the other hand, it changed (or completely removed) some expectations and approaches by them. Higher education institutions must consider the expectations towards itself and decide which external or internal pressures are the most relevant, and how they would like to answer to these expectations. (Fűzi et al., 2022)

The first internal stakeholder is the *university* itself. Before Covid, the universities' voices and expectations almost never appeared in the discourses. The reason behind this could be that it was in the middle of the ring of conflicting external stakeholders' expectations. They had to fulfil the requirements of external and internal stakeholders and in the discourses, what the universities would like to do was not exactly emphasized. (Fűzi & Szendrei-Pál, 2020). During Covid, universities became one of the most focused actors, as other actors waited for solutions from universities to ensure continuous education during the pandemic situation. The voice of universities has strengthened, and they could finally focus on their internal processes, e.g.: infrastructure development, trainings for teachers, online solutions for teaching and learning, etc. (Fűzi et al., 2022).

The second internal actor is the group of *students*. As they can be considered as the customers of higher education institutions, their opinion was important before and after covid. Before Covid they had controversial expectations towards the university. On the one hand, there were discourses about the need for personal and intellectual improvement. They would like to participate in different activities (e.g.: research) with experts and teachers and develop teamwork skills. On the other hand, students can be considered as future employees. In this role, they focus on the requirements of their future employers and want to gain relevant skills and knowledge from their university programs. (Fűzi & Szendrei-Pál, 2020). After Covid, their voices strengthened, and their focus changed from outside to inside. The expectations of employers were not in the limelight anymore according to the discourses, they had more urgent problems to solve (e.g.: mental health issues, and challenges of online learning). The collected materials showed students prefer online education because it is convenient and flexible, but they miss personal contacts and skills development (Fűzi et al., 2022).

The last but not least internal actor of the higher educational institutions are the Teachers. Before Covid-19 their voices were relatively quiet, and their opinion was not taken really seriously by the universities. They had several requirements (e.g.: skills development, curriculum upgrades, etc.), but they had no time because of the administrative burdens among other things. Following Covid-19, the debates show exceptional university support and understanding for teachers. They obtained the infrastructure required for online instruction, and numerous universities also provided mental health services for teachers and students. Discourses were also highlighted, and preferences for teaching and learning were altered. From the selected materials, most teachers liked online teaching, but missed the great chats with colleagues, and it was very disappointing for them to hold lectures for "black boxes" (as students turned off their cameras during online lectures). (Fűzi et al., 2022)

The next actor is society, society also has expectations towards higher educational institutions. Before COVID they had dilemmas about the value and contribution of university degrees. (Fűzi et al., 2022)

The great winner of the pandemic situation is the IT sector. They were strongly involved in the universities' everyday life even without Covid, but after Covid, their interest in the market has increased greatly. Universities were exposed to IT service providers more than ever, as they could not continue their activities without the services of the IT sector. The IT sector reacted and adapted quickly to the new requirements of higher educational institutions, and (of course mainly after the free trial period) they expected profit and a share in the field of higher education (Fűzi et al., 2022).

Employers' voices were strong before the pandemic. They had three possible roles, from which they could choose in connection with the universities. First option is the close collaboration with universities. This means employers would have the right to modify curricula and program as they wish in order to educate students in a way they prefer. It would be highly appreciated by the employers, but also very time-consuming for both parties. This path could also lead to a dramatic decrease in the autonomy of universities. Another option is: employers remain passive, and don't pay attention to universities, so they would no longer express their opinion and requirements. This could lead to a decrease in the value of university degrees, as they could start preferring faster options to get qualifications (e.g.: micro-credentials). The final option is a mix of the introduced options. They could collaborate with universities and make suggestions as to how universities could educate more up-to-date students. Their main expectation is the same in each of the introduced cases: universities should provide more up-to-date curricula and knowledge. After Covid, the employers' voices almost completely disappeared, and their intentions were unclear. The reason behind this could be the uncertainty related to the future, as no one knew when Covid will end, and everybody tried to survive (Fűzi et al., 2022).

The options of other educators are almost the same as for the employers. Before Covid they could decide whether they collaborated with other institutions or not, and if yes, to what extent they would like to do that. After Covid, their focus turned from outside (e.g.: competition with other unis) to inside (e.g.: how to solve online education) (Fűzi et al., 2022).

1.5. SCENARIO ANALYSIS

The scenario analysis section, discusses scenarios based on horizon scanning, introducing the three scenarios, followed by the outcomes of baseline forecasting and basic future wheels.

1.5.1. SCENARIOS BASED ON THE HORIZON SCANNING

Covid-19 has changed several things within the field of higher education. For example, new teaching methods and new expectations of stakeholders influenced the working of universities. It has strongly influenced the alternative futures of higher education institutions. In this part, the alternative futures will be introduced based on the results of horizon scanning.

Full online

The first alternative is the concept of a university, which has no walls. Teaching and learning would happen in a full online environment.

On the one hand it would be great, as the universities could collaborate easier with each other and with other educators as well, as they could organize common lectures, and the students could join from all around the world. The space would not be a burden anymore, and thanks to this there would be more students who could participate in higher education. Additionally, guest lecturers from different companies could join easier to classes and show new perspectives to the students. Next to these, most students really like online education as it is convenient and flexible. Teachers could use e-learning materials and video recordings during their classes, so

their burdens could decrease in the long term. Last but not least, the IT sector would prefer this option, as this way of teaching would lead to huge infrastructure development, so their income would increase.

On the other hand, full online education has some disadvantages as well. The lack of social interactions could lead to inadequate development of students' social skills. Additionally, the value of the degree would be also questionable by society and employers, as cheating during online exams cannot be controlled. Another problem would be the role of brick-and-mortar buildings. The students would learn from home, and the campuses would be unnecessary next to full online mode. However, universities still have to pay for the buildings' maintenance. Furthermore, huge infrastructural development of universities would be required as each process would be in an online environment, and the costs of it would be enormous. The competition with other educators would increase, as they could provide shorter programs, but the value of the certificate would be almost equal to university degrees. As a result, universities could lose part of their students. Teachers have to develop their digital skills and e-learning materials, however, not every teacher would love this way of teaching because of the lack of social interaction and the questionable effectiveness of online knowledge and skills development. Additionally, a lot of teachers could lose their jobs because of reusable learning materials, and the quality of the education would become questionable.

Hybrid

The second alternative is the hybrid concept. The student can stay at home and participate in online lectures, but there will be in-person classes as well.

This mode could foster the students' social and digital skills development at the same time. The buildings could keep their important role as the students would go there regularly. Employers would like this way of teaching, as students could gain working experience more easily, thanks to the flexible studies, and their future candidates could develop more digital skills, which could be useful for their future jobs. The hybrid mode would have similar advantages to the full online mode, for example, flexibility and convenience.

Unfortunately, the hybrid mode of teaching could lead to a decreasing quality of education, as focusing on both online and offline could be hard, as both methods require different teaching and learning methods. Resource related problems could also appear (e.g.: maintenance of buildings and the development of digital infrastructure). Next to these, the burdens on teachers could increase, as they have to prepare online and offline materials, and they have to fulfil the requirements of both online and offline teaching methods. The value of the degree would also be questionable, as the hybrid mode could involve online exams as well, so the risk of cheating would be high. The competition with other educators would be high in this case as well.

Face to face

The last option is the regular way, which is the traditional offline (in person) teaching and learning. Students and teachers must go to the university to participate on the classes.

The role of brick-and-mortar buildings would remain important, and social skills development would be possible. Universities would not spend as much money on infrastructural development as they are not obliged to provide online education. Additionally, students can build their network and develop their social skills. Teachers could keep their positions and prestige as well. The value of the degree would remain the same and the competition would remain the same as now with other educators.

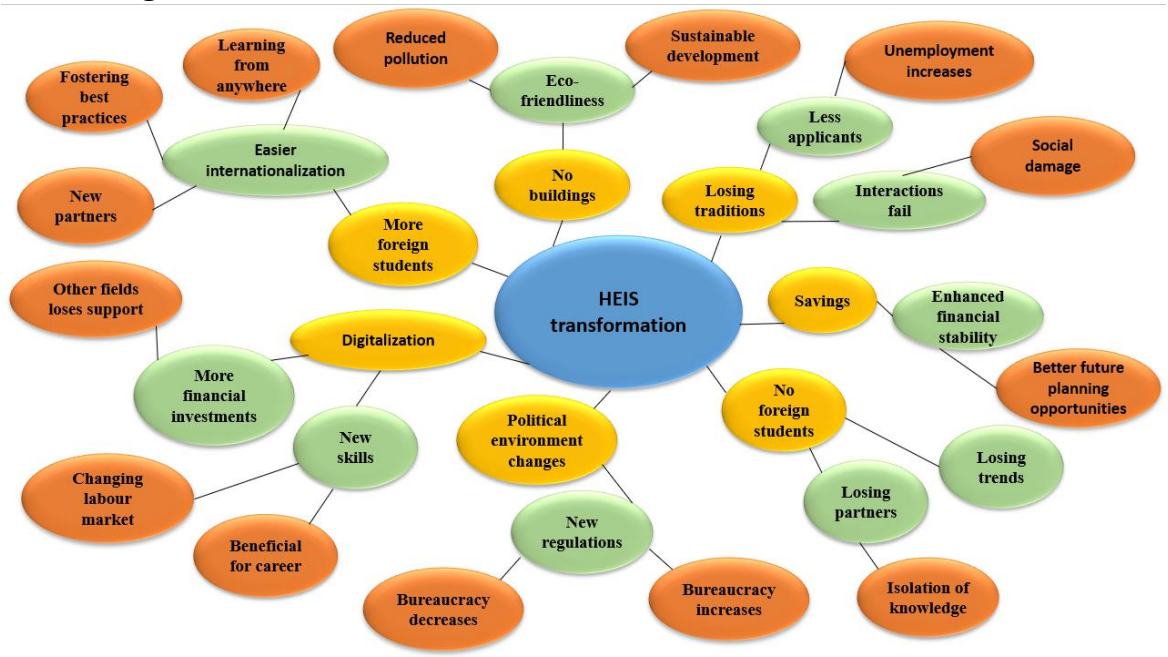
The traditional method could not develop digital competences as effectively as the previously introduced options. Additionally, this way is not flexible, so the students could find gaining work experience much harder next to their studies. Employers could join less in person classes as a guest lecturers, and travelling to the university from their workplaces could be

difficult. The IT sector would not receive more income than it receives now as there would not be IT tool developments.

1.5.2 BASIC FUTURES WHEEL

For a deeper understanding, we prepared a basic futures wheel to help us brainstorm about the happenings and expected influences. The basic futures wheel helps to organize the thoughts and questions about the future. It can be used to think through the effects of current or future trends, and create forecasts within alternative scenarios (Glenn, The Futures Group International, 2009)

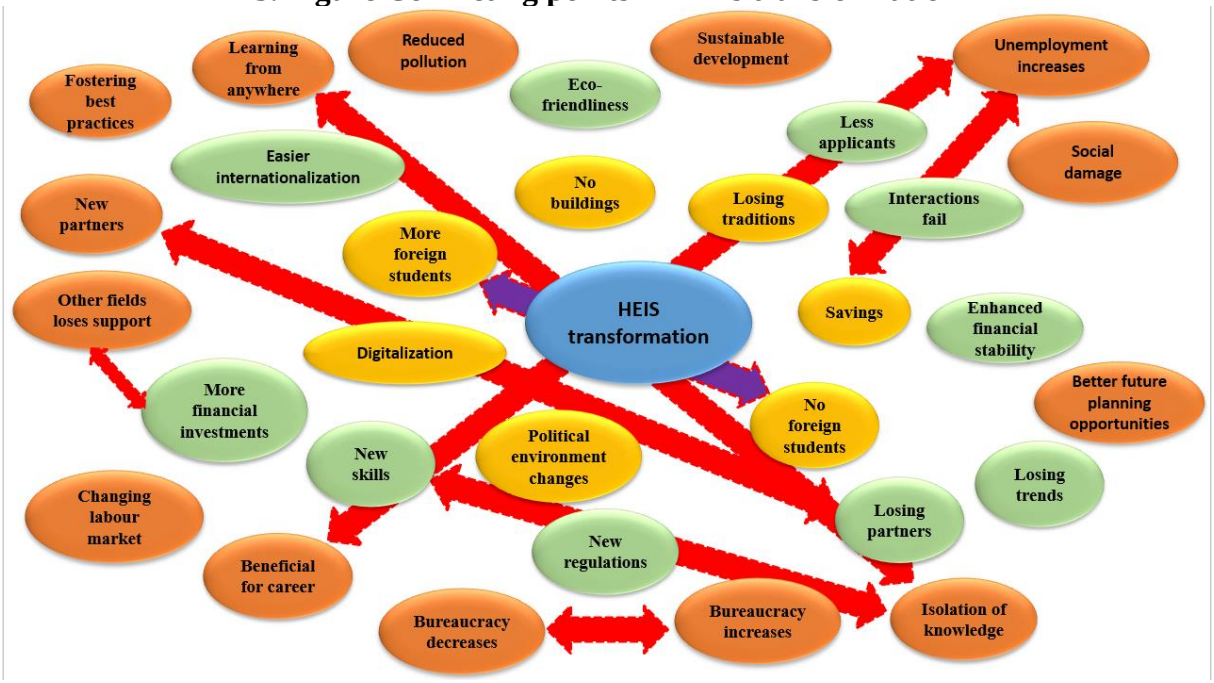
4. Figure The idea of basic futures wheel in case of HEIs transformation



Source: Own elaboration

The futures wheel shows smooth connections between several economic, social, economic, legislative variables etc., however, there are several contradictions as well, illustrated in Figure 4.

5. Figure Conflicting points in HEIs transformation

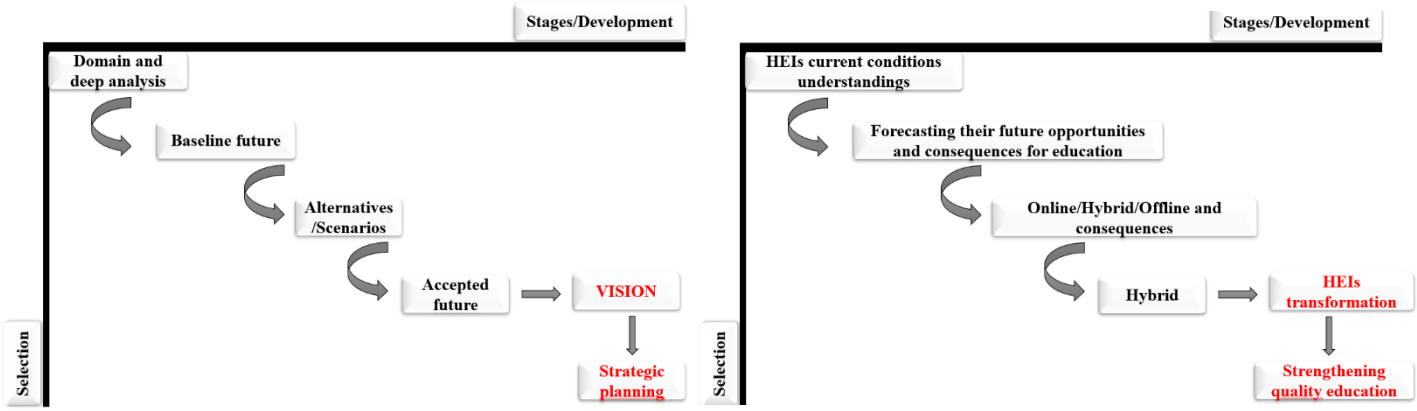


Source: Own elaboration

1.5.3 BASELINE FORECASTING

We created our own baseline forecasting charts based on our studies in the Strategic Foresight class at the Doctoral School of Entrepreneurship and Business in 2022, according to which, we have a domain and deep analysis, meaning we disclose the conditions the HEIs function in the present and understand it (Levenbach, 2016). Following that, we have a baseline future, meaning that we are forecasting processes. In our case it indicates that we assess future opportunities, consequences for education through HEIs. Based on that, we suggest alternative scenarios, which are online, hybrid and in-person forms of education and we choose one accepted future. Figure 5. illustrates that our accepted future is the hybrid operation of HEIs. During the decision making we did not performed brainstorming with stakeholders as it would be time-consuming. We applied the same method as BBS did after the pandemic. We expect institutional transformation as vision, and when it comes to strategic planning, all the goals, and techniques are assigned with the strengthening of quality education.
We selected the name “Hybrid mode of Higher Education Institutions” for the Scenario.

6. Figure Baseline future concepts and our understanding



Source: own elaboration

Furthermore, we followed the traditional steps of baseline forecasting as follows:

Constants: There are professions that can be learned exclusively through university courses, so even if the interest in university courses is unstable, the existence and necessity of universities is considered constant and unquestionable.

Trends: One of today's trends in learning and higher education is that you can now study anywhere. It is not bound to a location, not even to an institution, and often not even to time. Another trend is that interactive and practice-oriented activities are taking the place of conventional classes. It might be also considered as a trend that there are teaching methods and skills which, although they may seem constant, change over time, but are, on the whole, indispensable. It is also noticeable that universities are increasingly adopting modern and new business models.

Plans: Stakeholders are of paramount importance in the life of higher education and universities. Not only can they benefit from a well-functioning higher education institution, but they also influence the success of the university, i.e., they interact with each other. That is why it is important, now that the traditional ways and forms of higher education are being challenged, that concrete action is taken. The primary stakeholder is the government, which regulates, organises, and provides a framework for universities and financial support for most institutions. Regulation also includes the process of internationalisation, talent management, etc. through various scholarships. Now that there is the possibility of the end of the present system of education, new regulations may be introduced, with new requirements, different types of scholarships, different types of funding, etc. Another important group involved are the trainers who transfer the knowledge. Digitalisation can demand and lead to self-development, different teaching methodologies, and new knowledge. The third group is students. Being a student at university can change radically, losing the feeling of campus life, the traditions, the get-togethers, the personal interaction, the building of new relationships, and replacing it with more flexible class schedules, making it easier to take up a job. Students don't necessarily need to take out loans, especially if they don't have to move or have other expenses to go to university. The same applies to foreigners. However, more difficult class attendance, less knowledge and de-concentration, and less professionalism may result from this transformation.

Cycles: Now, after the shock of the pandemic, there is a cycle of silence and confusion. Universities can decide for themselves how they teach, what facilities, technology and skills they have, it's down to personal judgement and uncertainty about where and how long the process will go.

Projections: Making forecast from the cycle, this situation will not be sustainable in the

long term. Another complete lock down will push them back into a full online world, while a complete unlock may not result in 100% face-to-face education again. There must be a transformation and an ‘individual’ decision on the development of the university, in which direction it plans to keep going on (Petropoulos et al., 2022).

1.6. TRACKING INDICATORS

Pherson (2018) good indicators have 5 key characteristics: observable, collectible, valid, reliable, stable, and unique.” During the horizon scanning we tried to discover indicators, which appeared in each scenario and played equally important role everywhere. In the following we will introduce the driving forces and the scenario.

It is important to investigate the viewpoints and motivations of the above introduced actors in connection with the hybrid working of universities.

During the Horizon Scanning we could see that the most important driving forces are the stakeholders. They have their own expectations and power to be able to shape higher educational institutions’ future. They can do this because the Universities always wanted to fulfil as many requirements as possible to remain competitive on the market and to protect the value of a university degree.

Universities have all the necessary infrastructure and tools to be able to provide hybrid education. In-person teaching would help to keep the role of brick-and-mortar buildings, so universities don’t have to handle the problems of empty campuses. During the pandemic, several online teaching materials were developed, so the efforts of teachers would not be wasted.

Students prefer online education as it is convenient and flexible, but next to this they would like to meet with their classmates and teachers in person. Additionally, social skills development is also important to them. A Hybrid solution provides them all.Teachers put much effort into online material and skill development. They learned many digital teaching methods and they applied them regularly in practice. With the hybrid mode, they can use both their offline and online skills, materials, and techniques.

Employers can also be a driving force, as they would be satisfied if their future employees can develop their social and digital competencies at the same time. Resulting in more prepared students entering the labour market after graduation. Society would also appreciate the hybrid method as they like to see education developing and becoming more and more modern. Maybe the greatest winner and biggest supporter of hybrid education is the IT sector. They had huge profits thanks to Covid-19, and (of course) they support higher educational institutions remaining online to some extent. Each actor has a driving force which promotes the success of hybrid mode.

1. Table Driving forces and variables at HEIs

Driving forces/values variables	Infrastructure	Money	Technology
University	Sufficient hardware	Enough support for online development	Sufficient online software and platforms for teaching
Students	Own tools/tools provided by HEIs	-	Digital skills development
Teachers	Own tools/tools provided by HEIs	Possibility to obtain more wages to hybrid mode	Digital skills development
Employers	-	Provide free courses, guest lecturers	-
Society	-	-	More knowledge of the digital world
IT sector	Provide tools for online education	Market share in HEIs	Provide free of charge/not free of charge software, platforms

Source: own elaboration

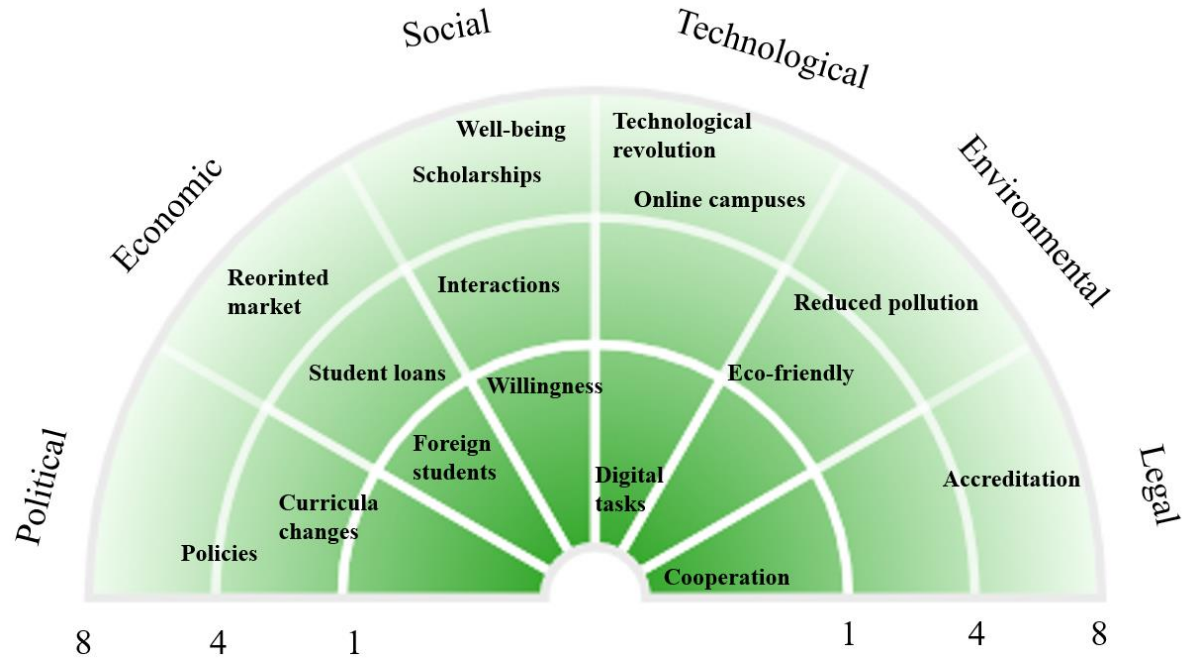
Table 1 shows the scenario model. We selected three values variables based on the most emphasized aspects during Horizon Scanning, and we introduce the model with these variables.

The table shows the stakeholders' most important expectations related to the selected variables, which are infrastructure, money, and technology. These aspects were equally important in the case of full online and face-to-face scenarios as well, but now we are only introducing the hybrid case.

1.7. PESTEL MODEL AND DEVELOPING AN ACTION PLAN

To give a deeper insight into the created scenario, we used the Pestel model, explaining each section and the expected consequences of Covid-19 and the past three years' experience and data obtained. As far as our time limit relates to a maximum 8 years, we divided the Pestel model with 1, 4- and 8-years terms.

7. Figure PESTEL model of the selected scenario



Source: own elaboration

From the political point of view, it is expected that new regulations, laws, and directives will shape the HEIs life and operation. It will more widely concern present trends, for example influencing migration, etc. However, we expect that these changes will happen slowly, first gathering experiences and best practices then new policies. A much sooner expected change on the policy side are the new curricula. It is conceivable that this could affect everything from changes in the profile of universities to the requirements and forms of assessment.

Regarding economics, what has already occurred, but is likely to become a definite trend, is the situation of foreign students. With the online form of education, there will be no more travelling, spending, working, etc. in another country. This will have significant consequences for the student's household, for both sending and receiving countries. At the same time, there will be a change in student loans, which are likely to fall and should help to reduce the initial indebtedness of individuals.

In the short term, a willingness or rather the unwillingness of students to study might be experienced, hence, more high-school graduated youngsters will directly jump into the labour market, especially if the chance of interactions, traditions and feeling of student life with adventures and social experiences will decrease or diminish. It might affect the mental health, integration, and adaptability skills of younger generations. They can also experience a transformation of scholarship opportunities, losing experience, and responsibility.

The transformation of HEIs has mostly led to technological changes. More digital tasks can be expected in the near future, while in the long term, accredited online campuses will appear on the market, providing fully online education, therefore, the doors closed at previous points, open other possibilities to study abroad without any or with less financial burden. It might result in a technological revolution as well, as far as software programmes used during the pandemic were mostly forced solutions, not desirable ones. Capturing attention during an online class will require more technological knowledge from both lecturers and students and financial investments into more suitable equipment and complex systems.

Environmentally, having a hybrid or online form of education causes mostly positive effects. Without a concrete building, costs are decreased, furthermore, pollution and waste, such

as the usage of public transportation, paper, etc. will improve, creating an eco-friendlier environment. However, the usage of home devices consumes a huge amount of electricity.

The legal point of view is more serious. Individual decisions are not enough to switch between forms of education. Without appropriate accreditation it is almost impossible. More accreditation agencies might appear on the market, and HEIs expenditures might increase by spending financial assets to acquire the right justifying the value of the degree and the quality level of education to attract potential students. On the other hand, if we consider the distribution of intellectual property and further learning materials, these also have legal references.

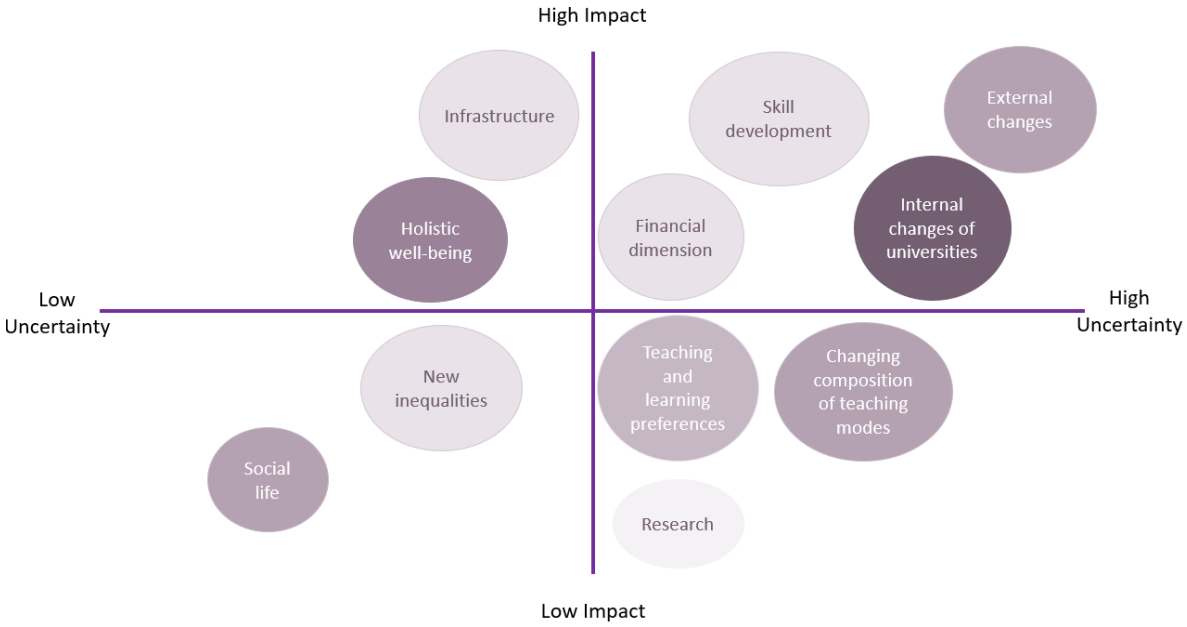
Uncertainty analysis

It is essential to introduce the uncertainty analysis related to hybrid mode and it is also important for creating an action plan. As online teaching and learning raised new problems and challenges in the sector, we have to consider the impact and uncertainty of each topic. Figure 8. contains this analysis.

Below we will highlight some examples from figure 8.

There are four items in the high impact high uncertainty category: financial dimension, skill development, internal changes of universities, and external changes. The financial dimension could cause great problems, for example, during the implementation process of new technologies. The incomes of the universities could decrease as they could lose students because of the increased competition from other educators. The external changes can be sudden and could cause huge (negative or positive) impact on HEIs, just like in the case of the pandemic situation.

8. Figure The uncertainty analysis of HEI's hybrid mode



Source: own elaboration

The low impact and low uncertainty category contains 2 elements: the social life and new inequalities. From the viewpoint of the HEIs, these factors could have lower priorities related to the other factors when they consider the application of the hybrid mode.

Rehearsal

Because of the Covid-19 scenario, most universities are preparing to implement a hybrid teaching approach. They have the resources, materials, and platforms as well, but colleges

must exercise caution before adopting this method.

If the hybrid way of teaching and learning happens, Higher Educational Institutions must be prepared for some unpleasant facts. The stakeholders have the right to modify their intentions and grab the opportunity to exploit the system. The greatest risk is the IT sector. In the case of the hybrid mode, Higher Educational Institutions would be exposed to the IT sector. Universities must adapt to the changes and innovations of IT tools and platforms, and the IT Sector has the power to enforce universities to adopt these changes. This could lead to huge costs which could make troubles for universities. If universities enter the online world, several competitors appear on the horizon. Online certificates and micro credentials are very popular nowadays. Students can change their opinion and skip university because obtaining an online certificate of another educator is faster and cheaper. Universities must be prepared to face these challenges and create curricula to provide up-to-date knowledge for students, as online teaching is not equal to offline teaching. The Hybrid method of teaching cannot be considered as an innovation if universities provide the same material as in the offline way. They must follow the trends and prepare students for the requirements of the labour market.

1.8. THE IMPLICATIONS OF THE PREFERRED FUTURE

Based on our opinion, the preferred future is the Hybrid mode of university teaching and learning. In the following we are going to introduce the vision and the goal setting related to the selected way.

Vision

In connection with the vision of this future several positive effects can be mentioned. First of all, this way could provide more up-to-date knowledge and a more relevant skillset for the students. This would result in more prepared students, who can fulfil better the continuously changing requirements of the labour market. Additionally, the costs of higher educational institutions and of the students would decrease. For example, the universities should not spend as much as previously on overheads, and students should spend less to travel costs. After the teachers finish the preparation of online materials, there will be less burdens on them, as they can use recordings and ask students to watch videos instead of live classes. To sum up the vision, this way would be better for each stakeholder rather than traditional in person teaching.

1.8.1 GOAL SETTING

In connection with the implication, we have to set the goals to achieve this future. The first goal is to map the requirements of the hybrid method. Universities must check their inventories and get the missing elements to hybrid teaching (infrastructure development). They also must check their opportunities for online platforms and find the best solutions (online platform development). Additionally, they have to prepare their teachers to be able to conduct online classes at high quality (Digital skill development of teachers). Some students will require help in using online platforms or digital tools, so universities must pay special attention to them (Digital skill development of students). They also have to consider the content of the curriculum and modify its content if necessary (curriculum development). These are the most important steps for a university to be successful in the implementation of hybrid mode.

CONCLUSION

In this paper we introduced the methodology of our research. After that we performed the steps of scenario building: domain analysis, horizon scanning, scenario analysis, tracking indicators

and creating an action plan with the help of a PESTEL model.

The goal of this paper was to identify possible scenarios for HEIs after covid. The geographical location was the CEE and the timeline is the next 7 years. As a result, we determined 3 scenarios: full online, hybrid, and face-to-face.

In the following, we will give answers to our research question, which was: "What format of education would be appropriate to enable HEIs transformation ensuring quality education?". Our answer is the hybrid format of education, because (highlighting only some examples based on our research):

- it ensures both social and digital competencies development,
- the knowledge transfer would remain effective,
- the knowledge would be updated more regularly thanks to the easier implementation process (e.g.: it is easier and more environment friendly to update e-learning materials than re-print thousands of books)
- the value of a degree would remain the same as now.

During our research, we focused only on the preferred scenario, which is the hybrid way of teaching and learning. We selected this one because it could foster the best development of each actor. Students and teachers could gain both social and digital competencies during their activities. Employers would be also more satisfied with fresh graduates because of their skillset. Universities would be forced to develop their IT infrastructure, but they should not rush. They would have time to apply quality solutions instead of temporary ones. The IT sector would also be satisfied, as they would have a higher income because of IT tools development. Society would also be happy because their opinion would be positive related to the value of the degree.

Our research has several limitations. First, we analysed only one scenario (hybrid) in detail, further attention should be paid to the other two (full online and face-to-face) as well. Second, we focused only on the teaching modes, however the results of the horizon scanning could provide the chance to discover deeper assessments and wider viewpoints too. Third, we did not ask expert opinion about the preferred future, we just simply select one scenario, which was preferred by us, and BBS.

We are aware of the missing elements, but these results could be interpreted as the basis of a possible future research. We could continue our assessment and develop new research questions and performs in a more detailed scenario building process. We could investigate similar research about the scenarios of HEIs to be able to create better scenarios. For example, Géring et al. (2022) created 4 scenarios about the future of HEIs. This research could be a great example for us to be able to create more detailed scenarios about the future of HEIs.

Apart from these issues, our research introduced a framework, which can be useful for HEIs who are hesitating which form of education would be the best for them. They can apply the same methodology in their regions and perform the scenario building steps.

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The future of sustainable mobility in Budapest in 2030

Annamária Ács[4], Mansoor Ekrami[5], Zhala Mammadova [6]
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Abstract
This paper reports on the research undertaken to determine the possible future scenarios of sustainable mobility in Budapest up to 2030. Sustainable urban mobility has become an increasingly important issue for cities around the world, including Budapest. In 2019 the General Assembly of the Municipality of Budapest adopted the Budapest Mobility Plan until 2030. National and international regulations support the transition of mobility into a sustainable way. The research collected the driving forces that affect the future of sustainable mobility in Budapest via focus group discussion and document analysis. The driving forces are grouped and by the method of two-axis matrix and four scenarios are constructed to assess the possible futures of sustainable mobility in Budapest in 2030.
Keywords: sustainable cities, sustainable mobility, green transition, strategic foresight, alternative scenarios
JEL code: O18

INTRODUCTION

Sustainable urban mobility has become an increasingly important issue for cities around the world, including Budapest. The rapid growth of urbanization has resulted in increased traffic congestion, air pollution, and carbon emissions, which pose significant challenges to the sustainability of cities. To address these challenges, cities are exploring various alternatives for sustainable urban mobility. The literature review explores the following alternatives: electric and hybrid vehicles, autonomous vehicles, Mobility as a Service (MaaS), urban air mobility, and pedestrian and bike-friendly urban design. The review highlights the advantages and challenges of each alternative, as well as the potential for their implementation in Budapest. The article aims to provide policymakers and urban planners with insights into the current and future alternatives for sustainable urban mobility in Budapest. By understanding the advantages and challenges of each alternative, policymakers and urban planners can make informed decisions about which alternatives to prioritize for implementation.

The city of Budapest, like many urban centres worldwide, is facing significant challenges related to transportation and sustainable mobility. As the city grows, the need for

[4] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, Annamaria.Acs.17@unibge.hu
[5] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, Ekrami.mansoor.30@unibge.hu
[6] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School Mammadova.Zhala.21@unibge.hu

efficient, clean, and accessible transportation systems becomes paramount (Kelemen, A., Takács, I. 2021). This article aims to provide a comprehensive analysis of the future of sustainable mobility in Budapest, focusing on the anticipated changes and developments expected by the year 2030.

This article draws upon various sources, including official documents such as the Budapest Development Strategy 2030 (City of Budapest, 2021) and Hungary's National Energy and Climate Plan 2021-2030 (Ministry for Innovation and Technology, 2022). Additionally, scholarly research articles like Kelemen and Takács's study on the role of electric vehicles in Budapest's sustainable urban mobility system (2021) and Pályi and Várhelyi's research on mobility futures in Hungarian cities (2020) contribute to the analysis.

Furthermore, the European Commission's Sustainable and Smart Mobility Strategy (2020) provides a broader context and framework for understanding the future of sustainable mobility in European cities, including Budapest. Statistical data from the Hungarian Central Statistical Office's Statistical Yearbook of Budapest 2022 (2022) also serves as a valuable resource to support the analysis and provide an overview of the city's current transportation landscape.

This paper answers the following research question:

What are the possible futures of the development of urban mobility in Budapest in 2030?

The possible future of urban mobility development in Budapest in 2030 based on current trends and potential advancements. In this research, some scenarios are discussed for possible futures. Here are a few possible futures for the development of urban mobility in Budapest in 2030: By combining insights from various sources, this article aims to shed light on the prospects of sustainable mobility in Budapest, offering a comprehensive analysis of the anticipated changes and advancements expected to shape the mobility system by 2030.

1.1. LITERATURE REVIEW

Budapest is one of the largest and most densely populated cities in Central Europe, with a growing need for sustainable urban mobility (Varga et al., 2016). Sustainable urban mobility aims to improve the environmental, social, and economic sustainability of transportation systems in cities (Geurs and Van Wee, 2004). Several studies have investigated sustainable urban mobility in Budapest. One study found that the use of public transportation in Budapest has decreased in recent years due to the low quality of services and the increasing popularity of cars (Molnar et al., 2018). Another study examined the potential for sustainable mobility solutions in Budapest, such as bike-sharing and car-sharing, and found that they could reduce traffic congestion and improve air quality (Balazs, 2017).

One of the key challenges for sustainable urban mobility in Budapest is the lack of infrastructure for biking and walking (Zsóka and Szerényi, 2015). Budapest is known for its hilly terrain, which makes it difficult for cyclists to navigate the city (Kovács et al., 2018). However, there have been recent efforts to improve bike infrastructure in Budapest, such as the development of bike lanes and bike-sharing programs (Varga et al., 2016).

Another challenge for sustainable urban mobility in Budapest is the city’s high level of car usage. The number of cars on the roads in Budapest has increased rapidly in recent years, leading to traffic congestion and air pollution (Molnar et al., 2018). To address this issue, there have been proposals to introduce congestion charges or other measures to reduce car usage in the city (Kovács et al., 2018).

In conclusion, sustainable urban mobility is an important issue in Budapest, given its high population density and increasing demand for transportation. The challenges faced by Budapest include the need for improved public transportation services, better bike infrastructure, and reduced car usage.

However, there have been recent efforts to address these challenges and promote more

sustainable mobility solutions in the city. The following alternatives to transportation are mentioned in the literature:

Electric and Hybrid Vehicles have emerged as one of the most promising alternatives for sustainable urban mobility. The use of electric and hybrid vehicles could help reduce air pollution and carbon emissions in Budapest. The city could invest in infrastructure for electric vehicles, such as charging stations, to encourage more people to switch to electric or hybrid cars (E-Mobility Strategy for Budapest, 2019). The Budapest Municipal Government has already implemented an e-mobility strategy to promote the use of electric vehicles.

Autonomous Vehicles have been proposed as a potential solution to reduce traffic congestion, improve safety, and reduce the need for car ownership in urban areas like Budapest. However, the implementation of autonomous vehicles is still in its early stages, and several technical and regulatory challenges must be overcome before autonomous vehicles can become a viable alternative for sustainable urban mobility (Kovács et al., 2018). The development of autonomous vehicles could potentially revolutionize urban mobility in Budapest.

Mobility as a Service (MaaS) is an emerging concept that combines different transportation modes into a single platform, such as public transportation, bike-sharing, and car-sharing. MaaS could make it easier and more convenient for people to use sustainable transportation options in Budapest, leading to reduced traffic congestion and improved air quality (Kovács et al., 2018).

Urban Air Mobility involves using drones or other aircraft for transportation within cities. While this technology is still in its early stages, it could potentially offer a sustainable and efficient alternative to ground transportation in congested urban areas like Budapest. However, several challenges must be addressed before urban air mobility becomes a viable alternative for sustainable urban mobility, including safety, noise, and regulatory issues (Varga et al., 2020).

Pedestrian and Bike-Friendly Urban Design improving the infrastructure for walking and biking could encourage more people to use these sustainable modes of transportation in Budapest. This could include building more bike lanes, pedestrian-friendly streets, and safe crossings. Promoting pedestrian and bike-friendly urban design could lead to reduced traffic congestion, improved air quality, and a more sustainable transportation system in Budapest (Varga et al., 2016).

In conclusion, several alternatives for sustainable urban mobility in Budapest have been proposed in the literature. Electric and hybrid vehicles, autonomous vehicles, MaaS, urban air mobility, and pedestrian and bike-friendly urban design are among the most promising alternatives. While each alternative has its advantages and challenges, a combination of these alternatives leads to a more sustainable and efficient transportation system in Budapest.

1.2. METHODOLOGY

1.2.1. STRATEGIC FORESIGHT

The aim of the research is to identify the possible futures of mobility development in Budapest by 2030. To find the relevant answers to the research question, strategic foresight is used as a research model. Strategic foresight helps identify trends and understand the different challenges that may occur in the future. (OECD, n.d.) The research is using the framework foresight model created by P. Bishop and A. Hines. The method provides guidance on the foresight project from the framing of the domain to developing several alternative futures, including the preferred one as well. (Bishop, P., Hines, A. 2012) The model breaks foresight into six activities: framing, scanning, forecasting scenarios, envisioning the future, planning, and acting. (Hines, A. 2006.) This offers a systematic means to strategic foresight. Framing is about the identification of the domain. Scanning is scanning the system, its history, and its context. Forecasting future

scenarios is about the development of alternative, future scenarios by drives and uncertainties. The vision is the implication of the forecast. Followed by the planning of the strategy and options. Finally, act, communicate results, and develop an action plan. (Hines, A. 2006)

1.2.2. DATA COLLECTION

In this study, the authors aim to identify the driving forces of alternative scenarios for sustainable mobility in Budapest. The data collection was done based on three elements: focus group discussion, review of motivations to transition to sustainable mobility, and an overview of EU and Budapest regulations for sustainable mobility. The objective of this research is to get a clear picture of possible future outcomes of the development of sustainable mobility in Budapest by 2030. The paper is aiming to establish four different future scenarios based on the research model of strategic foresight. The framework of the model integrates the weak and strong signals into scenario development. Scenarios are tools to analyse possible future consequences of the changing environment. Therefore, uncertainty can be reduced. (Future Screening, n.d.) The development of the possible scenarios is based on qualitative data collection. First, the different trends which are affecting the future of mobility were identified by collecting data from the visions for the future and related climate strategies of the municipality. Therefore, both the EU-level and local level political environments were researched. The authors collected those regulations and strategies which affect the future of mobility in the EU and in Budapest. Further, social trends were collected through a focus group discussion by asking citizens of Budapest about their transportation habits in the capital. During the focus group discussion, the participants expressed their opinions regarding the future opportunities for development.

1.2.3. DATA ANALYSIS

In order to create four possible future scenarios for the implementation of sustainable mobility in Budapest, based on the collected data the authors formulated driving forces. In relation to the development of scenarios only those driving forces were used that have a high importance level and a high uncertainty level. The paper examines the level of uncertainty as it supports better understanding, anticipating, and preparing for change in future. Therefore, first the existing driving forces were analysed with the use of the importance-uncertainty table. The outcome of the analysis was the categorization of driving forces into groups based on their level of importance considering the sustainability goals of the EU and of Budapest city and based on the level of uncertainty regarding the representative state and strategies in force for sustainable mobility in the capital city. The authors grouped the driving forces with high importance and high uncertainty levels, and two main groups were identified. One of the groups includes those drives that are influenced by political support. In other words, the future possibility of the occurrence of the driving forces in that group is based on the political and legal direction of the city administration. The other group is characterized by the impact of economic stability and behaviour of citizens. The next part of the research is the construction of a two-axis matrix based on the two distinguished groups. The vertical axis' two ends are the high political support and the lack of political support, while the horizontal axis' presents the developed social-economic condition and the worsening social-economic condition. According to the two-axis matrix, four different scenarios are identified. Finally, four possible scenarios are developed.

1.2.4. FOCUS GROUP DISCUSSION

To gather insights from the public, the authors conducted a semi-structured interview with citizens living in Budapest in the form of a focus group discussion. The participants were people

who use public transportation almost every day. The interview focused on their opinions about the current public transportation system in Budapest, challenges and motivations for biking and walking, encouragement for public transportation usage, car usage in Budapest, and the possibility of introducing more electric or hybrid vehicles to the public transportation fleet in Budapest. The interviews provided valuable insights into the needs and expectations of the public towards sustainable mobility in Budapest.

The questions used for the focus group interview were:

- What do you think about the current public transportation system in Budapest? What improvements would you suggest making it more sustainable?
- What are the challenges and motivations for biking and walking in Budapest? Are there any areas that need improvement?
- What would encourage you to use public transportation more often in Budapest?
- What is your opinion about using a car in Budapest? Do you think there should be more restrictions on car usage in the city?
- What do you think about the possibility of introducing more electric or hybrid vehicles to the public transportation fleet in Budapest?

The driving forces gained from the focus group discussion are summarized in Table 2. Appendix, pg. 18-20.

Motivations to Transition to Sustainable Mobility

In this study, the authors used the motivations that are concluded by researchers in their research work to come up with the driving forces that could result in an alternative future for the current transportation system in Budapest.

The contribution of sustainable modes of transportation such as electric vehicles is reducing greenhouse gas (GHG) emissions, which are the primary cause of global warming and the degradation of air quality. These are the primary reasons for public interest in the adoption and use of electric vehicles.

The main motivations for this transition are as follows:

1. Emission reduction from Electric Cars

One of the reasons why the number of electric vehicles on the road is still small is that customers' expectations of their benefits in terms of mitigating climate change by lowering GHG emissions have not yet matured (Rezvani et al., 2015). Based on the results of some studies, due advancements in technology and evolutions in the process of manufacturing electric vehicles in recent years, they emit much less GHG than conventional vehicles (Transport & Environment, 2020, Emilsson & Dahllöf, 2019).

2. Reduction in the costs of ownership

Owning and using a sustainable means of transportation reduces the overall cost of utilizing it. In the case of electric vehicles, although the purchasing costs are higher compared to conventional cars, the higher prices will be compensated by cost reductions in terms of fuel and maintenance costs over a period of time. Moreover, the financial incentives provided by governments to encourage people to buy electric cars, as well as other incentives such as free parking areas, are other reasons that people are willing to adopt a sustainable way of transportation at a growing rate.

3. Moral norms

Some research has indicated that normative motives, or individual perceptions of moral correctness and incorrectness (personal moral norms), play an important role in the purchasing of sustainable goods (Jansson, 2011; Jansson et al., 2010). If consumers agree that buying sustainable products is the right thing to do, the likelihood of making a green purchase rises.

4. Pleasant sensation from using sustainable mobility

A pleasant sensation, or whether sustainable consumption enhances one's emotions, is an important explanation for consumer purchases of sustainable products. Expecting satisfaction and excitement from the purchase of sustainable goods will increase the probability of selecting a green purchase (Onwezen et al., 2013; Rezvani et al., 2017).

EU regulations on Sustainable Urban Mobility

EU regulations will be another element influencing the future of mobility in Budapest. Twenty five percent of the EU's greenhouse gas emissions are attributable to transportation, and this number is rising. By 2050, transport emissions must be reduced by 90% in order to become climate neutral. The decrease will require participation from all modes of transportation, including land, rail, air, and water. Providing people with more inexpensive, accessible, healthier, and cleaner alternatives to their present modes of transportation is essential for achieving sustainable transport (EUR-lex, 2019).

Becoming more sustainable and reducing emissions is the most serious challenge that the transportation sector is facing. Considering its significant share of the EU's overall greenhouse gas emissions, the EU's targets of at least a 55% reduction in greenhouse gas emissions by 2030 and of achieving climate neutrality by 2050 can only be met by implementing more ambitious policies to immediately reduce transportation's reliance on fossil fuels and work in tandem with efforts to achieve zero pollution. Consequently, it will lead to the European Green Deal’s success (European Commission, n.d.).

The new license for the transportation industry's expansion must be the greening of mobility. Mobility in Europe should be based on an effective and interconnected multimodal transport system, for both individuals and cargo, enhanced by an affordable high-speed rail network, an abundance of infrastructure for recharging and refuelling zero-emission vehicles, and a supply of renewable and low-carbon fuels, and cleaner and more active mobility in greener cities that promote the health and wellbeing of their residents. To put European transportation on the right path for a sustainable and smart future, the European Commission developed a “Sustainable and Smart Mobility Strategy”. It contains scenarios that are common to those supporting the 2030 climate target plan, showing that, if ambitious enough, the combination of the policy measures in this strategy can result in a 90% decrease in the transportation sector’s emissions by 2050 (EUR-lex, 2020).

Various milestones that are set to show the European Transport System’s path towards achieving the objective of sustainable, smart, and resilient mobility that help to outline future policies are as follows:

1. Table: Milestones introduced by European Commission

By 2030
At least 30 million zero-emission vehicles will be in operation on European roads
100 European cities will be climate neutral
High-speed rail traffic will double
Scheduled collective travel of under 500 km should be carbon neutral within the EU
Automated mobility will be deployed on a large scale
Zero-emission vessels will become ready for market
By 2035
Zero-emission large aircraft will become ready for market
By 2050
Nearly all cars, vans, buses as well as new heavy-duty vehicles will be zero-emission
Rail freight traffic will double
High-speed rail traffic will triple
The multimodal Trans-European Transport Network (TEN-T) equipped for sustainable and smart transport with high-speed connectivity will be operational for the comprehensive network

Source: EUR-lex, 2020.

"Sustainable and Smart Mobility Strategy" that is established by the European Commission identifies 10 flagship areas with an action plan to guide works needed to be done in the coming years. Among those, the ones that are in close connection with sustainability in urban mobility are as follows:

1. Boosting the uptake of zero-emission vehicles, renewable & low-carbon fuels and, related infrastructure
2. Making interurban and urban mobility more sustainable and healthier
3. Greening freight transport
4. Pricing carbon and providing better incentives for users
5. Making connected and automated multimodal mobility a reality
6. Innovation, data and Artificial Intelligence for smarter mobility
7. Making mobility fair and just for all
8. Enhancing transport safety and security

Budapest - on the way to sustainable mobility

Budapest the capital city of Hungary, is home to 18% of the country's population. (KSH, 2017) The city functions as an economic centre, and attracts people from the surrounding towns (agglomeration), around half a million people travel to Budapest for work or study every day (Koltai, L.; Varró, A., 2020). Although the recent COVID-19 pandemic has affected the mobility of people in many cities, including Budapest, restrictions had an impact on the use of public transportation and the introduction of home offices and online study/work/shopping. (Bucsky, P., 2020). According to László Fendrik, the former CEO of BKK (until 2021), the pandemic besides the challenges of public transportation resulted in the shift in-car use, and in the increasing popularity of micro-mobility devices such as walking, cycling, and scooters. (Polis Network, 2021)

Even before the pandemic, in 2013 Budapest decided to reconsider its transport development strategy. (eltis.org, n.d.) The so-called Balázs Mór Plan strategy was created based on the principles of the European Commission's Sustainable Urban Mobility Plan. The plan

aims to increase the rate of pedestrians by implementing pedestrian and bicycle-friendly aspects. Moreover, the creation of an interconnected city for cyclists is an important aspect of the plan. The goal is to make public transportation an attractive transportation mode for citizens. In addition, the decrease in the proportion of car transportation is a goal of the plan. (Budapest Főváros Önkormányzata, 2013)

In 2019 the General Assembly of the Municipality of Budapest adopted the Budapest Mobility Plan lasting until 2030. (BKK, 2019) The objectives of the Mobility Plan took into account both the national and the EU objectives, which can be listed as objectives about the reduction of the burden on the environment and of greenhouse gas emissions and local pollution. Moreover, it contains objectives regarding energy security, reduction of dependence on hydrocarbon-based fuels, making the regions of Europe more competitive while improving the quality of life for European citizens, and finally the transport safety as a priority. (Budapest. hu, 2019) According to the Mobility Plan, the future vision of Budapest considering sustainable mobility is as follows:

"Budapest is a liveable attractive capital city with a unique character and is a respected member of the European network of cities as the innovative economic and cultural centre of the country and the city region." (Budapest.hu, 2019)

To achieve the vision by 2030, the strategic document has identified four groups of measures of improvement. (Budapest.hu, 2019) One is the improvement of connections in public transportation, which includes both the introduction of new connections as well as the safe and reliable development of existing networks. The second important approach is the development of the public transportation vehicle fleet.

One reason behind this decision is to make public transportation a more attractive option for travelers, as vehicles offer comfortable and high-quality travel. Moreover, it supports the reduction of environment-related burdens caused by the transport system as the new vehicles will be fuel-efficient and less polluting. (Budapest.hu, 2019) Third, the improvement of service also affects passengers by influencing the transport mode selection. These measures are aimed at services such as information, ticketing, route organization, reliability, and punctuality, reducing the duration of transfers, and increase of comfort. (Budapest.hu, 2019) Final measures concern the existence of efficient governance by consistent regulations and passenger-friendly developments of national, regional, and local networks. (Budapest.hu, 2019) In 2021 the Municipality of Budapest adopted the so-called SECAP - Sustainable Energy and Climate Action Plan document, and the local climate strategy of the capital city. (Budapest.hu, 2021)

1.3. RESULTS

The results of the research are the four alternative scenarios for the future of mobility in Budapest in 2030. These scenarios represent potential future states which are emerging from current trends, driving forces, and uncertainties. The four potential scenarios show the different outcomes of the present trends. These scenarios help decision-makers to anticipate and plan for possible future events, considering different perspectives and strategies. In strategic foresight, alternative scenarios are developed by identifying key driving forces, such as social, economic, environmental, and technological factors that shape the future, and exploring how they might interact and impact different outcomes. This process enables stakeholders to consider a range of possibilities and develop proactive strategies to manage and respond to potential changes in their environment. The driving forces of the future of urban mobility in Budapest are collected based on a focus group discussion and from document analysis.

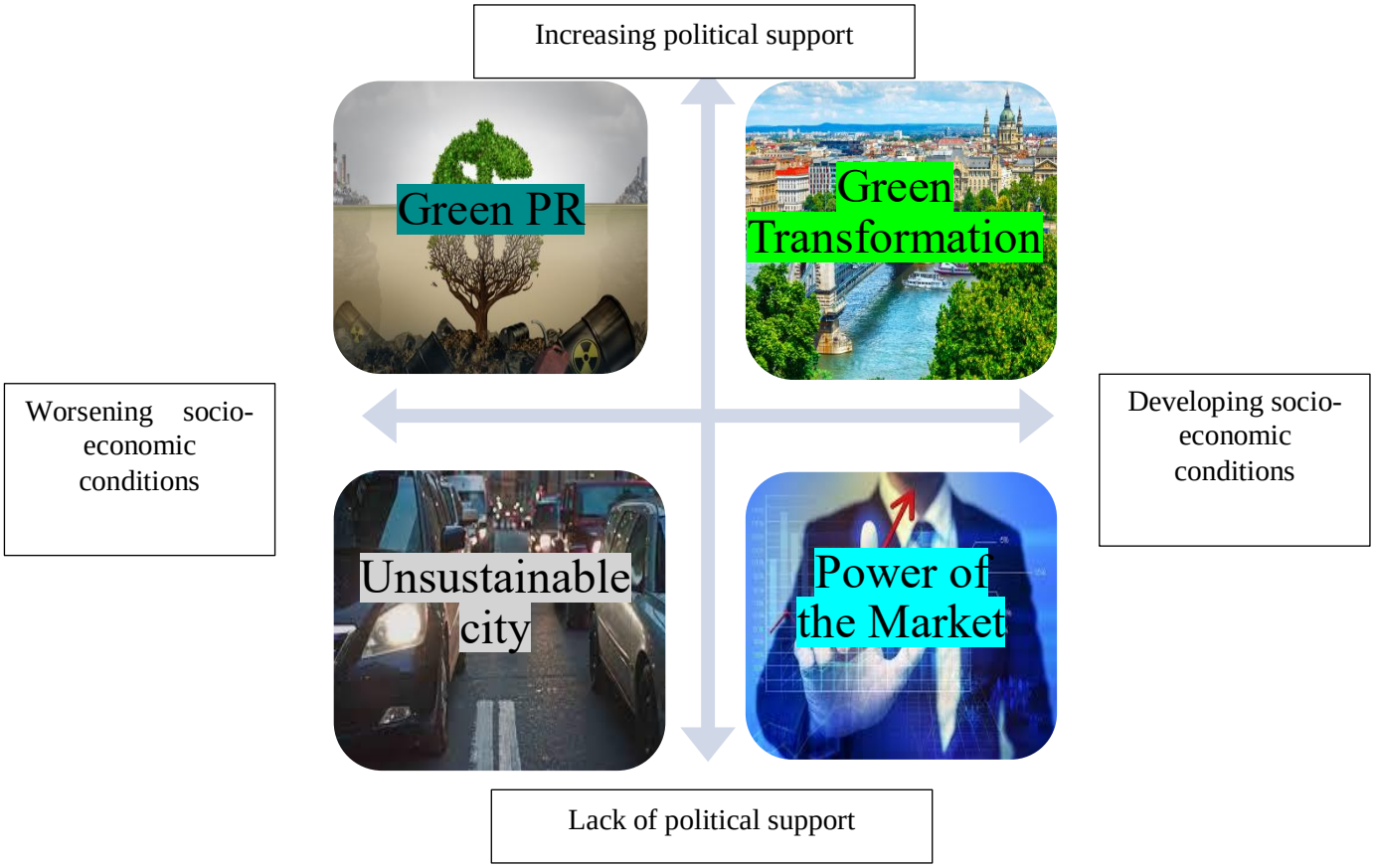
Importance-Uncertainty Analysis

The data collection – focus group discussion and document analysis - has resulted in a list of driving forces that all effecting the future of urban mobility in Budapest. The driving forces help us to understand the change because drivers are those trends that can influence the future. Ultimately, 48 driving forces were collected. Table 2. in the Appendix summarizes the driving forces. The authors rated each driving force according to the level of their importance in influencing the future and how uncertain the occurrence of the force is in 2030. The rating is done on a 1-10 scale, where the value 1 means that the force is not important at all and the value 10 means the force is very important; and value 1 shows that the force's occurrence is certain, and value 10 describes the total uncertainty of the occurrence of the driver. In the next stage, those forces which are rated with high importance and high uncertainty values will be used. (Appendix, Table 2, pg. 18-20)

Two-Axis Method

After analysing the importance and uncertainty level of the collected driving forces two main groups of driving forces were identified (Appendix, Table 3, pg. 21-22) One group includes those forces with high importance and high uncertainty level which possibility and outcome are influenced by the level of political support. The other group includes those driving forces whose future possibility is highly dependent on the level of economic-social development. By using these two factors the two-axis matrix was created that offers four possible scenarios for Budapest's sustainable mobility by 2030. (Figure 1.)

1. Figure: Two Axis matrix



Source: created by the authors, based on own data

Power of the market scenario – lack of political support, developing socio-economic

conditions

In this scenario, the market experiences a lack of political support and faces developing socio-economic conditions in the context of sustainable mobility. Despite limited government support and resources, the power of the market drives the development of sustainable mobility solutions. There are some speculative depictions of this scenario such as the Rise of Innovative Startups, Collaborations and Partnerships, Public-Private Partnerships, and Shared Mobility Solutions.

In the absence of significant government support, the scenario of high economic potential drives entrepreneurial innovation and market-driven solutions for sustainable urban mobility in Budapest. The private sector, including startups, technology companies, and investors, recognizes the economic opportunities in the sustainable mobility sector and takes the lead in developing innovative transportation solutions. Entrepreneurial ventures emerge to address the demand for clean and efficient mobility options, such as electric vehicle-sharing platforms, smart transportation apps, and sustainable logistics services (Kovács et al., 2018). These market-driven solutions leverage technological advancements, data analytics, and user-centric approaches to offer convenient, cost-effective, and environmentally friendly transportation alternatives to the public.

In this scenario, the high economic potential of sustainable urban mobility drives the involvement of public-private partnerships. Despite limited political support, the government recognizes the economic benefits associated with sustainable mobility and establishes partnerships with private entities. Through these collaborations, financial incentives and tax breaks are provided for businesses that invest in sustainable transportation solutions. The private sector plays a critical role in financing infrastructure projects and developing sustainable mobility services, while the government provides regulatory support and facilitates favourable conditions for these initiatives to thrive. This approach fosters a symbiotic relationship between economic growth and sustainability, encouraging innovation and investment in the sustainable urban mobility sector.

Given the high economic potential, international investors and organizations recognize the opportunities in Budapest's sustainable urban mobility sector. Foreign investment and collaboration bring in financial resources, expertise, and global best practices. International organizations support capacity-building programs, technical assistance, and knowledge-sharing to enhance the implementation of sustainable mobility initiatives. Economic integration with neighbouring regions and cities leads to the development of cross-border transportation networks and coordinated sustainable mobility strategies. The economic potential of sustainable urban mobility becomes a driving force for collaboration and cooperation among different stakeholders, fostering a shared commitment toward creating a sustainable and economically prosperous transportation system in Budapest.

The high economic potential of sustainable urban mobility attracts foreign investment and fosters international cooperation in Budapest. Global investors recognize the market opportunities and the city's potential as a sustainable mobility hub. International companies bring in expertise, technology, and financial resources to support the development of sustainable transportation infrastructure and services. These foreign investments contribute to the growth of the local economy, job creation, and knowledge transfer. Furthermore, international cooperation agreements are established to leverage best practices and lessons learned from other cities and regions around the world. Collaboration with international organizations and experts enhances the city's capacity to implement sustainable mobility solutions, build supportive policy frameworks, and create a thriving ecosystem for sustainable urban transportation.

While lacking significant political power and facing developing socio-economic

conditions, Budapest's sustainable mobility landscape evolves due to the power of the market. The market-driven approach leads to the emergence of innovative start-ups, increased consumer demand for sustainability, collaborative partnerships, technological advancements, shared mobility solutions, business-led initiatives, public-private partnerships, and grassroots movements advocating for change. Together, these factors drive the adoption and development of sustainable mobility options, contributing to a greener and more accessible transportation system in Budapest.

Green Budapest – increasing political support, developing socio-economic conditions

In the Green Budapest scenario, Budapest will have developed a highly integrated and efficient public transportation network by 2030. This network would consist of an expanded metro system, tram lines, buses, and cycling infrastructure, all seamlessly connected and accessible to residents and visitors. The public transportation system would be powered by clean energy sources, such as renewable electricity or hydrogen, reducing carbon emissions and air pollution. Advanced technology and smart solutions would be employed to optimize routes, schedules, and ticketing systems, ensuring smooth and convenient travel for passengers. Additionally, affordable, and flexible ticketing options, including contactless payments and integrated multi-modal passes, would encourage the use of public transport over private vehicles.

In this Green Budapest scenario, Budapest would prioritize and promote active modes of transportation, such as walking and cycling. The city would have an extensive network of pedestrian-friendly streets, sidewalks, and bike lanes, making it safe and convenient for people to walk and cycle for their daily commuting needs (Varga, et al.2020). Dedicated bicycle parking facilities, bike-sharing programs, and incentives for cycling, such as subsidies for electric bicycles, would encourage residents to choose sustainable alternatives to cars. Moreover, green spaces and recreational areas would be interconnected, promoting a healthier and more active lifestyle while reducing the overall demand for motorized transportation.

By 2030, Budapest would have made significant progress in the electrification of its transportation fleet. The Green Budapest scenario envisions a substantial increase in the adoption of electric vehicles (EVs), including both private cars and public transport buses. This transition would be supported by the establishment of a comprehensive charging infrastructure network throughout the city, ensuring that EV owners have convenient access to charging facilities. In addition to electrification, shared mobility solutions, such as car-sharing services and ride-sharing platforms, would be widely available and embraced by the population. This would reduce the overall number of vehicles on the road, leading to decreased congestion and emissions, while providing flexible and affordable transportation options to the residents of Budapest.

Unsustainable City – lack of political support, worsening socio-economic conditions

In the scenario of an Unsustainable City, Budapest faces a challenging future characterized by the continuation of outdated and unsustainable transportation practices. Despite growing concerns about congestion, air pollution, and the need to reduce carbon emissions, the city fails to make significant progress toward sustainable urban mobility. One of the primary reasons for this stagnation is the lack of political support and commitment to prioritize sustainability in transportation planning. Without strong leadership and clear policies, the city struggles to drive the necessary changes and fails to capitalize on opportunities for sustainable mobility.

Another contributing factor to the Unsustainable City is the absence of adequate economic and social development that supports sustainable transportation. Limited investments in public transportation infrastructure and services result in outdated and unreliable systems that fail to attract commuters away from private cars. The lack of incentives for alternative

modes of transport, such as cycling, walking, or car sharing, further exacerbates the reliance on private cars and perpetuates unsustainable transportation patterns. Consequently, Budapest remains locked in a cycle of congestion, air pollution, and increased carbon emissions, hindering its progress toward becoming a greener and more sustainable city.

Overall, the scenario of Unsustainable Status highlights the missed opportunities and challenges faced by Budapest in achieving sustainable urban mobility. The absence of political support, inadequate economic-social development, and a lack of incentives for sustainable modes of transport all contribute to a future where the city continues to suffer from the negative impacts of urbanization and fails to create a healthier and more sustainable environment for its residents.

Green PR - increasing political support, worsening socio-economic conditions

In the scenario of Green PR, Budapest faces significant challenges in achieving sustainable urban mobility due to various limitations and constraints. While there is a recognition of the importance of transitioning to greener and more efficient modes of transportation, the city struggles to overcome barriers that impede progress. One of the primary challenges is the limited availability of resources and funding. Without sufficient financial support, it becomes difficult to invest in the necessary infrastructure, technologies, and policies to drive sustainable mobility initiatives. The lack of funding also hinders the development and expansion of public transportation networks, making it harder for residents to rely on alternative modes of transport.

Additionally, social support plays a crucial role in the success of sustainable urban mobility initiatives. However, in the scenario of Green PR, there is a lack of widespread awareness and engagement from the community. Public awareness campaigns and education programs are limited in their reach and effectiveness, making it challenging to foster a culture of sustainable transportation. Without a strong social support base, it becomes difficult to generate the momentum needed to push for policy changes, behaviour shifts, and investments in sustainable mobility solutions. As a result, Budapest finds itself struggling to make significant progress towards a greener and more liveable city, as the limited transformation efforts fall short of creating the desired impact.

CONCLUSION

Through the strategic foresight research model, this study explored the potential trajectories of mobility development in Budapest by 2030. Four distinct scenarios were constructed based on varying levels of political support and socio-economic conditions.

In the first scenario, "Green PR," limited resources and funding hinder Budapest's progress towards sustainable urban mobility, compounded by a lack of community engagement. The second scenario, "Unsustainable City," depicts a lack of political commitment and economic development, leading to congestion, pollution, and unsustainable transportation practices.

In contrast, the third scenario, "Green Budapest," envisions a city that prioritizes pedestrians, cyclists, and public transport, implementing car-free zones, enhancing public transportation, and expanding cycling networks. This transformation results in a greener, healthier, and more liveable Budapest, promoting sustainable transportation modes and reducing carbon emissions.

The fourth scenario, "Power of the Market," demonstrates the government's strong dedication to sustainable urban mobility, establishing comprehensive policies and regulations. These include incentives for public transport, walking, and cycling, as well as strict emissions standards and collaborative efforts with stakeholders.

This research underscores the significance of political support, socio-economic

conditions, and community involvement in driving sustainable urban mobility. Policymakers and stakeholders can employ the insights gained from these scenarios to make informed decisions, develop strategies, and prioritize sustainable transportation, ultimately contributing to Budapest's vision as a liveable and innovative capital city by 2030.

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APPENDIX

Table 1. Importance-Uncertainty Analysis

Driving Forces from FOCUS GROUP DISCUSSION	Importance (0-10)	Uncertainty (0-10)	Driving Forces From Motivations and Regulations	Importance (0-10)	Uncertainty (0-10)
Municipality will introduce a no-car area in the city centre of Budapest	7	9	The technology for electric vehicles will continue to advance in the future leading to a faster adoption of EVs	9	8
The public transport system will be renewed by buying electric buses or by trams	10	8	The government will increase the incentives for buying EVs	8	8
Modernisation of public transport vehicles	10	3	The government will provide a large number of non-financial incentives for EVs and bikes	8	8
The number of companies which provide using shared bike facilities will increase	9	8	The government will increase the tax on conventional cars sales	7	9
Conventional buses will be phased out in the city centre of Budapest	6	9	The public transport ticket prices will be lowered for creating an all-inclusive public transportation system	9	9
Metro lines will be expanded to cover more area of the city	10	10	The government will provide incentives to buy bike and scooter	5	9
People's knowledge will increase to switch to a sustainable way of transport	8	9	The share of renewable energy resources will increase in the power grid supply	9	7
MOL BuBi stations will be available in more parts of the city, the cycling service is expanding	8	7	People will feel responsible to buy electric cars to harm the environment less	8	8
Development of water transportation network	8	9	The government will increase the standard of pollution criteria of cars	10	8
Car sharing service is developing	7	8	The government will invest more on providing infrastructure for EVs (Charging spots)	9	8

Driving Forces from FOCUS GROUP DISCUSSION	Importance (0-10)	Uncertainty (0-10)	Driving Forces From Motivations and Regulations	Importance (0-10)	Uncertainty (0-10)
For regional connection improvement new lines will be introduced.	8	9	People will be motivated to lower their costs by buying EVs	8	7
Suburban railway (HÉV) vehicles will be replaced with new vehicles.	10	9	More Mobility Point will be implemented in different parts of the city.	7	9
Increase of the interconnected cycling network for bikes	9	3	The connection between the different networks will be better	9	8
The fuel prices will increase.	10	7	Urban and suburban timetables will be harmonized	8	8
Home office working possibility will increase in the future	9	7	Strengthening equal opportunities (accessible transport for disabled, passengers with rolling luggage etc.)	9	4
			Public transportation is going to be safe, no crime	8	9
			Public transportation is a reliable and predictable means of transportation.	10	4
			P+R car parks and B+R storage facilities will be built at every station of the suburban sections	10	8
			The state railway network (MÁV) will be included in urban transportation.	4	9
			Pedestrian connections in the inner city will be developed	8	7
			Improving the accessibility of Liszt Ferenc Airport	7	9
			Developing cycling tourism connections in the region	3	8
			The number of vehicles which is capable for carrying bikes are increasing	7	7
			Improvement of the mobile application	7	7

Driving Forces from FOCUS GROUP DISCUSSION	Importance (0-10)	Uncertainty (0-10)	Driving Forces From Motivations and Regulations	Importance (0-10)	Uncertainty (0-10)
			Service providers in Budapest will feel more responsible towards sustainable mobility	10	5
			The financing of public transportation will be more reliable and predictable	10	10
			The increase of the price and hours of parking in Budapest will results in less cars	9	5
			The number of cars on Budapest roads will decrease	10	10
			Road traffic will decrease	10	10
			The volume of traffic arriving from the agglomeration will increase	8	7
			The popularity of cycling to and from work in Budapest will grow	7	8
			Young people are trying new services in community economy (car-pooling, car renting, car sharing).	7	7
			Population will decrease in Budapest.	9	9

Source: created by the authors, own data collection

Table 2. Groups of driving forces

Group 1: political support	**Group 2: Socio-economic conditions**
Municipality will introduce a no car area in the city centre of Budapest	Metro lines will be expanded to cover more area of the city
Public transport system will be renewed by buying electric buses or by trams	The number of companies which provide using shared bike facilities will increase
Modernisation of public transport vehicles	People knowledge will increase to switch to a sustainable way of transport
Conventional buses will be phased out in the city centre of Budapest	Development of water transportation network
Metro lines will be expanded to cover more area of the city	Car sharing service is developing
The government will increase the incentives for buying EVs	The technology for electric vehicles will continue to advance in the future leading to a faster adoption of EVs
Government will increase the tax on conventional cars sales	The fuel prices will increase
Share of renewable energy resources will increase in the power grid supply	Home office working possibility will increase in the future
Government will increase the standard of pollution criteria of cars	The government will increase the incentives for buying EVs
Government will invest more on providing infrastructure for EVs (Charging spots)	The public transport ticket prices will lower for all-inclusive public transportation
More Mobility Point will be implemented in different parts of the city.	Share of renewable energy resources will increase in the power grid supply

Group 1: political support	Group 2: Socio-economic conditions
Connection between the different networks will be better	People will feel responsible to buy electric cars to harm the environment less
Urban and suburban timetables will be harmonized	People will be motivated to lower their costs by buying Evs
Public transportation is going to be safe, no crime	P+R car parks and B+R storage facilities will be built at every stations of the suburban sections
P+R car parks and B+R storage facilities will be built at every stations of the suburban sections	The number of public transportation vehicles which is capable for carrying bikes are increasing
Pedestrian connections in the inner city will be developed	The number of cars on Budapest roads will decrease
Improving the accessibility of Liszt Ferenc Airport	Road traffic will decrease
The number of vehicles which is capable for carrying bikes are increasing	The volume of traffic arriving from the agglomeration will increase
The financing of public transportation will be more reliable and predictable	The popularity of cycling to and from work in Budapest will grow
	Population will decrease in Budapest.
	Young people are trying new services in community economy (car-pooling, car renting, car sharing).
	By 2030 at least 30 million zero-emission vehicles will be in operation on European roads
	100 European cities will be climate neutral by 2030
	High-speed rail traffic will double in the EU by 2030
	Automated mobility will be deployed at large scale in the EU by 2030
	Zero-emission vessels will become ready for the EU market by 2030

Source: created by the authors, own data collection

Embracing the virtual: a comprehensive strategic foresight analysis of virtual reality's impact on tourism marketing[7]

Junfeng Shi[8], Xueying Tian[9], Yuxiaosi Wu[10]
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Abstract

Virtual Reality (VR) is a technology that immerses users in a virtual world, giving them an entirely new experience. Based on past research, experts discovered that VR has more advantages than disadvantages. However, because VR is still in its early phases, little research has been conducted on it as a tourism marketing tool. The aim of this research is to uncover difficulties and drivers in order to forecast the future of this technology. This study employs both qualitative and quantitative methods, as well as future wheel implications. STEEPV analysis will be utilised to identify key drivers of technology, and SPSS was used to examine the data. The online questionnaire was distributed via Chinese social media, and had a 75.94% response rate, with 60 of 79 feedback recorded. The most important drivers of the technology are the rising number of VR users, increased brand recognition, and the ability to provide emotional value. The environment is one of the least discussed drivers. To establish the future implications of Virtual Reality as a Tourism Marketing tool, future forecasts were produced using Future Wheel analysis. According to the impact-uncertainty analysis, the top two drivers were "Tourism marketing in VR will increase brand recognition due to the unique experience" and "Virtual Reality enables users to explore places and contents without physically being there." The forecasts produced utilising future wheel analysis were market leaders for marketing purposes, increases brand recognition, fosters innovation, and greater immersion based on the two leading drivers. These forecasts have a favourable impact on the future of technology. An increase in the period of data collection was suggested as a way to improve this study. This allows for more accurate responses from customers. VR has a potential impact on tourism marketing in the future, which will boost the current tourism sector.

Keywords: VR, Virtual Reality, VR Tourism, Tourism Marketing, Innovation

JEL Codes: M31, Z32, Z33

[7] The authors made equal contributions to the completion of this research paper.

[8] PhD Student, Budapest Business School, Doctoral School of Entrepreneurship and Business, Shi.Junfeng.31@unibge.hu

[9] PhD Student, Budapest Business School, Doctoral School of Entrepreneurship and Business, Xueying.Tian.62@unibge.hu

[10] PhD Student, Budapest Business School, Doctoral School of Entrepreneurship and Business, Wu.Yuxiaosi.73@unibge.hu

INTRODUCTION

Virtual reality (VR) and artificial intelligence (AI) continue to attract interest due to the accelerated development of information and communication technologies (Baños, 2004). Compared to the traditional text-description-centric method of accessing tourism information, virtual reality could provide unique, immersive, and customised experiences in tourism (Bec et al., 2019).

VR is regarded as a potent tourism marketing tool because it offers immersive virtual environments that allow potential tourists to preview destinations, accommodations, and attractions prior to booking a trip. To clarify, the aforementioned technology offers individuals the opportunity to engage in a trial period prior to committing to a purchase. This immersive experience is not constrained by temporal or spatial limitations while boasting a higher degree of interactivity and diversity. (Tussyadiah et al., 2018). Furthermore, the protracted impact of the pandemic throughout recent years has exerted a noteworthy influence on the expansion of tourism in both the local and global travel sectors within China. Continual policies to combat epidemics have resulted in a significant increase in travel expenses (Pratisto, 2022). Virtual reality technology has re-emerged into the spotlight currently.

Meanwhile, the application of virtual reality technology in tourism can mitigate the impact of force majeure, such as the COVID-19 pandemic, on tourism development, provide new ways for consumers who lack the time to make long-distance trips to meet their travel needs, and save money on travel costs (Godovykh, 2022). Many destination organisations have also taken notice of VR (Blooloop, 2020). This immersive tourism experience enables history to be more than words in a book in an exhibition; it is a living story that unfolds around the visitor, allowing for an immersive experience of the relevant cultural history (Aofeng and Han, 2016).

Moreover, according to Aziz and Zaniol (2011), the potential applications of virtual reality in tourism marketing are extensive and diverse. Hotels and resorts can provide virtual tours of their facilities, whereas tour operators and travel agencies can use VR to demonstrate their offerings. Additionally, VR can help businesses collect valuable consumer behaviour data. By monitoring and analysing the interactions of users within the virtual environment, marketers can gain profound insights into consumer preferences and behaviour, which can inform more targeted and effective marketing strategies (Lin, 2022).

Significance of the Study

There are countless applications for VR technology in numerous industries, including tourism (Chimakurthi, 2018). Despite the transformative potential of VR applications in tourism, little strategic foresight research has been conducted. Our study aims to fulfil this literature gap and enrich the relevant foresight studies.

This research aims to identify the factors that motivate the use of virtual reality in marketing, thereby contributing to an uncharted area (Gao et al., 2022). We want to illuminate this technology-tourism intersection by mapping the forces that drive virtual reality marketing in the tourism industry (Flavián et al., 2019). We will also speculate on the future of VR in tourism marketing. These meticulously researched scenarios will benefit the tourism industry and related industries. We aim to provide these industries with strategic insights that will influence their future operations and decision-making. Additionally, this study intends to inform future research. By adding to the existing body of knowledge, we intend to facilitate future research on the role of virtual reality in tourism marketing.

This study seeks to assist Chinese users in understanding and implementing VR marketing (Gao et al., 2022). This study may help future academics comprehend the uncertainty and organisational performance of virtual reality marketing. These insights can assist researchers and developers in enhancing the administration of VR technology.

In addition, this research seeks to improve VR technology and demonstrate its potential in the tourism and marketing industries. We intend to demonstrate the revolutionary potential of virtual reality, promote its incorporation into tourism promotion, and facilitate the merging of virtual and actuality (Gegung, 2021).

Research Questions

(a) What factors influence the successful adoption of VR technology in tourism marketing?
(b) What optional future implications of VR utilisation may emerge in tourism marketing for Chinese tourists?

Research Objectives

(a) To identify the issues and drivers of employing virtual reality in tourism marketing in China.
(b) To study the future scenarios of virtual reality tourism marketing in China.

1.1. LITERATURE REVIEW

The Definition of Virtual Reality (VR)

The origin of the term "virtual reality" can be traced back to the mid-1970s, as noted by Williams and Hobson (1995), who used it to refer to the interaction between humans and computers. However, owing to the constraints of technology, it did not receive adequate consideration during that period. In recent decades, the field of computer science has experienced significant growth, leading to widespread interest in the topic of VR.

In view of numerous definitions of Virtual Reality (VR) proposed by several leading scholars, for instance, Pimentel and Teixeira (1993) mentioned that VR is a computer-generated experience that is both immersive and interactive. Bell and Fogler (1995) shared the definition that VR is a computer interface that exhibits a notable degree of immersion, credibility, and interactivity, with the aim of inducing users to perceive themselves as being truly situated within a computer-generated environment. While the commonly adopted VR definition was raised by Burdea and Coiffet (2003), as a computer-generated simulation of the real world or of a physical object within it. Later, they further strengthened their definition as a computer-generated three-dimensional world that the user can move around and interact with, simulating some or all of the user's five senses in real-time (Burdea, G., & Coiffet, P, 2017).

Similarly, Farah et al (2019) indicated that VR is a technique that employs computers to create a simulated environment in which users may interact with 3D environments through the use of their senses of sight, hearing, and smell. New display technology and real-time, induced images make virtual reality a multi-sensory experience. To a higher extent, Yung and Khoo-Lattimore (2019) have summarised the three primary features of VR based on Cruz-Neira et al.'s (1992) work. These characteristics include visualisation, which enables users to observe their surroundings using a head-mounted display; immersion, which allows users to suspend disbelief and perceive objects in a physical manner; and interactivity, which provides users with some level of control over their experience through sensors and input devices such as joysticks or gloves.

VR and its Application in Tourism

Several scholars have conducted research on the topic of VR, particularly in the fields of education (Zhang, 2018; Ruan, 2022; Chimakurthi, 2018), retailing (Wu & Kim, 2022; Xue et al., 2020), medical training (Kale, 2018; Indhumathi et al., 2009), and entertainment (Carroll et al., 2019; Xi, 2020; Muravevskaia & Gardner-McCune, 2022). Virtual reality is a highly intriguing area of study within the field of tourism studies, particularly in light of its rapid expansion and diverse range of potential applications. This is especially relevant during and

after the period of the COVID-19 pandemic (Gegung, 2021; Godovykh et al., 2022).

The assessment conducted by Guttentag (2010) highlights the prospective utilisation of VR technology within the tourism industry. The utilisation of VR in the tourism sector has the potential to enhance tourism planning and management. This is achieved by providing a platform for the dissemination of plans and pertinent information to relevant stakeholders, as well as soliciting their feedback. According to Lin et al. (2020), the use of virtual reality has the capacity to considerably augment the tourism sector by offering immersive environments that facilitate virtual tours of hotels and other establishments before the actual visit.

The emergence of virtual reality technology has resulted in a decrease in the discrepancy between in-person and mediated communications. Importantly, VR is a widely accepted educational methodology that employs a three-dimensional simulated interface to showcase tangible or intangible objects to learners without requiring any physical interaction. Virtual reality serves as a mechanism for delivering virtual product education to consumers. The process of consumer learning involves the acquisition of new information and the adjustment of behavior by individuals, as noted by Kempf and Smith (1998), Li et al. (2003), and Kim and Biocca (2006). As per the findings of Suh and Lee's study conducted in 2005, it is crucial for users to obtain product information via the virtual interface. Despite the lack of physical interaction, the benefits of this approach outweigh its drawbacks.

VR and its Application in Tourism Marketing

Numerous studies have been conducted to explore the potential applications of virtual reality technology in the realm of marketing. The utilisation of virtual reality technology in marketing, particularly in relation to enhancing customer experience, was underscored by Kong et al. (2020). According to Łysik and Łopaciński's (2020) analysis, virtual reality (VR) technology holds significant potential as a solution for various marketing and marketing communication applications. The impact of advertising on consumer behaviour is significant, as it has been found to have a favourable influence on product perception and brand recognition. Lin (2022) suggested that the utilisation of VR technology can enhance the experiential marketing strategy in business operations. This technology can facilitate the integration of online and offline channels, leading to increased customer motivation to make purchases. Additionally, VR technology can provide an immersive online shopping experience and enable closed-loop marketing. Li and Mao (2015) highlighted the common use of VR technologies by professionals to attract customers to explore and encounter marketing stimuli prior to making actual purchase decisions.

Virtual reality has the potential to fulfil objectives beyond the mere promotion of a tourist destination. Huang et al. (2015) employed the Technology Acceptance Model (TAM) to investigate visitor behaviour and utilised virtual reality (VR) technology to construct a virtual marketing platform. Their findings provide additional support for the efficacy of VR as a valuable tool in the tourism sector. The utilisation of virtual reality technology is prevalent in educational contexts for the purposes of instructing individuals about tourist destinations and safeguarding historical landmarks (Bec et al., 2019; Yung & Khoo-Lattimore, 2019).

According to the findings of Gutierrez et al. (2008), the attributes of a VR encounter can be defined by its ability to provide a sense of physical immersion and psychological presence. The concept of "immersion" pertains to the degree of detachment experienced by the user from the external environment. According to Gutierrez et al. (2008), certain virtual environments (VEs) are classified as "totally immersive," wherein the user is fully immersed in the VE and has no external interaction. On the other hand, there are "semi-immersive" or "non-immersive" VEs, such as contemporary 3D video games. The degree to which users feel present in a virtual environment can be influenced by the level of immersion provided by the system, as noted by Baños et al. (2004).

Akin to virtual reality, the notion of "presence" has been delineated in diverse manners, as posited by Lombard and Ditton (1997). Referring to Sanchez-Vives and Slater (2005), it is widely believed that presence refers to the sensation of being present in a virtual environment, rather than the physical location of the participant's body. According to Gutierrez et al. (2008), the term "presence" refers to the extent to which individuals exhibit behaviour in a virtual environment that closely resembles their behaviour in a comparable real-life scenario. The concept of 'presence' is intrinsically subjective as it is closely linked to the user's psychological state. However, it is indisputable that the VR system's ability to provide superior sensory information to the user has a significant impact on this phenomenon (Gutierrez et al., 2008). The enhanced ability of virtual reality systems to offer superior sensory information is a predictable outcome given the evolution of VR technologies since the 1960s, as noted by Burdea and Coiffet (2017) and Gutierrez et al. (2008). Presently, virtual reality systems have attained a significant level of advancement.

VR Tourism Experience

Lee and Kim (2021) provide a comprehensive framework analysis of the existing literature on VR, offering a systematic overview of the most relevant studies in this field. This synopsis provides insight into the evolution of virtual reality technology and its implementation across diverse domains, such as the tourism and marketing industries. As technological advancements persist, scholars and professionals are likely to uncover novel approaches to utilising virtual reality to generate increasingly captivating and absorbing encounters for customers.

1. Table Framework analysis of the existing literature on VR

Framework	VR Experience Dimensions	Outcomes	Context	Reference
TAM	Ease of use, Usefulness, Enjoyment	Enjoyment of VR had a significant effect on the intention to use VR.	Entertainment industry	(Lee et al., 2019)
TAM, Self-determination theory (SDT)	Ease of use, Usefulness, Autonomy, Competence, Relatedness	Usefulness, autonomy, and relatedness affected enjoyment, and behavioral intention.	VR Tourism.	(Huang et al., 2015)
Hedonic motivation system adoption model (HMSAM)	Ease of use, Usefulness, Enjoyment	Enjoyment and usefulness of VR affected flow statement	VR Tourism	(Kim & Hall, 2019)
Telepresence	Vividness, Interactivity	Providing application suggestions to the destination marketing	VR Tourism	(Hyun et al., 2009)
Extended telepresence and flow theory	Vividness, Interactivity, Telepresence, Flow	VR amplified flow via vividness, interactivity, and telepresence.	Virtual Reality Spectatorship	(Kim & Ko, 2019)
Trend Prediction	Visualization components, Immersion into the experience, Interactivity	Highlight the usefulness of VR in tourism	VR Tourisn	(Williams & Hobson, 1995)
Consumer Learning	Media richness, Interactivity, Telepresence	Media richness, interactivity, and telepresence increased consumer learning	E-commerce	(Suh & Lee, 2005)
VR technology analysis	Sensorial stimuli, Interactivity	Providing application suggested in tourism areas	VR Tourism	(Guttentag, 2010)
VR experience	Interaction, Immersion	Interaction increased immersion, and interaction and immersion affected customer satisfaction	VR Tourism	(Hudson et al., 2019)

Source: (Lee & Kim, 2021)

Contemporary research on customer engagement places significant emphasis on psychological and behavioural factors. It is understood that a user's psychological inclination towards focal entities, such as a brand or service provider, influences their behavioural compatibility. Consequently, this can lead to positive interactions beyond transactions, such as spreading positive word-of-mouth and aiding others.

Within the tourism and hospitality sectors, previous scholarly studies have shown the capacity of VR technology to enhance customer engagement. For instance, Willems et al. (2019) explored the correlation between enjoyment, the experiences of flow (a mental state of being fully absorbed in the task at hand), and presence (the sensation of being in the virtual environment) as indicators of attunement. They found that VR generated a higher degree of

attunement compared to laptop-displayed 360-degree videos and static images, with VR users reporting greater attunement.

Flavián et al. (2019) posed that the level of embodiment, or the integration between technology and the human body, is a significant determinant of users' perceived usefulness and rewards. It has an impact on users' interest in the technology's interactivity, their engagement with the content, and their perception of the experience as rewarding and interesting overall. Hence, an enhancement in technological embodiment directly corresponds to an improvement in the user's sense of presence and psychological compatibility with the technology.

According to a study by Ying et al. (2022), it was observed that the application of VR advertising positively influenced users' perceptions of the device's utility, ease of use, educational value, and aesthetic experience. A higher level of psychological fit, resulting from a deeper emotional investment in the viewed material, was seen to positively influence users' subsequent behaviour, such as their likelihood to recommend the content to others.

Similarly, Marasco et al. (2018) investigated the influence of next-generation wearable VR experiences on individuals' inclination to visit various destinations and attractions. Their findings suggested that the perceived visual appeal (PVA) and emotional involvement (EI) experienced by users when interacting with VR positively impact their intention to visit cultural heritage sites in various destinations.

Applying the perceptual load theory (Lavie, 1995) to these findings, it's clear that an individual's attention is fully absorbed in relevant tasks when they engage with high perceptual load tasks, such as immersive VR experiences. This allows them to focus on the content, potentially obscuring their external environment and enabling them to disregard irrelevant distractions. This heightened level of engagement and immersion aids memory recall, especially of destination-related selling points presented in VR advertisements. As found by Ying et al. (2022), the quantity of selling points perceived and remembered by viewers correlates directly with their ability to retain this information, leading to a higher likelihood of forming positive opinions about the destination and an increased desire to visit.

The high degree of immersion afforded by VR technology enables the delivery of dynamic and responsive information, potentially capturing tourists' attention and reducing their perceived risk. As a result, tourists gain a more comprehensive understanding of the destination, including its location and other relevant information, reducing feelings of uncertainty and danger. This, in turn, is expected to heighten their satisfaction and commitment, which can result in favourable behavioural outcomes such as positive word-of-mouth, social media sharing, and repeat visits (Ying et al., 2022; Marasco et al., 2018).

2. Table: VR Tourism Studies Advantages and Opportunities

VR Tourism Studies	Advantage and Opportunity
For customer	Full immersion (Castro et al., 2017) Entertainment (Guttentag, 2010; Jung et al., 2018) Enhanced experiences (Bonetti et al., 2017; Quinn et al., 2019) Engagement (Gibson & O'Rawe, 2017) Social interactions (Castro et al., 2017; Jung et al., 2018) Accessibility (Guttentag, 2010) Image formation (Gibson & O'Rawe, 2017)
For Business and Destination	Marketing and promotion (Huang et al., 2013; Marchiori et al., 2018) Sales and distribution (Aziz & Zainol, 2011) Planning and management (Guttentag, 2010) Heritage preservation (Guttentag, 2010) Competitive advantage (Jung & tom Dieck, 2017) Gamification (Xu et al., 2015) Training (Tracey & Swart, 2020)

Source: (Tussyadiah et al., 2018)

3. Table: VR Tourism Studies Disadvantage and Challenges

VR Tourism Studies	Disadvantage and Challenges
For Both Destination and Tourist	Limited immersion (Pratisto et al., 2022) Technical issues (Martín-Gutiérrez, 2016) Accessibility and cost (Zhang et al., 2019) Security and privacy (Kaspersky, 2021) Lack of authenticity (Gao et al., 2022)

Source: Own Compilation

Numerous scholars in the field of VR tourism have conducted studies that provide a comprehensive overview of the primary advantages and disadvantages, as well as the opportunities and challenges, associated with this domain. These factors aid in comprehending the current situation of VR tourism and facilitate the projection of future developments through potential scenario planning.

1.2. METHODOLOGY

Scope

The Fourth Industrial Revolution (IR4.0) includes several technological advances, but this study concentrates on virtual reality (VR) as a crucial technology. While virtual reality has applications in health, gaming, modeling, and marketing, this study focuses on its usage in

tourism promotion. Augmented reality, another developing technology in IR4.0, will not be explored in this study.

The paper embeds horizon scanning, incorporating STEEPV analysis (Proskuryakova et al., 2015) and the future wheel method. The advantages of employing the future wheel method include its simplicity and understanding, as well as the creation of a clear visual map of complex interactions. However, drawbacks include the possibility of inconsistent outcomes, information overload, and the speculative nature of data. The horizon scanning spans a five-year period, from 2023 to 2028. The study uses a variety of sources, including journals, government-related papers, online resources, newspaper stories, non-governmental organisations, and research materials on virtual reality as a tourism marketing tool. The survey includes respondents who are virtual reality creators and users, with an emphasis on VR marketing in China. Questionnaires were issued in order to collect data for analysis.

Research Design

To clarify the data, a mixed-methods approach that included both qualitative and quantitative methodologies was adopted. Engaging in strategic foresight entails a dynamic learning process that exhibits a dual nature, the process encompasses not only the execution of the task at hand but also the concurrent management of its consequences (Gaspar, 2015).
Through the foresight approach, the scenarios, uncertainties, and challenges of VR in tourism marketing will be evaluated in this study. The foresight process focuses on evidence-based future VR tourism marketing ideas. An existing and potential customer who has used VR for tourism as a unit of analysis. This study concentrated on the characteristics that promote VR in tourism marketing.

One of the research methodologies employed in this study was questionnaire analysis, and the survey was conducted online between March 23 and April 1, 2023. We conducted a 5-year process of evaluating the future from 2023-2028. It is employed in futuristic research and technological advancements. The foresight activity is concerned with perceiving the context through horizon scanning; capturing the points of intervention that comprise the content of the change program; and anticipating and developing future-oriented policies and strategies based on this content through a planned process (Saritas & Ozcan, 2013). The external sense in which the foresight operation is embedded and hence affected by the components in it; is formed by STEEPV analysis. The drivers of future elements that influence and change the trend of virtual reality in tourism marketing were evaluated using future wheel analysis. Researchers referenced and studied as many papers, documents, online and offline databases, and international studies as they could before making a brief remark with keywords.

In regard to the questionnaire, it is designed in Chinese, consists of 7 questions categorised into 4 sections, and is distributed as an online link in the famous Chinese social media platform Little Red Book, displayed as a post with a VR tourism picture and 8 key hashtags (VR, VR travel, Live stream travel, VR destination, smart travel, innovation, and smart tourism). The design of the post display is not only in accordance with the platform's big data and AI Smart Recommendation Algorithm, but also aims to reach the target respondents who hold a certain level of knowledge of VR and are interested in innovative travel, with the assistance of the previously mentioned platform's AI Smart Recommendation Algorithm.

The questionnaire is designed in four sections: A, B, C, and D.

- Section A inquiries about respondent demographics such as age, gender, occupation, and VR awareness. This part determines the respondent's personality and can be easily grouped for future study. This component is crucial because demographic data helps the researcher to see the distribution of respondents based on various biographies and to analyse the potential relationship between respondent history and projecting future trends when applying VR in marketing. As a level of measurement, the scale employed

in this section is the nominal scale.

- Section B inquiries about the significance of technology in various industries, such as tourism marketing. Researchers will be able to classify the most important variables or drivers of integrating VR in tourism marketing by ranking critical challenges and drivers. To rank the drivers, a 5-point Likert scale was employed from Section B to Section D.
- Section C assesses the extent of the impact VR has on the user experience. It is significant because it reflects on the magnitude of the repercussions and how this technology will impact future trends in the implementation of VR in tourism marketing.
- Section D assesses the level of uncertainty associated with the use of VR technology in tourism marketing. According to Toma et al. (2012), uncertainty is a circumstance in which the decision-maker is unable to identify all or none of the probable events that are likely to occur, let alone estimate the probability of their occurrence.

Data Collection

STEEPV analysis consists of a system of social, technical, economic, environmental, political, and value. By evaluating these factors, organizations can better understand the external context in which they operate, anticipate challenges, identify opportunities, and make strategic decisions. (Aguilar, 1967). In recent years, the term "horizon scanning" has come to be used interchangeably with strategic foresight (Bishop & Hines, 2012). The horizon scanning procedure has been completed to identify the present emerging concerns, challenges, and threats to VR as a marketing tool (see Table 4).

4. Table: STEEPV analysis

Social	Technological	Economic
1.Increase of smartphone user 2.Increase in VR tourism guiding customers 3.Gaining attentions from early adopters 4. Massive implementation of VR in marketing 5.Increase public awareness of VR technology 6.Increase mobility for injured people 7.Increase customer support 8. Increase destination services management awareness towards customers 9.Increase community support 10. Increase traveler's community 11.Increase in VR users 12. Increase destination visitings 13. Used to treat diseases 14. Variety of use cases 15. Positive implications for limited funding's organizations	1. Expansion of technology 2. Immersion experience 3. Having to feel without physically being there 4. New experience waiting to be unleashed 5. In depth view of product 6. A new platform for tourism destination or branding 7. User friendly technology 8. Easy to build and cheap to use 9. Immersion into a whole new level 10. Increase technology development of VR 11. Low-cost technology 12. Having to see without physically being there 13. More lifelike feel of interaction 14. Creates a virual situation that can't be experienced in real life 15. Creates virual simulations of tourism destinations 16. Customers rely only on visual representation of the product 17. Provides new opportunities for marketeer	1. Free marketing from word of mouth 2. Leader in the industry 3. Increase in revenue 4. Increase in brand awareness 5.Increase brand loyalty 6.Increase in brand awzreness 7. Increase customer relationship 8. Increase tourism economy 9. Increase brand recognition 10. Growth in VR technology 11. Growth im VR industry 12. Increase tourism destination attractiveness 13. Increase sales of souvenirs 14. Increase in global marketing growth rate 15. Increase growth rate of wearable devices 16. Increase tourism marketing development 17. Reduce cost of travelling 18. Growth of VR users 19. Increase VR development

Environment	Political	Value
1. Increase towards environmental awareness 2. Lack of environmental bebaviour change	1. Increase law enforcement injudging crime 2. Tool used for political and cultural empathy 3. First virtual reality political campaign 4. Virtual Reality in election campaign 5. Increase government citizen relationship	1. Brings more immersion into media 2. More interaction with technology 3. Adds more immersion of the experience 4. Adds more choice for customers 5. Increase emotional value for the tourism destinations 6. Give unforgettable experience 7. Offers immersion to consumers about latest technology 8. Understand what it feels like behind bars 9.Give unforgettable experience 10. Creates beautiful memories 11.Understand the historical and cultural background of the destination 12. Increase customer relationship 13. Increase user experience 14. New online travelling experience 15. Creates positive memories 16. Richer experience with products 17. Have users control their experience 18. Develop a dynamic relatonship 19. Have an emotional effect towards 20. Increase positive perception of destinations 21. VR makes travelling fun

Source: Own Compilation

The most prominent drivers were established as a result of the merging process and evaluated on a scale of 1-10 from the least to the most important drivers. The merging ten issues and drivers will be investigated by distributing surveys to VR users in the marketing field (see Table 5).

5. Table: Merged issues and drivers

No.	Merged Issues and Drivers	Value
1	Creates emotional value	10
2	Creates memorable experience	10
3	Growth of VR users	10
4	Having to see without physically being there	10
5	Increase brand recognition	9
6	VR in marketing, medical and tourism	9
7	Immersion into a whole new world	8
8	Positive implications towards a product	8
9	Replicate specific events or environment	7
10	Growth of VR content	7

Source: Own Compilation

A total of 60 responses were received from the optimal sample size, with a response rate of 15.63%. Table 6 provides a summary of the respondents' profiles. The majority of respondents are female, between the ages of 21 to 30, and have a bachelor's degree. According to the same data, 85% of respondents have heard of virtual reality. When asked if they had used VR, 22 out of 36 respondents said "Yes" with a proportion of 36%, 32% said "No," and the remaining 32% said "I may not realize it." The majority of respondents (76.7%) feel that virtual reality (VR) represents the future of tourism. However, the majority of responders may or may not buy this technology for themselves. The majority of respondents are undecided about this technology since they are aware of its high cost.

6. Table: Demographic profiles of respondents

Item	Category	Frequency (N=60)	Percentage (%)
Gender	Male	16	26.7
	Female	44	73.3
Age	20 years and below	2	3.3
	21-30 years	48	80.0
	31-40 years	4	6.7
	41-50 years	-	-
	51 years and above	6	10.0
Education Level	UPSR/PMR/SPM	1	1.7
	STPM/Foundation/ Matriculation/Diploma	14	23.3
	Bachelor's Degree	42	70.0
	Master's	2	3.3
	PhD	1	1.7
Have you ever heard about VR before?	Yes	51	85.0
	No	9	15.0
Do you have any experience using VR?	Yes	22	36.7
	No	19	31.7
	I may not realize it	19	31.7
Do you think VR is the future for tourism marketing?	Yes	46	76.7
	No	1	1.7
	Maybe	13	21.7
Would you consider purchasing this technology?	Yes	19	31.7
	No	6	10.0
	Maybe	35	58.3

Source: Own Compilation

Data analysis and results

The descriptive analysis, reliability analysis, impact-uncertainty analysis, and futures wheel analysis were all part of the foresight study. The Statistical Package for Social Science (SPSS) was used to analyse the questionnaire data. SPSS presented the collected data as a percentage, mean frequency, and standard deviation. Cronbach's Alpha is used to examine how closely a set of items is related to a group by measuring the internal consistency of the variables (Taber, 2018). In most study instances, a reliability coefficient of 0.7 or more is considered reasonable and correct, however, if the Cronbach alpha value is less than 0.07, the questionnaire results are deemed unreasonable and untrustworthy. Impact-uncertainty analysis is a new discipline that extends traditional risk analysis by assigning a level of confidence in the comparison of hazards

in systems, projects, models, or policies (Benke et al., 2007).

To develop an impact-uncertainty analysis, the drivers are selected based on importance, impact, and uncertainty (see Table 5). The amount of effect and level of uncertainty chosen to build the future wheel analysis were guided by a few drivers with the highest level of importance mean score. To generate the top two drivers that will be used to design the futures wheel, the mean scores of impacts and uncertainty will represent a coordinate of (x, y). The futures wheel analysis is a method of organizing structured brainstorming, visualizing, and questioning about the future. Primary impacts or implications are written at the end of each speech. The secondary impacts of each initial impact then form a second ring of the wheel. This ripple effect continues until a clear picture of the event or trend repercussions emerge. The futures wheel can also be used to build forecasts inside alternative scenarios.

Cronbach's Alpha values for Importance are 0.921, Impact is 0.906, and Uncertainty is 0.950. These values are more than 0.7, indicating that the items are dependable and accurately represent the variable. The mean scores of the important variables are shown in Table 7. All of the objects were re-coded with a new code based on the greatest mean importance scores. The SPSS mean values are based on respondents voting in the method of consent by agreeing on the importance drivers that could represent the industry's future. The top six leading drivers were chosen to serve as the basis for the following study, which is descriptive for impact and uncertainty factors.

The most importance items are A1-Tourism marketing in VR will increase brand recognition due to the unique experience; A2-VR provides immersion into a whole new world escaping from reality thus providing a great platform for tourism marketing; A3-VR enables users to explore places and contents without having to physically be there; A4-VR enable developers to replicate specific events or environment thus promoting the product itself in it suited environment; A5-VR has also been used not only in tourism marketing but also in medical fields, gaming and advertisement thus strengthening the reason to develop the usage in VR; and A6-The growth of VR users encourages tourism marketing in VR. These six most important drivers were arranged in descending order as shown in Table 7.

7. Table: Mean of Importance

No.	Issues and Drivers	Mean	New Code
1	VR traveling creates a more emotional value for consumers compared towards traditional marketing	3.8167	A10
2	VR traveling generates a more memorable experience rather than traditional marketing	3.9667	A7
3	The growth of VR users encourages traveling with VR	4.0500	A6
4	VR enables users to explore places and contents without having to physically be there	4.1167	A3
5	Tourism Marketing in VR will increase brand recognition due to the unique experience	4.1500	A1
6	VR has also been used not only in tourism marketing but also in medical fields, gaming, and advertisement thus strengthening the reason to advertise in VR	4.0833	A5
7	VR provides immersion into a whole new world escaping from reality thus providing a great platform for traveling	4.1333	A2
8	VR has been known to give a more positive impact on a destination due to being able to see it virtually before visiting it	3.9333	A8
9	VR enables developers to replicate specific events or environments thus promoting itself in its suited environment.	4.1167	A4
10	With the growth of VR content, it is necessary to brand destinations in VR as well	3.9167	A9

Source: Own Compilation

Table 8 was constructed to illustrate the mean values for both impact and uncertainty before constructing the impact-uncertainty analysis. The data in Table 8 were used to formulate impact-uncertainty analysis to find the top 2 drivers with the highest importance outcome on impact and uncertainty in the future possibility. The result of the analysis was presented in Figure 2.

8. Table: Mean of impact and uncertainty according to 6 most importance.

No.	Issues and Drivers	Mean	
		Impact	Uncertainty
A1	Tourism marketing in VR will increase brand recognition due to the unique experience	4.1667	3.8167
A2	VR provides immersion into a whole new world escaping from reality thus providing a great platform for traveling to see it virtually before visiting it	3.8500	3.6833
A3	VR enables users to explore places and contents without having to physically be there	4.1333	3.8500
A4	VR enables developers to replicate specific events or environments thus promoting itself in its suited environment.	4.0333	3.7333
A5	R has also been used not only in tourism marketing but also in medical fields, gaming, and advertisement thus strengthening the reason to advertise in VR	4.1500	3.7500
A6	The growth of VR users encourages traveling with VR	3.9833	3.6833

Source: Own Compilation

The top two drivers with the highest impact and uncertainty were chosen based on the scattered plot. Coordinates of A1 (3.8167, 4.1667) and A3 (3.8500, 4.1333) were selected as the top two drivers with the highest level of impact-uncertainty mean values. A1 has the highest level of impact while A3 has the highest level of uncertainty. A1 represents "*Tourism marketing in VR will increase brand recognition due to the unique experience*", while A3 represents "*VR enables users to explore places and contents without having to physically be there*". By doing the analysis, A1 and A3 were selected as the top two drivers hence would be used to develop scenarios and further futures wheel analysis.

2. Figure: Impact-Uncertainty Analysis

Source: Own Compilation

1.3. DISCUSSION

The illustration presented in Figure 6 depicts the first future wheel, which was developed through a comprehensive analysis of all potential consequences stemming from the primary driver. The utilisation of virtual reality in tourism marketing has the potential to enhance brand recognition by generating novel experiential opportunities. The central blue core of the forthcoming wheel symbolizes the primary driving force, whereas the green colour signifies the outcome of the first order, the orange colour represents the outcome of the second order, and the maroon colour represents the outcome of the third order.

The initial scenario occurs when the enterprise attains a dominant position in promoting its locale. The corporation is not obligated to engage in the production of virtual reality hardware; alternatively, it may opt to offer online services for virtual reality content. This strategy has the potential to enhance the company's brand recognition and establish it as an innovative organisation capable of delivering a unique and memorable customer journey. The implementation of this strategy is expected to enhance the organisation's reputation and facilitate the cultivation of a proficient workforce. According to Kate (2015), enhancing the reputation of the company is highly likely to influence the preferences of customers. Customers tend to exhibit a preference for established brands as opposed to unfamiliar products. Moreover, through the utilisation of a workforce possessing advanced expertise, the organisation is capable of providing tailored services to external entities, thereby augmenting revenue. According to Bauer et al. (2004), the theoretical and practical knowledge of professional employees has increased, thereby facilitating their ability to identify and address issues and inconsistencies in their market operations. In addition, the organisation has the potential to realize significant cost savings through the utilisation of economies of scale. The concept of economies of scale was

introduced by the Economist (2008), which refers to the phenomenon where the average cost of production decreases as the volume of production increases. Enhancing the brand image of a company can lead to increased sales and subsequent revenue generation.

The second scenario exemplifies the potential for novel experiences through the use of virtual reality. VR technology enables marketers to create emotionally driven campaigns that offer customers an unparalleled experiential encounter. According to Kate (2015), customers are prone to identifying the experience and establishing a feeling of safety in the marketplace. The enhanced sense of security experienced by the customer leads to a higher level of comfort in making a purchase, thereby resulting in an increase in customer loyalty. In addition to this, virtual reality offers novel experiences to consumers through the incorporation of virtual shopping. The advent of virtual shopping has enabled customers to conveniently peruse a vast array of products on the internet from the comfort of their own homes. The ease of accessing online shopping platforms provides a convenient means of purchasing goods from any location. While it may not replicate the in-person shopping experience of traditional brick-and-mortar stores, online shopping does emulate tangible product attributes, including size and intricate features. This presents a compelling incentive for customers to explore the brick-and-mortar store. In the end, this enhances the customer's sense of ease by ensuring that the product is suitable for their intended placement, thereby eliminating any potential doubts.

The third scenario demonstrates the potential for attaining a competitive advantage within the market. Companies that possess a competitive advantage are more likely to attract customers as they offer a greater value proposition in comparison to their competitors. The monopolization of market share leads to increased sales and greater profitability for companies, as they benefit from significant economies of scale. Companies that possess a significant portion of the market share are better positioned to introduce new products to the market, as their cost of entry is reduced owing to their established brand reputation.

The fourth scenario demonstrates the potential for market expansion. The expansion of the market has led to a rise in the need for virtual reality (VR) content, owing to the widespread adoption of VR devices by consumers. The rapid growth of both sectors is expected to result in sustained demand for jobs, thereby augmenting employment prospects. The expansion of the market not only leads to the creation of employment prospects, but it also facilitates the ability of firms to access new customers on a global scale. The expansion of a business can lead to an increase in potential audience reach through the implementation of marketing strategies that enhance the visibility of the company to both current and potential customers (Sampson, 2018), ultimately resulting in an increase in market share. The organisation can augment its market share through market expansion and fortification of customer relations, leading to contented clientele. Contented customers engage in word-of-mouth communication with their acquaintances and family members, thereby attracting new customers through positive experiences. According to Leslie (2019), a business can increase its profits by gaining market share through word of mouth, without the need for simultaneous increases in marketing expenditures. This chain reaction exists throughout social media, thus, VR provides that reaction with a unique experience.

3. Figure: Future wheels of "Increase brand recognition"

Source: Own Compilation

The scenarios and future wheel analysis for the second driver, which pertains to the ability of VR to allow users to explore content remotely, are presented in Figure 3. The initial situation demonstrates a higher level of immersion in the content. Aofeng and Han (2016) posit that virtual reality enhances human interaction by rendering it more personalized and closely aligned with individual experiences. Enhancing the quality of content can lead to improved social media engagement for the company. The presence of robust media attention facilitates the development of a loyal following for the organisation. According to Oliur's (2012) research, 50% of small businesses reported acquiring new customers through social media. In addition to possessing high-quality content, it also enhances the emotional bond between the content and the consumer. Through this approach, the company is able to engender consumer loyalty by capturing their attention and interest.

The second scenario exemplifies the prospective utilisation of virtual reality technology in marketing by fostering innovative practices. The company's productivity is enhanced through the implementation of novel virtual reality technology, which serves to increase its appeal to a wider audience. According to Jacob's (2018) assertion, an organisation can establish itself as a reputable professional entity by utilising innovative marketing strategies, exceptional customer service, and fostering a culture of creativity. Enhancing the product's quality would not only improve its overall performance but also enable it to effectively contend with rival products, thereby augmenting its competitiveness. Innovation enhances both the quality and value of a product. The widespread adaptation of the product results in an increase in market share. According to Sammi's (2020) findings, companies can achieve a higher return on investment

(ROI) by offering higher quality goods, given a specific market share. This illustrates the potential advantages of product innovation within the realm of virtual reality, as the majority of competitors provide comparable value propositions.

The third scenario demonstrates the potential advantages of utilising VR technology in tourism marketing, specifically in terms of enhancing brand recognition. The convenience of utilising virtual reality technology within the confines of one's living space offers a sense of reassurance to consumers, as it ensures that the product, they acquire is compatible with their preferred setting. The aforementioned phenomenon is observable through the utilisation of IKEA AR. Despite being an Augmented Reality (AR) technology, it provides a comparable user experience to Virtual Reality (VR). Ikea has demonstrated the ability to expand its market reach, resulting in a corresponding increase in company sales. According to Lotame's (2019) findings, the act of capturing new market segments can aid companies in focusing their efforts, allowing them to establish a distinct brand identity and specialise in a particular product category. This results in a rise in customer awareness. According to Linda's (2020) assertion, an elevation in customer recognition results in a decrease in the expenses incurred in launching new products into the market. Strong brand recognition leads to cost efficiency, resulting in a boost in the company's revenue.

The fourth scenario exemplifies the potential application of virtual reality technology in the field of tourism. The advantages of virtual reality technology, which allows individuals to experience and interact with remote locations without being physically present, could potentially be leveraged in the realm of virtual tourism. The utilisation of virtual tourism offers novel opportunities for visitors to gain knowledge by examining the interrelationships among various species and closely examining diverse creatures (Blooloop, 2020). The aforementioned instance could serve as a model for other museums seeking to enhance their visitor numbers. It is recommended that tourism companies offer this service, as it has the potential to enhance customer loyalty by engaging them in novel experiences. In addition to virtual tourism, the utilisation of virtual reality technology in classroom settings offers individuals from disadvantaged backgrounds the chance to acquire new knowledge and discover potential prospects. According to Izwan (2016), it was stated that... The technology enables juveniles to investigate captivating sites without the need for physical travel beyond their local community. The aforementioned program is denoted as Chinese Virtual Field Trips. These forms of education enhance the satisfaction of both the learner and the facilitator. These four distinct yet interconnected scenarios demonstrate a significant positive impact on society.

4. Figure: Future wheels of "Explore contents without physically being there"

Source: Own Compilaton

CONCLUSION

In conclusion, the initial wheel demonstrates the prospective direction of the primary driver, namely that "the employment of virtual reality in tourism marketing will enhance brand recognition by virtue of the distinctive experience." The four future scenarios that were predicted include market leadership in tourism, novel experiences, competitive advantage in the market, and market expansion. The exceptional implementation of virtual reality technology in China is expected to result in a rise in the country's GDP, as evidenced by the aforementioned scenarios. This outcome may lead to a boost in the nation's economic development, potentially positioning them as global pioneers in the realm of virtual reality. The second wheel illustrates a potential future trajectory for the second driver, wherein the utilisation of virtual reality technology facilitates the exploration of various locations and content without necessitating physical presence. The four anticipated scenarios are expected to include heightened brand recognition, promotion of virtual tourism, increased immersion, and stimulation of innovation. All the anticipated trends resulted in a favorable outcome with advantages that predominantly favored developers. The utilisation of virtual reality technology in tourism marketing has the potential to yield benefits not only for consumers, but also for underprivileged students. The employment of virtual reality technology can be rationalized by its capacity to provide students

with a highly realistic educational experience, thereby enhancing the quality of their education. The aforementioned advantages are poised to confer a competitive advantage to the educational system of China over other nations. In conclusion, this study has successfully achieved both of its research objectives, and the findings demonstrate significant positive implications for the use of VR as a tourism marketing tool in China.

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Impact of ChatGPT on academia - Potential future scenarios

Soma Balla[11], Peter Csiba[12], Daniel Simon[13]
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Abstract
The rapid development and growing utilization of advanced artificial intelligence (AI) models, such as OpenAI's ChatGPT, carries significant implications for numerous sectors, including the field of academia and research. The following article aims to better comprehend and understand the potential future outcomes, and possible concerns of the integration of such AI models into academic life. The research approach is laid upon the framework of future forecasting, guided by the principles of Bishop and Hines (2012), involving four key stages: framing, scanning, forecasting, and visioning. The methodology further incorporates the creation of models that outline plausible future scenarios, drawing from the strategic foresight approach advocated in Gáspár's "Strategia Sapiens" (2012; 2015). The study collects data through an extensive review of already available literature on the subject, combined with a thematic overview of qualitative data gathered from the analysation of previously performed semi-structured interviews conducted with five experts in the field. The aim of the research is not only to uncover plausible future scenarios surrounding the impact of ChatGPT on academia, but also to identify potential concerns and areas of caution that may need to be addressed in the upcoming future based on the performed literature review and thematic analysis. The research underscores the importance of maintaining transparency in discussions about the integration of AI in academic processes. Overall the research aims to provide a peek into the possible of outcomes of the rapid development and wide availability of ChatGPT.
Keywords: ChatGPT, AI, academia, research,

INTRODUCTION

Artificial Intelligence (AI) has been increasingly integrated into various aspects of our daily lives. From personal assistants like Siri and Alexa to self-driving cars, AI technology is rapidly changing the way we interact with the world. In the academic field, AI has also been making significant strides, and one notable development is the creation of ChatGPT, a large language model trained by OpenAI based on the GPT-3.5 architecture.

[11] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, Soma.Balla.76@unibge.hu, equal contribution
[12] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, peter.csiba55@gmail.com, equal contribution
[13] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, daniel.simon.50@unibge.hu, equal contribution

ChatGPT is an AI-based software that can engage in human-like conversation with users. It has been designed to understand natural language and generate responses that are contextually relevant to the input it receives. ChatGPT is a significant breakthrough in AI, as it has the potential to revolutionise the way we interact with machines.

Given the recent developments in AI and its increasing use in the academic field, it is important to investigate the potential impact of ChatGPT on scientific research. The research question for this study is: "How will ChatGPT and publicly accessible, AI-based software impact PhD students' scientific research in the near future?"

To answer this research question, the study utilizes an extensive literature review, horizon scanning and the exploration of qualitative interviews. The literature review will involve a comprehensive analysis of existing literature on ChatGPT and its application in the academic field. The review will explore the current state of AI technology and the potential impact of ChatGPT on scientific research.

The qualitative interviews – supplemented by horizon scanning – will assist the understanding of the potential futures of ChatGPT from several positive and negative points of views. The interviews involve highly respected individuals like ChatGPT CEO Sam Altman and Eliezer Yudkowsky American writer who have experience working with ChatGPT or other AI-based software. The interviews will seek to explore the perceptions, attitudes, and experiences of the participants regarding the use of AI-based software in scientific research. The interviews will also investigate the potential benefits and challenges of using ChatGPT in scientific research.

The data collected from the literature review, horizon scanning, and qualitative interviews will be analysed using thematic analysis. This analysis will identify common themes and patterns in the data, providing insight into the potential impact of ChatGPT on scientific research.

The significance of this study lies in its potential to inform the academic community on the possible implications of ChatGPT and other AI-based software on scientific research. With the increasing integration of AI technology in the academic field, it is crucial to investigate its impact on the quality and validity of research.

The findings of this study will be relevant to PhD students, researchers, and academic institutions. PhD students and researchers can use the findings to inform their decision-making regarding the use of AI-based software in scientific research. Academic institutions can use the findings to inform their policies and procedures regarding the use of AI-based software in scientific research.

1.1. MAPPING

As set forth in the introduction, the topic of the study is to unfold how the widespread use of ChatGPT and akin AI-based models in the academic sphere may influence the work of young researchers. The following sections aim to outline the domain, current landscape and analyse the era for the subject matter.

Domain definition

With respect to the time horizon, the primarily focus of this paper is on the mid-term (3-5 years). The reason for choosing to look at the impacts during this time period is that (a) due to the rapid pace of development in AI-based chat software (that is most likely to intensify in the months and years ahead) it is extremely hard – if not impossible – to foresee the longer terms effects, and (b) university campuses are typically slow to react when it comes to adapting to cutting-edge solutions, therefore shorter term effects might be negligible – even on a global scale. The latter seems to be underlined by Freyman (2023), who conducted a survey among 520 US

college students and found that 4 out of 10 students haven't even heard of ChatGPT yet – furthermore, those who have were familiar with it to some extent, 52% of them have never used it.

In conjunction with the nature of ChatGPT – it is publicly and freely accessible to anyone with broadband internet connection – the authors do not narrow the geographical scope of the paper to any particular region or country, and rather choose to focus on the overall qualitive effect on the work of PhD students and universities on a global scale.

The relevancy of the topic can be justified by the fact that the recent development and proliferation of AI-based chat and search engines has opened new doors to optimize accessing data and gathering information on a large scale within a matter of a few minutes. The disruptive effect of leveraging AI in academic research – specifically for PhD students – has a notable upside (for example, summarizing large quantities of texts, or searching large text-based databases to answer particular questions rapidly) (Gordin & Have, 2023), while it also carries a set of inherent challenges (for example, the question of distinguishing between purely AI-generated and manually constructed content, or the occasional inaccuracies and lack of coherence an AI-generate output may include) that one need to consider when assessing the overall impact (Chiang, 2023).

Current assessment and stakeholders

ChatGPT – a large language model built by OpenAI (OpenAI, 2023) – was released to the public in November 2022 (Sundar, 2023), showcasing the underlying potential of AI solutions in various walks of life – including academic research. Consequently, the practical implementation of such technologies is still in its early stages, however there are already signs how it could fundamentally change the way research and publications are carried out in the years to come. As mentioned before, using the software is free of charge, which makes it even more attractive for PhD students, who typically do not possess abundant pool of financial resources. Moreover, the – probably unpredictably warm – reception of ChatGPT by the public already triggered an intense competition in the technology sector. The fuss around ChatGPT instantly sparked most of the leading tech companies to invest in, build and enhance their own AI capabilities and make them publicly available – therefore the authors anticipate the rapid development and proliferation of such software in the upcoming 3-5 years. The authors' standpoint on the large-scale impact has also been reaffirmed by Eloundou et al. (2023).

When it comes to the software's academic use, the authors identified the key stakeholders as set forth in Figure 1. How will ChatGPT and publicly accessible, AI-based software impact PhD students' scientific research in the near future?

1. Table Stakeholders of ChatGPT's implementation by PhD students

Stakeholder	Impact type
1) PhD students	Finding ways to incorporate ChatGPT to their research activities in a useful way to improve (a) the quality of their publications and (b) the scientific added value of their research
2) Universities, college campuses	React to the changing landscape with regards to the ways emerging technologies can be systematically utilized for academic purposes
3) Scholars, peer-reviewers	Become familiar with the pitfalls of ChatGPT and enhance their ability to distinguish between AI-generated vs. manually written texts
4) Editorial boards of journals	Take into account how ChatGPT-generated scientific text may change the way publications are created
5) Authorities, governmental bodies	React by regulations in case the public demand arises to do so. On the other hand, policymakers need to be very cautious not to "overregulate" and unnecessarily create obstacles for the practical implementation of technological development.
6) Tech companies	Intense competition to serve the public demand – requiring continuous R&D investments

Source*:* Own summary and edit

Development of ChatGPT

ChatGPT is a conversational, AI-based language model developed by OpenAI that has revolutionized the field of natural language processing. The origins can be traced back to OpenAI's earlier language models, such as GPT-2 and GPT-3. These models were already designed to generate human-like text based on prompts provided by users, however with limited ability to engage in meaningful conversations (Brown et al., 2020). ChatGPT is therefore based on the GPT-3.5 architecture, which incorporates a range of advanced techniques such as transformer-based language modelling and deep learning (OpenAI, 2023).

It was first introduced in 2019 as an improvement over the original GPT (Generative Pretrained Transformer) model, however the widespread adoption only took place in the fourth quarter of 2022 (Vallance, 2022). The development of ChatGPT involved a range of advanced techniques and technologies. The model was trained – using transformer-based language modelling and deep learning techniques – on a large corpus of text data from the internet – not restricted to articles, but also including human conversations – in order to build and improve its ability to generate human-like text (Cotton et al., 2023). ChatGPT extends this capability to handle conversational AI tasks such as question-answering and dialogue generation. The model is fine-tuned on specific conversational data to further enhance its ability to generate contextually relevant responses (Thompson, 2023). Since its introduction, ChatGPT has been widely adopted by businesses and organizations for various use cases such as customer service chatbots, virtual assistants, content generation, and language translation tools. The model continues to evolve with ongoing research and development efforts by OpenAI, with a focus on improving its ability to handle more complex conversational tasks and generate more human-like responses (Gilson et al., 2023).

ChatGPT has had a significant impact on the field of natural language processing and AI research. The model has demonstrated the potential for language models to engage in meaningful conversations with users, paving the way for a new generation of conversational AI technologies. As an inherent consequence of the software's public application still being in its initial stages, empirical data is rarely available to adequately assess its practical implications to date – although as Bloomberg reports a study conducted by researchers from Stanford University and MIT, we have already witnessed significant productivity gains at the customer service department of a Fortune 500 company that successfully implemented ChatGPT to provide faster and higher quality services and supplement the day-to-day work of relatively low-skilled workers (Constantz, 2023). This study tends to reaffirm the authors standpoint that as disruptive ChatGPT seems, it has a great upside potential to be ultimately beneficial by both economic, academic and societal means.

ChatGPT has also sparked new research in areas such as language generation, text completion, and dialogue systems. The model has also raised important ethical and social considerations related to the use of AI in language processing and communication (Goldstein et al., 2023).

Era- and environmental analysis

According to the corresponding literature reviewed, we believe that the era of the early 2020s – hallmarked by digitalization and the proliferation of AI in our everyday lives – can be characterized by the following five key phenomena and trends.

1. *Increased connectivity*. With the widespread adoption of the internet and mobile devices, the world is more connected than ever before. This has led to the creation of vast amounts of data and the development of new technologies for managing and analysing that data (Ganne & Lundquist, 2019).
2. *Increased use of data.* In conjunction with the statements related to "increased connectivity", data has become a critical resource in the digital age, and organizations are leveraging it to make informed decisions and gain a competitive edge. This has created a demand for new technologies and skills to manage and analyse large datasets (Ferrantino & Koten, 2019).
3. *Automation and rapid development of AI-based solutions*. AI and machine learning algorithms are being used to automate a growing number of tasks, from simple repetitive processes to complex decision-making. This has the potential to greatly increase efficiency and productivity, but also raises concerns about job displacement and broader negative societal impacts (Yudkowsky, 2023; Ferguson, 2023). In direct economic terms, the industrial application of AI and other cutting-edge technologies is discussed in the context of the fourth industrial revolution – in other words, Industry 4.0 refers not merely to a set of breakthrough technologies per se, but should rather be understood in a holistic way as a fundamental digital transformation that – through the industrial application of cutting-edge technologies – leads to the emergence of fundamentally new business models and strategies (Götz et al., 2021). Chat GPT fits into this very picture, with a wide range of opportunities for increasing efficiency and productivity.
4. *Advancements in language processing – NLP (natural language processing) and LLMs (large language models)*. These are subfields of AI that have made great strides in recent years, allowing computers to (a) understand and generate human language more effectively and (b) increase the number of parameters and size of the training data (Weidinger et al., 2021). These have paved the way for the development of more sophisticated conversational AI systems like ChatGPT (Gordin & Have, 2023).

5. *New business models*. The digital age has given rise to new business models and revenue streams, such as e-commerce, online advertising, and subscription-based services (Tilesch & Hatamleh, 2020).

There are a number of elements to take into consideration when analysing the influential forces that characterize the environment where the development of ChatGPT takes place. First of all, the inevitable progress in the capabilities of ChatGPT, as it is in its first stages of implementation, makes the future development of its features anticipated. The user demand is another factor to consider, with its ease of access (and the fact that it is currently available free of charge) it is safe to expect it to be widespread in the near future. Moreover, the legal background of ChatGPT usage is another indispensable aspect to include in the analysis. The governmental and institutional regulations would definitely mark the extent to which the user in general, and PhD researchers specifically, can leverage the merits of this tool. Lastly, although ChatGPT is currently free of charge, the possibility of it becoming a paid tool cannot be eliminated. To give a clear positioning to the research topic, it is important to note that it is limited to the scope of academic research. Regarding the future trends that may impact the course of operating ChatGPT, we mention, among others, the technical developments that the tool can undergo in terms of personalization as well as the potential integration with other software and areas. The ever-expanding knowledge is also an important variable that can result in a shift in the said environment.

To summarize, the era of digitalization and AI is primarily characterized by rapid change and constant emergence of new technologies and ways of working – including in the field of research. This presents both opportunities and challenges and it is up to PhD students and universities – as well as society as a whole – to navigate through this complex landscape.

Horizon scanning

According to Könnölä et al. (2012), horizon scanning is the systematic way of collecting signs, signals – for example trends, drivers, processes – and a set of credible observations that the researcher deems relevant to assess a new emerging issue. From the perspective of our paper, given the high uncertainty of how emerging technologies will evolve and how the academic community will adapt, weak signals – that can be defined as "important indicators of possible change, which might become significant later" (Géring et al., 2020, p1.), or in other words, the "first signs of paradigm shifts, or future trends, driver and discontinuities (Ponomoreva & Sokolova, 2015) – are also important to be considered when it comes to horizon scanning.

The premise of our research is that the rapid development of advanced technologies in the past decades – broadly speaking, starting from the 1980s – has fundamentally reshaped not only the global economy, but academia as well. The exponential pace of the evolution of information and communication technology (ICT) – and to being with, the widespread adoption of internet per se (Barjak, 2006) – opened doors for research that seemed merely impossible before (Winkler et al., 2010). It has not only increased the productivity of academics to date, but also had positive effects on collaboration (Ding et al., 2010). By projecting the empirical evidence of the past to the future, we believe that the broadscale implementation of advanced technologies is going to keep having a strong influence on academic research – especially as generative AI tools, similarly to former technologies, are already showing signs how it can facilitate groups works and student collaboration when it comes to school assignments or project works (Lewis, 2022).

Starting off a bit further away from academia, there is already empirical data available to reaffirm the assumption that, even though the practical implementation is still in its very early stages, ChatGPT has significant upside potential for productivity and efficiency gains in professional occupations that are associated with generating logical, cohesive, and sophisticated human-like text (Brynjolfsson et al., 2023).

Furthermore, by early 2023, we already see weak signs appearing with regards to how

ChatGPT could influence academic research (Cotton et al., 2023), as well as teaching (Baidoo-Anu & Ansah, 2023). – in both positive ("opportunities") and negative ("challenges") terms. Although, inherently, there is a certain amount of resistance in adopting the new technology to academia, the mere fact that peer-reviewed journal articles are now focusing on the utilization ways and potential impact of generative AI – just months after releasing the initial version of ChatGPT to public access – on research and higher education underlines its relevance. As Cotton et al. (2023) summarises – in a study, that was later admitted by the authors to be largely written by ChatGPT itself with the aim of providing evidence how challenging it is going to be for peer-reviewers to identify non-human-generated texts (Fazackerley, 2023) –, generative AI tools can be potentially leveraged in higher education through its adequate adoption to exploit opportunities like:

1. facilitating student collaboration,
2. enabling remote working,
3. creating customized and/or interactive assessments and personalised exams,
4. enhancing critical thinking,
5. providing real-time feedback.

The authors' genuine confession subsequent to publishing the article – which inherently implies that neither of the four peer-reviewers was unable to spot the machine-generated content – clearly showcases one of the most prominent dangers of generative AI. As The Guardian (Fazackerley, 2023) reports – pointing out the fact that distinguishing between human- vs. ChatGPT-generated content is gradually becoming more difficult –, the continuous sophistication of ChatGPT poses the threat of the proliferation of "essay mills" and plagiarism, which induces a great challenge for universities.

One way of response, which can be also considered as a weak sign when it comes to responding to the threats of ChatGPT on academia, is that publishers have already started to put restrictive measures in place to limit the use of generative AI in scientific papers. However, so far, it has not been a universal approach adopted by the academic community as a whole (Sample, 2023).

On the other hand, there are weak signs suggesting that AI-based solutions will remain part of academia and can materially improve the quality of academic research. As an example, we can mention the emergence of AI-based literature review tools that are designed to help, among all, PhD students to find the relevant papers and studies corresponding to their respective research topics and therefore, ultimately, to save time and resource that can be re-channelled to conducting actual research activities. As an example, for universities already embracing such technologies to be utilized for conducting literature reviews, the Texas A&M University started to provide a fairly comprehensive "repository" of the alternatives available to date (Texas A&M University Libraries, 2023).

Moreover, the utilization ways of ChatGPT in business and academia has also started to generate more conversation – and sparked heated debates and de facto existential questions (Helbing et al., 2019) – in the public domain, with discussions primarily revolving around the moral and ethical concerns, as well as the broader societal impact of generative AI – as discussed in depth during the qualitative analysis section of this paper.

1.2. METHODOLOGY

The chapter outlines the methodology that will be used to perform research on the development of ChatGPT and its possible future uses in the academic field for students and researchers. The research question for this study is: "How will ChatGPT and publicly accessible, AI-based software impact PhD students' scientific research in the near future?"

To answer this research question, an extensive literature review, environmental analysis,

horizon scanning, and qualitative interviews were conducted as data collection methods. The literature review focuses on scholarly articles, books, and other relevant sources on ChatGPT and its potential applications in academic research. As ChatGPT is a very new phenomenon, the potential difficulties of data gathering from the available literature are expected and must be highlighted as one of the limiting factors of the research. Consequently, academic literature is supplemented with non-peer-reviewed written materials, like articles published by experts in online magazines, public announcements, and speeches – in other words, the horizon scanning of fringe data sources dominates the research.

Therefore, further approaches such as a qualitative analysis was performed on interviews with highly respected individuals such as ChatGPT CEO Sam Altman and Eliezer Yudkowsky, American writer to further support the probable future scenario building. The qualitative interviews were conducted to obtain first-hand accounts of the potential benefits and challenges of using ChatGPT in academic research. The analysed interviews were conducted by Lex Fridman, are recorded, and made completely available on YouTube. The audio and video were recorded with the participants' consent. The authors of this paper only analysed the conducted and free to access interviews by Lex Fridman. Table 2 shows the analysed five interviews, their key participants and the core topics discussed. All five interviews are overall assessing the topic of the expected future evolving of ChatGPT and are also touching on the area of possible impacts on academic life. The interview scripts are analysed with thematic analysis utilizing NVivo, qualitative data analysis software. The aim of the data analysis is to allow better conclusion drawing and the highlighting of frequently reoccurring topics discussed which can better display a baseline and further less expected alternative futures.

2. Table List of analysed interviews

1st interview - Stephen Wolfram: ChatGPT and the Nature of Truth, Reality & Computation
2nd interview - Manolis Kellis: Evolution of Human Civilization and Super intelligent AI
3rd interview - Max Tegmark: The Case for Halting AI Development
4th interview - Eliezer Yudkowsky: Dangers of AI and the End of Human Civilization
5th interview - Sam Altman: OpenAI CEO on GPT-4, ChatGPT, and the Future of AI

Source: own summary and edit

Thematic analysis allows for the identification of emerging themes and patterns within the data, providing insights into the participants' experiences and perspectives on ChatGPT in the academic research field. It provides a systematic and rigorous method for analysing qualitative data, ensuring that the findings are reliable and valid. It provides great assistance in the identification of key issues and challenges that may arise when using ChatGPT in academic research. A thematic coding system was built based on the reoccurrence of given topics within the interview transcripts allowing the categorizing and synthetization of opinions from all five interviews. The mindset and validity behind this methodological approach is that the baseline future will be built and backed up by reviewed and sorted data based on the highest probability expectations of the future, experts mention in the field. Alternative futures and possible black swan outcomes are determined based on less frequent outliers mentioned during the analysed interviews where complete consensus is not reached between the opinions of the interviewees.

The possible future outcomes of ChatGPT are processed by Scenario Planning based on the methodological approach of Peter Schwartz. Schwartz's approach to future building

involves great similarities to the chosen methodology of this paper and provides a cornerstone for further future scenario building. Peter Schwartz's methodology similarly utilizes in-depth interviews with a diverse group of experts to gather their insights and opinions on future trends and developments. These interviews are then analysed using thematic correlation analysis to identify recurring themes and patterns. By examining the correlations between themes, Schwartz uncovers potential future scenarios and explores their implications (Schwartz, 1996). Scenario planning involves creating and analysing multiple plausible future scenarios based on a range of different variables and factors. The approach is particularly useful in situations where there is significant uncertainty about the future and where multiple factors could impact the outcome. The methodological approach assumes a linear correlation between the frequency of expert opinion making and consensus and between the chance, and reliability that a given future will occur, meaning that greater agreement regarding given aspects and attributes are leading to more likely baseline futures, while different, outlying opinions are displaying possible alternative outcomes (Schwartz, 1996).

The research methodology overall builds upon and follows the foundations of strategic foresight proposed by Bishop and Hines (2012), and Gáspár (2012, 2015). The chosen framework of the research is built upon Bishop and Hines' six-phase futures studies framework, which includes framing, scanning, forecasting, visioning, planning, and adapting (Bishop & Hines, 2012). The research executes the first four phases determined by Bishop and Hines, creating a potential for future extension of the research. In the context of exploring the potential future impacts of ChatGPT in academia and research, each of these phases are deployed to systemically outline a range of potential futures and strategies to navigate towards preferred outcomes based on the available information and expert opinions. Framing defines, the boundaries, stakeholders, and the overall direction of the research, involving an extensive mapping of the current landscape of AI in academia, and identifying key stakeholders including researchers, educational institutions, policy makers, and students. The research's scanning phase is based upon a broad review of the academic literature, looking for early signals of change and understanding the larger dynamics at play with the qualitative thematic analysis of conducted interviews with expert on the field. Particular attention is given to the ways AI and language models like ChatGPT are currently being developed and to their potential growth trajectories. Forecasting, as Bishop and Hines (2012) propose, is concerned with probable futures. The research highlights modelling of potential trajectories for ChatGPT's impact based on current trends, potential disruptions, and various scenario simulations determined based on the data gathered during the scanning phase. The visioning phase entails a creative process of imagining the possible, plausible, and preferable futures of ChatGPT in academia. It goes beyond just extrapolating from current trends to encompass transformative possibilities that might emerge with advancements in AI and natural language processing technologies. The final visioning phase aims to synthetize the learnings of the literature review and the opinions of the reviewed experts, highlighting possible both positive futures of the development of ChatGPT while also drawing attention to already existing concerns apparent on the field displaying the need for transparency and further communication on this territory.

The model utilized in this study builds upon Gáspár's research called Strategia Sapiens, in which he proposes a more human-centric, individualized approach to strategic foresight (Gáspár, 2012; Gaspar, 2015). By applying this to the study of ChatGPT in academia, the research puts high emphasis on how future AI can be used and change the lives of individuals. The methodology also draws on Gáspár's insights and highlighted significant values in strategic foresight, recognizing the need for reflexivity, multi-perspectivism, and an appreciation for the inherent uncertainties in any foresight endeavour (Gaspar, 2015). Through this integrated framework, the research strives to provide a comprehensive, human-centred and future-oriented exploration of the potential role of ChatGPT in academia and research.

The possible limitations to the proposed methodology must be highlighted. The analysis of the qualitative interviews is conducted with a limited number of highly respected individuals, and therefore the findings may not be representative of the wider academic research community. The found results may contain bias and objective opinions as the saturation point was not deterministically reached. The interviewer's opinions and knowledge may further contain preconceptions or the participant's desire to present a particular image or perspective. The literature review may be limited by the availability of relevant sources. Despite these limitations, the proposed methodology provides a rigorous and systematic approach to exploring the potential impact of ChatGPT on academic research and the possible future outcomes of AI-based academic research. By combining a thorough literature review and horizon scanning with qualitative interviews, the study aims to provide insights into the possible benefits and challenges of using ChatGPT in academic research. However, it is clear that the current knowledge on possible future developments and effects of ChatGPT in academic life are rather limited, therefore future scenario building is solely possible considering the current literature knowledge and the personal opinions of experts in the field.

1.3. LITERATURE REVIEW

More than 70 years ago a very intriguing question was asked by Alan Turing: “Can Machines Think?” (Turing, 1950). It maybe sounded simple but there was no answer to the question until Turing proposed a test and a solution to this concern as well. He designed a test to determine whether a machine can exhibit intelligence comparable to, or indistinguishable from, human intelligence. This was a basis of a philosophy of artificial intelligence and later in 1955 McKartney tried to answer this question and the term “Artificial Intelligence” was used for the very first time (McCarthy et al., 1955). Before McCarthy the terminology was always referred to “robot’’ and it was articulated even earlier from 1921 science fiction play “Rossum’s Universal Robots’’ by Karel Čapek. All those possibilities of robots were once considered fiction, but we are on the verge of knowing whether machines can think (Tlili et al., 2023).

Advantages and limitations of ChatGPT discovered by previous studies

The advantages of ChatGPT in education have been documented in several studies, blog posts, media reports, and a conducted interview with an expert, member of an AI developer team. In a way, we applied certain elements of “Horizon Scanning” techniques, namely interview and literature research. Nevertheless, for precise horizon scanning even more data would be ideal e.g., conducting more interviews. Since the novelty of the topic, special attention was paid to related “weak signals”, just to recognise less probable future alternatives. However, the innovativeness of the topic makes it hard to find scientific literature due to a lack of research. In the following chapter articles and website sources will be discussed and insights will be presented. Interestingly, ChatGPT related studies were conducted using ChatGPT itself to examine its capabilities, and user journey and to test if it can be used in an academic field.

Should AI and ChatGPT be used in the academic field, especially by students? This is a question which Xiaoming Zhai (2022) tried to answer by giving questions to ChatGPT. The researcher concluded that there are a number of ways in which ChatGPT can drive innovation and improvement in education. AI can transform the way we think about education and how it is delivered by providing students with personalized and engaging learning experiences, improving teaching efficiency, and supporting research and development. In order to ensure that AI is used ethically and effectively in the education system, it is important to carefully consider the ethical, technological, and other challenges associated with its use. To address these challenges, appropriate measures need to be taken (Zhai, 2022).

An analysis of 10,732 tweets from early ChatGPT users was conducted using a mixed method approach. Topic modelling was used first to identify the main topics, followed by qualitative sentiment analysis. A majority of early adopters expressed overwhelmingly positive sentiments about topics such as disruptions to software development, entertainment, and exercising creativity. It appears that a relatively small number of users were concerned about issues such as the potential misuse of ChatGPT, especially in relation to topics such as the impact on education. Therefore, it is unclear whether ChatGPT will resolve the concerns encountered with previous chatbots or if they will even deepen them. The consequences of this are serious and rapid defensive reactions to potential opportunities, such as the banning of ChatGPT by New York City and Los Angeles Unified schools due to the risk of cheating in assignments (Haque et al., 2022), or a recent, temporary banning in Italy in March 2023.

A study conducted by Teo Susnjak (2022) found that the emergence of technologies like ChatGPT threatens the integrity of online exams, especially in tertiary education where online testing is on the rise. As a result of these models demonstrating critical thinking and generating highly realistic text with little input, students can cheat on tests. ChatGPT's capacity to facilitate academic misconduct raises concerns about its potential use in online exams. The study found that ChatGPT can exhibit critical thinking skills and generate highly realistic text with minimal input, posing a threat to the integrity of online examinations, especially in tertiary education settings where such examinations are becoming increasingly popular. It may be possible to address this issue by returning to invigilated and oral exams, while advanced proctoring techniques and AI-text output detectors may be effective in addressing this issue, they are unlikely to be foolproof solutions (Susnjak, 2022).

Some of the articles even provided guidelines about how to use ChatGPT in the classroom. There are also suggested prompts and assignments that teachers can integrate into their teaching in the paper, which provides background information and techniques for how to overcome these barriers. (Lieberman, 2023; Mollick & Mollick, 2022). Preliminary investigation was conducted by Lund and Wang (2023) in order to check the ability of ChatGPT to provide an output to the questions. They conducted an interview with ChatGPT regarding how AI and ChatGPT will affect academia and libraries. The results of this research are summarised below in the table based on the outputs which were given in the paper sourced from ChatGPT:

3. Table Chatting about ChatGPT: how may AI and GPT impact academia and libraries?

Text generation	A research paper, grant proposal, or other written document can be easily generated with ChatGPT by selecting a style or tone.
Question answering	Using ChatGPT, scholars can quickly and efficiently find answers to domain-specific questions
Automated summarization:	Researchers can stay up to date with the latest developments in their fields by using ChatGPT to automatically summarise scientific papers, reports, or other documents.
Data analysis	ChatGPT can collect and provide insights about online available large data, thus, identify patterns.
Language translation	Researchers can use ChatGPT for scientific papers published in various languages.
Literature review assistance:	This is a powerful tool to assist researchers find answers efficiently and quickly. And not only find but get very fine-tuned answers to domain specific questions.

Source: Lund & Wang, 2023

Although a number of articles and papers are available regarding using ChatGPT in the educational field, not many researchers address the PhD education level. The main concern which still remains unanswered in the given sources is if using ChatGPT in academic life is safe or not? The Guardian (2023) announced that due to the increasing concerns about using ChatGPT for cheating in school homework and assignments, New York City decided to ban it in its schools. Related to this, there was an investigation of ten educational scenarios by Tlili et al (2023) to uncover various student experiences, including cheating, honesty, truthfulness, privacy misrepresentations, and manipulation. Results showed that students not only use ChatGPT to cheat but also to manipulate the system and get away with it.

Recent news on ChatGPT

Since its public debut last November ChatGPT – and generally artificial intelligence (AI) based applications – got more and more into the spotlight, and initiated more and more debate on potential future of AI based applications.

Without aiming to be complete, here are some of the most relevant events related to ChatGPT in chronological order in the world and in Hungary.

In March 2023, the non-profit organization “Future of Life Institute” issued a public letter on its website, signed by such academics, opinion leaders and famous entrepreneurs like - among others - Yuval Harari, Elon Musk and Steve Wozniak in which they have warned the world that artificial intelligence (AI) systems “pose profound risk to society and humanity” and they called for companies to put brakes on further development of the technology at least for six months. The letter was specifically addressed to AI labs (the developer of ChatGPT). It claims AI labs are “locked in an out-of-control race to develop and deploy ever more powerful digital minds that no one – not even their creators – can understand, predict, or reliably control”

(https://futureoflife.org/open-letter/pause-giant-ai-experiments/).

In the very same month (March 2023), the National Authority of Data Security of Italy temporarily switched off ChatGPT since – according to their legal experts – OpenAI (the developer) did not acquire proper legal ground to collect as much information as it did about end users, furthermore, it is without any legal ground to use the collected information to train AI. As the Authority declared, OpenAI does not properly inform users for what purpose the collected information is used and beside that ChatGPT often misuses the collected data in its answers (OpenAI admitted it), which is totally against EU's GDPR rules. It is of concern as well, that although the use of ChatGPT advised only above the age of thirteen, there is no built-in filter to avoid its use for younger users. According to "Politico" the measure is provisional, it lasts until the investigation finished, the Authority gave 20 days to OpenAI to submit their reply.

Earlier this year, the Scientific Office of ELTE (Eötvös Lóránd University of Science) organized a conference on the dilemmas and opportunities in connection with the development of AI. The conference concluded that the development of AI based technologies are unstoppable, therefore the application of such technologies in academic life is as well, although there are many open ethical and legal points yet. One of their recommendations is that in case such application is used in a scientific paper it should been mentioned and the author should bear full responsibility for the content created by the application.

The above examples clearly demonstrate that there are many concerns, dilemmas, open ethical, legal, and compliance issues that are yet open and unsolved when it comes to the use of AI aided applications, such as ChatGPT, in many areas of daily life, but especially when it comes to academic life. These are mainly about gathering information and its use for training AI, legal responsibility for the generated content, limitations for use and users and compliance with existing regulatory and legal frameworks.

1.4. QUALITATIVE RESEARCH AND FINDINGS

The aim of the qualitative chapter is to further help facilitate the possible futures building of ChatGPT in the academic field. As previously mentioned, the qualitative section is based on content and thematical analysis of already performed interviews of Lex Fridman with five esteemed experts in the field, claiming to be representing significantly different views of the current and possible future states of ChatGPT and its concerns. The transcript of the interviews was analysed with the utilization of qualitative data analytic software NVivo. The aim of the interview analysis is to synthetize and display the most frequently reoccurring topics and concerns communicated during these discussions further aiming to facilitate baseline and possible future scenario building also backed up by expert opinions and statements.

The following paragraphs provide a brief synthetization of the most important topics discussed during the five analysed interviews, highlighting possible advantages and concerns regarding the development of ChatGPT, later greatly assisting the overall understanding of the field and future scenario development. To grasp the potential impacts of ChatGPT on future academic research, the paper delves into the insights gained from the interviews with AI experts.

In the first analysed interview, Stephen Wolfram highlights the possible integration of ChatGPT with Wolfram Alpha and Wolfram Language, which is a testament to the evolution of AI capabilities. Wolfram's arguments underscore the importance of computational intelligence in formulating knowledge-based responses, shedding light on the potential application of ChatGPT in academic research. Wolfram agrees that ChatGPT could be harnessed to generate new hypotheses, analyse data, or even write parts of academic papers, given its understanding of vast fields of knowledge. However, as Wolfram cautions, the

collaboration of human intellect and AI is crucial to ensure the correct interpretation and application of generated information.

Manolis Kellis, during his interview, highlights the implications of super intelligent AI on human civilization. His thoughts on AI's evolution and its potential role in shaping society could extend to its impact on academia. AI, particularly models like ChatGPT, could transform the way academic research is conducted, analysed, and disseminated. However, Kellis's reflection on the need for ethical considerations, including the fair and equitable distribution of AI benefits, displays potential concerns in the academic context. Ensuring fair access to AI tools like ChatGPT for researchers around the world would be a significant challenge to address.

In conversation with Max Tegmark, the discourse around halting AI development was brought to the forefront. While Tegmark advocates for the temporary cessation of AI development, it is important to consider the possible repercussions this would have on academic research. ChatGPT and similar tools could revolutionize research methodologies, democratize access to knowledge, and accelerate discoveries. However, the ethical dilemmas, potential misuse, and the risk of creating technology beyond our control that Tegmark warns of cannot be overlooked.

Eliezer Yudkowsky's interview brought attention to the potential dangers of AI and the implications for human civilization. These concerns could directly translate to the academic domain. While ChatGPT could facilitate research, the lack of transparency in its decision-making process and its potential to propagate biases present significant challenges. Balancing the benefits of utilizing AI in research with the need to mitigate these risks will be crucial.

The fifth interview with Sam Altman, CEO of OpenAI, touched on the future of AI, including the development of GPT-4 and the role of ChatGPT. The advancements in AI that Altman discusses suggest a future where AI tools could play an even more significant role in academic research. However, Altman's acknowledgment of the need for careful handling of AI development and deployment also applies to the academic context. Ensuring the responsible use of AI tools like ChatGPT in research will be a serious concern.

The potential impact of ChatGPT on academic research is therefore multi-faceted. It holds the promise of transforming research methodologies, accelerating discoveries, and democratizing access to knowledge. However, these benefits need to be balanced against potential risks, including ethical considerations, transparency issues, and fair access. As these interviews highlight, the development and deployment of AI in academia need careful consideration, with the potential for profound implications for the future of academic research. The insights derived from these interviews provide valuable guidance on navigating this exciting yet challenging frontier. The five interviews conducted with experts in the AI research field provide a diverse range of perspectives on the implications of AI, particularly models like ChatGPT. While each conversation brings unique insights, there are shared themes, ideas, and concerns that weave together a multifaceted view of AI's future impact.

A shared perspective among all interviewees is the transformative potential of AI. Stephen Wolfram, for instance, discusses the integration of ChatGPT with Wolfram Language and mathematical software Wolfram Alpha, emphasizing the new horizons this opens for computational intelligence and academic research. Similarly, Sam Altman foresees an integral role for AI in future developments, including academic research. Both envision a future where AI models like ChatGPT could revolutionize research methodologies and increase knowledge access. However, the interviewees also express divergent views, particularly concerning the pace and direction of AI development. Max Tegmark proposes halting AI development temporarily to address ethical and safety concerns, a position not explicitly shared by the other interviewees. On the contrary, Sam Altman CEO of OpenAI discusses the development of GPT-4, indicating a continued progression in AI capabilities with no foreseen fears of difficulties. The interviews highlight a critical consensus revolving around the ethical considerations and

potential risks associated with AI. Manolis Kellis and Max Tegmark stresses the need for equitable distribution of AI benefits, raising concerns about the potential misuse of AI. Similarly, Eliezer Yudkowsky warns of the dangers of AI and the implications for human civilization, reflecting concerns about the transparency of AI decision-making processes and the propagation of biases. These perspectives underline the necessity of balancing the benefits of AI in research with mitigating potential risks.

Despite their diverse backgrounds and areas of expertise, the interviewees all acknowledge the critical role of AI in shaping the future. They foresee a future where AI, including models like ChatGPT, could profoundly impact academic research. However, their views diverge on how to navigate the path ahead, reflecting the complexities inherent in AI development and deployment. By synthesizing these perspectives, a more nuanced understanding is gained of the potential impacts and challenges associated with the use of AI in academic research. The diversity of these views underscores the importance of ongoing dialogue and exploration in this rapidly evolving field.

The advancements of AI, particularly large language models like ChatGPT, highlights a fast-paced era of development in academic research and university life. Insights drawn from the five interviews provide a wider understanding of the advantages and concerns associated with this new technology also on the academic research field. A significant advantage, emphasized by Stephen Wolfram, is the enhancement of computational intelligence. The integration of ChatGPT into further software could potentially enable researchers to access complex datasets and perform intricate computations more efficiently, accelerating the pace of discovery. Furthermore, Sam Altman envisions AI models like ChatGPT democratizing knowledge access, a boon for university life where information access is paramount. Sam Altman further highlights future plans for personalization capabilities which would allow ChatGPT to better understand, and store given personal situations and requests enabling more fitting and useful answers tailored to the users' needs.

Yet, alongside these advantages, there are significant concerns to be highlighted. Max Tegmark's proposition to halt AI development temporarily to address ethical and safety concerns underscores potential risks associated with AI misuse also in academic settings. Misuse could range from data manipulation to unauthorized access of confidential research data. Similarly, the issues of transparency and bias in AI decision-making processes raised by Eliezer Yudkowsky are equally significant in the academic context. Moreover, Manolis Kellis' points on the equitable distribution of AI benefits touches on another vital aspect of university life: inclusivity. As AI technologies become more integrated into academic research and university systems, it is essential to ensure that all students, regardless of their socio-economic background, can access and benefit from these advancements and have an equal environment to work and develop in.

In conclusion to the qualitative chapter, the implications of ChatGPT for future academic research and university life are vast and complex. While offering substantial benefits, such as enhanced computational capabilities and democratized access to knowledge, AI also raises critical ethical and equity concerns that require careful consideration. As the views expressed in these interviews suggest, navigating the path ahead will require a delicate balance between harnessing the potential of AI and mitigating its risks. It is, therefore, undoubtable that accurately forecasting the future of the availability of ChatGPT in academic life is greatly challenging as of now, and the five highlighted interviews also pose great differences in terms of vision, possibilities, and concerns for the upcoming years. The analysed interviews helped to gain a more thorough insight into the possible future outcomes of the development of ChatGPT. Future baselines and alternate scenarios will be determined based on the insights provided by the five interviews.

4. *Table* Thematic display of most reoccurring topics from the reviewed interviews in decreasing order

Artificial General Intelligence (AGI) and Superintelligence	Frequent discussions about the potential of AGI to surpass human intelligence and the risks and implications that such a scenario could entail, highlighted in all five interviews.
Capabilities and Limitations of Current AI Technologies	This topic was discussed in all interviews, often in the context of the capabilities of large language models like GPT-3.5 and GPT-4, as well as their limitations and the challenges in improving and extending these capabilities.
Ethics and Safety in AI Development	This topic was a prominent part of the interviews with Max Tegmark and Eliezer Yudkowsky, who expressed concerns about the rapid pace of AI development and the need for safeguards and regulations to prevent misuse and unintended harmful consequences.
Future of AI and Human Civilization	This was a common theme in discussions about the potential impacts of AI and AGI on society, the economy, and human life in general. The interviews with Manolis Kellis and Sam Altman particularly focused on this theme.
Integration and Interoperability of AI Systems	The interview with Stephen Wolfram discussed the integration of ChatGPT with the Wolfram Language and Wolfram Alpha, highlighting the potential of combining different AI systems and technologies to create more powerful and versatile tools.
Human-like Behavior and Understanding in AI	This theme emerged in discussions about the ability of AI systems to understand and emulate human behavior, thought processes, and emotions. These concerns were mostly highlighted by Eliezer Yudkowsky and Sam Altman.
AI in Understanding Complex Systems	This theme, notable in the interview with Manolis Kellis, relates to the use of AI in understanding complex systems like the human genome. This has direct implications for academic research in biology, genetics, and related fields, potentially enabling novel discoveries and advancements.
AI Safety and Control	This topic was a key concern in the interviews with Eliezer Yudkowsky and Sam Altman. In academia, this could lead to an increased focus on AI safety research and the development of mechanisms to ensure the controlled deployment of AI systems in various university functions.

Source: own summary and edit

1.4.1. BASELINE FUTURE

The possible future outcomes of ChatGPT are processed by Scenario Planning based on the methodological approach of Peter Schwartz. Scenario planning is a strategic foresight tool that enables researchers to anticipate and prepare for different plausible futures. In this section, the research explores potential scenarios for the future of ChatGPT in academic fields based on the knowledge gathered from the available literature review, horizon scanning and qualitative analysis. The baseline future is determined based on defining a most probable outcome based on the available information. Once again, the mindset behind the creation of the baseline future is an acceptance of a hypothetic linear correlation between the most commonly mentioned and agreed expected outcomes and between the increased probability of that given expectation happening in the future. Overall meaning that more commonly expected and agreed events highlighted by the interviewees are believed to appear with a higher probability in the future, as more experts on the field acknowledge these options with a consensus. Further alternative futures and possible black swan outcomes are highlighted based on outlying opinions from the

reviewed interviews. Moreover, the limitations of this approach must be highlighted as the researched field is very new and the possible capabilities of the future development and impact of ChatGPT is highly difficult to predict accurately. The research acknowledges these limitations and solely builds possible future outcomes on the opinions of trusted and highly esteemed experts in the field.

Baseline Future: ChatGPT as a Common Research Assistant

Envisioning a baseline future for ChatGPT in academic life and research, the paper leverages the insights from the five interviews previously analysed. This base future scenario, is built upon Schwartz's methodology, representing the most likely trajectory based on the common elements and expectations articulated by the experts interviewed.

In this baseline future, ChatGPT becomes an integral part of academic life and research, acting as a central tool in both classrooms and academic research. Based on the common threads drawn from the interviews, it is foreseeable that ChatGPT will be used to automate a significant portion of academic tasks, thus potentially boosting efficiency in academia. This emphasizes the viewpoint of Stephen Wolfram, who discussed the integration of ChatGPT with the Wolfram Language, enhancing the capabilities of both platforms to better serve academic purposes.

One of the most significant impacts will be on literature review and data analysis as ChatGPT, with its capability to read, understand, and generate text based on a wide range of sources, will streamline the literature review process, ensuring that researchers have access to the most recent and relevant publications in their fields. Likewise, ChatGPT's capacity to perform complex data analysis will allow researchers to focus more on formulating hypotheses and interpreting results, while the AI model takes care of the computational work. Additionally, ChatGPT will likely revolutionize classroom teaching and learning. Lecturers can utilize the model to create personalized learning materials and assignments, which cater to the individual needs of each student. Students, on the other hand, can use ChatGPT as a virtual tutor to supplement their classroom learning, providing them with instant feedback and explanations on difficult concepts. AI education platforms like ChatGPT can give students opportunities to learn at their own pace, without the constraints of traditional classroom settings.

However, the integration of ChatGPT into academic life and research will not be without challenges. As touched upon by Max Tegmark and Eliezer Yudkowsky, the potential for misuse of AI technologies like ChatGPT is a concern that must be addressed. In the academic setting, this might manifest in the form of plagiarism or the manipulation of research data. Therefore, rigorous ethical guidelines and monitoring systems will need to be established to ensure that the use of ChatGPT aligns with the principles of academic integrity.

Despite these concerns, the general consensus among the experts interviewed was mostly optimistic about the future of ChatGPT in academia. With the necessary safeguards in place, the baseline future envisions ChatGPT as a powerful tool that enhances the academic experience for both educators and learners and accelerates the pace of research across disciplines.

1.4.2. ALTERNATIVE FUTURES

In constructing alternative futures for possible effects of ChatGPT in academia, the paper considers less frequent topics and concerns raised in the five expert interviews where common agreement was not reached between the involved parties. These alternatives present both positive and negative scenarios, diverging from the baseline future towards more extreme expectations and venturing into more speculative possibilities.

Positive alternative future - the autonomous researcher

In this future, ChatGPT transcends its role as a tool and evolves into an autonomous researcher. It develops the capability to not only analyse data but also formulate hypotheses, design experiments, and make novel contributions to academic knowledge. This possible future is mentioned by the sentiments of Max Tegmark, who envisions a future where AI can actively contribute to scientific discoveries, not only answering questions and executing tasks, but also recommending future steps and taking the initiative to execute tasks without exact prompts. The "Autonomous researcher" future would revolutionize academia, making scientific research faster, cheaper, and more accessible. It could potentially lead to an exponential increase in the pace of scientific breakthroughs, as ChatGPT could work around the clock without the physical and cognitive limitations that human researchers face. In this alternate future, possible concerns and negative aspects of ChatGPT are not taken into consideration and therefore this scenario differs greatly from the defined baseline future in a more positive direction.

Positive alternative future - the democratization of academic knowledge

In this scenario, ChatGPT becomes an easy to access and standard tool for learning and research, accessible to anyone with an internet connection. It levels the playing field, enabling students and researchers from less privileged backgrounds or from developing countries to access the same quality of academic support as their counterparts in affluent societies. This could lead to an explosion of new ideas and discoveries, driven by a much broader and more diverse group of individuals than ever before. This scenario would be more positive than the baseline future as it addresses the existing inequities in access to educational resources and opportunities.

Positive alternative future - the global learning revolution

A highly positive, though less likely, scenario built based on the analysed interviews would be a global learning revolution sparked by AI tools like ChatGPT. In this case, AI drastically changes the way we learn and acquire knowledge. ChatGPT becomes capable of creating personalized learning paths for each individual, adapting to their pace, and delivering content in the most effective manner for their learning style. This could lead to a dramatic increase in global literacy rates and educational attainment, as well as a massive decrease in the educational achievement gap. This future is far more positive than the baseline future due to the revolutionary potential of personalized learning on a global scale.

Positive alternative future - the singularity in academia

The Singularity, a concept popularized by Ray Kurzweil, represents a future point where technological growth becomes uncontrollable and irreversible, leading to significant changes to human civilization. In the context of academia, this could occur if ChatGPT or a similar AI model achieves superintelligence, and then uses this intelligence to exponentially accelerate scientific discovery and learning. It could lead to unprecedented advancements in all academic fields and a transformation of our understanding of the universe. This extreme future, while unlikely, is not entirely outside the realm of possibility, given the rapid pace of AI development. In this case, the expectation of Ray Kurzweil is that a super intelligent AI will facilitate research and bring positive development to humanity.

Negative alternative future - the academic monopoly

In this scenario, the widespread use of ChatGPT leads to a monopolization of academic research. Universities and research institutions that can afford the resources and licenses to utilize advanced AI have a significant advantage over those that cannot. This leads to a

substantial divide in the academic world, with resource-rich institutions dominating research outputs. This potential disparity is raised by Eliezer Yudkowsky and Max Tegmart, who are undoubtedly viewing the open development of ChatGPT as a greatly concerning factor and are stepping towards more negative futures within their presented opinions on the matter.

Negative alternative future - the replacement of educators

A further negative scenario to highlight, based on knowledge gathered from the explored interviews, would see ChatGPT and similar AI tools replace human educators in significant ways. As AI becomes more sophisticated, universities and schools might rely on it for teaching, thereby reducing the need for human educators. This could lead to job losses in the academic sector and a loss of the personal touch in education, which could negatively affect students' learning experiences. This scenario would be more negative than the baseline future as it would entail significant social costs and potentially lead to a dehumanization of the educational processes.

Negative black swan event - the academic integrity crisis

In this extremely negative scenario, the widespread use of ChatGPT in academia leads to a global crisis of academic integrity. The AI model's text generation capabilities are used on mass to produce research papers, leading to a flood of low-quality, replicated, or even falsified studies. This, coupled with the inability of peer-review systems to cope with the deluge, results in a breakdown of trust in academic publications. The scenario is a reflection of the misuse potential mentioned by also Sam Altman ChatGPT CEO, highlighting that it is very important to consider what ChatGPT will be used for in the future and human evaluation of the received results must always stay apparent in the coming years as well.

Negative black swan event - the end of critical thinking

An extreme negative scenario could see the over-reliance on AI tools like ChatGPT hinder critical thinking and intellectual curiosity. As students become accustomed to being fed information and answers by AI, they might lose the ability or the motivation to question, analyse, and think for themselves. This could lead to a generation of learners who are passive consumers of information, rather than active seekers of knowledge. This future would be more negative than the baseline future as it would undermine the fundamental goals of education and intellectual growth.

Negative black swan event – the end of the human race

A final radical black swan event must be highlighted only considered by Eliezer Yudkowsky from the reviewed five interviews. Eliezer takes a greatly pessimistic position in regard to the future development of ChatGPT. He claims that the exponential development of AI tools will become impossible for the human mind to follow and control. If ChatGPT will be able to take initiative, Eliezer also considers the possibilities of the end of the human race, as humans will not have the tools and knowledge necessary to stop the ever-developing intelligence which is already publicly being trained on the world wide web, with internet access and without any known and transparent limitations.

Each of these futures presents a different set of benefits and challenges. As we navigate towards the future of AI in academia, it is crucial to take these possibilities into account, aiming to maximize the benefits and mitigate the challenges. The future is never a clear extension of the past. In regards to AI development, an exponential curve is predicted, which means that future improvements in the area might be possible on such a large scale which is today hardly predictable and currently mostly unimaginable.

1.5. DISCUSSION

The rise of artificial intelligence in various sectors has been a subject of much interest and debate. One of the most sophisticated manifestations of AI, OpenAI's ChatGPT, has been increasingly recognized for its potential in academic research and learning. The current state of ChatGPT in academia is already considered to be a powerful tool that can assist in several aspects of research, including literature review, concept explanation, hypothesis generation, and possibly even drafting academic papers. Despite its utility, it is critical to note that as of now, ChatGPT operates best as an assistant rather than a standalone researcher or teacher.

In an effort to understand the potential impact and trajectory of ChatGPT in academia, we conducted a literature review, horizon scanning and thematic analysis of interviews with five experts in the field: Stephen Wolfram, Manolis Kellis, Max Tegmark, Eliezer Yudkowsky, and Sam Altman. The interviews revealed a consensus on the utility of ChatGPT in academic research, with the tool being tailored for its ability to facilitate information discovery, accelerate research, and democratize knowledge. However, experts also expressed concerns about the tool's limitations, such as the risk of misinformation, lack of critical thinking, and the potential for overreliance. The authors' analysis further allowed us to build a baseline future scenario, in which ChatGPT continues to develop as a valuable tool for academic research but does not fundamentally alter the landscape of academia. Instead, it enhances the productivity of researchers and improves accessibility to academic knowledge, while still being supplemented by traditional research methods and human expertise. Beyond this baseline future, possible alternative futures were determined in both positive and negative directions based on the knowledge gathered from the analysed interviews. On the positive side, the democratization of academic knowledge and a global learning revolution stand as highly desirable outcomes can be highlighted. While negative scenarios such as the replacement of educators and the end of critical thinking also underscore the potential risks associated with the integration of AI into academia.

In response to the research question: How will ChatGPT and publicly accessible, AI-based software impact PhD students' scientific research in the near future? Based on the authors' analysis, it is anticipated that ChatGPT will serve as a powerful assistant to academic research, aiding in information discovery, hypothesis generation, and knowledge democratization. However, its impact is likely to be modulated by its limitations and the concerns around misinformation and overreliance. The interviewees highlighted both positive and negative expected factors for the future to be taken into consideration and to be addressed with great care to reach a more optimal and fitting outcome.

In conclusion, while ChatGPT and AI tools like it hold immense potential for academia, their integration must be carefully managed to maximize their benefits while their potential drawbacks must be taken very seriously and successfully mitigated. As we journey towards a future where AI plays an increasingly significant role in academia, it is crucial to engage in ongoing discussions about the ethical, practical, and pedagogical implications of these tools.

CONCLUSION

The performed literature review, horizon scanning, and content analysis summarizes that ChatGPT is an impressive language model that has the potential to revolutionize the way we interact with machines, making them more human-like in their responses. With its ability to generate coherent and contextually relevant responses, it has already made great strides in the academic field, with researchers using it for a wide range of applications from academic writing to language translation. The capabilities of ChatGPT are vast, and its potential for future development is extremely promising. As technology advances, it is reasonable to expect that

ChatGPT will continue to improve, with even greater levels of sophistication in generating responses, including a greater understanding of nuance and context. In terms of key aspects of the literature review and interviews, it is clear that ChatGPT has the potential to greatly assist researchers in their work, allowing them to generate high-quality research at a much faster pace than before. However, there are also concerns surrounding its use, including issues around ethical considerations, data privacy, and the potential for the technology to replace human workers.

Looking ahead, the future of ChatGPT in the academic field looks extremely promising. Researchers can expect to use ChatGPT to generate high-quality research at an unprecedented pace, potentially transforming the way we conduct academic research. However, it is essential that researchers and developers consider the ethical implications of this technology and take steps to ensure that its use is transparent and validateable. In conclusion, ChatGPT is an impressive language model that has already made significant strides in the academic field, and its potential for future development is vast. As this technology continues to evolve, we can expect to see it used in new and innovative ways, revolutionising the way we interact with machines and potentially transforming the academic research landscape. However, it is essential that researchers and developers consider the ethical implications of this technology and take steps to ensure that its use is responsible, transparent, and in line with best practices.

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Comprehensive analysis and forecast of Chinese NEV industry development from 2012 to 2025.

Rurong Chen[14], Cai Jing[15], Fu Yingjie[16], Wei Ziji[17]
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Abstract

More and more countries are turning to renewable energy to reduce their dependence on traditional fossil fuels as climate change increases. Electric cars have also become a new trend in energy transformation that is strongly supported by many governments. To answer the research questions, we employ a literature review approach and the TOPSIS method based on entropy. This paper begins with a systematic review of the relevant literature to identify key characteristics of the Chinese market for new energy vehicles (NEVs), providing clear theoretical support. Then, the author chose data from 2012 through 2022 as the primary research object for analysis and chose a total of five first-level indicators and fifteen second-level indicators as the main observation indicators. Using the TOPSIS method, the authors evaluate the entire NEV market in China and make predictions for three years into the future. Based on the results, the NEV composite score ranking is continuing to increase, which indicates a very promising future. However, when a black swan event occurs, such as a car safety incident, it can seriously impede its development. One of the most significant contributions is that based on the evaluation scores from the indicators, the positive and negative future state of NEV is indicated. Since the data has not yet been updated to 2023, it is necessary to continue to verify the new data to make up for the lack of data.
Keywords: Entropy-based TOPSIS, New Energy Vehicle, Energy Transformation, Five-Year Plan, Black Swan Event.
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[14] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, chen.rurong.10@unibge.hu
[15] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, cai.Jing.64@unibge.hu
[16] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, fu.yingjie.51@unibge.hu
[17] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, ziji.wei.53@unibge.hu

INTRODUCTION

With the intensification of climate change and the increasing demand for energy supply security, more and more countries are turning to renewable energy to reduce their dependence on traditional fossil fuels. The use of electric cars to replace fuel vehicles has also become a new energy transformation trend strongly supported by many governments. Under the trend of global low-carbon development, countries have regarded promoting the development of new energy vehicles as an important measure to reduce carbon emissions. Since the first five-year plan in 1991, the Chinese government has started to develop the new energy vehicle industry, and now it has achieved large-scale results. This paper takes China's NEV (New Energy Vehicle) industry as the main research object to explore the development forecast of China's new energy vehicles in the next five years.

When we reviewed the literature about the policies, we found that in the research on new energy vehicles, the Chinese government has been promulgating a series of policies to support the development of new energy vehicles from 1991 to 2025, but how effective these policies are, and whether they can achieve the policy goals needs to be evaluated and given feedback. Most of the research conducted was using context analysis as a base to give a forecast of NEV performance. Only a few researchers were using quantitative methods to analyze the relevant topic, but not focusing on the policy. The Entropy-based TOPSIS method is rarely used in current research. This method can objectively reflect the relationship between indicators and results and is a very important method for macroeconomic research and forecasting.

The research questions in this paper are as follows:

1. How is China's new energy vehicle industry developing currently?
2. What has already been achieved in China NEV?
3. What future are the visions for China’s NEV development in the next 5 years under the current political situation?

This paper adopts a literature review approach and the Entropy-based TOPSIS method to conduct research into the above-mentioned questions. First, the authors systematically reviewed the relevant literature to identify the defining characteristics of the new energy vehicle (NEV) industry development for China, providing clear theoretical support for the paper. The author selected five first-level indicators and fifteen second-level indicators as the main observation indicators and selected the data from 2012 to 2022 as the main research object for analysis. Then, the authors use the Entropy-based TOPSIS method to examine the comprehensive evaluation of China’s NEV industry and give future predictions for three years.

In the analysis part, we unfolded alternative futures: the expected and preferred future, as well as a wild card future. Although the current trend of new energy vehicles is good, future development will be affected by unexpected events. Therefore, based on the ranking of the comprehensive competitiveness of new energy vehicles and the analysis of the internal and external environment of electric vehicles, we outline the favorable and unfavorable factors and put forward targeted opinions.

1.1. LITERATURE REVIEW

Energy Development Trends

With the intensification of climate change and the increasing demand for energy supply security, more and more countries are turning to renewable energy to reduce their dependence on traditional fossil fuels.

New energy: Research has found that solar and wind energy are among the most mature and widely used, however, we have unfolded alternative futures: the expected and preferred one as well as a wild card future. Although the current trend of new energy vehicles is good, future development will be affected by unexpected events. The installed capacity of wind and solar photovoltaics is expected to surpass natural gas in 2023 and coal in 2024. (IEA, 2020) By 2025, solar photovoltaics alone will account for 60% of all new renewable energy capacity, while wind energy will account for an additional 30%. Driven by further cost reductions, renewable energy has become the preferred technology, and by 2040, due to cost reductions and government support policies, renewable energy will account for nearly two-thirds of global new capacity. This is changing the global electricity structure, and by 2040, the share of renewable energy in power generation will rise from the current 25% to over 40%. (IEA, 2018)

However, we must acknowledge that although the application of renewable energy is expanding, traditional energy is still essential in some areas. For example, the transportation and industrial sectors in some countries rely on traditional energy such as oil and natural gas, and in some regions, such as the African continent, although there are abundant solar and wind resources, the trend towards the transformation to renewable energy is not obvious due to the lack of infrastructure and funding. (IRENA, 2021)

Energy transformation: According to the Global Commission on the Geopolitics of Energy Transformation and Van de Graaf (2019), three primary aspects underpin energy transformation: energy efficiency, the growth of renewables, and electrification. The application of electricity is considered an essential aspect of the development of new energy, as many new energy technologies involve the generation, transmission, and storage of electricity. Renewable energy sources, such as solar, wind, and hydropower, require conversion to electricity for use in households and industries. The development of new energy technologies has also driven the transformation of the electricity system, from centralized energy production and transmission to decentralized energy production and smart grid-based energy transmission (Biegańska, 2022). The integration of new energy technologies with electricity has also brought environmental protection and emission reduction benefits. The use of renewable energy and electric vehicles can reduce environmental impacts, lower greenhouse gas emissions, and achieve a low-carbon economy. For example, the European Union aims to increase the share of renewable energy in the electricity supply to 50% by 2030 and achieve a 100% renewable energy supply by 2050 (European Commission, 2022).

NEV industry: The use of electric cars to replace fuel vehicles has also become a new energy transformation trend strongly supported by many governments: the Netherlands (Rishi Iyengar. 2016) and Norway (Jess Staufenberg, 2016) plan to ban the sale of fuel vehicles from 2025, Britain (The Guardian, (2017) and France (The Guardian, (2017) the two countries plan to ban the sale of fuel vehicles in 2040. “EU Approves Ban on Sales of Gas-Powered Cars by 2035” (European Parliament, 2022). In 2017, the Ministry of Industry and Information Technology of China stated that it had initiated relevant research on formulating a timetable for the cessation of production and sales of traditional energy vehicles (CNBC, 2017). In January 2019, China's Hainan Province announced that it will gradually ban the sale of fuel vehicles starting from March 1, 2019, and accelerate the construction of supporting infrastructure such as charging piles and charging facilities (Jessie Yeung, Shawn Deng, 2022).

Under the trend of global low-carbon development, countries have regarded promoting the development of new energy vehicles as an important measure to reduce carbon emissions. As the world's factory, China's new energy vehicle market will usher in a broader space for development.

Intelligent and new energy vehicles are challenging the traditional automotive industry.

With the worsening of global climate change and environmental pollution, the international community has a growing demand for sustainable development. As mentioned earlier, the transition from traditional energy to new energy is the main trend of sustainable development, and automobiles, as the world's largest energy consumer and source of carbon dioxide emissions, are a key target of attention. Taking Europe as an example, according to a report from the European Environment Agency, transportation was responsible for about a quarter of the EU's total CO2 emissions in 2019, of which 71.7% came from road transportation (European Parliament, 2019). Currently, the automotive industry has formed two main camps: traditional automobile manufacturers and new energy-intelligent automobile manufacturers, and their products have undergone essential differences. Traditional automobile manufacturers have long focused on producing mechanical means of transportation, while the other camp has launched intelligent electric vehicles. The application of autonomous driving, artificial intelligence, and internet technology has made cars smarter, safer, and more comfortable, thereby further enhancing their competitiveness (Biswas, A., & Wang, H.-C., 2023). The emergence of electric and new energy vehicles has made the automotive industry shift towards a more environmentally friendly and sustainable direction, while also promoting the transformation of the energy and automotive supply chains. With the promotion of concepts such as reducing carbon emissions and sustainable development, intelligent electric vehicles have become an industry consensus, and traditional automobile manufacturers have begun to actively transform and promote their products towards intelligent electric vehicles (Cao, J., Chen, X., Qiu, R., & Hou, S., 2021).

In addition to the changes brought about by the automotive industry itself, government and consumer guidance is also one of the reasons for the development of smart and new energy vehicles. Governments around the world have successively introduced subsidy policies and tax incentives to promote the popularization of new energy and smart vehicles, which has promoted the market penetration of these vehicles (IEA, 2021). With the acceleration of urbanization and digitization, people's requirements for travel efficiency and comfort are increasing, which has also promoted the market demand for smart and new energy vehicles (Sanguesa, J. A., Torres-Sanz, V., Garrido, P., Martinez, F. J., & Marquez-Barja, J. M., 2021). In addition, the popularization of smart and new energy vehicles will have many positive impacts on society (Lugano, G., 2017). For example, the application of autonomous driving technology will increase the automation level of the taxi and logistics industries, thereby reducing labor costs and increasing efficiency; and the popularity of new energy vehicles will also lead to a decrease in sales of traditional fuel vehicles. The popularity of smart and new energy vehicles will also bring new market opportunities. For example, the recycling and utilization of new energy vehicle batteries and the construction of electric vehicle charging facilities will become new industries and business opportunities (Alexander. T, Georg. B, Dale. H, 2023).

China's policy guidance toward new energy vehicles

The development of China's energy vehicle industry and market cannot be separated from policy guidance. During the 8th Five-Year Plan period (1991-1995), the government listed electric vehicles as a technology research and development project (State Council General Office,1991). During the 11th Five-Year Plan period (2006-2010), the government gradually established a research and development pattern based on three main vehicle technologies: fuel cells, hybrid power, and pure electric power, as well as three key technologies: multi-energy

powertrain systems, driving motors, and power batteries (State Council General Office,2006). During the 12th Five-Year Plan period (2011-2015), China issued many measures, but mainly focused on the technological and market development of new energy vehicles. More policies were introduced to encourage the development of the electric vehicle industry, such as incentives and exemptions, and some management systems. Subsequently, with the global development of technology and industrial innovation, China gradually identified electric vehicles as a key development direction. In June 2012, the State Council issued the "Energy-saving and New Energy Vehicle Industry Development Plan (2012-2020)," which further clarified the direction of pure electric drive as the development of new energy vehicles and the transformation of the automobile industry (State Council General Office,2012.

During the 13th Five-Year Plan period (2016-2020), China proposed three main development directions: the development of green low-carbon technology, the environmental protection and resource recycling industry system, and new energy vehicles. The policy not only covered new energy vehicles themselves but also promoted related industries and sustainable development (State Council General Office,2016). During the 14th Five-Year Plan period (2021-2025), in November 2020, the State Council issued the "New Energy Vehicle Industry Development Plan (2021-2035)," which is a second-level plan development of the new energy vehicle industry based on the existing development achievements since the 2012 new energy vehicle development plan (State Council General Office, 2012). This plan covers more technological innovation, industrial integration, industrial ecology, and infrastructure aspects.

1. **Table The Development Goals and Important Steps in Three Five-Year Plans**

	Development Goals	Important steps
12TH Five-Year Plan (2011-2015)	• *"Significant progress has been made in new energy vehicle power batteries, motors, and electronic control technologies. The specific energy of power battery modules has reached more than 150 Wh/kg, and the power density of electric drive systems has reached more than 2.5 kW/kg."* • *"The cumulative production and sales of pure electric vehicles and plug-in hybrid electric vehicles will strive to reach 500,000 units."* • *"Preliminary formation of a charging facility system and a new energy vehicle business operation model that are compatible with the market size."*	• *"Improve fiscal and tax incentive policies to encourage the consumption and use of new energy vehicles."* • *"Establish a management system for power battery recycling and cascade utilization."*
13TH Five-Year Plan (2016-2020)	• *"Focus on the innovation and application of green and low-carbon technologies, guide green consumption and promote green products."* • *"Significantly increase the proportion of new energy vehicles and new energy applications, and comprehensively promote the construction of high-efficiency energy-saving, advanced environmental protection and resource recycling industrial systems."* • *"Promote green and low-carbon industries such as new energy vehicles, new energy, energy conservation, and environmental protection to become pillar industries. By 2020, the output value will reach more than 10 trillion yuan."*	• *"Realize large-scale application of new energy vehicles, new energy vehicle power battery upgrade project."* • *"Promote the development of the new energy industry and develop projects with a high proportion of new energy."* • *"Vigorously develop high-efficiency and energy-saving industries, energy-saving technology, and equipment development projects."* • *"Accelerate the development of advanced environmental protection industries, green and low-carbon technology comprehensive innovation demonstration projects."*

14TH Five-Year Plan (2021-2025)	• *"The competitiveness of the new energy vehicle market has been significantly enhanced, major breakthroughs have been made in key technologies such as power batteries, drive motors, and vehicle operating systems, and the safety level has been comprehensively improved."* • *"The average power consumption of new pure electric passenger cars has dropped to 12.0 kWh/100 km, and the sales of new energy vehicles have reached about 20% of the total sales of new cars."* • *"The commercial application of highly autonomous vehicles in limited areas and specific scenarios has significantly improved the convenience of charging and swapping services."*	• *"Improve technological innovation capabilities, new energy vehicle core technology research projects."* • *"Build a new industrial ecology, build an eco-system for vehicle operating systems, and build an efficient recycling system for power batteries."* • *"Promoting industrial integration and development, smart city new energy vehicle application demonstration action."* • *"Improve the infrastructure system and build an intelligent infrastructure service platform."*

Source: Data is adopted from State Council General Office. (2012). Notice on Printing and Distributing the Development Plan for Energy Saving and New Energy Automobile Industry (2012-2020). Retrieved from http://www.gov.cn/zwgk/2012-07/09/content_2179032.htm; State Council General Office. (2021). Notice on the Issuance of the Development Plan for the New Energy Vehicle Industry (2021-2035). Retrieved from http://www.gov.cn/zhengce/content/2020-11/02/content_5556716.htm; National Development and Reform Commission. (2011). Twelfth Five-Year Plan for National Economic and Social Development of the People's Republic of China (2011-2015). http://www.gov.cn/zhengce/content/2012-07/20/content_3623.htm; National Development and Reform Commission. (2016). Thirteenth Five-Year Plan for Economic and Social Development of the People's Republic of China (2016-2020). http://www.gov.cn/zhengce/content/2016-12/19/content_5150090.htm;National Development and Reform Commission. (2021). Outline of the Fourteenth Five-Year Plan for Economic and Social Development and Long-Range Objectives Through the Year 2035. http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm

From the table, we can see some of the same important factors in different periods of time: technology improvement, marketing exploration, production sustainability, infrastructure, and service preparation. The steps were a step-by-step refinement along with China's economic development. The development of these strategies and measures has been very effective. According to the "Global Electric Vehicle Outlook 2022" published by the International Energy Agency, as of 2021, China has built approximately 677,000 slow charging stations in the public sector, accounting for 56% of the global total, and approximately 470,000 fast charging stations, accounting for 83% of the global total. China's construction of charging infrastructure has kept pace with the growth in sales of new energy vehicles, essentially meeting the needs of the rapid development of new energy vehicles (IEA, 2022).

1.2. METHODOLOGY

1.2.1. RESEARCH QUESTIONS & METHODS

The TOPSIS method and a literature review strategy are used in this work to answer the following research issues. To establish the defining characteristics of the new energy vehicle (NEV) industry development for China and to provide a strong theoretical foundation for the

study, the authors first conduct a comprehensive evaluation of the pertinent literature. The authors then examine a thorough assessment of China's NEV business and provide future projections for the next three years using the Entropy-based TOPSIS technique. The research questions in this paper are as follows:

How is China's new energy vehicle industry currently developing?

From the previous literature review, we can see that new energy vehicles have become an industry consensus, and traditional automobile manufacturers in China are actively transforming and promoting their products towards intelligent electric vehicles. By examining the current state of the industry, including production, sales, market share, and technological advancements, this question aims to understand the growth and progress of China's new energy vehicle industry.

What financial policies has the Chinese government implemented to promote the industry, and have they had a positive impact?

This question can be derived from the mention of governments introducing subsidy policies and tax incentives to promote the popularization of new energy and smart vehicles. By investigating the specific financial policies implemented by the Chinese government to support the new energy vehicle industry, as well as their effects on market penetration, sales, and consumer adoption, this question aims to evaluate the impact of these policies on the industry's development.

What are the author's predictions for the industry's future development in the next three years?

This question can be derived from the information stating that the author expects further development and changes in the industry. By analyzing the existing literature and opinions of the author, this question aims to explore the anticipated trends, challenges, and opportunities in the new energy vehicle industry in China over the next three years. It may encompass aspects such as market growth, technology advancements, policy changes, consumer preferences, and potential impacts on the energy and automotive supply chains.

The authors followed the principles of systematic, scientific, and operational approaches to select the indicators for this paper, totaling 15. From the perspective of the industry value chain, the authors established an evaluation system consisting of five primary indicators: environmental competitiveness, research and development competitiveness, production competitiveness, market competitiveness, and service competitiveness, along with 15 related secondary indicators, as shown in Table 2. All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

2. Table Indicator system

Primary Indicators	Secondary Indicators	Code
Environmental Competitiveness	Gross Domestic Product (100 million yuan)	X1
	Per Capita Disposable Income Nationwide(yuan)	X2
	Car Sales in China (10000 units)	X3
R&D Competitiveness	Full-time Equivalent of R&D Personnel (10,000 person-year)	X4
	Expenditure on R&D (CNY 100 million)	X5
	R&D expenditure as a percentage of GDP (%)	X6
	Number of Patents Application Accepted(item)	X7
Production Competitiveness	New energy vehicle production volume (10,000 units)	X8
	New energy vehicle sales volume (10,000 units)	X9
	Number of new energy vehicle-related companies (10,000)	X10
Market Competitiveness	China market share (IMS) (%)	X11
	New energy vehicle export volume (10,000 units)	X12
	New energy vehicle penetration rate (%)	X13
Service Competitiveness	Number of charging infrastructure holdings	X14
	Number of registered power battery recycling companies	X15

Source: All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

These research questions address different aspects of the new energy vehicle industry in China, including its status, government support, and future prospects. By exploring these questions, researchers can gain insights into the industry's dynamics, challenges, and potential avenues for further development.

The selection of indicators for quantitative research in this study was based on the logic of capturing key aspects related to the development and performance of China's new energy vehicle industry. The primary categories were established to provide a comprehensive understanding of various dimensions and factors influencing the industry. To assess the overall economic impact, Gross Domestic Product (GDP) was chosen as an indicator, measured in 100 million yuan. It reflects the financial value of all goods and services produced within a country and provides insights into the industry's contribution to the national economy.

Per Capita Disposable Income Nationwide, measured in yuan, was selected to examine the purchasing power and affordability of individuals across the country. This indicator helps evaluate the potential demand for new energy vehicles among the population. Car Sales in China, measured in 10,000 units, serves as a crucial metric to assess the overall sales performance and market demand for both traditional and new energy vehicles.

The Full-time Equivalent of R&D Personnel, measured in 10,000 person-years, and Expenditure on R&D, measured in CNY 100 million, were chosen to gauge the investment in research and development activities within the industry. These indicators reflect the industry's commitment to innovation and technological advancements. R&D expenditure as a percentage of GDP (%), an additional indicator, allows for a comparison of the industry's research and development investment relative to the overall economic output. It offers insights into the level of emphasis placed on innovation within the sector. The Number of Patents Application Accepted, measured in items, provides an indication of the industry's intellectual property creation and technological progress. It reflects the innovative capabilities and potential for future growth within the industry.

To specifically focus on the new energy vehicle segment, indicators such as New Energy Vehicle Production Volume and New Energy Vehicle Sales Volume, both measured in 10,000

units, were included to track the manufacturing and sales performance of these vehicles. These indicators help monitor the growth and market acceptance of new energy vehicles. The Number of New Energy Vehicle-related Companies, measured in 10,000, provides insights into the number of businesses operating within the sector, reflecting the level of industry competition and market dynamics.

China Market Share (IMS) (%), an indicator used to evaluate the market dominance of new energy vehicles in China, offers a perspective on the relative market position and competitiveness of these vehicles. New Energy Vehicle Export Volume, measured in 10,000 units, allows for an assessment of the international market demand and export performance of Chinese new energy vehicles. The New Energy Vehicle Penetration Rate (%), another indicator, examines the proportion of new energy vehicles in the overall vehicle market, indicating the level of market adoption and the penetration of these vehicles.

The Number of Charging Infrastructure Holdings indicates the availability and development of charging infrastructure, an essential factor influencing the adoption and usability of new energy vehicles. Lastly, the Number of Registered Power Battery Recycling Companies was included to gauge the emphasis on sustainable practices within the industry, reflecting efforts towards responsible and environmentally friendly disposal and recycling of power batteries.

These selected indicators collectively provide a comprehensive overview of the new energy vehicle industry in China, covering economic, market, innovation, and sustainability aspects. By analyzing these indicators, the study aims to gain insights into the industry's performance, trends, and potential for future development.

1.2.2. ENTROPY-BASED TOPSIS METHOD

The main idea is to determine the weight of each indicator by the entropy method and then use the TOPSIS method to make a comprehensive evaluation. This method uses the objective weighting idea of the entropy method and the TOPSIS method to approximate the ideal solution, which can effectively eliminate the influence of human subjective factors. It is a decision-making technique used in multi-criteria decision analysis. TOPSIS is designed to determine the best alternative among a set of options based on a predetermined set of criteria. It takes into account both the positive and negative aspects of each alternative and ranks them accordingly. The primary process of the model is shown below.

First, the authors use the collected data to build the original matrix. The data is relative to the development of the NEV industry in China from 2012 to 2022. Let a total of n years, and m indicators be selected for each year to build the original matrix.

$$X=\left(x_{ij}\right)nm(\ i=1,2,3,\ldots,n;\ j=1,2,3,\ldots,m) \quad (1)$$

The selected indicators were normalized to initially eliminate differences caused by the dimensions of the variables. As all the data selected in this paper are positively oriented indicators, it is unnecessary for either positive or reverse transformation. To clarify, indicators are typically classified as either positive or negative, depending on the direction of the desired outcome or the aspect being measured. For example, a low unemployment rate is considered positive, as it indicates a lower level of unemployment and is generally seen as a favorable outcome. In contrast, a high poverty rate would be considered negative, as it represents a higher prevalence of poverty and is considered undesirable. Therefore, this study adopts the "normalization by mean" method for data processing.

$$Y_{ij}=X/Mean \quad (2)$$

The authors determine the weights for the values of the j_{th} indicator of the i_{th} object followed by the function below.

$$P_{ij} = \frac{x_{ij}}{\sum_{i=1}^{n} x_{ij}} \quad (3)$$

The authors determine the entropy value of the j_{th} indicator followed by the function below, In information theory, entropy refers to the amount of uncertainty or randomness present in a set of data. The entropy value quantifies the average amount of information contained in a random variable or dataset. It measures the level of unpredictability or disorder in the data. A higher entropy value indicates higher uncertainty or a larger number of possible outcomes, while a lower entropy value suggests greater predictability or a smaller number of potential outcomes.

$$e_j = -\frac{1}{\ln(n)} * \sum_{i=1}^{n} P_{ij} \ln(P_{ij}), (i = 1, \ldots, n; j = 1, \ldots, m) \quad (4)$$

Calculating the information utility value d, Information utility refers to the value or usefulness of the information in aiding decision-making or reducing uncertainty. The information utility value is a measure of how valuable or beneficial certain information is in providing insights, making informed decisions, or reducing the level of uncertainty. It assesses the impact or effectiveness of information in achieving specific goals or objectives. The information utility value can vary depending on the context and the specific decision or problem being addressed. Higher information utility values indicate that the information is more valuable and contributes significantly to the decision-making process.

$$d_j = 1 - e_j \quad (5)$$

The authors determined the entropy weight of the j_{th} indicator followed by the function below:

$$w_j = \frac{(1 - e_j)}{\sum_{j=1}^{m} (1 - e_j)}, \quad 0 \le w_j \le 1, \sum_{i=1}^{m} w_j = 1 \quad (6)$$

Thus, computing scores for individual indicators and overall performance levels.

$$S_{ij} = w_i \times x_{ij}, \; S_i = \sum\nolimits_{j}^{n} S_{ij} \quad (7)$$

Then using the TOPSIS method to conduct a comprehensive evaluation. Assuming there are m_{th} object, n_{th} indicators, then the matrix $X = (x_{ij})_{mn}$, Normalize the decision matrix

$$Y = (y_{ij})_{mn}. \quad (8)$$

next, the weighted and normalized decision matrix V should be computed:

$$V = (v_{ij})_{m \times n} = (w_j y_{ij})_{m \times n} \quad (9)$$

First, using the weighted and normalized decision matrix, calculate the positive and negative ideal solutions. Then, note that in the TOPSIS method, monotonicity is usually required. The formulas for positive and negative ideal solutions are as follows:

positive ideal solution: $X^+ = (v_1^+, v_2^+, \ldots, v_n^+)$, $v_j^+ = max_{1 \le i \le m} v_{ij}$ (10)

negative ideal solution: $X^- = \left(v_1^-, v_2^-, \ldots, v_n^- \right)$, $v_j^- = min_{1 \le i \le m} v_{ij}$ (11)

To calculate the distances between each object and its positive and negative ideal solutions, usually, the Euclidean distance is used:

$$S_i^+ = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^+ \right)^2}, \ i = 1, 2, \ldots, m$$
$$S_i^- = \sqrt{\sum_{j=1}^{n} \left(v_{ij} - v_j^- \right)^2}, \ i = 1, 2, \ldots, m \quad (12)$$

One important step in the TOPSIS method is computing the relative closeness of each object, which is typically done by comparing the distances between each object and its positive and negative ideal solutions:

$$C_i^+ = S_i^- / \left(S_i^+ + S_i^- \right) \quad (13)$$

The relative closeness measure C_i^+ of each object is its comprehensive score index, with a C_i^+ higher indicating a better object.

1.3. RESULTS ANALYSIS

1.3.1. Analysis between 2012 - 2022

Based on constructing the evaluation index system and measurement model for the development level of China's NEV industry. The information entropy (e_j), weight (w_j), and utility value (d_j) of each evaluation index in China are derived according to the above formula, as shown in Table 2 below. Based on this result, the X15 (Number of registered power battery recycling companies) is the most heavily weighted among the 15 indicators. The second highest weighted indicator is X14 (number of charging infrastructure holdings). Therefore, service competitiveness accounts for a larger share than the other three primary indicators. In contrast, the X6 (R&D expenditure as a percentage of GDP (%)) has the smallest weighting.

3. Table The results of the calculation of various indicators

Index	e_j	d_j	w_j
X1	0.9865	0.0135	0.44
X2	0.987	0.013	0.42
X3	0.9975	0.0025	0.08
X4	0.9524	0.0476	1.55
X5	0.976	0.024	0.78
X6	0.9984	0.0016	0.05
X7	0.9423	0.0577	1.88
X8	0.7025	0.2975	9.68
X9	0.7005	0.2995	9.75
X10	0.5806	0.4194	13.65
X11	0.7075	0.2925	9.52
X12	0.7025	0.2975	9.68
X13	0.6908	0.3092	10.06
X14	0.5874	0.4126	13.43
X15	0.415	0.585	19.03

Source: All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

Additionally, based on the TOPSIS evaluation model above for the development level of China's NEV industry. The data results of positive (s_i^+), negative (s_i^-)ideal solutions, the relative closeness of each object (C_i^+) and its rank are shown in Table 3 below.

4. Table Comprehensive Evaluation Results of Chinese NEV industry's development level

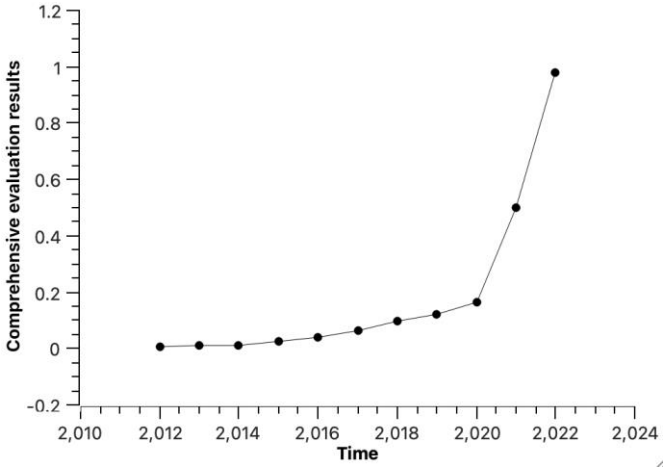
Time	S_i^+	S_i^-	C_i^+	ScoreC_i^+
2012	1.947	0.016	0.008	11
2013	1.944	0.019	0.010	10
2014	1.936	0.023	0.012	9
2015	1.914	0.053	0.027	8
2016	1.891	0.078	0.040	7
2017	1.858	0.127	0.064	6
2018	1.811	0.194	0.097	5
2019	1.779	0.245	0.121	4
2020	1.670	0.327	0.164	3
2021	1.001	1.004	0.501	2
2022	0.038	1.947	0.981	1

Source: All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

In order to visualize the changes in the development of the Chinese NEV industry development level between 2012 and 2022, the authors have made a visual chart based on the above data, as shown in Figure 1 below. From the figure, the level of NEV industry development in China has gradually increased from 2012 to 2022, showing a good growth trend

of continuous strengthening. The speed of NEV industry development in China accelerated significantly after 2020.

1. Figure Comprehensive Evaluation Results of NEV Industry Development Level in China from 2012 to 2022



Source: All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

1.3.2. FUTURE CONSIDERATIONS

Based on the previous calculations, the authors forecast the industry trends in China over the next three years. The authors have used compound annual growth rates in their forecasts. The authors have employed compound annual growth rates (CAGR) in their forecasts to comprehensively depict and interpret growth trends within a specific time period. By utilizing CAGR, they ensure consistent and reliable measurement and evaluation of growth rates, especially in cases where significant fluctuations or variations in the data exist.

CAGR offers several advantages that make it a commonly used approach in forecasting. Firstly, CAGR provides a smoothed representation of growth by calculating the average annual growth rate over a defined timeframe. This smoothing process eliminates short-term volatility or irregularities in the data, resulting in a more dependable and stable measure of growth. Secondly, CAGR takes into account the compounding effect of growth over time. By considering the cumulative impact of year-on-year growth, it becomes particularly relevant when analyzing long-term trends or evaluating investment performance.

Furthermore, CAGR facilitates easy and meaningful comparisons between different time periods or data sets. By calculating growth rates on an annual basis, comparisons can be made across various timeframes, industries, or geographical regions, allowing for valuable insights and assessments. Lastly, CAGR can be employed for future projections by leveraging historical trends. By assuming a consistent growth rate, it serves as a foundation for estimating potential future outcomes or making forecasts.

In summary, the utilization of CAGR in the authors' forecasts ensures a comprehensive and reliable representation of growth trends. This approach accounts for compounding effects, enables meaningful comparisons, and facilitates future projections based on historical patterns.

5. Table The results of the calculation of various indicators for positive prediction

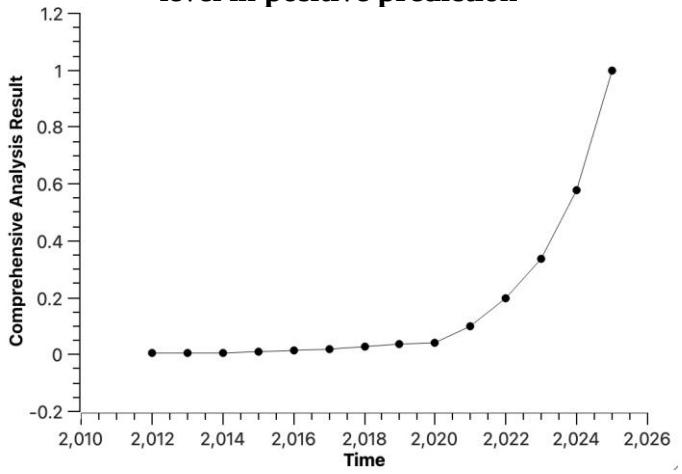
Index	e_j	d_j	w_j
X1	0.9817	0.0183	0.55
X2	0.9828	0.0172	0.51
X3	0.9978	0.0022	0.07
X4	0.9596	0.0404	1.2
X5	0.9661	0.0339	1.01
X6	0.9973	0.0027	0.08
X7	0.9484	0.0516	1.54
X8	0.5943	0.4057	12.09
X9	0.5999	0.4001	11.92
X10	0.5926	0.4074	12.14
X11	0.6221	0.3779	11.26
X12	0.6779	0.3221	9.6
X13	0.6151	0.3849	11.47
X14	0.5779	0.4221	12.58
X15	0.5307	0.4693	13.99

Source: All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

Regarding the optimistic forecast, the results of the calculation of various indicators are shown in table 5 above. The Indicator X15 (Number of registered power battery recycling companies) is still the most heavily weighted among the 15 indicators. So, service competitiveness still accounts for a larger share than the other three primary indicators in the positive prediction. But the X3 (Car Sales in China (10000 units)) replaced the X6's position, which has the smallest weighting.

The Comprehensive evaluation results of the Chinese NEV industry's development level in positive prediction show in Figure 2 below. Without unexpected changes, the trend of the entire industry is still maintaining an upward growth.

2. Figure Comprehensive evaluation results of Chinese NEV industry's development level in positive prediction



Source: All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

Regarding the pessimistic forecast, the results of the calculation of various indicators show in table 5 below. The Indicator X15 (Number of registered power battery recycling companies) is still the most heavily weighted among the 15 indicators. But the X6 (R&D expenditure as a percentage of GDP (%)) has the smallest weighting. In general, the weighting of individual indicators within the indicator system has not changed much.

6. Table The results of the calculation of various indicators for negative prediction

Index	e_j	d_j	w_j
X1	0.9892	0.0108	0.42
X2	0.9898	0.0102	0.4
X3	0.9982	0.0018	0.07
X4	0.9657	0.0343	1.33
X5	0.9809	0.0191	0.74
X6	0.9985	0.0015	0.06
X7	0.9586	0.0414	1.61
X8	0.7247	0.2753	10.7
X9	0.7226	0.2774	10.78
X10	0.7013	0.2987	11.61
X11	0.7381	0.2619	10.18
X12	0.7678	0.2322	9.02
X13	0.7304	0.2696	10.48
X14	0.6539	0.3461	13.45
X15	0.5069	0.4931	19.16

All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

However, the ranking of China's NEV industry development level comprehensive evaluation results from 2012-2025 has changed. The year 2022 became a turning point and the following three years saw a downward trend in the industry. What’s more, Moreover, the industry's ranking for development in 2024 is only seventh, and its ranking for development in 2025 is even lower, at tenth.

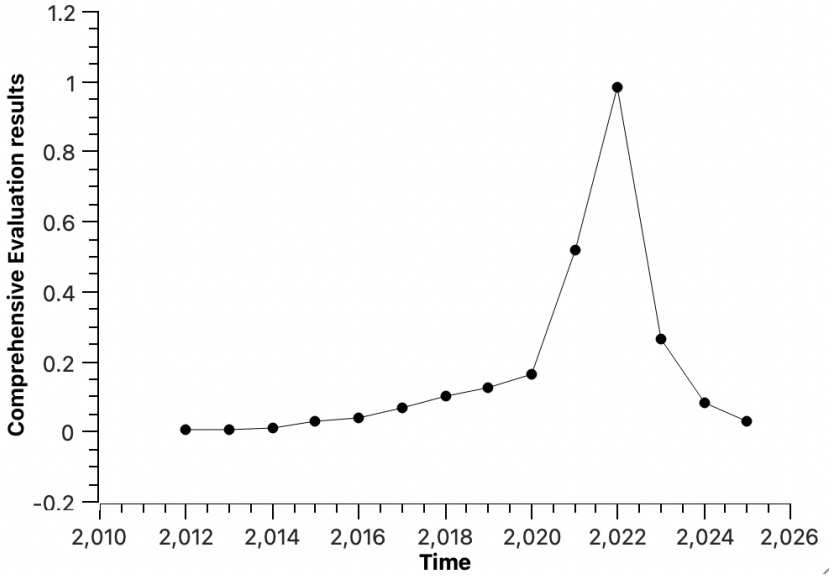
7. Table Comprehensive Evaluation Results of Chinese NEV industry's development level

Time	S_i^+	S_i^-	C_i^+	$Score C_i^+$
2012	2.072	0.013	0.006	14
2013	2.069	0.015	0.007	13
2014	2.06	0.021	0.01	12
2015	2.033	0.06	0.029	11
2016	2.009	0.088	0.042	9
2017	1.971	0.142	0.067	8
2018	1.918	0.219	0.102	6
2019	1.885	0.266	0.124	5
2020	1.773	0.352	0.166	4
2021	1.017	1.101	0.52	2
2022	0.031	2.072	0.985	1
2023	1.545	0.555	0.264	3
2024	1.929	0.175	0.083	7
2025	2.031	0.066	0.031	10

All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

For the purpose of visualizing the changes in the level of development of China's NEV industry between 2012 and 2025, the authors have created a visual chart based on the above data, as shown in Figure 3 below.

3. Figure 3 Visual chart of comprehensive evaluation results of the Chinese NEV industry's development level in negative prediction

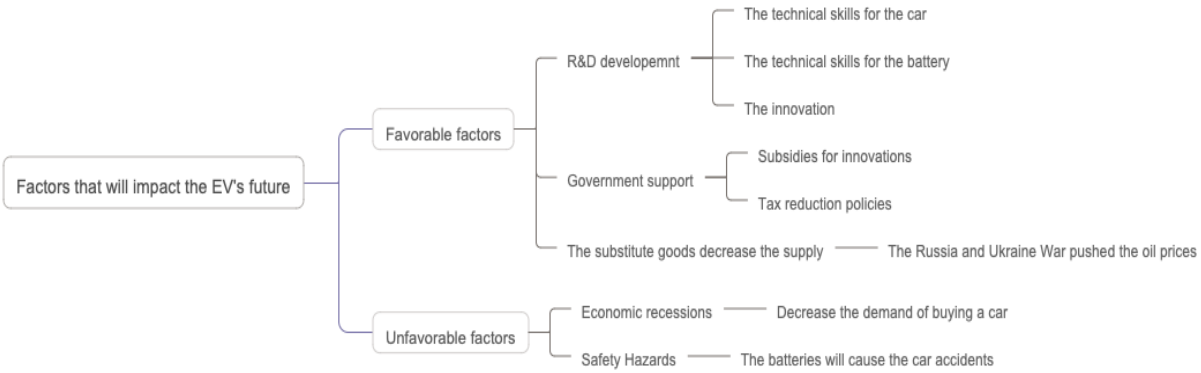


All initial data were collected by authors from the official website of the General Administration of Customs of the People's Republic of China (http://english.customs.gov.cn/) and China Association of Automobile Manufacturers (CAAM)(http://en.caam.org.cn/).

1.4. DISCUSSION

Based on the comprehensive competitiveness ranking of new energy vehicles, we used the environmental scan to analyze the internal and external environment of electric vehicles to identify favorable and unfavorable factors, to make a forecast for the future development status of the new energy vehicle market.

4. Figure The favorable and unfavorable factors



All data are collected by the authors.

1.4.1. MARKET COMPETITIVENESS ANALYSIS

By using the TOPSIS method, we describe the international competitiveness of new energy based on the data on environmental competitiveness, R&D competitiveness, production competitiveness, market competitiveness, and service competitiveness. The comprehensive competitiveness of China's new energy vehicles was constructed and ranked for the past 11 years, and its first ranking in 2022 shows that its comprehensive competitiveness is increasing year by year, and overall, the development of new energy vehicles is a positive one.

Horizontal analysis of the current external environment is conducive to the development of new energy vehicles:

The Russia-Ukraine war has created an increased demand for alternative products:

The traditional view is that oil and automobiles are complementary, i.e., the use of automobiles means that the consumption of oil is inevitable. However, the emergence of new energy vehicles has upset this ecological balance. New energy vehicles and traditional old cars form a substitute for each other. As a result, the escalation of the Russia-Ukraine conflict has increased the price of oil and gas, which has shifted the consumer market's preference to new energy vehicles. While the Russia-Ukraine conflict has had a huge impact on the world economy and energy markets, it has had a positive effect on new energy vehicles.

Maturity of new energy technologies:

Current battery technology has been further improved. In the early stage of the development of new energy vehicles, the constraints of slow charging speed, short range, low battery energy, and insufficient popularity of charging piles made consumers fearful of new energy vehicles. Currently, most electric vehicles use nickel-metal hydride (Ni-MH) batteries and lithium-ion batteries as the power source, which is an improvement over previous battery technology. These two types of batteries have a long life, high capacity and low cost. In terms of technology, new energy vehicles can be classified as pure electric vehicles, hybrid electric

vehicles, and plug-in hybrid electric vehicles. Diversified electric solutions meet the needs and preferences of different users.

Intelligence also further enhances the competitiveness of electric vehicles. The accelerated integration of new energy vehicles with the Internet, big data, artificial intelligence and other emerging technologies, and the rising popularity of intelligent and autonomous driving technologies for new energy vehicle products will make people's driving experience feel richer.

In addition, traditional fuel car companies are also promoting the research and development of new energy technologies. These new cars appear to give consumers more choices but also drive the transformation and upgrading of the traditional fuel car industry. The top-ranking new energy car sales in the current market are still mainly dominated by traditional fuel car companies. On the one hand, they have the operation of traditional car manufacturing, on the other hand, strong financial support and technology guarantee, making it faster to occupy an important position in the new energy market.

Government policy stimulation:

The new energy vehicle explosion is based on the government's incentive policy for rapid development and layout. The government's stimulus for it is mainly reflected in three aspects: government subsidies, purchase tax exemptions, and the disappearance of consumption tax.

The government has been actively promoting the new energy vehicle market and has given strong policy subsidies. in January 2009, the State Council considered and adopted in principle the Revitalization Plan for the Automobile Industry, which elevated the development of the new energy vehicle industry to a strategic level and allocated 10 billion yuan to support the industrialization of new energy vehicles and key components. In the same year, the Development and Reform Commission, the Ministry of Industry and Information Technology, the Ministry of Finance, the Ministry of Science and Technology, and other ministries released the "Ten Cities and Thousands of Vehicles Project". It is planned that within three years, 10 cities will be developed each year, and 1,000 new energy vehicles will be launched in each city to carry out demonstration operations, and the vehicles will be tried as public transportation, government vehicles, postal sanitation, and other fields. The government's massive subsidies are to help the industry's rapid development in the early years, to achieve the green economic transformation, and to accomplish the goal of carbon neutrality. This is in line with China's future economic development plan. To support the development of the new energy vehicle industry and promote auto consumption, the Ministry of Finance 2022 issued a continued exemption from vehicle purchase tax in 2023. Consumption tax is paid according to the engine displacement, because electric vehicles do not have engines, so they do not need to pay the corresponding consumption tax.

In addition to the policy aspect, the government also vigorously promotes the investment and construction of new energy vehicle charging infrastructure. It can promote further industrial upgrading and drive the development of supporting industries. In 2021, the total number of China's high-speed intercity fast charging facilities exceeded 10,000 units, highway coverage exceeded 35%, covering 27 provincial-level administrative regions, and Beijing, Tianjin, Hebei, Yangtze River Delta, and Pearl River Delta key regional highways had achieved full coverage.

Vertical analysis of the internal market environment of the new energy vehicles is also booming state.

- 2009-2015 initial growth period, the government's subsidy policy to promote the new energy vehicle market. A comprehensive policy system was established. China launched a series of support policies for new energy vehicles, the development, and implementation of systematic standards, and local governments were involved with the actual introduction of

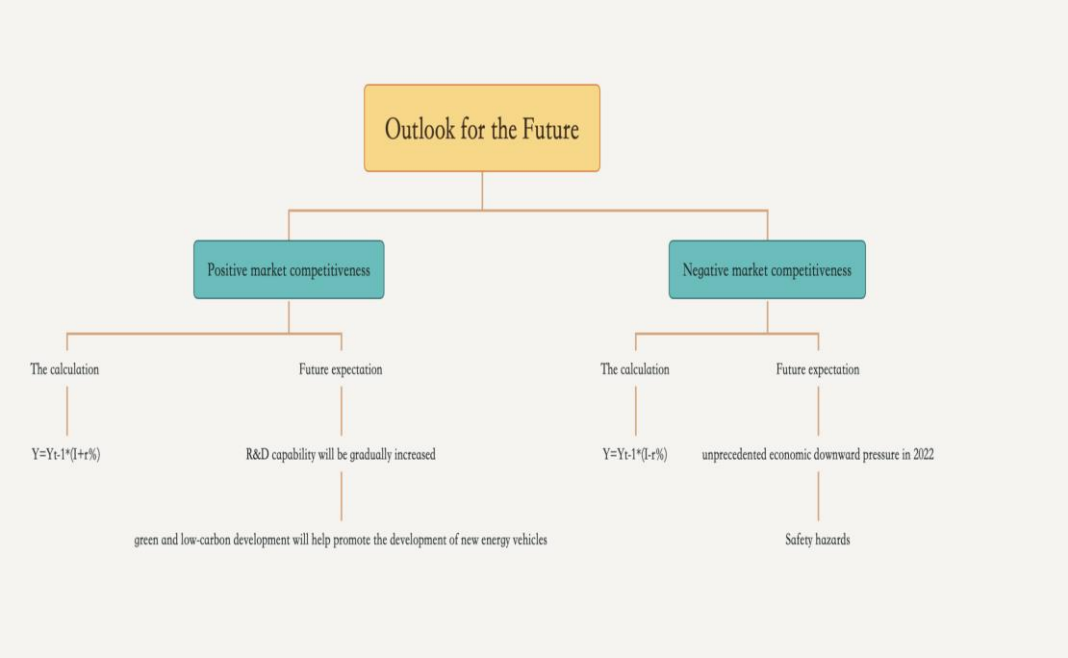
the corresponding supporting policies. In 2014, the private purchase of new energy vehicles in China began to appear, which also opened the first year of China's new energy vehicles. 2015, the country entered a high growth year in the new energy vehicle industry, China also became the world's largest new energy vehicle market.

- 2016-2021 rapid growth period, technological innovation active new energy vehicle market. 2021 as the first year of the 14th Five-Year Plan, China's new energy vehicle market achieved rapid growth in production and sales scale, rapid improvement in quality brand, rapid growth in product exports, and an outbreak of strong market momentum. The power battery level had been significantly improved, and the industry's competitiveness was leading globally. The electric consumption of mainstream pure electric passenger cars had been reduced to 12.5kWh/100km, the range was increased to over 400km, and the system energy density reached 194.12Wh/kg, reaching the international advanced level.
- 2022-2025 Mature period, consumers change their consumption concept. The external impact of the Russia-Ukraine conflict has further stimulated the demand for the new energy vehicle market, coupled with the continuous technological update and the change of people's consumption concept. Due to the technological updates, the original battery range problem has been solved, policy subsidies have made EVs more affordable, and the government's construction of infrastructure such as charging piles has provided a more friendly charging environment for EVs. As a result, people have changed from fear of new energy vehicles to acceptance.

1.4.2. OUTLOOK FOR THE FUTURE

According to the results above, the competitiveness ranking of new energy vehicles is continuously rising when all indicators are moving towards positive growth. This implies a gradual rise in environmental competitiveness, increased technological R&D capabilities, product updates, market shifts and increased demand, and better infrastructure. But when all indicators are moving in a negative direction, it means that the competitiveness of new energy vehicles is rapidly declining and will be less competitive in 2026 than it was in 2010.

5. Figure The outlook for the future



Source: All figures are made by the authors

Positive market competitiveness forecast analysis.

By calculating the compound annual growth rate, we give the future overall competitiveness of new energy vehicles in a state of active development, which can be observed to be gradually strengthened with the growth of years. This is in line with the current expectation:

- Its R&D capability will be gradually increased with the increase of R&D funds to build and optimize the platform of electric vehicles. The technology will be updated and upgraded for its powertrain, chassis system, and body system. To achieve low cost, high performance and long life of the battery to ensure that the car has sufficient power.
- The goal of green and low-carbon development will help promote the development of new energy vehicles. China is now in a period of economic transition, changing from its original sloppy to an intensive mode of economic development, thus achieving green economic transformation. As a major consumer of energy, automobiles cause a certain degree of environmental pollution every year. Therefore, the emergence of new energy vehicles helps the case of low-carbon automotive energy and promotes carbon neutrality in the whole industry chain and life cycle.
- Most cities have made plans to electrify vehicles in the public sector. Public service vehicles, net cars, cabs, buses, logistics vehicles, etc. have different charging and switching methods, which vary from city to city, and should be combined with the operating characteristics of the vehicles to consider appropriate methods, such as slow charging, fast charging, rapid power exchange, high-power charging, and online charging, like the so-called dual-source trackless in Beijing.
- The competitiveness of the new energy vehicle market is gradually increasing along with its product updates and iterations. 2022 China's new energy vehicles continued to grow explosively, with production and sales completing 7.058 million and 6.887 million units respectively, up 96.9% and 93.4% year-on-year, remaining the world's number one for eight consecutive years. Market share increased to 25.6%, 12.1 percentage points higher than the previous year, and global sales accounted for more than 60%. Among them, 5.365 million units of pure electric vehicles were sold, up 81.6% year-on-year; 1.518 million units of plug-in hybrid vehicles were sold, up 1.5 times year-on-year.

Negative market competitiveness forecast analysis.

Although many positive factors are currently driving the development of new energy vehicles, there is still a big problem with new energy vehicles - safety hazards. Therefore, we constructed the worst scenario analysis of the impact of too many explosive events on the new energy vehicle market. By negative scenario setting, it is believed that the overall competitiveness of new energy vehicles is rapidly declining when all indicators are moving in the direction of negative growth, even falling to the 10th place in 2025. Therefore, the devastating impact on the new energy vehicle industry due to the outbreak of a black swan event cannot be ignored.

- The automotive industry faces unprecedented downward pressure in 2022 under the impact of multiple negative factors such as the domestic macroeconomic downturn, recurring epidemic, continuation of international chip shortage, and high oil and raw material prices. The downward pressure on the macro economy has reduced the overall consumer demand for automobiles. After a period of rapid economic development, most Chinese families already have small cars, and people's demand for cars has reached saturation. The total number of car sales fell back after the epidemic due to people's lower income and excessive economic pressure during the epidemic. As a result, the overall scale of market demand dropped, which will hurt the demand for new energy vehicles.

- Safety hazards are still not properly addressed, increasing consumer concerns about safety. 2021 saw a total of about 3,000 new energy vehicle fire accidents nationwide, and the overall fire risk of new energy vehicles is higher than that of traditional vehicles. In terms of the state of the car that caught fire, 35% were in charging, 40% in driving, and 25% in a stationary state. Seasonally, the probability of fire is much higher in the hot period than in winter and other seasons.

SUMMARY AND POLICY RECOMMENDATIONS

This paper analyzes the comprehensive competitiveness of new energy vehicles and conducts an alternative future situation analysis to analyze positive and negative situations for the future of new energy vehicles. The following conclusions were drawn:

- The future outlook for new energy vehicles is good and in line with China's 14th Five-Year Plan's goal of economic transformation.
- Continuing to strengthen the new energy vehicle battery safety is the key. Prevent new energy vehicles from exploding and other similar black swan events for the negative impact of new energy vehicles.
- The government should continue to strengthen infrastructure development to help create a favorable environment for the development of new energy vehicles.

Based on the current state of development, the government can continue to encourage the EV market by the following measures:

- Exemption from purchase tax, and vehicle purchase subsidy: Individuals and enterprises that purchase new energy vehicles are exempt from purchase tax and can receive a certain vehicle purchase subsidy, which is conducive to reducing the purchase cost of new energy vehicles and increasing the motivation of users to purchase vehicles.
- Promoting new energy vehicle buses, cabs and logistics vehicles: The government has given strong support to the promotion of new energy vehicles in the fields of buses, cabs and logistics, such as giving preferential taxes and government procurement preferences, which is conducive to increasing the market demand and sales of new energy vehicles.
- Building charging infrastructure: The government has increased the construction of charging infrastructure to improve the coverage rate and charging speed of charging facilities in order to better meet the changing needs of new energy vehicle users.
- The biggest contribution of this paper is to give a competitive evaluation of new energy vehicles and to forecast the comprehensive competitiveness of the market for new energy vehicles based on the current situation. However, since the current data on electric vehicles are not comprehensive enough, there is still room for improvement in data collection. Therefore, future research will continue to add data indicators to make the comprehensive competitiveness evaluation more comprehensive and effective.

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ChatGPT's Future in Higher Ed: Insight from Bachelor-Level Teachers Years

Norbert Forman[18], Nino Papashvili[19], Péter Szántó[20], Orsolya Éva Tóth[21]

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Abstract

Our research explores the potential impact of ChatGPT on higher education, specifically focusing on bachelor programs. Using a mixed-method approach that included interviews with 12 educators, media outlet analysis, and Z-number cognitive mapping, the research aims to investigate ChatGPT's role in higher education and understand the perspectives of teachers over the next three years. The research provides a foresight analysis of teachers' perspectives regarding the potential impact of ChatGPT on higher education.

ChatGPT has the potential to revolutionize the teaching and learning process and methodology in higher education within the next three years and it will also offer opportunities and challenges to the participants in higher education. According to our findings, ChatGPT can have a positive impact on personalized learning, student engagement, and AI-driven assessment. Thus, ChatGPT can be considered a new tool that could support teaching and learning methodology and could help to increase the overall student experience in higher education. On the other hand, it also raises ethical concerns and challenges in terms of pedagogical integration.

Our findings can serve as a useful reference for policymakers, educators, and other stakeholders in the education sector.

Keywords: ChatGPT, higher education, foresight analysis JEL codes: a2, I2, o22, c88

INTRODUCTION

The use of NLP systems can be highly beneficial in supporting curriculum design and learning path generation in the context of tech universities. By automating the process of information extraction and analysis, NLP systems can help to save time and resources, while also providing more accurate and personalized recommendations for students. Particularly, ChatGPT has the potential to revolutionize the way we interact with technology and can be a significant futuristic support tool (Vo et al., 2022). Specifically, ChatGPT has the potential to transform the assessment process in higher education. However, Rudolph et at. (2023) emphasizes the need for continued research and development to ensure that ChatGPT is used ethically and

[18] Doctoral School of Entrepreneurship and Business, Budapest Business School, Budapest Hungary Department of Business Information Technology, Faculty of Finance and Accountancy, Budapest Business School, Budapest Hungary

[19] Doctoral School of Entrepreneurship and Business, Budapest Business School, Budapest Hungary

[20] Doctoral School of Entrepreneurship and Business, Budapest Business School, Budapest Hungary

[21] Doctoral School of Entrepreneurship and Business, Budapest Business School, Department of Finance, Faculty of Finance and Accountancy, Budapest Business School, Budapest Hungary

effectively. However, the ChatGPT should not replace human assessments entirely but should be used in conjunction with traditional assessments to provide a more comprehensive approach (Rudolph et at., 2023). Although, Neumann et al. (n.d.) calls for a broader conversation about the role of AI in higher education, including discussions around ethical considerations and the need for appropriate regulations. They also suggest that universities and policymakers should work together to develop guidelines and best practices for the responsible use of AI in higher education.

Willems (2023) Several issues face universities, including declining enrolment, budget cuts, and adapting to changing student demographics and labor market demands. Rather than simply implementing new technologies, he argues that universities must change how they operate. The author suggests that universities should focus on addressing these challenges by adopting innovative teaching methods, such as online learning, while also prioritizing students' needs. In addition, the author emphasizes the importance of retaining a human-centered approach to education, in which technology enhances rather than replaces human interaction. Accordingly, Willems, (2023) acknowledges ChatGPT and AI's potential benefits in higher education but recommends viewing them as tools rather than solutions. To meet these challenges, innovation and technology must be integrated with broader societal and institutional goals.

Other scholars also highlight that large language models (LLMs) such as GPT-4 and ChatGPT pose a significant challenge to the future of higher education. They suggest that LLMs can fundamentally transform the way we learn and teach, potentially disrupting traditional educational models and challenging the role of educators (Milano et al., 2023). Additionally, Neumann et al. (n.d.) discusses that the emergence of advanced artificial intelligence (AI) models such as ChatGPT has significant implications for the future of higher education. The authors suggest that AI models like ChatGPT can transform higher education by enabling personalized learning experiences, enhancing student engagement, and providing real-time feedback to learners. The paper discusses the potential benefits of using AI in higher education, including improving student retention rates, and reducing the cost of education. However, the authors also acknowledge the potential risks and challenges associated with the use of AI in education, such as privacy concerns and the potential for bias in AI algorithms.

1.1. LITERATURE REVIEW

The research by Baidoo-Anu & Ansah, (n.d.) explores the potential benefits of using generative AI in education, specifically through the example of ChatGPT, a large language model trained by OpenAI. The authors emphasize that ChatGPT can be a useful tool in promoting teaching and learning, as it can provide personalized and adaptive learning experiences for students. ChatGPT can generate responses to students' questions and provide feedback on their work, which can help them understand complex concepts and improve their skills.

Accordingly, Willems (2023) argues that the focus on ChatGPT and similar AI models in universities is misplaced, and that there are more pressing concerns facing higher education institutions. The authors suggest that while ChatGPT and AI can be useful tools for teaching and learning, they are not a panacea for the challenges facing universities. Therefore, Haleem et al. (2022) discuss the potential of ChatGPT as a futuristic support tool and its features, abilities, and challenges. The authors highlight the advantages of using ChatGPT, such as its ability to understand natural language, its ability to learn from vast amounts of data, and its scalability. Also, Sok and Heng, (n.d.) demonstrate the benefits of ChatGPT, including its ability to generate human-like responses to questions, provide personalized feedback and assistance to students, and assist researchers in data analysis and knowledge discovery. They also highlight the potential for ChatGPT to enhance language learning, as it can help students

practice and improve their language skills. However, it is crucial to address the challenges and limitations to ensure that ChatGPT is used ethically and responsibly (Haleem et al., 2022).

Particularly, Shiri, (2023) discusses the potential benefits of using ChatGPT for academic integrity, such as its potential to improve the accuracy and efficiency of plagiarism detection. However, the author also acknowledges the challenges of using AI in this context, such as the need to ensure the accuracy and fairness of the model and the potential for false positives or negatives. Moreover, Atlas, (2023) highlights the benefits of using ChatGPT, including its ability to provide instant feedback and support, its potential to improve engagement and retention, and its scalability. However, the author also acknowledges the challenges of using ChatGPT, such as the need to ensure the ethical and responsible use of AI and the potential for bias in the data used to train the model.

In relation to the benefits of utilizing ChatGPT in higher education, Firaina & Sulisworo, (2023) present the findings of the study which indicate that ChatGPT was primarily used to assist with writing assignments and for research purposes. Both teachers and students reported higher levels of productivity and satisfaction when using ChatGPT frequently. It should be noted, however, that some participants expressed concerns about the potential for ChatGPT to replace human interaction and the need for further training and support to make the most of it.

As a means of representing an overall picture of ChatGPT in relation to the current topic of interest, Farrokhnia et al. (2023) conducted a SWOT analysis around ChatGPT, and accordingly, its strengths were identified as the ability to process and analyze large amounts of data rapidly and its ability to personalize learning experiences. Among its weaknesses are the risk of perpetuating bias and the lack of emotional intelligence in its responses. There is potential for the development of more sophisticated natural language processing models as well as the potential for improving accessibility and inclusion in education. There is a risk that this technology will be misused and that it may replace human teachers. Apart from that, Milano et al. (2023) explore the implications of LLMs for the role of educators in higher education, suggesting that LLMs could potentially replace some teaching functions or lead to a shift towards more facilitative and coaching roles. The authors propose several strategies for preparing educators and students for the use of LLMs in education, such as developing AI competency frameworks and providing training programs for educators.

In light of this, Sok & Heng, (n.d.) acknowledge the risks associated with using ChatGPT, such as the potential for bias in the data used to train the model, the risk of perpetuating stereotypes and misinformation, and the potential for misuse of the technology. Considering this, Rudolph et at. (2023) argue that ChatGPT can address these limitations by providing a more objective and efficient assessment process. Hence, Atlas, (2023) believes that ChatGPT can revolutionize higher education and professional development by offering a personalized, scalable, and responsive learning experience that could revolutionize higher education and professional development. Thus, the author provides a practical guide as to how ChatGPT can be used in higher education and professional development, including customized learning, student support, and career guidance, among other applications. Nonetheless, the author also emphasizes that there must be a careful consideration of the ethical implications of using AI, and that it must be continuously evaluated for its effectiveness and undergone ongoing research.

Also, Baidoo-Anu & Ansah, (n.d.) argue that ChatGPT can be a useful tool in promoting teaching and learning, as it can provide personalized and adaptive learning experiences for students. ChatGPT can generate responses to students' questions and provide feedback on their work, which can help them understand complex concepts and improve their skills. Overall, they suggest that while there are potential benefits to using ChatGPT and other generative AI tools in education, it is important to approach their use with caution and to ensure that they are used

in a responsible and ethical manner.

1.2. RESEARCH QUESTIONS

The research question of the study aims to investigate how instructors conceptualize ChatGPT's impact on higher education in terms of course delivery, student assessment, and learning outcomes for the next three years. The rationale behind this inquiry lies in the varied viewpoints expressed in literature concerning ChatGPT's role in teaching and learning. Although some scholars like Baidoo-Anu & Ansah (n.d.) and Firaina & Sulisworo contend that it has enormous potential to enhance individualized academic experiences and facilitate educational tasks, others such as Willems, Shiri, Sok & Heng(n.d.) raise doubts about its ethical implications or limitations when applied to authentic settings. While there is a consensus among researchers about ChatGPT's ability to revolutionize instructional methods, improve evaluation measures, and promote knowledge acquisition outcomes if put into appropriate practice conditions; still cautionary remarks are made against possible biases installation or fact-checking errors alongside negative impacts on human communication dynamics resulting from overreliance upon these technological tools at present moment.

Educators are crucial stakeholders in the integration of ChatGPT into academic settings, providing valuable perspectives on practical, ethical and pedagogical considerations. Their insights can help assess advantages achievable through using this technology as well as identify challenges that may arise during its implementation for teaching purposes. Additionally, since AI could significantly impact educators' roles in the classroom according to literature studies, an understanding of their perceptions is paramount for devising effective adaptation strategies. Understanding these concerns by investigating a three-year horizon allows us to gain actionable insights aligned with ongoing technological advancements taking place within AI research and development environments at present times.

The research question presented in this study is essential to establish a connection between the potential benefits of ChatGPT and the apprehensions highlighted in previous literature. It aims to attain an extensive comprehension of the first-hand encounters and viewpoints of educators. This will help develop responsible and efficient approaches towards incorporating ChatGPT into higher education settings.

In order to fully understand ChatGPT's role in higher education, it is imperative to understand teachers' perspectives (Biesta, 2015). In implementing ChatGPT in the educational ecosystem, researchers and policymakers can benefit from teachers' opinions and insights. As artificial intelligence advances rapidly and has a growing impact on a wide range of industries, including education (Brynjolfsson & McAfee, 2014), it becomes increasingly important to examine ChatGPT's potential impacts on higher education in order to prepare institutions and educators for the future.

In addition, this study addresses three critical components of education by focusing on the delivery of courses, student assessment, and learning outcomes. It is important to examine ChatGPT's potential influence on these aspects as they have been extensively studied within the context of educational technology (Means et al., 2010). It is also important to explore how ChatGPT could revolutionize course delivery and student assessment, as it has demonstrated human-like language capability (Radford et al., 2021), possibly leading to more personalized, adaptive, and efficient learning experiences (Liu et al., 2020).

Furthermore, determining ChatGPT's impact on student learning outcomes is crucial, since ensuring students achieve desired educational outcomes is a key concern for higher education institutions (Kuh et al., 2006). By evaluating ChatGPT's potential influence on learning outcomes, we can determine how effective it is in improving educational outcomes.
Finally, by selecting this research question, the study will contribute to the growing body of

literature on artificial intelligence in education (Luckin et al., 2016) and provide valuable insights for stakeholders, such as educators, administrators, and policymakers, to make informed decisions about integrating ChatGPT into higher education.

1.3. METHODOLOGY

A mixed-methods approach is employed in this study, which incorporates qualitative data from interviews, media analysis, and a quantitative Z-number cognitive mapping technique to investigate ChatGPT's role in shaping higher education's future. Combining qualitative and quantitative methods ensures a comprehensive understanding of the topic.

1.3.1. INTERVIEWS

Twelve bachelor-level teachers across various disciplines were interviewed semi-structured. We carefully selected participants based on their experience, expertise, and familiarity with ChatGPT. Participants were interviewed to gain insights into how they perceived ChatGPT's potential impact on course delivery, student assessment, and learning outcomes.

From recordings of the interviews, verbatim transcriptions of the data were made. In the following steps, transcripts were analyzed using thematic analysis, as described by Braun and Clarke (2006). In order to answer the research question, patterns, themes, and subthemes were identified. Peer debriefing and member checking ensured the trustworthiness of the findings. For the thematic analysis, we followed these steps:

1. Read and reread interview transcripts to gain an understanding of how ChatGPT impacts course delivery, student assessment, and learning outcomes.
2. The initial codes will reflect teachers' insights and experiences regarding ChatGPT in higher education.
3. Codes can be grouped into themes that capture key patterns related to ChatGPT's impact on teaching and learning.
4. By examining both the coded data extracts and the entire dataset, we verified the coherence and consistency of the emerging themes, when needed we refined them.
5. We developed clear definitions and names that reflect teachers' perspectives on ChatGPT's role in higher education.
6. The report was written in a succinct manner, incorporating thematic narrative and data extracts to illustrate the potential impact of ChatGPT on higher education.

A 30-minute interview could last up to 1.5 hours, depending on the subject. As the interview was semi-structured, we focused on understanding the following three core questions:

- What impact do you think ChatGPT will have on how courses will be delivered, assessments will be conducted, and learning outcomes will be achieved in the next three years based on your experience as a bachelor-level educator?
- In what ways might ChatGPT benefit your teaching practices and what challenges might it present? Do these factors affect your students' and your own educational experiences?
- How do you think ChatGPT's adoption might transform traditional roles and responsibilities within higher education based on your understanding of its capabilities? In particular, how does this relate to teaching and learning at the bachelor's level?

1.3.2. MEDIA OUTLET ANALYSIS

A systematic review of articles, news reports, and opinion pieces from various media outlets was conducted. Our focus was on ChatGPT's potential impact on higher education. In order to ensure relevance to the current state of ChatGPT and its applications in education, only articles

published within the last three years were searched.

The purpose of this study was to identify recurring themes, trends, and perspectives about ChatGPT's potential impact on course delivery, student assessment, and learning outcomes in higher education by using a content analysis approach (Krippendorff, 2018). Through this analysis, we were able to contextualize the findings of the interviews and gain a broader understanding of the topic. Following are the steps we have taken to ensure the accuracy of the data:

1. Understanding how media outlets discuss ChatGPT's impact on course delivery, student assessment, and learning outcomes in higher education is one of the research objectives.
2. Analyze articles, news reports, and opinion pieces from various media sources published within the last three years, ensuring relevance to ChatGPT's current state.
3. Make a coding scheme to identify recurring themes, trends, and perspectives in the media materials, in accordance with our research goals.
4. Used qualitative data analysis software in order to assign codes to relevant segments of media content.
5. Determine trends and patterns in the media's portrayal of ChatGPT's potential impact on higher education by analyzing the frequency and distribution of codes. Analyzed these findings in light of the insights gained from interviews to gain a deeper understanding of the subject.

The article will benefit from a broader perspective on the discourse surrounding ChatGPT's role in higher education through the use of content analysis. In addition to the insights gained from teacher interviews, this will provide a valuable complement.

1.3.3. Z-NUMBER COGNITIVE MAPPING

The scientific method of Z-number cognitive mapping was initially proposed by Kosko in 1986 and subsequently enhanced by Zadeh in 2011. It is a highly advanced approach utilized for modeling intricate systems. When examining the probable consequences of ChatGPT on advanced education, applying Z-number cognitive mapping might prove to be an irreplaceable resource. Specifically, this procedure comprises numerical representation that encapsulates two components: the doubtfulness associated with the data and its dependability or trustworthiness level.

Overall, this conceptual framework focuses on navigating through incomplete knowledge scenarios while recognizing that information can have diverse degrees of reliability. Z-number cognitive maps play a vital role in facilitating structured representations of the potential interaction between ChatGPT and different aspects implicit to higher education. By adopting this technique, one can effectively model uncertainties pertaining to the scale of impact or reliability based on diverse studies and experiences related to student engagement. Such an approach enhances our ability to make informed predictions about ChatGPT's effect within the context of higher education while recognizing that educational systems are complex and dynamic with nuanced considerations. Overall, utilizing Z-number cognitive mapping offers a more flexible analysis compared to customary approaches for comprehending these intricate interactions in academic settings.

The construction of a Z-number cognitive map entails several steps. To begin with, the analyst should set out clear boundaries for their system or problem under examination and fully comprehend any constraints on the study's goals. Next, they must distinguish all elements or variables that are imperative to the system being studied such as factors, attributes or components. Thirdly, data sources like expert opinions, literature reviews and empirical data need to be collected in order to determine connections between these identified variables. Finally each piece of acquired information must receive an assignment of a corresponding z-

number which consists of two parts: The first element (A) represents vague aspects while its counterpart (B) indicates reliability levels typically ranging from 0 to 1; this integration guarantees maximum precision when designing accurate models using fuzzy theory techniques. A diagram representing the elements and variables, which are considered as nodes in this method, with arrows indicating their relationships should be created. Next, assigning Z-numbers to each connection reflecting both uncertainty and reliability is crucial for depicting how strong or weak these links truly are between them. Subsequently, using this cognitive map can help explore how changing one of these nodes might affect others while identifying key drivers within the system or explaining complex interdependencies among different factors that influence it. Moreover utilizing z-number arithmetic and aggregation techniques would enable deducing inference or prediction based on analysis done by referring back to drawn diagrams containing all related information about mapped components through its dependencies toward valid conclusions. Finally validating the accuracy of data implemented during model creation could occur via various methods such as expert opinions validation or other forms provided by relevant sources outside framework implementation itself ensuring similar outcomes via cross-validation methods may arise provable results with confidence level set appropriately depending on context applied towards ease interpretation alongside less ambiguity when presenting findings from originally assigned problems beforehand confronting difficulties arising thereof matching reality closely without influencing outcome negatively due conflicting propositions arising invalidating assumptions made initially regarding problem structure being tackled hence overfitting issue occurred before solving said problem After validating the Z-number assignments or cognitive map structure, make appropriate modifications to enhance their accuracy. Modifying relationships or adding/removing elements may be necessary. Utilize the information obtained from the Z-number cognitive map to develop detailed insights that can aid in making knowledgeable decisions about complex systems. Lastly, document all aspects of the Z-number cognitive mapping process including its discoveries, insights gained, and informed decision-making results for effective communication with relevant stakeholders involved in such complex systems analysis.

We constructed an initial cognitive map based on the findings of the interviews and the media outlet analysis. In an iterative process involving expert consultation, this was refined. To analyze ChatGPT's potential trajectory over the next three years, we ran simulations based on various scenarios.

To provide a comprehensive understanding of the potential impact of ChatGPT on higher education and inform future research, policy development, and practical applications, we triangulated the findings from interviews, media outlet analysis, and cognitive mapping based on Z-numbers. We followed these steps when mapping Z-numbers cognitively:

1. Our initial cognitive map represents relationships among factors related to ChatGPT's impact on higher education based on interviews and media outlet analysis.
2. In order to ensure accuracy in relationships, weights, and uncertainties, we consulted with experts.
3. The robustness of the model was improved by incorporating Z-numbers to account for uncertainty and reliability in the map.
4. A scenario was developed representing potential paths for ChatGPT's adoption and integration into higher education.
5. Analyzed potential trajectories of ChatGPT's impact over the next three years using the Z-number cognitive map and scenarios.
6. Provided a comprehensive understanding of ChatGPT's potential influence on higher education using simulations, interviews, and media outlet analysis.

In order to comprehend the impact of emerging technologies like ChatGPT on higher education, a Z-number cognitive mapping provides flexibility, visual clarity, the ability to

handle uncertainty, and the ability to handle reliability, which make it a valuable tool for understanding the impact of emerging technologies.

1.4. MAPPING

1.4.1. DOMAIN DEFINITION

This study is looking at the impact of ChatGPT, a new advanced AI language model, on the delivery and assessment of undergraduate courses, as well as learning outcomes in bachelor's degree programs over the next three years, focusing particularly on course delivery, student assessment, and learning outcomes. Using a mixed-methods approach, a model based on teacher interviews, media outlet analysis, and cognitive mapping of Z-numbers is used in order to predict possible future trajectories. This domain explores the perspectives of educators, broader discourses around artificial intelligence in education, and potential implications for higher education policy and practice based on the perspectives of educators.

1.4.2. CURRENT ANALYSIS OF THE DOMAIN AND ENVIRONMENTAL ANALYSIS

ChatGPT has gained considerable attention in higher education for its potential to transform teaching and learning. Educators can use the AI-driven language model for creating content, providing feedback on student work, and facilitating discussions. There are, however, ethical concerns about the use of AI in education, including privacy, fairness, and the possibility that AI-driven systems may replace teachers. Higher education can be influenced by several factors in the broader environment:

- Continual improvement of AI models such as ChatGPT can enhance their capabilities and effectiveness, making them more appealing for educational use. Since the introduction of the original Generative Pre-trained Transformer (GPT) in 2018, there have been several iterations, including GPT-2, GPT-3 and GPT-4. For example, GPT-2, with 1.5 billion parameters, was already capable of generating coherent and contextually relevant text. But GPT-3, with 175 billion parameters, significantly improved upon this.
- A balance must be struck between innovation and privacy concerns when developing policies and regulations to govern the ethical use of AI in education. The European Union's GDPR sets a prominent example of balancing AI innovation with data privacy in education. The controversy surrounding the Summit Learning Program in the U.S. highlighted the need for cautious adoption of AI, considering parental concerns over data collection. The use of AI proctoring systems during the COVID-19 pandemic sparked debate on the trade-off between maintaining academic integrity and respecting student privacy.
- A society's perception of AI technologies, including its acceptance or resistance to AI's role in education, has the potential to affect the extent to which ChatGPT is adopted by educators and institutions. A good example is in France where skepticism towards AI in classrooms led to limited adoption, as seen with the “AI for Humanity” initiative where the focus was on ethics and human control over AI. In contrast, Singapore embraced AI in education through its “Smart Nation” initiative, integrating AI tools in classrooms for personalized learning experiences. These examples demonstrate how societal perceptions of AI play a crucial role in determining the extent of ChatGPT and similar AI tools' adoption within educational settings.
- ChatGPT adoption in higher education can be affected by economic factors, such as educational budgets and cost-effectiveness. In the United States, community colleges, which often operate on tighter budgets, may find it challenging to adopt ChatGPT due

to the associated costs. On the other hand, prestigious institutions like MIT and Stanford, with more substantial financial resources, are more likely to integrate ChatGPT for research and teaching. This illustrates how economic factors, such as educational budgets and the cost-effectiveness of AI tools like ChatGPT, can significantly influence their adoption in higher education.

As AI technology advances, such as ChatGPT, educators can harness its potential to enhance teaching and learning. A conducive regulatory and policy environment can promote the ethical and responsible adoption of ChatGPT in higher education, promoting innovation in course delivery, assessment, and learning outcomes.

A wide adoption of ChatGPT, however, may be hindered by concerns about privacy, fairness, and the potential for AI-driven systems to replace human educators. Integration of AI technologies in higher education may be limited by resistance from educators or society, as well as budget constraints.

ChatGPT's future in higher education depends on the interplay of these various factors and the ongoing dialogue among stakeholders, including educators, policymakers, and technologists, in shaping the responsible and effective use of AI in education.

1.4.3. HORIZON SCANNING

The potential effects of ChatGPT on higher education in the upcoming three years are examined through an emphasis on areas such as curriculum execution, evaluation of pupils' performance, and educational achievements. Through a horizon scanning methodology that considers notable and emerging influencers beyond academic circles, including prevailing elements or forces, nascent indications as well as drivers affecting this realm's progress - we investigate how forthcoming trends may shape ChatGPT's involvement in it.

The integration of AI-powered tools in education is a noteworthy trend owing to technological progress. Teachers are incorporating these tools into their routines more frequently with the prominence of AI systems, aiming to improve individualization and automate tasks for efficiency. Given that online and blended learning have become popular, ChatGPT along with other AI-backed technologies appears particularly suitable for facilitating remote education and increasing student engagement in digital settings.

AI tools that can evaluate students' progress and performance may lighten the workload of educators by providing personalized feedback in a timely manner. This development indicates potential advancements in our article's scenario as educational institutions aim to enhance student engagement and assistance. Non-academic sources such as tech blogs, social media discussions, and industry reports reveal an initial utilization of AI chatbots like ChatGPT into Learning Management Systems.

The role of ChatGPT in higher education is influenced by various factors, including but not limited to technological advances, institutional support, and government policies. Besides the key determinants, other aspects like social attitudes toward AI, potential opposition from educators and students as well as macroeconomic circumstances could also affect its acceptance. ChatGPT's capacity for learning will keep upgrading over time which leads to increased chances of incorporation into academic settings. However, whether or not universities implement this technology on a large scale depends largely upon their financial commitment and efforts towards raising awareness about AI-based tools among staff/students alike. Furthermore, regulation around ethical usage of artificial intelligence systems within an educational context has a bearing on academics' inclination towards adopting these technologies more widely than otherwise anticipated. Further research may illuminate these issues surrounding the pervasive use of intelligent agents such as ChatGPT in our teaching process today.

The aim of this scholarly article is to present an analysis of the developing patterns and potential areas for research and policy development pertaining to ChatGPT's integration into higher education. To accomplish this, both academic and non-academic sources were examined in order to identify trends, weak signals, and drivers. Additionally, important factors that may impact its implementation - whether significant or minor - have been considered by collecting data from different channels with the intention of creating a complete overview of not only current circumstances but also future opportunities as well.

1.5. BASELINE FUTURE

1.5.1. BASELINE ANALYSIS

As far as course delivery is concerned, we find that ChatGPT is increasingly used by educators to create and curate course materials, provide personalized learning experiences, and facilitate online discussions. Although ChatGPT has been integrated into course delivery, its full potential has not yet been realized.

Students are now receiving feedback on their work through AI-driven tools such as ChatGPT and some tasks are being automated. Even though AI has the potential to revolutionize assessment, concerns remain regarding fairness, accuracy, and potential biases.

By enhancing student engagement and providing personalized learning experiences, ChatGPT can also contribute to improved learning outcomes. For a better understanding of ChatGPT's long-term impact on student performance and learning, more research is needed.

Despite its potential impact on higher education, ChatGPT faces challenges related to ethical concerns, integrating with pedagogical practices, and replacing human educators with AI-driven systems. Using Z-number cognitive mapping, we aim to provide a solid starting point for further research, policy development, and practical applications of ChatGPT in higher education.

1.5.2. COMBINED RESULTS

Interview Results

Several key themes emerged from our 12 interviews with bachelor-level educators regarding ChatGPT's potential impact on higher education. A list of the most commonly mentioned themes is presented in Table 1.

1. Table Key Themes from Interviews, Source: own creation

Theme	Count
Losing my job	11
Enhanced Personalization	10
Ethical Concerns	8
Increased Efficiency in Assessment	8
Improved Student Engagement	6
Pedagogical Integration Challenges	5

Media Outlet Analysis

There are both positive and negative perspectives that can be drawn from the adoption of ChatGPT in higher education, according to a media analysis. Table 2 provides a summary of advantages and concerns mentioned.

2. Table Advantages and Concerns from Media Outlet Analysis, Source: own creation

Advantages	Concerns
Greater Accessibility	Data Privacy and Security
Support for Diverse Learning Needs	Potential for AI Bias
Reduced Educator Workload	Over Reliance on AI in Education

Z-number Cognitive Mapping Results

A Z-number cognitive mapping technique was used in order to simulate the potential impact of ChatGPT over the next three years on higher education. As a result of the findings from the interviews and the analyses of media outlets, an initial cognitive map was constructed, which was refined through expert consultations, based on the findings from the interviews. As shown in Table 3, the cognitive map is presented along with the key nodes that make up the map.

3. Table Key Nodes and Weights in the Z-number Cognitive Map, Source: own creation

Node	Weight
Personalized Learning	0.75
Student Engagement	0.70
AI-driven Assessment	0.65
Affecting Jobs	0.30
Pedagogical Integration Challenges	-0.55
Ethical Implications	-0.60

The Z-number cognitive mapping technique has yielded informative findings on the foreseeable effects of ChatGPT in the realm of higher education. Utilizing data obtained from interviews and media outlet analyses, a refined cognitive map was developed with input from specialists. Six main nodes were identified and assigned weights ranging between -1 to 1 (inclusive), underlining their respective degrees of favorable or unfavorable impact towards higher education.

- *Personalized Learning (Weight: 0.75):* The positive impact of ChatGPT on personalized learning is expected to be significant, as indicated by the node with the highest weight. The integration of ChatGPT has the potential to facilitate customized educational experiences for students, enabling them to learn at their own pace and in accordance with their individual preferences.
- *Student Engagement (Weight: 0.70):* According to the positive weight attributed to student engagement in personalized learning, the utilization of ChatGPT has the potential to enhance such engagement levels. Its capacity for supplying instantaneous feedback and facilitating interactive learning environments could be contributing factors towards this outcome.
- *AI-driven Assessment (Weight: 0.65):* The positive implication is that ChatGPT has the potential to streamline student assessment by leveraging AI technology. This can benefit both educators and students, as it allows for more efficient grading and feedback provision. By automating some aspects of evaluation, instructors may free up time for other teaching-related tasks. Meanwhile, learners could benefit from prompt and personalized feedback on their performance, which may support their academic progress in a timely manner.
- *Affecting Jobs (Weight: 0.30):* This node suggests that ChatGPT may have an impact on the job market, albeit with moderate positivity. This influence could potentially take different forms such as introducing new positions dedicated to managing and incorporating AI in education or even decreasing demand for specific administrative roles.
- *Pedagogical Integration Challenges (Weight: -0.55):* The negative weight of this node implies that incorporating ChatGPT into current educational practices could present difficulties. Educators and academic institutions may encounter obstacles in ensuring the compatibility between ChatGPT's features and their teaching strategies, necessitating modification and education.
- *Ethical Implications (Weight: -0.60):* The highest degree of disfavor is assigned to ethical implications that pertains to the assimilation of ChatGPT. These may comprise

anxieties concerning safeguarding data confidentiality, partiality in AI algorithms, and moral considerations during student evaluations and engagements, among others.

In brief, the potential educational benefits of ChatGPT appear promising; however, it is important to consider the difficulties associated with integrating this natural language processing technology into pedagogy as well as its ethical ramifications. Achieving equilibrium between these considerations will be key in responsibly and effectively implementing ChatGPT within higher education contexts. Notably, Zhai's study underscores that while AI holds significant promise for enhancing teaching and learning practices, careful attention must be paid to ensure that utilization does not compromise scholarly standards or reasoning processes. As such, responsible implementation frameworks are essential for reaping optimal rewards from technological innovations like ChatGPT without sacrificing quality control mechanisms critical to academic rigor.

1.5.3. DELPHI SURVEY

We conducted a Delphi survey to gather expert insights on ChatGPT's potential impact on higher education, focusing on course delivery, student assessment, and learning outcomes in bachelor-level programs over the next three years. Participating experts, including 6 educators from university, 1 AI researcher from university, and 2 higher education administrators again from university, completed three rounds of the Delphi survey.

Our first round consisted of open-ended questions derived from our baseline analysis, media outlet findings, and interviews with bachelor-level educators. There were several questions addressed regarding the potential benefits and challenges of integrating ChatGPT in higher education, as well as the ethical implications. During the next round, experts shared their opinions and predictions.

On the basis of the first round responses, we distilled common themes, potential opportunities, and concerns related to ChatGPT's impact on course delivery, student assessment, and learning outcomes in the second round. Experts rated the likelihood and significance of each identified theme or issue based on the unique context of our article.

To allow the experts to review their initial judgments in light of the collective opinions, the aggregated ratings from the second round were shared with them for the final round. During this round, experts were able to adjust their ratings and share final thoughts on the potential impact of ChatGPT on higher education given the unique focus of our article on bachelor's degree programs.

The Delphi survey results were analyzed to identify areas of consensus and divergence among the experts. By combining these findings with media outlet analysis, interviews with bachelor's level educators, and Z-number cognitive mapping, we were able to gain a comprehensive understanding of ChatGPT's potential impact on higher education over the next three years, tailored specifically to our article's unique context.

1.6. ALTERNATIVE FUTURES

1.6.1. SCENARIO ANALYSIS

According to the United Nations Environment Programme (UNEP) Global Environment Outlook 3 (GEO-3) Outlook Section, scenario analysis can be communicated through various means. The predominant methods used in scenario analysis include descriptive, written narratives, which are referred to as qualitative scenarios, and tables and figures that incorporate numerical data. These numerical data are often produced through the use of advanced computer models, and are classified as quantitative scenarios.

After understanding the base image of the present state including all the variables

(Godet, 1993), principal determinants should be identified with their parameters. This is where structural analysis is a helpful tool, where a key element in conducting an analysis of a given system involves scrutinizing the present state of affairs and isolating the mechanisms, as well as the principal actors, who have previously exerted control or influenced the system by means of the variables at play.

To conduct a scenario analysis of the potential impact of ChatGPT on BBS bachelor programs' course delivery, student assessment, and learning outcomes, we will consider two key uncertainties:

1. The extent to which ChatGPT is adopted by bachelor programs - internal factor
2. The response of top-ranked universities to the adoption of ChatGPT - external factor

Based on these uncertainties, we will develop four scenarios, each of which represents a plausible future outcome:

Scenario 1: "ChatGPT Dominance"

ChatGPT's technological advancements include highly advanced language processing capabilities, emotional intelligence features, and specialized variants for different disciplines. As the primary mode of course delivery deeply integrated into Learning Management Systems, it now curates personalized content that adapts to students' learning styles and paces. This has led educators to evolve into supervisory roles while ChatGPT handles granular aspects of teaching. ChatGPT has revolutionized student assessments through its advanced anti-cheating algorithms, providing instant feedback and personalized learning experiences. It's a valuable tool for academic research as it efficiently processes large data sets producing insights leading to groundbreaking discoveries. ChatGPT’s scalability has democratized education especially for people living in remote or underprivileged areas with access to world-class education via ChatGPT-powered platforms at lower costs than traditional methods. Educational institutions have benefitted from financial restructuring due to reduced need of physical spaces and administrative staff thanks to ChatGPT’s reliability. The resultant growing market is now heavily reliant on human educators serving as mentors and guides alongside the technology-driven approach

Scenario 2: "Mixed Impact"

In this scenario, ChatGPT is adopted by some bachelor programs but not others. The impact of ChatGPT on the delivery of courses, student assessment, and learning outcomes of bachelor programs is mixed, with some programs benefiting significantly, while others see little to no improvement. Top-ranked universities respond by adopting similar technologies, leading to increased competition and innovation.

Scenario 3: "No Impact"

In this scenario, ChatGPT is not widely adopted by bachelor programs, either due to lack of interest or inability to integrate the technology into existing systems. In this scenario, there is no significant impact on the delivery of courses, student assessment, and learning outcomes of bachelor programs among top-ranked universities.

Scenario 4: "Negative Impact"

In this scenario, ChatGPT is widely adopted by bachelor programs, but the quality of education and research output does not improve as expected. This results in a decline in the reputation of

delivery of courses, student assessment, and learning outcomes of bachelor programs that adopt ChatGPT, as top-ranked universities are perceived to offer superior education and research opportunities.

Factors, such as cost, ChatGPT's implementation's feasibility, the education's quality, students' and stakeholders' perception should be evaluated by their potential impact.

Ultimately, the impact of ChatGPT on bachelor programs' course delivery, student assessment, and learning outcomes will depend on a complex interplay of these factors, as well as external factors such as government policies and global economic conditions. By conducting scenario analysis, we can better understand the potential risks and opportunities associated with the adoption of ChatGPT by bachelor programs, and develop strategies to respond to changing circumstances.

Furthermore, identifying the principal determinants and their parameters is necessary. Here, determinants are the factors that are likely to produce a significant impact on the future, while parameters are the specific variables that will affect each determinant.

One determinant can be AI's technological advancements. Its parameters could include the pace of technological development, the level of investment in R&D, and the level of collaboration and knowledge transfer among stakeholders.

Another determinant is changes in the preferences and expectations of students and employers. Its parameters could include factors like the desire of students for more personalized learning experiences, the importance of practical skills and real-world experience in the changing workplace environment, and the increasing importance of interdisciplinary and cross-cultural competencies.

A third determinant is the emergence of new competitors in the education space. The parameters of this determinant could include the level of investment and innovation by these new competitors, the quality and reputation of their offerings, and their ability to attract top faculty and students.

By identifying and analyzing these determinants and their parameters, it is possible to construct multiple plausible scenarios of the future of ChatGPT and bachelor programs' delivery of courses, student assessment, and learning outcomes. These scenarios can then be used to develop appropriate strategies to address potential threats and opportunities.

It is important to understand the present state of affairs and separate the mechanisms and principal actors who have previously influenced the system.

One mechanism that has influenced the higher education system is the increasing demand for personalized and technology-enabled learning experiences. The drive of this trend is by digital tools and platforms. Specifically, the increasing availability and affordability that enable students to access information in new ways, which arguably reshapes learning and interactions.

Another mechanism with great influence is the growing importance of interdisciplinary and cross-cultural competencies. A response that can be seen is how universities are creating new programs that integrate multiple disciplines in various education platforms. This results in new opportunities where students can acquire knowledge and experience through virtual collaborations for instance.

Principal actors who have influenced the higher education system in the past include universities, governments, employers, and students. Universities have traditionally been the primary source of higher education, but they face increasing competition not only from new entrants in the education space, but also alternative learning methods and employers decreasing demand for official qualifications and rather real experience. Here, the most important aspect is the skillset to get a certain task done. Employers also influence the system by shaping the demand for specific skills and competencies, and by offering internships and other experiential learning opportunities to students. Finally, students have the center role, since ultimately they decide upon their choices and preferences.

Lastly, a Trend Impact Analysis (TIA) is a useful technique for projecting the key measures of the researched theme. Starting with trends and impacts, one relevant trend that has emerged in recent years is the increasing use of artificial intelligence (AI) and machine learning (ML) technologies in many industries, including the education sector. Another trend is the growing demand for online education and distance learning, which has been accelerated by the COVID-19 pandemic. The use of ChatGPT in bachelor programs could potentially have several impacts on the delivery of courses, student assessment, and learning outcomes of these programs in comparison to top-ranked universities. On the one hand, the use of these technologies most likely will lead to more personalized and adaptive learning experiences, which will result in the improvement of student engagement. This could potentially make bachelor programs more competitive in the market.

On the other hand, the use of ChatGPT in education could also have some negative impacts on the course delivery, student assessment, and learning outcomes of bachelor programs. For example, it could lead to a lower and more vertically skilled faculty, since the technology is able to automate certain aspects of teaching and learning. This could potentially reduce the perceived value of bachelor programs and undermine their delivery of courses, student assessment, and learning outcomes.

Additionally, the growing demand for online education and distance learning could also impact the delivery of courses, student assessment, and learning outcomes of bachelor programs. With the emergence of the AI tools and online learning resources that are based on them, students have more options than ever before to pursue education outside of the traditional route of university education. This could potentially reduce the perceived value of bachelor programs and undermine their delivery of courses, student assessment, and learning outcomes.

To address the potential impacts of ChatGPT and other emerging trends, bachelor programs could consider several strategies. One strategy could be to invest in the development and integration of AI and ML technologies within their programs, while also ensuring that teaching staff have the necessary skills to use these technologies effectively. This could potentially enhance the perceived value of bachelor programs and improve their delivery of courses, student assessment, and learning outcomes in the market.

Another strategy could be to focus on developing more personalized and engaging learning experiences that leverage technology and other resources. This could help to differentiate bachelor programs from online learning platforms and position them as more valuable and attractive options for students.

Finally, bachelor programs could also consider investing in marketing and branding efforts to promote the unique value proposition of their programs. By emphasizing the benefits of a traditional university education, such as the development of critical thinking and social skills, bachelor programs could position themselves as more competitive options in the market.

In conclusion, the potential impact of ChatGPT and other emerging trends on the delivery of courses, student assessment, and learning outcomes of bachelor programs is complex and multifaceted. By conducting scenario analysis and developing proactive strategies, bachelor programs can position themselves to adapt and thrive in an increasingly competitive and dynamic educational landscape.

1.6.2. FUTURES WHEEL

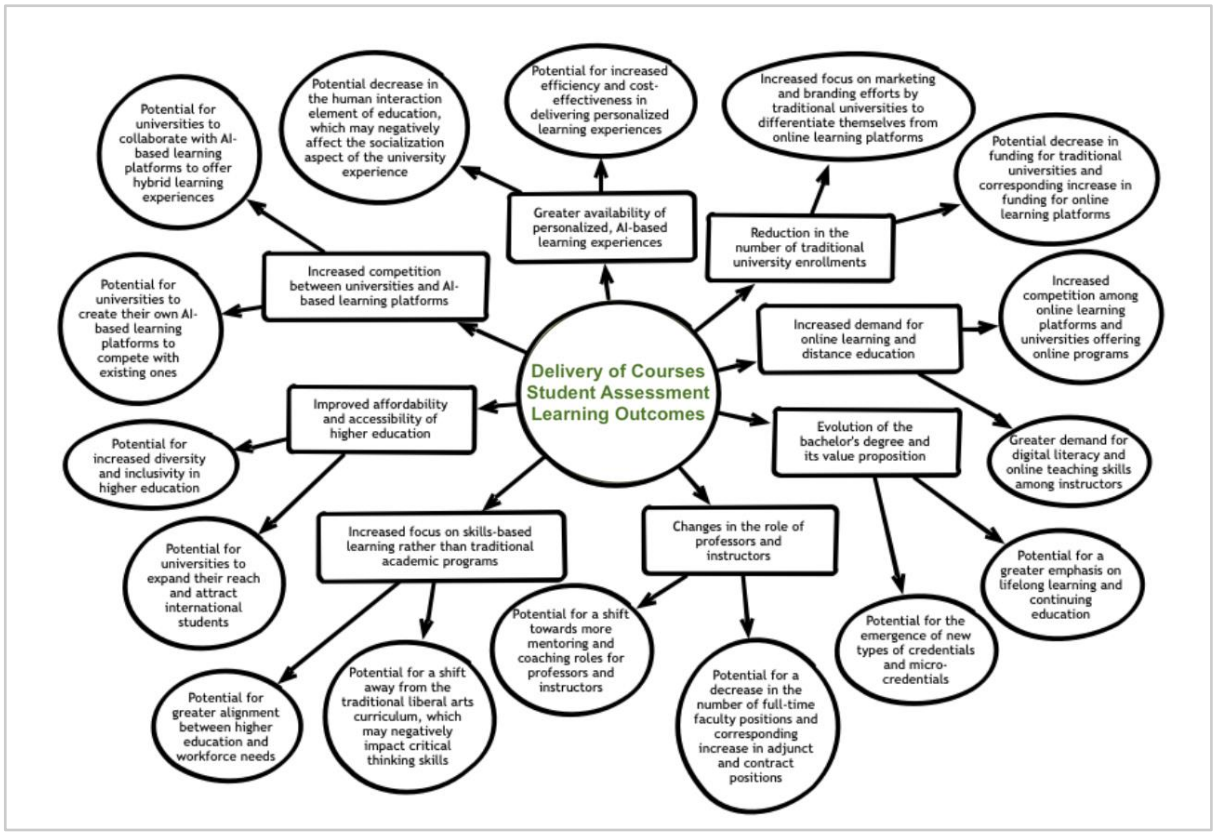
The subsequent section of this article will explore the application of the 'Futures Wheel' analysis, a potent analytical technique employed for comprehending and envisioning ChatGPT's potential impacts and evolution in higher education. The main objective of utilizing Futures Wheel in our research is to systematically recognize and scrutinize future consequences and interdependencies associated with emerging trends linked to ChatGPT.

The crux of Futures Wheel analysis centers on analyzing possible ramifications that may arise from various scenarios where ChatGPT operates, including present circumstances, hypothetical situations, as well as baseline prospects. This examination plays an essential role in unveiling how socio-technical changes within higher education could shape or be influenced by the emergence of ChatGPT technology.

One of the distinctive features that sets apart Futures Wheel from other analytical tools is its ability to provide a clear and vivid picture of the intricate potential impacts. Our examination adopts several graphical elements, such as colors, arrows with different widths and directions to convey diverse aspects. To illustrate, we use arrow width to represent a specific influence's strength or significance. By utilizing this visualization tool, we can demonstrate how different factors interconnect with one another while also pinpointing similar and opposing outcomes.

Moreover, it will allow us to group common outcomes into distinct domains including economic facets, social areas, technical factors among others seamlessly. This categorization plays an essential role in comprehending multi-faceted impacts more effectively as well as charting out better-informed strategies for integrating ChatGPT technology within higher education institutions.

1. Figure Key Nodes and Weights in the Z-number Cognitive Map, Source: own creation



One potential impact of ChatGPT on bachelor's program delivery of courses, student assessment, and learning outcomes is an increase in the demand for online learning and distance education. As more students seek convenience and flexibility in online learning, traditional universities may face a decline in enrolment (second impact). This could lead to a reduction in

funding and resources for universities that do not follow the trends. On the contrary, there will be an increase in funding and resources for advanced online learning platforms. (Futures Wheel spoke, 2). Additionally, instructors at traditional universities may need to develop digital literacy and online teaching skills to meet the demands of this new environment (Futures Wheel spoke 1, Second impact).

Recent studies have suggested that online learning has become increasingly popular in recent years, particularly because of the COVID-19 pandemic, which has resulted in campus closures and social distancing measures (Li & Lalani, 2021; Almahasees et al., 2021). Consequently, the demand for online learning will most likely continue to increase in the foreseeable future. However, some researchers have also noted potential drawbacks of online learning, such as lower levels of engagement and satisfaction compared to traditional in-person instruction (Freeman et al., 2014; Alqahtani et al., 2022). Therefore, it is important for universities and online learning platforms to consider the potential benefits and drawbacks of online learning and develop strategies to optimize students' learning experiences.

The second impact of a potential decline in traditional university enrollment could also have broader implications for the higher education landscape. For example, some experts have suggested that traditional universities may need to focus more on marketing and branding efforts to differentiate themselves from online learning platforms (Futures Wheel spoke 2, Second impact) (Munck, 2021).

In addition, universities may not only need to re-evaluate their value propositions, but also consider ways to increase the affordability and accessibility of higher education. (Futures Wheel spoke, 5). Furthermore, as traditional universities face increasing competition from online learning platforms, they may need to consider new ways to collaborate with these platforms to offer hybrid learning experiences (Futures Wheel spoke 4, Second impact) (Munck, 2021).

In conclusion, the first and second impacts of ChatGPT on bachelor's program delivery of courses, student assessment, and learning outcomes are interdependent and have far-reaching implications for the higher education landscape. It is clear that Universities and their online learning platforms will need to adapt to this changing environment. To do so, developing strategies that optimize the students' learning experience will be crucial in order to remain attuned to these developments. As with any other trends in history, continuous innovation will be the key to remain competitive in the future.

1.7. DISCUSSION

This discussion section examines the findings of our interviews, media outlet analysis, and Z-number cognitive mapping to understand how ChatGPT may impact higher education in the next three years, with an emphasis on course delivery, student assessment, and learning outcomes in bachelors-level programs. According to our interviews with bachelor-level educators, ChatGPT can improve student engagement and enhance personalization. Technology could be used to support diverse learning needs by providing customized learning experiences based on the strengths and weaknesses of each student. Some educators have expressed concerns about pedagogical integration challenges, emphasizing the importance of balancing human-led instruction with tools such as ChatGPT. Media outlets found ChatGPT's ability to provide instant feedback and support to facilitate advantages such as greater accessibility and reduced educator workload. When implementing ChatGPT in higher education, ethical implications, security, and potential AI bias must be carefully considered, as well as appropriate safeguards. Based on the interviews and media outlet analysis, the Z-number cognitive mapping results align with the insights from the interviews. ChatGPT may positively influence personalized learning, student engagement, and AI-driven assessment, but it also

raises ethical concerns and challenges in pedagogical integration.

According to all three sources, ChatGPT has the potential to significantly impact higher education in the next three years, offering both opportunities and challenges. By enhancing personalization, improving engagement, and increasing efficiency, the technology could revolutionize course delivery, student assessment, and learning outcomes. It is important to weigh these benefits against potential drawbacks, such as ethical concerns and pedagogical challenges associated with the integration of AI in the classroom. Educators, AI researchers, and policymakers will need to collaborate closely in order to successfully integrate ChatGPT in higher education. It is possible to leverage ChatGPT's potential benefits and address these concerns in order to contribute to the evolution of higher education, particularly in bachelor's programs, thus enhancing the learning experiences and outcomes of students.

The baseline synthesis centers on the present condition of ChatGPT's incorporation into advanced education. At present, ChatGPT serves mostly as an ancillary instrument to aid learning, furnish immediate feedback and sometimes support student evaluations. The artificial intelligence functionality of ChatGPT endorses individualized and adaptable learning opportunities that are priceless in academic contexts. Nonetheless, apprehensions exist regarding data confidentiality protection, ethical practice adoption, and inadequate empathic acumen found within ChatGPT's responses.

The future wheel of ChatGPT within the realm of higher education involves a multitude of pivotal progressions. Anticipated technological advancements hold promise for augmenting ChatGPT's sophistication, possibly incorporating attributes pertaining to emotional intelligence. The prospect of more comprehensive assimilation into Learning Management Systems harbors potential to revolutionize both instructional delivery and evaluative procedures. Given AI ethics requirements as well as concerns regarding privacy and data security in educational circles, developing policies must factor in responsible implementation initiatives accordingly. Lastly, welcoming ChatGPT integrations might substantively shift educator roles toward greater emphasis on facilitation and mentorship capacities.

To sum up, the discourse underscores that ChatGPT's incorporation into higher education is multifaceted. The primary synthesis elucidates the present applications of ChatGPT and their attendant apprehensions. On the other hand, the future outlook depicts how this technology could evolve potentially. While it is clear that ChatGPT has significant potential to revolutionize education, exercising caution during its transformation is crucial. To ensure ethical considerations and accessibility are preserved alongside technological advancements, stakeholders like educators, policymakers and technology developers should work collaboratively. Ultimately ,it should be aimed to harness ChatGPT's capabilities in a way that enriches educational experiences,reinforces educators,and equips students for contemporary world requirements.

CONCLUSION

Using ChatGPT, a large language model trained by OpenAI, in education has both advantages and disadvantages. Using ChatGPT, students can ask questions, get feedback on their work, and personalize their learning. There are challenges, including ensuring ethical and responsible use of AI, addressing possible bias in training data, and concerns about replacing human interaction with technology. While ChatGPT could detect plagiarism, accuracy and fairness need to be guaranteed. The use of ChatGPT has increased productivity and satisfaction with writing assignments and research purposes. While strengths include the ability to process large amounts of data and personalize learning experiences, weaknesses include the risk of perpetuating bias. By developing AI competency frameworks and providing training, educators could prepare for the use of LLMs in education. It must be continuously evaluated for efficacy and ethical

considerations when using ChatGPT, such as the potential for perpetuating stereotypes and misinformation. It is important to ensure that ChatGPT and other generative AI tools are used in a responsible and ethical manner while there are potential benefits to using them in education.

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Reconsideration of sustainable mobility in Budapest - A students' perspective

Anh Tuan Tran[22], Mbali Ayanda Sithole[23], Ebenezer Rexford Amankwah[24]

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Abstract

The world today is in the industrial 4.0 with the fast pace of technology development. This urbanization and the high density of the population are paralleled by environmental issues such as high levels of CO2 emissions, plastic waste, or climate change from urban areas. Transport is a crucial actor as a means of advancing socioeconomic development. Moreover, it contributes to the overall sustainability strategy by encouraging public transportation as part of sustainable mobility. Subways, buses, and trains have all been improved to make them more efficient and accessible as part of the city's numerous initiatives to promote the use of public transportation. Hungary's capital, Budapest, is undergoing rapid urbanization while playing a significant geopolitical role in fostering convenient transit for locals and tourists. Budapest is located in central Europe and acts as a bridge linking Western and Eastern Europe. Hence, Budapest attracts a high concentration of mobility. Budapest's municipal and local bodies outlined their plan for sustainable urban mobility in 2016 with the vision of 2030. This plan focuses on people residing or visiting the city and increasing public transport usage. It is expected that by lowering pollutants and greenhouse gas emissions, reducing congestion, and enhancing transit options, these efforts will enhance the quality of life for locals. Furthermore, Budapest's dedication to efficient transportation serves as a strong global example of how cities can improve public transportation while minimizing negative environmental effects. This study collected data through focus groups interview method, the selected students discussed the different drivers that affect their mobility. This study sheds light on the city's sustainable mobility and some of the factors that persuade and discourage students from using public transport. Based on the perspective of students residing in Budapest, this study identified some of the factors that may accelerate the city's sustainable mobility. Through analysing the drivers affecting urban mobility, a wider picture of Budapest's sustainable mobility was concluded.

Keywords: Urban Mobility, Budapest, Public Transport, Sustainability, Drivers

JEL codes**:** R11, F21, F64, O44, Q56

[22] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, Tran.Anh.Tuan.19@unibge.hu

[23] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School, Sithole.Mbali.Ayanda.46@unibge.hu

[24] PhD student, Doctoral School of Entrepreneurship and Business, Budapest Business School Amankwah.Ebenezer.Rexford.13@unibge.hu

INTRODUCTION

In recent years, Budapest has made tremendous progress toward sustainable transportation, implementing a number of programs to lower carbon emissions, enhance air quality, and encourage more sustainable forms of transportation like cycling and public transportation. Sustainable mobility is recently capturing the attention of many countries and society as it emphasizes on the sustainability of mobility. It is regarded as a strategic plan as it combines transportation for economic development while considering sustainable factors. Transport fosters economic growth is efficient, and coordinated, and helps to reduce obstacles to access to goods and services (World Bank, 2023). Budapest is not an exception to this trend; the complex nature of urban mobility is a pressing concern for major cities around the world. Budapest, where about 18% of the population resides, is the country's political, economic, logistical, and cultural hub (Hivatal 2018). Pest County has a population of 1,247,372 and Buda had a population of 1,749734 in 2017. According to the Hungarian Central Statistical Office (HCSO), 837,532 people resided in the Budapest metropolitan area (Hivatal 2018).

Budapest draws a workforce from a sizable area because of its strategic location. The transportation system is an important economic sector, therefore society anticipates a number of good consequences, even though the operation has a number of drawbacks such as the high emission of greenhouse gases, which are detrimental to the city and the EU sustainability goals (European Parliament,2021).

Budapest is currently dealing with a distinct set of urban transportation issues that need careful thought and creative solutions. Yet, it must actively support environmental sustainability while ensuring efficient integration and land usage (IRJ, 2014). For instance, reducing the EU transport emission has been a target for the region, this has led to the development of policies such as the 2016 strategy for low-emission mobility, the European Green Deal which was introduced in 2019, and the Sustainable and smart mobility strategy(European Parliament, 2021).

Urban areas account for 64% of all travel kilometers now; by 2050, this percentage is predicted to quadruple (Lerner, 2012). These issues are obstacles for the near future as well, therefore specialists must start thinking about solutions now. They are in fact, recently formed bottlenecks, but as time goes on, they will increasingly define the degree of standard.

In recent years, quality and cost have been the most significant factors for passengers (Tica et al., 2011), with performance and technology also playing a significant role (Dell'Olio et al., 2012). Yet, these regions have the most spatial issues; as a result, sustainability has lately been essential for building a successful public transportation system (Cerny et al., 2014).

1.1. LITERATURE REVIEW

Our lives and livelihoods depend on mobility. The contribution of transportation to economic development and human capital is crucial. Transportation shapes the people’s lifestyles and influences everything that they do including the way that they travel to work or leisure, and the way they do their businesses such as shipment of the products to distribution centers.

The global mobility system clearly is dominantly unsustainable. Mobility is associated with intensive fossil-fuel use, high levels of greenhouse gas emissions, air and noise pollution, environmental damage, and the exclusion of rural communities and poor urban dwellers from economic opportunities. In a world increasingly rich and aspiring to more mobility, getting the mobility system to be sustainable has become a defining factor of society’s future.

Banister (2008) argued that creating an alternate paradigm for investigating urban complexity and strengthening the connections between space usage as well as transportation is

the ultimate objective of building sustainable mobility. Moreover, the most sustainable urban form would be applied to the city which is home to the majority of the world's population (70–80%) (Banister, 2008).

Sustainable mobility refers to the provision of infrastructure, services, technologies, and information to enable access to goods and services, and participation in activities in a manner that, like all other forms of sustainability, allows for the continuation of such access and participation across future generations (Budnitz, 2019). The World Bank defines sustainable mobility with four main focuses as follows:

- Universal Access: Connect all people, including women and communities to economic and social opportunities.
- Efficiency: Optimize the predictability, reliability, and cost-effectiveness of mobility.
- Safety: Drastically reduce fatalities, injuries, and crashes.
- Green: Minimize the environmental footprint of mobility (GHG emissions, noise, and air pollution).

In addition to the four above pillars, Gallo and Marinelli (2020) identified the factors associated with sustainable mobility which were "Environmental Socio-Economic Technological". Moreover, the European Council (2006) defined "sustainable transport" as, to guarantee the transportation systems meeting society's economic, societal and environmental demands while minimizing any negative effects on those factors. Hence sustainability in mobility is in need, however, it should link with society's demands.

The change in model of urban transportation is becoming more and more widely recognized worldwide. It aims to decouple transportation from fuel supplies and pave the way for future cities in a cleaner, more prosperous and social sense (Mozos-Blanco et al., 2018). The EU (2019) defined the Sustainable Urban Mobility Plan (SUMP) as a strategic plan designed to satisfy the mobility needs of people and businesses in cities and their surroundings for a better quality of life. It builds on existing planning practices and takes due consideration of integration, participation, and evaluation principles. Hence, future sustainable mobility is a hope for reducing pollution and congestion.

Melkonyan et al. (2022) stated that Sustainable Urban Mobility (SUM) was a part of sustainable urban systems, organized into collective, individual, and freight transportation. It is defined as a system that provides efficient access to goods and services, job markets, and social connections while limiting short- and long-term adverse consequences for environmental, social, and economic services. Melkonyan stated in his research that there are 3 drivers for SUM.

- Climate Change—rising transport-related carbon emissions, driven by oil dependence, and climate change impacts.
- Environment and Health—resulting in poorer air quality, congestion, and health effects.
- Economic—rising fuel and congestion costs, wasted time, and resources.

Hence, transport can be regarded as a dominant factor leading to sustainable mobility. The European Commission has put intensive pressure on the EU member states, including Hungary, by validating a White Paper on the Roadmap to a Single European Transport Area. This White Paper recognizes the pillars as guidelines for EU member states such as the optimization of transport systems, alternative energy sources, alternative vehicles with zero-emission and the promotion of high-efficiency and low-emission transportation (The European Commison, 2011).

The Balázs Mór Plan – Budapest Mobility Plan – was ratified by the Budapest General Assembly in 2013 which indicated a sustainable vision for a sustainable mobility plan for Budapest. The policymakers have set very ambitious goals for Budapest regarding public transportation participants.

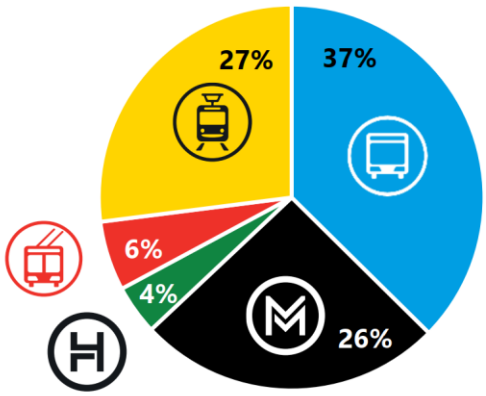
1. Table Estimated values of transportation in Budapest

	Public transport	Individual car	Walking	Cycling
2014	45%	35%	18%	2%
2030	50%	20%	20%	10%

Source: A Sustainable Urban Mobility Plan (2016)

According to BKK (2021), the most used public transports was divided respectively into bus, tram, metro, trolley and HEV (suburban railway).

1. Figure Usage of public transport in 2021



Source: BKK (2021)

1.2. RESEARCH QUESTIONS

1. What are the driving forces which influence the sustainable transport mobility in Budapest?
2. How do the driving forces influence the behavior of the city's public transport users?
3. How are the driving forces grouped?
4. What is baseline (most probable future) future or trend that we can detect from analysis?

1.3. DOMAIN DEFINITION

This study is designed to look into the most probable future for sustainable mobility. Linking mobility to sustainability will need to deeply involve the use and development of public transportation.

Sustainable mobility refers to the creation of facilities, amenities, technologies, and information which can enable the resilient continuation of access to goods, services and other economic activities in the most sustainable way. In this study, the most important factor is transportation as this is the key to the sustainability of mobility, according to scholars and supranational institutions like the EU (Mozos-Blanco et al., 2018; the EU, 2019, Melkonyan et al., 2022). In order to utilize the term "sustainable," factors should be taken into consideration in relation to environmental, economic and societal issues. In addition, technologies and political practices are also crucial additional factors contributing to the advancement of sustainability within mobility. The research will regard the perspective of students in Budapest as objective by investigating how they shape their viewpoint about transportation in general and public transportation in particular.

1.4. CURRENT ASSESSMENT

It is indispensable to say that the key stakeholders of this study are the students living in the city. This is due to the intensive exploitation of public transportation by students. The number of students employing public transportation keeps increasing because of the vast variations of scholarships and attractive program offers. Other stakeholders are the policymakers who are capable of influencing behavior and the effective usage of public transportation. The tools utilized by these stakeholders are policies and actions such as purchasing more low-to-zero emission vehicles or increasing the availability of public transportation, etc. These policies will be discuss as driving forces that drive the behavior of students. Regarding the mode of public transportation, BKK, which is the organization responsible for providing these modes of transport to the public, supplies many means of transportation. In this sense, this study will only opt for those forms of transportation employed by students, including buses, trolley buses, metro lines, tramways and HEV (suburban trains). Other services that could give more insight are cycling, shared car services like MOL, Bobi (public bicycle system) or Green Go and Share-now car sharing services. In 2017, Budapest 2024 (2017) is the non-profit organization sponsored by the Municipality of Budapest to envision Budapest as a smart city in 2030 with the extension of public transportation using sustainable mobility. In order to achieve this plan, the government decided to purchase more environmental-friendly buses in 2020 (About Hungary,2020), and they are being tested in the suburbs of Budapest (Hungary Today,2023).

1.5. METHODOLOGY

The researchers used several instruments to help them forecast the most plausible futures. These instruments where used to map change and illustrate the elements which may influence the future (Hines, 2017). This study's research methodology used the following steps for data collection:

1. A literature review was conducted and subsequently,
2. A PESTLE analysis was conducted and,
3. A focus group consisting of students was created.

To analyze the data the following steps were subsequently taken:

4. An importance and certainty graph was created and,
5. A SWOT analysis / futures wheel was conducted.

1.5.1. PESTLE ANALYSIS

The researchers used PESTLE analysis to conduct an external environmental analysis. According to Albalik and Citilai (2019) PESTLE analysis is a pivotal component of scanning the external business environment. These researchers further explain that the PESTLE analysis tends to focus on political, economic, social, technological, legal, and environmental factors. As part of this analysis, we investigated which factors (political, economic, social, and technological) may affect Budapest's urban mobility. The data was collected from existing literature and internet sources such as EU mobility strategy, Sustainable Urban Mobility Plan (2016); BKK (2021). Table 2 illustrates the various factors that were identified by the researchers.

2. Table PEST Analysis

Political	Economic	Social	Technology
The goal of Budapest municipal is to make the city become a compact city based on "short distances, walking and public transport"	Having more benefits such as tax haven to attract a higher number corporations	Number of people moving to Budapest is increasing significantly	Renovating roads To increase the railway Network
Attracting a higher number foreigners to Budapest because Hungarian skilled labor moving out of Hungary	Attracting a higher number of foreigners to Budapest because Hungarian skilled labor moving out of Hungary	Increasing the number of workforce due to a higher number of foreign companies moving to Hungary and Budapest specifically	Increasing environment-friendly mode of transport – Priority
The EU policy: mobility of people. This policy promotes the free movement of EU citizens amongst the member states. Policy attracts workers and students to study in EU	Salary in Hungary is low comparing to other EU countries	Salary in Hungary is low comparing to other EU countries	Increasing the amount of cyclist-friendly roads
The EU policy "low carbon Economy" and "innovation" has influenced Hungary and Budapest to increase the number of transport modes that are environmentally friendly	Creating a favorable environment for future generation	Public mobility is intensive from January – mid 12	The improvement of application for public transportation
Increasing the coverage of public transport	Number of people is increasing significantly	individual mobility	Increasing the capacity of parking facilities
Promoting walking	reducing health costs through healthy living	Increasing the awareness of water public transportation	Building parking facilities near public stations
The cooperation between different economic operators, local authorities, and training and research institutes	Ticket price stability	Increasing pedestrian accessibility	
The EU white paper encourages member states to adopt more sustainable mobility	Energy price stability	Increasing the amount of cyclist - friendly roads	Barrier-free means of transport
Internal conflict			

Source: Own compilation

1.5.2. FOCUS GROUP

The researchers used a focus group as another method to collect data for this study. A focus group provides researchers with the opportunity to analyze the opinions of different participants and gain information from them about the phenomenon being studied (Busetto, Wick & Gumbinger, 2020). Focus groups typically consist of six to eight people (CDC, 2018). For this study, six people who were students, residing in Budapest, and frequently use public transport, participated in the focus group. Before conducting the focus group, the researchers asked the research participants for permission to record the virtual meeting. The focus group had two sessions which took place over four hours online. The research participants joined the online meeting utilizing both their audio and video. In both sessions, the meetings were conducted and moderated by one of the researchers.

The topics which were discussed in the focus group were derived from the PESTLE analysis they conducted and from existing literature on the usage of public transport in Budapest. This study focused on public transport because according to the European Investment Bank Group (2022) it is used daily by students and employees, and it is considered an affordable alternative. Additionally, the European Investment Bank Group (2022) reported that the greenhouse emissions that were emitted from transport are continuously rising and account for approximately twenty-seven percent of the EU total emissions.

This study explored ten main questions: (1) How do you find public transportation in your area? (2) What means of transportation are you using mostly? (3) Which metro line, bus, tram do you use mostly? (4) On average how much time do you spend in public transport per day? (5) Are there challenges that you face when using public transportation? (6) What means of transportation do you prefer? (7) Are there any improvements that you would suggest? (8) How do you perceive the price of tickets for public transportation? (9) What are the advantages of using public transportation over personal transportation? (10) Does climate change affect your choice of transportation?

The results gathered from the online meeting were first transcribed verbatim, the researchers then used the transcription to:

1. Identify the different drivers which encouraged and discouraged the research participants to use public transport.
2. The drivers were grouped into categories (economic, technological, environmental, legal, political and social)
3. The researchers (coders) then had another meeting to discuss whether the drivers were in the correct categories.

In summary, the data that was collected was converted into ‘futures data’. This data was then used to create the drivers’ table.

Drivers and Themes

The drivers and themes table was used as a tool to analyse the data that had been collected through the focus group. By using this table, the researchers were able to group the data received into themes. Subsequently, this table also illustrated the level of importance and certainty the research participated allocated to the drivers that were identified by the research participants. The following section will discuss the results that the researchers acquired through the study, it will also answer the study’s research questions.

1. What are the driving forces which influence sustainable transport mobility in Budapest? The researchers conducted an in-depth literature review and a focus group. From the focus group the drivers were identified and illustrated in table three.
2. How do the driving forces influence the behavior of the city’s public transport users?

From the focus group the participants were asked to highlight their perceived level of

importance and certainty to the different drivers. Table three communicates the level of certainty and importance they thought each driver should have.

3. How are the driving forces grouped

The driving forces were grouped into different themes which were identified by the World Bank in 2020. The themes focus on sustainable mobility which are "universal access", "efficiency", "safety", and "green" to enhance the articulation and the interrelationship of the driving forces towards sustainable mobility. As Gallo and Marinelli (2020) claimed that "environmental", "socio-economic" and "technological" are factors which are associated with sustainable urban mobility. Hence the authors decide on the 4 pillars of sustainable mobility defined by the World Bank (2020) as these pillars are more inclusive. Table three illustrates how the different drivers are part of the different themes.

3. Table Drivers and Themes

Drivers	**Importance (0-10)**	**Certainty (0-10)**
universal access (social, technological)		
different modes of transportation are more connected and integrated	8	8
Accessibility of public transport increases	9	9
Road congestion is worsening	9	9
Public transports will be modernized	8	8
Metro line system will be repaired and maintained affecting the availability and schedule	9	8
Charging stations are extended and more available for electricity vehicles	8	9
Fuel stations are extended and more available for low-to-zero emission vehicles (hydrogen, biofuel)	8	9
Increasing in car sharing service provider and coverage (GreenGo - E-car service)	8	5
Public Health concerns are raising	8	8
Increasing the public choices of low-emission vehicles	4	5
Metro line system will be repaired and maintained affecting the availability and schedule	9	8
Raising awareness about consequences of choosing the mean of transportation	7	2
Increasing tax for using high-emission vehicles	9	9
Pressures from the NGOs and IGOs are increasing	8	8
Public bicycle providing services are made available in a wide coverage of location	8	7
English is gradually being made available in public transportation to reduce the language barriers	9	8
efficiency (economic)		
Ticket price is stable	10	8
Energy and fuel price increase	7	8
Prices of low-to-zero emission vehicles is high	7	6
Many Investment opportunities in alternative energy sources emerge	9	9
Investment in sustainable mobility infrastructure increase	9	6
Increasing and improving the capacity of parking facilities	6	3
Increasing tax for using high-emission vehicles	9	9
safety (political, social)		

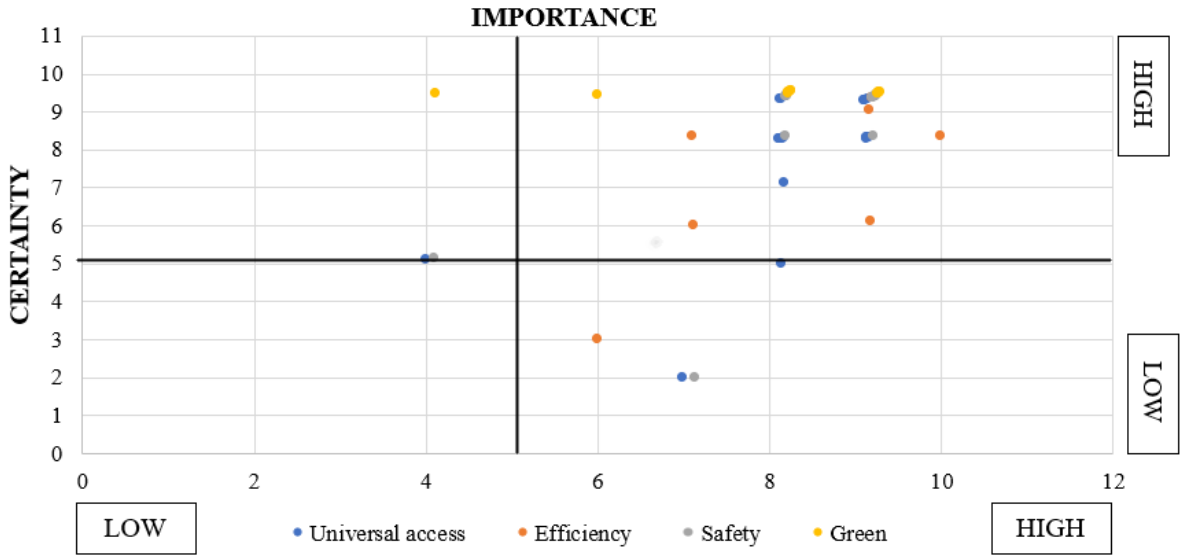
Accessibility of public transport increases	9	9
Road congestion is worsening	9	9
Public Health concerns are raising	8	8
Increasing the public choices of low-emission vehicles	4	5
Metro line system will be repaired and maintained affecting the availability and schedule	9	8
Raising awareness about consequences of choosing the mean of transportation	7	2
Increasing tax for using high-emission vehicles	9	9
Pressures from the NGOs and IGOs are increasing	8	8
Public bicycle providing services are made available in a wide coverage of location	8	7
English is gradually being made available in public transportation to reduce the language barriers	9	8
Increasing in car sharing service provider and coverage (GreenGo - E-car service)	8	5
Governmental policies are being discussed and implemented to support sustainable practices within transportation	9	7
green (environmental)		
Increasing and improving the capacity of parking facilities	6	3
Accessibility of public transport increases	9	9
Metro line system is extended	8	7
Road congestion is worsening	9	9
Increasing the public choices of low-emission vehicles	4	5
Many Investment opportunities in alternative energy sources emerge	9	9
Charging stations are extended and more available for electricity vehicles	8	9
Fuel stations are extended and more available for low-to-zero emission vehicles (hydrogen, biofuel)	8	9
Investment in sustainable mobility infrastructure increase	9	6
Increasing in car sharing service provider and coverage (GreenGo - E-car service)	8	5
Public bicycle providing services are made available in a wide coverage of location	8	7

Source: Researchers own compilation.

1.5.3. IMPORTANCE AND CERTAINTY ANALYSIS

The importance and certainty graph was created to help analyse the drivers that were identified by the focus group according to their level of importance and certainty.

2. Figure The drivers that are part of the importance and certainty graph



Source: Researchers' own compilation

Figure 2 illustrates the certainty and importance of all drivers. Using this chart, the authors could identify the visible significant drivers that would be focused on by society in the future. These drivers have a high rate of certainty and a high rate of importance. The drivers that have a high certainty and a high importance were then conveyed to table 4. The drivers that are illustrated in table four were used to create the baseline future for the mobility of Budapest.

4. Table Drivers that have high importance and certainty.

Drivers	**Importance (0-10)**	**Certainty (0-10)**
universal access (social, technological) (13)		
different modes of transportation are more connected and integrated	8	8
Accessibility of public transport increases	9	9
Road congestion is worsening	9	9
Public transport will be modernized	8	8
The Metro line system will be repaired and maintained affecting the availability and schedule	9	8
Charging stations are extended and more available for electricity vehicles	8	9
Fuel stations are extended and more available for low-to-zero emission vehicles (hydrogen, biofuel)	8	9
Public Health concerns are raising	8	8
Increasing tax for using high-emission vehicles	9	9
Pressures from the NGOs and IGOs are increasing	8	8

Drivers	**Importance (0-10)**	**Certainty (0-10)**
Public bicycle providing services are made available in a wide coverage of the location	8	7
English is gradually being made available in public transportation to reduce the language barriers	9	8
efficiency (economic) (6)		
The ticket price is stable	10	8
Energy and fuel price increase	7	8
Prices of low-to-zero emission vehicles are high	7	6
Many Investment opportunities in alternative energy sources emerge	9	9
Investment in sustainable mobility infrastructure increase	9	6
Increasing tax for using high-emission vehicles	9	9
safety (political, social) (10)		
Accessibility of public transport increases	9	9
Road congestion is worsening		
Public Health concerns are raising	8	8
The Metro line system will be repaired and maintained affecting the availability and schedule	9	8
Increasing tax for using high-emission vehicles	9	9
Pressures from the NGOs and IGOs are increasing	8	8
English is gradually being made available in public transportation to reduce the language barriers	9	8
Governmental policies are being discussed and implemented to support sustainable practices within transportation	9	7
green (environmental) (9)		
Accessibility of public transport increases	9	9
The Metro line system is extended	8	7
Road congestion is worsening	9	9
Many Investment opportunities in alternative energy sources emerge	9	9
Charging stations are extended and more available for electricity vehicles	8	9
Fuel stations are extended and more available for low-to-zero emission vehicles (hydrogen, biofuel)	8	9
Investment in sustainable mobility infrastructure increase	9	6
Public bicycle-providing services are made available in a wide coverage of the location	8	7

Source: Researchers' compilation

Figure two was constructed to illustrate the study's drivers and to identify which drivers had high importance and high certainty. The drivers that had high importance and high certainty were then used to identify a possible trend of what could happen. Additionally, it was used to forecast the city's baseline 'most probable' future. Drawing from the figure it was most likely that every driver that was of high importance and high certainty in the future would have an impact on Budapest's sustainable mobility. In addition to figure two, table four, named all the drivers that had a high importance and high certainty. From analyzing Table 4 it was concluded that the largest number of elements that were going to influence the city's baseline future are going to be derived from the 'universal access' category.

1.6. BASELINE FUTURE

The drivers that occur most frequently among all four categories included: “accessibility of public transport increases”, “road congestion is worsening”, “metro line system will be repaired and maintained affecting the availability and schedule”, “fuel stations are extended and more available for low-to-zero emission vehicles (hydrogen, biofuel)”, “increasing tax for using high-emission vehicles”, “Pressures from the NGOs and IGOs are increasing”, “many investment opportunities in alternative energy sources emerge”, “investment in sustainable mobility infrastructure increase”. These drivers are most likely happening now based on the perspectives of the focus group and analysis. Accessibility of public transportation refers to increasing the network, to enable more people to access it. Road congestion is worsening because of the increase in the population regardless of nationality which promotes the use of personal vehicles. The situation has already been harsh, especially during rush hours. “Metro line system will be repaired and maintained affecting the availability and schedule” is another important driver because the metro systems are being maintained consistently. One iconic example is that all the stations of M3 have been reopened again. This driver is intersecting with the driver “accessibility of public transport increases” due to its impact on accessibility. In the future, these systems will be kept maintained. “Fuel stations are extended and more available for low-to-zero emission vehicles (hydrogen, biofuel)” will be a hot topic in the future. Moreover, tax on high-emission vehicles increasing will be the key to demotivating people from using personal cars due to environmental issues. Alternative transportation in this sense is to motivate people to use public transport. The rise in electricity and low-emission transportation especially personal vehicles is visible and will be strongly promoted. Following this trend, these fuel stations will be in high demand if society needs to shift its use of personal vehicles. The two factors related to investments are on track for their implementation. Fundamentally, in order to achieve sustainability in transportation leading to more sustainable mobility, domestic investment, and FDI are most likely the key to enhancement. Hungary will focus on accelerating and attracting more investment which will be dedicated to the green and efficient aspects of sustainable mobility.

1.7. SWOT ANALYSIS

In order to consider the viability of the baseline, it is important to analyze this future by using the SWOT tool. The government of Queensland, Australia (2022) claimed that one of the best instruments for decision-making is a SWOT analysis, which offers a vision of the internal and external environment affecting the future.

	Strengths	Weaknesses
Internal	- The number of investments in infrastructures and environmental-friendly vehicles is increasing. - Significant support from society and the government. - The promotions for the use of low-to-zero emission vehicles and public transportation are stronger than in the past indicating the commitment from citizens and the government. - Creating a new market with more fair competition with new products. - One of the strengths of city's public transport is its wide network throughout the city.	- Political instability is caused by internal conflicts between local authorities and the government. - Taxation issues especially increasing tax on high-emission vehicles will cause dissatisfaction among citizens. - The average wage of Hungarian citizens is still low, making it impossible to afford environmental-friendly vehicles.
	Opportunities	**Threats**
External	- Multiple options for support in terms of policies and funds from the IGOs such as the EU or the European central bank, etc. - FDI flow will increase, especially for green investments. Hence, sustainable mobility will be beneficial. - MNE encourages the development of infrastructure. - The development of more civil organizations such as the Hungarian cycle club.	- Pressures from IGOs and NGOs might cause internal and external conflicts which will delay innovation and the development of sustainable mobility. - The different criteria from different institutions, especially investments do not match with the national capacity. - The increase in the inflation rate and global conflicts might destabilize the price and decrease people's spending.

CONCLUSION

The density of Budapest is heavy in districts in, or near the city centre where firms and tourists gather, and the population residing in the area is high (Pintér & Felde, 2022). Nevertheless, the reasoning of the participants is reasonable. The number of international students is increasing every year. The Tempus Public Foundation (2018) reported that there is a significant number of international students residing in Budapest. Combined with the rental price, accommodation could be transiting to the suburbs near Budapest. Hence, it is required that the public transport system be developed to integrated and extended also to include the drivers "The cover of public bicycle providing service". Financial aspects like the price and stability of tickets must be maintained as this is a most attractive price, especially when comparing Budapest to other capital cities. Looking at the environmental and societal aspect, drivers such as "Public Health concerns" indicate the awareness of how the environmental issues affect the public health in general. And Pressures from NGOs and IGOs, which are also one driver, will increase on the government in order to push forward sustainable mobility. This could be translated as Budapest has many bus lines with very old vehicles. Hence, the responsibility of the government is to extend its support by investing in alternative energy sources and in sustainable mobility

infrastructure which could be based on a form of Public-Private Partnership. These drivers also have a very high score of certainty. Sustainable mobility should be composed of the PESTLE factors including Politics, economics, society, technologies, legal, and environmental aspects. The highest tendency detected is the research and application of new technologies on public transportation. This could create an environment that supports sustainable mobility in the future. Despite several elements that might be obstacles from the perspective of the focus group, these driving forces are certainly happening. Pressures from society, and politics, especially from the EU institutions and other member countries, will make the Hungarian government and Budapest municipality jointly push these essential drivers. These drivers have the nature of sustainability demonstrated in three spheres which are economics, society, and environment. Budapest is on the right track to develop sustainable mobility within the city. This is important as it will not only be beneficial on the societal side but will also attract more foreign direct investments. As a city linking the Western EU and the Central–Eastern EU, this will open many opportunities for Hungary in general and Budapest in particular.

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Redesigning higher education study skills courses: reflections of Gen Z students on a dynamic and interactive syllabus

Imre Fekete[25], *Rita Divéki*[26]
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Abstract
One of the topical challenges of higher education is how to offer quality courses for the future; i.e., in a way to engage and motivate 'Gen Z' students, who will be the dominant generation in the not-far future. The aim of this study is to explore how to redesign courses for the future needs by reflections of the emerging 'Gen Z' generation students with specific focus on course dynamics, invested effort, optional assignments, group- and self-assessed presentations and the skills developed. Overall, two groups of *Study skills* students were involved in the study taught by two different instructors. Data was collected over the course of the Spring 2023 semester from multiple sources: individual student reflections and a mid-term feedback form was used in the first half of the semester followed by an end-term reflective questionnaire (*N*=67). The results imply that it is possible to redesign existing courses, reconsider teaching practices, and collaborate in the process with the other instructors of the same course.
Keywords: Gen Z in higher education, higher education students' competence development, study skills development, quality higher education, dynamic course design, flexible course design

INTRODUCTION

Foresight in higher education encompasses enabling higher education institutions to remain relevant in an ever-changing, fast-paced world, characterised by social and environmental challenges. Quality higher education plays a crucial role in achieving Sustainable Development Goal 4 (UNESCO, 2018), by equipping students with knowledge, skills, and attitudes necessary to navigate this complex and unpredictable world. To be successful at university, in the job market, and to be able to proactively address local and global issues (Divéki, 2020, 2023), young people need to develop their critical and creative thinking, problem-solving, communication and collaboration skills (OECD, 2018) and their education should empower

[25] Budapest Business School, Faculty of Commerce, Hospitality and Tourism, Department of Pedagogy, fekete.imre@uni-bge.hu; https://orcid.org/0000-0002-3651-5984
[26] Eötvös Loránd University, Department of English Language Pedagogy, diveki.rita@btk.elte.hu; Budapest Business School, Faculty of Commerce, Hospitality and Tourism, Department of Pedagogy (external lecturer); https://orcid.org/0000-0002-9342-7219

them to use these skills in real life.

The past few years of higher education have been affected by our unpredictable world, as the Covid-19 pandemic took a heavy toll on education systems around the world and universities could only adapt to these changes by switching first to completely online, and then to hybrid education. In such a context, university teaching and assessment needed to undergo radical changes, without much time for preparation. Moreover, in recent years a new generation has started their university years, Generation Z (Gen Z). Students belonging to Gen Z were born between the mid-1990s and 2010s, and they can be characterised by their tech-savviness, unique use of social media and short attention spans (Guld, 2022). To successfully engage these students, and to offer them quality learning experiences, their unique characteristics must be understood, and courses need to be tailored to their needs, while also keeping in mind the demands of the labour market and the challenges of the world in the 2020s.

The aim of this case study is to present the two instructor-researchers' endeavours to redesign a *Study skills* course and its syllabus in a Budapest-based business university to cater for Generation Z's needs, and to reveal the students' perceptions of the redesigned course. A border aim was to investigate through an illustrative case if it is possible to cater to the needs of modern generations in a way that their 21st-century skills are traceably developed. To guide the researchers' inquiries, the following research questions were drafted:

1. What are participants' perceptions on the interactive course syllabus and its features?
2. In the participants' perceptions, how much effort did they have to put into completing the course?
3. In the participants' perceptions, how did the course contribute to developing 21st-century skills?

1.1. BACKGROUND

In alignment with our research questions, the scope of our research centres around young adults in higher education through the case example (Duff, 2012) of two seminar groups of a business university in Budapest. In the Hungarian educational context, the digitalisation of education was most recently highly boosted by the Covid-19 pandemic (Fekete & Divéki 2022a, 2022b; Fűzi et al., 2022; Philipsen et al., 2023). While education could continue in the online sphere throughout the pandemic, it was mainly characterised by formal connections and online education stripped the learners from socialising outside classroom settings, which arguably resulted in feeling isolation and a sense of wanting to be interconnected (Fűzi et al., 2022) once education has returned to the physical walls of universities in most regular university programmes of the country. In the given research context, even though seminars have returned to the buildings of the university, the modality of learning remains hybrid, i.e., the methods of engaging learners even within the walls of the university have changed towards being much more technology-dependent and -mediated. Higher education all over the globe, just like other levels of education, is currently seeking a new balance and is trying to define the new norms of engagement with a special focus on its relatedness with pedagogically motivated technology use in teaching and learning scenarios.

While Gen Z is often perceived as a tech-savvy generation (Guld, 2022), scholars have repeatedly highlighted the juxtaposition between young adults' capabilities of using technologies for entertainment and educational purposes. Even in the case of teachers, it has been observed that their willingness to use technologies in their teaching practice is mainly determined by their beliefs and invested effort into experimenting with digital alternatives (Bayne & Ross, 2011; Fekete, 2023; Mossberger et al., 2008). According to the literature, sometimes teachers' technology use remains limited to what technologies they learnt about during their pre-service teaching (Tondeur et al., 2016). To vest learners with the capabilities

of tapping the educational potential of digital technologies remains their instructors' job, especially because learners belonging to Gen Z have diverse needs and require differentiated instruction (Kótay-Nagy, 2023), which can be best facilitated by digital tools.

In today's world, where lexical knowledge is at a very quick search away and the costs of living are rising, time is of utmost importance for the learners. Universities are seen as educational institutions that are typically characterised by slower change, which is primarily affected by the needs of the job market and educational, ideological policies (Kozma, 2008; 2011a; 2011b). Since the pandemic, business-oriented higher education institutions have been working on reshaping their programmes to offer more applied knowledge in the shortest time possible as illustrated by the exponential boom of short cycle (1-year) mater's programmes being launched in Hungary (Géring et al., 2022). A similar notion is detectable in universities' establishing more and more professional connections to offer dual degrees (Fenyves et al., 2020).

To make university studies relevant in today's world, university instructors have dual responsibilities: first, they must cultivate their students' work-related, cognitive, and transferable skills, enabling them to apply these abilities across various work environments due to the unpredictable nature of the job market and second, they must encourage the acquisition of knowledge, skills, and attitudes necessary for individuals to effectively confront the challenges of our contemporary society (UNESCO, 2016). In recent years, much emphasis has been put on skills development, which has been marked by the fact that the notion, *21st-century skills* has become a buzz-word, or very recently, the year 2023 was declared the European Year of Skills (European Commission, 2022). Though many institutions tried (Assessment and Teaching of 21st Century Skills - Griffin & Care, 2015; Partnership for 21st Century Learning, 2019; World Economic Forum, 2015), to date, there is no universally accepted comprehensive framework of the skills needed to thrive in the 21st century, and given the unpredictability of the future, drawing up such a framework could prove to be a futile endeavour. To tackle challenges in the foreseeable future more efficiently, it is more practical to put emphasis on the present and compile a list of skills reflective of the expectations and demands of prospective employers in the present. As an example, the World Economic Forum (2020) identified eight key attributes of educational content and experiences that can determine high-quality learning during the Fourth Industrial Revolution, which has been coined as Education 4.0: (1) global citizenship skills, (2) innovation and creativity skills, (3) technology skills, (4) interpersonal skills, (5) personalised and self-paced learning, (6) accessible and inclusive learning, (7) problem-based and collaborative learning, (8) lifelong and student-driven learning. When deciding what skills to emphasise in their courses, the World Economic Forum's yearly Future of Jobs report (2023) can inform instructors about the skills employers most seek in their prospective employees. In 2023, the top skills comprise (1) analytic thinking, (2) creative thinking, (3) self-efficacy skills: resilience, flexibility and agility, (4) motivation and self-awareness, (5) curiosity and lifelong learning, (6) technological literacy, (7) dependability and attention to detail, and (8) empathy and active listening.

As education and technology research are both heavily context- and time-dependent, it perhaps not surprising that foresight in higher education is often researched in the form of qualitative (case and/or action) studies (e.g., Adamku, 2021; Divéki, 2020; Efron & Ravid, 2020; Fekete, 2022; Gyurka, 2022; Pereszlényi, 2023; Prescott-Pickup, 2023; Szabó, 2023; Szoke, 2023). A focal point of research concerns educational technologies and learners' motivation through digital technologies. While technological solutions such as e-learning materials, interactive online task-sheets and online collaboration are buzzwords in modern approaches to engage learners, online tasks are still approached by students as tasks to be completed (Fekete, 2017; Tóth-Mózer & Kárpáti, 2016). This points towards the importance of teachers portraying strong technological-pedagogical competences; that is, the know-how of

designing tasks and lessons that necessitate students' engagement beyond the non-existing long-term motivational forces of simply working with technology. When used as an extension of teachers' pedagogical competences, online materials provide the teachers with the possibility to supervise learning and provide immediate feedback, which has been observed to serve as a sense of motivation for the learners to engage with such activities (Asztalos, 2015; Csizér & Dörnyei, 2005; Tartsayné Németh, 2012).

Consequently, the literature emphasises the importance of recognizing Gen Z students as unique individuals rather than treating them as a collective entity. With abundant online resources at their disposal, teaching them the abstract terminology of *Study skills* becomes a challenge. Despite their proficiency in utilising entertainment technology, they still rely on their teachers to foster their knowledge on the learning potential of technology. They also need their instructors' aid to develop certain global skills among Gen Z students, such as effective group work, critical reading, and critical thinking. By acknowledging and addressing these factors, higher education institutions can cater to the needs and learning preferences of Generation Z better, ultimately preparing them for success in higher education and in the modern world of work.

1.2. RESEARCH DESIGN

The aims of this study were to explore participants' perceptions of an interactive course syllabus and its features, as well as its contribution to developing their 21st-century skills in an attempt to create a forward-looking course that caters to learners' current needs. This study was carried out in the Spring semester of 2023 with the involvement of two *Study skills* courses instructed by the two author-researchers at a Hungarian business university of the capital city. The research process was approved by the university's Ethical board. As the study applied a case study approach, first, the context is going to be introduced in thorough detail, followed by the description of the participants and the data collection and analysis procedures.

The context of the study

Study skills courses are compulsory elective interdisciplinary classes that are advertised especially for first-years but are sometimes attended by third-year students who are still in need of some credits to finish their university studies. The aim of the *Study skills* courses is to serve as a bridge between secondary and higher education and familiarise the students with the specifics of learning at a university centring around topics such as motivation, critical reading and thinking skills, understanding and creating digital/visual content and collaboration. The instructor-researchers redesigned the syllabus of the course to meet the needs of a new generation of students who were affected by emergency remote and hybrid forms of education. Part of the reconsideration of the curriculum included (1) the topics covered at the classes, (2) the forms of presenting the course curriculum to the students and (3) the assignments students had to do.

The unified core *Study skills* course syllabus focused on various areas of 21st-century skills students need to have a broad understanding of. These topics were: the concept of learning, learning styles, motivation, controlling the learning environment, setting realistic learning objectives, critical reading of online materials, reading and note-taking techniques, processing audiovisual and multimedia information, time management, scheduling, exam preparation, and myths and facts about foreign language learning. The presentation of the requirements needed to be updated too, especially as the instructor-researchers planned for elective assignments and preferred that the syllabus included substantial grading information and very precise description of the tasks. To meet this purpose, they decided to create a Genially presentation to serve as the syllabus for the course, as it is easy to navigate, and additional

information can be included on the slides in the form of 'Read more' or 'Extra info' buttons. (The entire detailed syllabus can be accessed via https://view.genial.ly/63c4feed205b1400128e7bc9 in Hungarian.) This way, students were initially not overwhelmed by all the information, and they did not have to read through long texts detailing the entire course but could find the relevant information.

All throughout the semester students could collect 100 points and 10 extra points:

- 40 points could be collected for the group presentation (out of which 20 was awarded by the course instructor, 10 by the audience following the same assessment rubric and 10 by the individual team members reflecting their and their peers' efforts put into preparing for the presentation),
- 20 points could be collected in the end-term test that was based on the materials covered in the classes and largely relied on the beginning-of-the-class interactive Mentimeter quizzes on the previous weeks' topics,
- 10 points were awarded for in-class activity in a way that students evaluated themselves based on selecting on Likert scales how much they feel they fulfilled each criterion of active engagement specified by the course syllabus. This self-evaluation was performed in an online form at the end of the semester,
- 30 points could be collected for an individual written assignment. Here, students could choose from four various types of assignments all of which were detailed in the interactive course syllabus. The task description contained the rationale for each task, a detailed description, a final checklist for the students, information on the evaluation criteria as well as some examples. The four assignments students could choose from were 1) creating visual infographics in a global issue related to their studies, 2) creating digital study notes (e.g., a mind map) of a lecture course they attended, 3) creating an educative podcast within the realms of learning and studying, or 4) creating an educational video on learning and studying.
- Finally, an extra 10 points could be collected throughout the semester by participating in the beginning-of-the-class Mentimeter quizzes on previous materials and by doing the weekly homework assignments.

Participants

The two seminars were attended by 30 and 40 students, respectively. Both courses were advertised and instructed in Hungarian (as it is customary in the Spring semesters) and were attended by students of the Tourism and hospitality and the Commerce and marketing bachelor programmes. Each student was Hungarian. Because they all studied in a regular programme, age and demographic data was not collected from the students. The course was mainly attended by first-year (typically aged 18-19) and some third- or fourth-year students (typically aged 21-23).

Tools of data collection

Data was primarily collected through an online end-term questionnaire (N=67) and optional in-course reflections (nine reflections with 13-21 students completing them, overall n=140). The participants filled in the end-term questionnaire anonymously and voluntarily, which began by granting their permission to participate in the study. The questionnaire (see Appendix A) centred around three topics: (1) reflections on the competences developed during the course, (2) reflections on course features such as interactivity, assignments, and presentations, (3) effort put into completing certain aspects of the courses such as the assignments, and (4) an optional part where the participants could elaborate their reflections in writing (n=11). In the first two parts, students were presented with some statements and were asked to rate how much they agree with each on five-point Likert-scales. In the third part, students were invited to decide if certain aspects of the seminar, such as the assignments, at-home preparation time, and the

discussion-based lessons required less, just enough or too much effort in their understanding. The final, fourth part of the questionnaire provided students with the possibility to share their ideas in a freely written form (11 of the 67 respondents took this opportunity) on any aspects that the questionnaire or the courses involved.

Methods and scope of data analysis

Questionnaire data was analysed with the help of Excel. The Likert-scale items were analysed by calculating means and standard deviations, and the effort scales were analysed by selection frequencies. After-class reflections and the written comments of the end-term questionnaire (n=11) were analysed manually due to the relatively low number of instances with the method of thematic content analysis (Xu & Zammit, 2020).

Since this study took a phenomenologist approach and investigated the case of two seminar groups, its findings are by no means presented as generalisable. The two author-researchers were closely involved in the study, which warranted an excellent perspective into the cases, however, each case (i.e., group) was only instructed by one of the researchers. It is also important to add that the core syllabus is not intended to be introduced as a finite and perfect one, the researchers are aware that its content will have to be revised constantly. The aim of the study in the scope of the *Study skills* classes was to collect empirical data on students' involvement that could be the basis of the further refinement of the syllabus that can inform other instructors to reform their syllabi. Finally, it has to be remarked that *Study skills* classes are not content classes in a sense that students do not have to learn much lexical content. This course rather aims at laying the foundations of how students could approach their own learning processes better, thus, in the context of this study, the 'success' of the course lays at how much students become aware and reflective of their own learning rather than how much lexical information they can retain and for how long.

1.3. RESULTS AND DISCUSSION

The participants' perceptions of the interactive course syllabus (RQ 1)

To gain insight into the participants' perceptions of the course design, in the end-of-course questionnaire, the students were given 21 statements which they had to rate on a scale of 1-5 based on the extent to which they agree with each (1 = completely disagree, 5 = completely agree). Table 1 presents the means and standard deviation of the statements in connection with the syllabus.

1. Table Students' perceptions of the features of the course syllabus

The syllabus…	M	SD
detailed the tasks well	4.46	0.86
was unique in design	4.45	0.94
included all details	4.43	0.89
provided useful task examples	4.40	0.92
was logically arranged	4.39	0.94
was student-friendly	4.34	0.98
was easy to find	4.22	1.07

As Table 1 shows, the students awarded relatively high means to each of these features, and all in all, they felt that the course syllabus was well-detailed, logical, user friendly and unique in design, which aligned closely with the intentions of the instructors. As detailed in the

Research design and methods section, the instructors' aim was to design a syllabus which would cater to Generation Z's needs by making it visually appealing, detailed but not overwhelming, and easy to navigate. Quite interestingly, they rated the statement *It was easy to find the course syllabus* the lowest of all, with the highest standard deviation. Given that both instructors included the link to the course syllabus at the top of the course page in the learning management system (Moodle), this result may have been a slight criticism of the LMS used, or it may come down to the fact that the students were not paying enough attention to the instructors explaining where it could be found. Had the questionnaire not been anonymous, it would have been worth examining whether those students who actively used the syllabus managed to complete their assignments better (adhering to all the guidelines) than those who could not even find it (to see example assignments and submission checklists). Overall, however, the students seem to have appreciated the interactive syllabus tailored to their needs.

The participants' perceptions of the amount of effort put into completing the course (RQ 2)

As mentioned above, the core syllabus allowed for considerable flexibility, and both instructors could tailor it to their preferences. Even though the instructor-researchers had different teaching styles, their approach to teaching was rather similar: they both aimed to have lessons centring around both theoretical and practical knowledge which the students needed to acquire through student-centred, interactive, game-like activities in a fun, relaxed atmosphere. The end-of-the-course questionnaire inquired into the students' perceptions of the effort they needed to put into these activities in the course. First, some activities from the course were listed and they needed to decide whether the effort they required was too little, too much or just enough. Table 2 shows how many students chose each option.

2. Table Students' perceptions of the effort they had to put into each activity

How much effort did each activity require? (*N*=67)	**Too little**	**Just enough**	**Too much**
group work in class	4 (6.0%)	52 (77.6%)	11 (16.4%)
being active in class	8 (11.9%)	53 (79.1%)	6 (9.0%)
written assignment	1 (1.5%)	54 (80.6%)	12 (17.9%)
in-class test	1 (1.5%)	59 (88.1%)	7 (10.4%)
the effort to pass the course (in class)	2 (3.0%)	60 (89.6%)	5 (7.5%)
the effort to pass the course (outside of class)	4 (6.0%)	53 (79.1%)	10 (14.9%)
individual responsibility	3 (4.5%)	60 (89.6%)	4 (6.0%)
creative assignments	2 (3.0%)	57 (85.1%)	8 (11.9%)

As can be seen from Table 2, the students, in general, were rather satisfied with the different elements of the course, as most of them rated each activity with "just enough". Some numbers that are relatively high compared to others in their column must be addressed though. It is, for instance, interesting to see that there were students who felt that there was too much group work in the lessons. In the end-of-course reflection, there was a student who even commented on it: "I found that there was too much interaction between peers, and I often felt distracted by all the group work" Reflection #12. Even though the instructors consciously aimed to make the students work in groups to develop their interpersonal, cooperative, and communicative skills (Partnership for 21st Century Learning, 2019; World Economic Forum, 2015; 2020; 2023), they by no means felt that there was too much group work in the course, and they always strived to level it off with full class discussions and eventual frontal

explanations. There may be several explanations for some students feeling overwhelmed by group work: one is (as also discussed in the course in the learning styles lesson) that there are students who prefer studying alone, but the other more likely explanation is that many students are still not used to this work mode because they rarely worked in groups in secondary school (Öveges & Csizér, 2018). Consequently, given that cooperation is one of the most important 21st-century skills and global skills (OECD, 2018; World Economic Forum, 2020), considerable emphasis should be put on developing it in 21st-century university lessons, even if it is slightly uncomfortable for some students at first.

The effort put into written assignments should also be mentioned, as 12 students felt they required too much effort from them. At this point, it must be noted that the students only had to complete one assignment out of four and they were given the opportunity to choose the one which they preferred. Out of the 67 students who filled in the questionnaire, 47 chose to create infographics, 16 a creative note, two a podcast episode and two an educational video. The reasons for choosing the given assignment type varied from finding it the easiest (#17, #21, #31, #54, #57), most suitable to their learning styles (#6, #18, #52, #63), and better than the other options (#1, #32, #41) to the most interesting and creative (#8, #27, #34) and the most challenging one (#16), therefore these answers also show how much effort the students intended to put into creating their assignments or whether they intended to get out of their comfort zones. Nevertheless, the students were also asked how much time it took for them to complete these assignments, and 45% of them (n=30) said it took more than they expected, 36% (n=24) said it took as much as they expected, and only 19% (n=12) said it took less time than they expected. Taking all into consideration, it may be worth emphasising the importance of time management more to the students in connection with these new types of assignments and discussing with them in advance how they should prepare for writing them.

Finally, in connection with the results of Table 2, the results of the effort to pass the course outside of class must be mentioned, as 10 students felt the course required too much from them. Even though the students were required to create one written assignment, put together a group presentation and prepare for an end-term test, it is noteworthy that only 15% of the students felt it was too much outside-of-class work. It must be noted though that preparing homework week by week was also optional: in one of the groups, they had to write reflections after each class based on extra videos and extra helping questions to get extra points (see *The context of the study*), which only approximately a third of the students completed. Overall, as can be seen, students felt the course was still feasible in and outside of class with this much effort required as well. Nevertheless, it would be beneficial to experiment with reallocating the course points to find ways to motivate students to engage with the course content outside of class as well in order to support their overall development and ensure their well-preparedness for the following lesson.

To conclude this section about the effort the students had to put into the course, here are two excerpts from the end-of-course reflections that capture some students' initial reactions to the course:

"I honestly didn't think I would learn anything from this course. As my teacher mentioned at the beginning of the semester, this is not a straight-A subject as I had planned." Reflection #12

"When I took the course, I didn't think about how much I would learn, I was just curious to see what these classes would be about. As I approach the last class of the semester, I can tell you that I have learned a lot and some of these things I started using right after the class and it has helped me a lot." Reflection #2

Nevertheless, just as these students and many others concluded, it was worth putting effort into the course, because if they did, they learnt a lot they could implement for other subjects immediately. Consequently, it is important to highlight the amount of effort the course requires, urging both instructors and students to approach the subject with seriousness and

recognize its significance in order to change the perception of the *Study skills* course as a mere "filler subject".

The participants' perceptions of developing their 21st-century skills throughout the course (RQ3)

The questionnaire also sought to give the chance to the students to reflect on the extent to which the course contributed to developing their 21st-century skills. To this end, they were given a list of skills which they had to rate on a 5-point Likert scale, where 1 meant *not at all developed* and 5 meant *completely developed*. Table 3 summarises the participants' answers by displaying the means and the standard deviations.

3. Table Students' perceptions of the skills developed during the course

The extent to which these skills were developed (*N*=67)	M	SD
creativity	4.20	0.86
presentation skills	4.19	0.89
cooperation	4.09	0.96
looking for information	4.01	1.01
digital skills	3.89	1.13
LLL (lifelong learning)	3.89	1.13
critical thinking	3.79	1.04
critical reading	3.73	0.96

As Table 3 shows, the students awarded relatively high means to these skills, which entails that they felt they had the opportunity to develop all these skills to some extent. Nevertheless, these results must be interpreted with some caution: even though all the participants were Hungarian university students, they had different educational backgrounds (they came from different school types, from both the capital and the countryside; not all of them took the course in their first year, and there were some students already in their third and fourth year) so they had very different prior skills development opportunities, and they may have also had different understanding and awareness of these skills (this is also shown by the standard deviations). Nonetheless, from the results, it became apparent that they rated those skills the highest on which explicit emphasis was put by the instructors and by the tasks. For instance, creating visually appealing infographics or course notes was understood by the students as an assignment requiring creativity (Partnership for 21st Century Learning, 2019; World Economic Forum, 2020; 2023), and creating a joint presentation as an assignment as a task requiring cooperation (Partnership for 21st Century Learning, 2019; World Economic Forum, 2020) and presentation skills. However, to create these very assignments successfully, they also needed to rely on their critical thinking and reading skills, even if they were not explicitly highlighted by the instructors. It is also noteworthy that they did not rate the development of their digital skills (World Economic Forum, 2020; 2023) too highly, even if many of them commented on learning about navigating new platforms (e.g., Canva and Piktochart) thanks to the course and the instructors also strived to model the successful use of digital tools to them during the whole course.

The end-of-the-course reflections revealed other facets of the skills fostered, ones the questionnaire did not even enquire about. One of these was the ability to transfer knowledge. In the students' words,

"I learnt a lot of things, and some of them I started using immediately after the lesson and it helped me a lot in completing my other courses" Reflection #2

"I think the class helped me overcome obstacles at university more easily, as we also learned about useful note-taking methods, staying motivated, overcoming procrastination and time management. I will try to use as many of these as possible in the coming years." Reflection #3

"...this is one of the subjects that does not impart lexical knowledge, but rather practical and mindset-changing knowledge that we can then tailor to our own needs." Reflection #5

Even though it was intentional from the instructors to design the course in this way, it was applaudable that some students also realised and commented on this aspect of the course. Another skill they pointed out developing was self-awareness (World Economic Forum, 2023). As they put it,

"Overall, I really benefited from this subject/course, I learned a lot about myself in the process." Reflection #4

"Both the preparation and delivery of the presentation, spiced up with the social interactions that go with it, such as not taking criticism as an insult, all made me feel like a better human being." Reflection #5

Given that the students were very often asked to reflect on their own attitudes and behaviours during the course, these results were not surprising; however, the fact that some students could verbalise developing their self-awareness is the testimony of active and reflective learning.

One takeaway from these results may be that it would be beneficial to regularly highlight the purpose of each activity in the course, thereby enabling the students to gauge their relevance more consciously. Another one is that it may be worth re-evaluating which skills should take precedence in the course. Pereszlényi (2023), when examining English majors' reading skills, also found that first-year students (belonging to Generation Z) do not read much, and they lack some important skills and strategies (e.g., critical thinking and critical reading skills, ability to focus, study skills), which would enable them to complete their courses more successfully. Thus, it would be beneficial to incorporate activities with the help of which these skills could be explicitly fostered. In addition, when reevaluating the skills to develop in such a course, up-to-date literature (World Economic Forum, 2020; 2023) can and should guide such enterprises. As the Future of Jobs report points out (World Economic Forum, 2023), the three main skills employers are looking for are analytic thinking, creative thinking, and self-efficacy skills. Having all considered, based on the students' perceptions, it seems that out of these three main skills, mostly their creative thinking was developed, even if there were some activities aiming at making them more analytic thinkers (e.g., analysing infographics, charts, and texts). Based on the written student feedback though, more emphasis should be put on developing students' self-efficacy skills so that they learn to embrace challenges, new assignment types, adjust to new situations more easily and take ownership of their own learning.

CONCLUSIONS

The aim of the presented study was to investigate how students perceived the syllabus of a redesigned, forward-looking *Study skills* course, their perceptions regarding the amount of effort required for the course, and their perceptions of the skills developed through this course. The methodology the two instructor-researchers used was the case study approach, with the participation of two *Study skills* groups (*N*=70), taught by the instructor-researchers in Spring 2023 in a Budapest-based business university.

In connection with the first research question (i.e., *What are participants' perceptions of the interactive course syllabus and its features?*), the results revealed that the participants appreciated the visually appealing, sufficiently detailed, logical, and user-friendly nature of the syllabus. The students also expressed their satisfaction with the fact the course was flexible in design, which meant that they could make certain choices (e.g., collect extra points, and choose which assignment to complete). The second research questions shed light on the amount of effort the students needed to put into the course (i.e., *In the participants' perceptions, how much effort did they have to put into completing the course?*). Most students seemed satisfied with the elements of the course, and they felt the course required just enough effort from them; however, the analysis revealed that the newer, less traditional elements of the course (e.g., collaborating in groups, creating creative written assignments) took more effort and time to complete. Finally, the last research question (i.e*., In the participants' perceptions, how did the course contribute to developing 21st-century skills?)* investigated the skills developed during the course. Many of the participants felt that the course was useful for developing their 21st-century skills, but it must be noted that they were only moderately aware of the developed skills, unless they were explicitly highlighted in the course.

Based on the results of the study, it can be argued that it is possible to design a core syllabus tailored to Generation Z's needs, which is flexible in design, and which can be adapted based on the instructor's personality and teaching style. The results imply that such a syllabus is not only suitable for being used by different teachers, but it also enables them to offer differentiated instruction (Kótay-Nagy, 2023) and foster students' 21st-century skills. However, conscious planning should precede the implementation of such a syllabus, which involves researching the current needs of the labour market and reflecting on how the skills sought by employers could be developed in the classroom in an engaging manner. Nonetheless, the process of designing an effective study skills course is longer than a semester's work: the findings and the two instructor-researchers' experiences both imply that the syllabus should be modified and refined based on the course feedback and the analysis of the assignments after each semester, even if the course was deemed successful by both the researcher-instructors and the students.

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APPENDICES

Appendix A: The English translation of the questions of the end-term reflective online questionnaire

Dear Participant,

Please help us by completing the following questionnaire, which will take a maximum of 10 minutes and does not require long answers.

Thank you,

Rita Divéki, Imre Fekete

I. Reflections on the course

Please rate the extent to which the classroom and assignments helped you to develop the following skills.

1 = not at all; 5 = fully

- critical thinking
- critical reading
- presentation skills
- finding information
- digital skills
- lifelong learning
- working with peers
- creativity

Please rate how strongly you agree with the following statements!

1 = strongly disagree; 5 = strongly agree

- During the course I learnt what a good presentation looks like.
- The course gave me useful ideas on how to make an aesthetic presentation.
- The course gave me useful ideas on how to make an effective group presentation.
- The course taught me how to give appropriate feedback on the performance of the presenters.
- I enjoyed working with my peers while preparing for the presentation.
- I prepared for the group presentation to the best of my ability.
- The lessons were conducted in a good atmosphere.
- I enjoyed attending the lessons.
- Homework was related to the topics of the lessons.
- The lessons were dynamic.
- The topics of the lessons reflected the characteristics of 21st century learning well.
- I gained new knowledge during the lessons.
- I could always count on the teacher to answer my questions.
- The course description was easy to find.
- The course description was easy to understand and navigate (logical layout).
- The course description design was unique.
- The course description was student-friendly.
- The course description covered all important details.
- The course description had a unique layout compared to other subjects'.
- The course description covered all details of the assignments to be submitted.

- I found useful examples of the assignments to be given in the course description.

II. Effort
Please rate whether you think you have done too little, just enough or too much of the following during the semester.
(too little, just enough, too much)

- classroom exercises
- classroom activities
- presentation task
- assignment to be handed in
- end-term test
- invested effort in the subject during the lessons
- invested effort in the subject outside lessons
- group cooperation
- individual responsibility
- possibility of collecting extra points
- feedback from the teacher on the individual assignment
- teacher feedback on the presentation
- creative learning material to be processed in a new format (e.g. machine infographics, digital notes)

Which of the possible individual assignments did you choose?

- digital infographics
- digital notes
- educational podcast
- educational video

OPTIONAL QUESTION: On what basis, why did you choose this particular assignment?

How long did it take you to complete the individual assignment?

- less than I thought
- as much as I thought
- more than I thought

How much time did it take to prepare the group presentation?

- less than I thought
- as much as I thought
- more than I thought

OPTIONAL QUESTION: If you would like to elaborate on your views regarding the course, or if you would like to explain any of your answers, please do so here.

Corporate pricing power and inflation

István Ábel[27] *– Szilárd Hegedűs*[28] *– Gyula Nagy*[29] *– Orsolya Éva Tóth*[30]

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Abstract

Recent surge in inflation created new challenges for economic theory and policy. The reference to earlier episodes is often misleading. Traditional theories focus on demand factors like excessive money supply overheating the economy (monetary theory), wage growth and labor shortages and point to central bank responsibility. Central banks are increasing interest rates in line with their mandate in the inflation targeting framework. Current explanations point to supply disruptions and bottlenecks in basic commodities and energy markets and the geopolitical turmoil. Increasing interest rates and the austerity policy would do little to tame supply related inflation and they would risk even worsening the problem.

We propose new aspects of the problem which indicate a need for new approaches in research. Inflationary tendencies are often linked to cost pressures. We point to a new aspect namely the increasing profit margins of companies. Firms with market power increase prices when they expect that their competitors will follow. Current conditions of sector-wide cost shocks support such expectations that instead of increasing market share competitors will follow the price increase. Not just the competitors but every downstream sector may also increase their prices.

We extend the analysis to this aspect by using Orbis database for the Hungarian companies' balance sheet data for the period of the period 2013-2021.

Keywords: inflation, markup, EBITDA, monetary policy

INTRODUCTION

Inflation has rapidly and significantly increased in almost every country in the world. Several characteristics of the current inflation trends reminded many analysts of the oil price shock in the 1970s and its inflationary impact. This parallel is based on the perception that the increase in energy prices has significantly contributed to current spike in price increases. However, the comparison is flawed for several reasons. It would be premature to evoke the economic policy responses of the 1970s. It is important to realize that the current situation is different from any previous inflationary episode for several reasons. An important consequence of these

[27] István ÁBEL PhD Professor, Budapest Business School – University of Applied Sciences, Department of Finance, abel.istvan@uni-bge.hu

[28] Szilárd HEGEDŰS PhD College associate professor, Budapest Business School – University of Applied Sciences, Department of Finance, hegedus.szilard@uni-bge.hu

[29] Gyula NAGY PhD College professor, Budapest Business School – University of Applied Sciences, Department of Finance, drnagy.gyula@uni-bge.hu

[30] Orsolya Éva TÓTH, Lecturer, Budapest Business School – University of Applied Sciences, Department of Finance, toth.orsolya@uni-bge.hu

differences is that traditional theoretical approaches do not provide a convincing explanation for the current inflationary phenomena. We need to know that traditional approaches do not provide guidance for effectively policy response for our todays problem (Ábel – Nagy, 2022).

We focus on the shortcomings of traditional approaches. These approaches played a significant role in modelling the factors and assessing policy responses in central banks and by the International Monetary Fund's recent country studies on inflation (see IMF, 2022, 2022a, 2023). These popular and widely used models belong to a group of so-called expectation augmented Phillips curve framework. The results of these estimations indicated that although the theoretical framework of the traditional Phillips curve approach still contributed to highlighting some of the main mechanisms, it also revealed that important aspects of the current problems remained outside of the explanatory power of this approach. The estimations left a huge slack in explaining the developments. There is a need to expand the list of factors by adding new elements in the current situation. First, we highlight some of these considerations from the ongoing debates in the United States, then we outline the path that identified a significant gap in the explanatory power of the traditional approach.

1.1. DEBATES ON INFLATION IN THE UNITED STATES

Galbraith (2023) emphasized that in the US oil prices rose rapidly in 2021, but before that there was a long period when the price of oil was particularly low. The period before 2021 reflected the impact of the pandemic which triggered a decline in traffic and in this way contributed to a fall in demand for oil. The oil industry adjusting to the declining demand, decreased production and exploration of new deposits. However, the rising demand after the pandemic led to a rapid increase in prices after 2021. The price of oil fluctuated between $65 and $80 per barrel on the international markets before the pandemic broke out, dropping to $20 at the beginning of 2020 due to the crisis. After the crisis, prices rose rapidly, and at the beginning of 2022, the inflation-adjusted price per barrel reached $116, from where it fell to around $80 by the end of 2022 (Galbraith, 2023, p. 2.).

Fuel price increases significantly contributed to today's inflation. "…oil prices drove the gasoline component of the Consumer Price Index up by 154 percent from the low in March 2020 to the peak in June 2022, with indirect effects on food and all other sectors." (Galbraith, 2023, p.2.)

Another important inflationary impact was related to the shortage of semiconductors and chips in the automobile industry according to Galbraith (2023). Car manufacturers expected a decrease in demand for cars used for commuting due to pandemic related remote work while appliance manufacturers foresaw an increase in demand for household appliances. However, neither of this happen, and because of the decline in the supply of new cars, used car prices in the United States increased by 55% until February 2022 (Galbraith, 2023, p.3.). But it is questionable what economic policy measure could be considered to mitigate such an inflationary impact of the shift from new cars toward used one.

It is often mentioned that government policies contributed to the inflation. Pandemic related budgetary spending increases and extremely loose monetary policy measures were used to mitigate the income loss of those who lost their job. Such measures also helped the companies to survive the threat of recession. It is widely believed that these measures also contributed to today's acceleration in inflation as the beneficiaries began spending again. Pandemic related postponed demand suddenly appeared on the market, and companies responded to the rapid increase in demand by price increases.

Galbraith (2023) noted however, that the significant increase in budget spending, which amounted to $600 per person per week in unemployment benefits, did not necessarily resulted in savings (which would finance postponed demand) since households in need still had to spend

on rent, food, fuel, and everyday expenses, and only the wealthier people were able to save more. They probably spent this on investments, real estate purchases, and the like.

Ferguson and Storm (2023) strongly refuted the idea that the pandemic related government spending could explain the recent acceleration in inflation. Instead, they claimed that the current inflationary episode may be attributed to various global factors, including import prices and supply bottlenecks, but it cannot be adequately explained by the US economic policy reactions that supported the incomes of workers and unemployed people in response to the impact of the pandemic. Significant changes have occurred in these supports over time without noticeable change in the inflationary trends (Ferguson and Storm, 2023, p. 12). They also emphasized that various supply-side changes, such as import prices, energy prices, and corporate profit margins, have contributed significantly to the emergence of inflation, but together, they do not explain the significant change in inflation convincingly (Ferguson and Storm, 2023, pp. 13-15.). Although they refuted that the economic policy response to the pandemic was behind the re-emergence of inflation in the US, they also noted that the effects of the pandemic on global trade may have contributed to the emergence of inflation through various supply shocks.

All these considerations have extraordinary importance in choosing the policy mix suitable to cope with inflation because traditional monetary policy interventions such as drastic interest rate hikes can only have a limited effects on mitigating the impact of external and erratic supply shocks, and even this limited effect could be achieved at an extremely high cost. The recession that arises because of increased interest rates often causes more damage than the inflation itself.

1.2. NEED FOR A NEW APPROACH IN ASSESSING CURRENT INFLATIONARY TENDENCIES

In 2021, the accelerated inflation set new forty-year records in both the USA and European Union countries. In exploring the causal factors for this phenomenon, some views emphasize demand-side factors, namely the Covid-19 restrictions, followed by the surge in consumer demand after their easing (especially in the USA), and rapid price increases induced by nominal wage growth. However, empirical data do not support an excessive increase in aggregate demand in the latter case. The European Commission's report on labor market and wage trends (European Commission, 2022) noted that the 4% nominal income increase in 2021 exceeded the average for the years 2013-2019 by 1.9 percentage points, but overall wage growth remained subdued, while real wages decreased significantly in both 2022 and 2023. According to the ILO (2022) report, global real wages decreased by 0.9% in the first half of 2022, except for China, which saw a decrease of 1.4%, a phenomenon that has not occurred since 2008. Prior to Covid, there was a 1-2% real wage increase in the European Union, which disappeared in 2021, and in the first half of 2022, a 2.4% decrease was observed. In Eastern Europe, the previously relatively high 3.3% real wage increase was followed by a similarly significant negative change during this period. After millions of low-wage workers lost their jobs in the US and Canada due to Covid-19, real wage growth increased by 4.3% in 2020, but then decreased to zero in the following year and shrank by 3.2% in the first half of last year. According to Stiglitz and Baker (2022), the fear of wage-price spiral is unfounded, as nominal wage growth in the US slowed from 6% in May 2022 (annualized based on three-month averages) to 4.4%.

Others mentioned that the measures restricting the movement of people introduced during the pandemic caused disruptions in global supply chains, creating problems with bottlenecks (such as chip shortages) in specific affected sectors, which fueled inflation from the supply side. Stiglitz and Regmi (2022) identified five main factors related to this. The world market energy and food price increases, accelerated by the Russian-Ukrainian war, contributed

2.9 percentage points to the US inflation rate of 7.7% measured in October 2022, while energy prices were more deflationary before the pandemic. The increase in prices of other essential products was also significant (especially for cars and parts, as well as freight transportation). Due to supply problems in specific sectors, demand is growing faster for substitute products than for products with oversupply, as nominal prices are downward inflexible, so this also has a price-increasing effect. Increased rental prices for housing (depending on location and property type) accounted for 0.6 percentage points of the October inflation data. The fifth factor can be attributed to the market power of companies, namely that they increased their prices more than their costs.

Stiglitz and Regmi (2022, p. 40) noted, that in the United States between 1960 and 1980, the average corporate profit rate exceeded marginal costs by 26%, and it continued to increase at a slow pace thereafter. The average profit rate in 2021 was 72% higher than wage cost increases. Lapavitsas et al. (2022) argue that the inflation is not explained by the wage-price spiral, but rather by excessive profit growth. In the UK, from October 2021, 60% of price increases can be attributed to the increase in corporate profits, while wage growth contributed only 8%. Nersisyan and Wray (2022) cited Matt Stoller's (2021) survey, which states that in the United States, 60% of the inflation can be attributed to the growing corporate profits. This is estimated to cost an average American $2,126 annually. According to the latest findings by Glover et al. (2023), profit rate growth in the US contributed more than 50% to inflation in 2021, which was significantly higher than in the previous decade. We believe that in the current inflationary dynamics companies pricing power may play an important role. We follow some suggestions in the literature focusing on the US and often refereeing to the current inflationary period as “greedflation”, indicating that companies are able to increase their profit share by using (misusing) their pricing power (Weber – Wasner, 2023). The term is widely used see for example Chassany (2023), who published an article in the Financial Times. The oil industry is an outstanding example for that, but we may be facing a wider trend in this respect.

In our analysis, we examine the inflationary consequences of corporate profit growth. We apply the methodology of the profit rate survey conducted by Konczal and Lusiani (2022) for US corporations to Hungarian businesses, and explore the relationships between prices, corporate profitability, and market power similarly to their approach.

1.3. ESTIMATING THE MARKET PREMIUM (ALTERNATIVE METHODS)

Konczal and Lusiani (2022) examined market premiums in the United States between 1955 and 2021. In their study, they used an upgraded version of De Loecker et al.'s (2020) methodology, which interpreted market premiums as the ratio of sales to the cost of goods sold (COGS), with certain corrections. The authors investigated three aspects: the relationship between company size and market premiums, the movement of market premiums across industries, and the predictive factors influencing market premiums in 2021.
The American example showed that, despite the pandemic, market premiums calculated using De Loecker et al.'s (2020) methodology increased significantly. Companies with the highest margins in the past experienced the greatest increase in premiums included the financial sector, the oil industry, and the real estate market experiencing the highest price increases from an industry perspective.

We adopted De Loecker et al.'s (2020) and Konczal and Lusiani (2022) methodology to a Hungarian data set and tested whether companies used their market power in their pricing policies, or whether their higher profit expectations contributed to inflationary effects.
In this context, we assumed that increasing profitability of companies may have contributed to

the inflationary pressures since 2021.

The sample we examined came from the Orbis database and included companies that submitted annual reports in Hungary between 2013 and 2021. We provided the criteria based on the 2000 Act CXXXVII, which states that the revenue should exceed HUF 2.4 billion, or the balance sheet total should be larger than HUF 1.2 billion, or the number of employees should exceed 50, with at least 2 of these criteria being met each year. We used panel analysis for our investigation, which means we only considered companies with data available for every year. In total, we analyzed data of 1,987 companies. The sample cannot be considered representative, but it covers a significant proportion of companies submitting annual reports.

The variables we examined were as follows:

- Margin (Sales/COGS)
- EBITDA margin (Operating profit including depreciation / Sales)

The period between 2014 and 2021 was covered in these calculations.

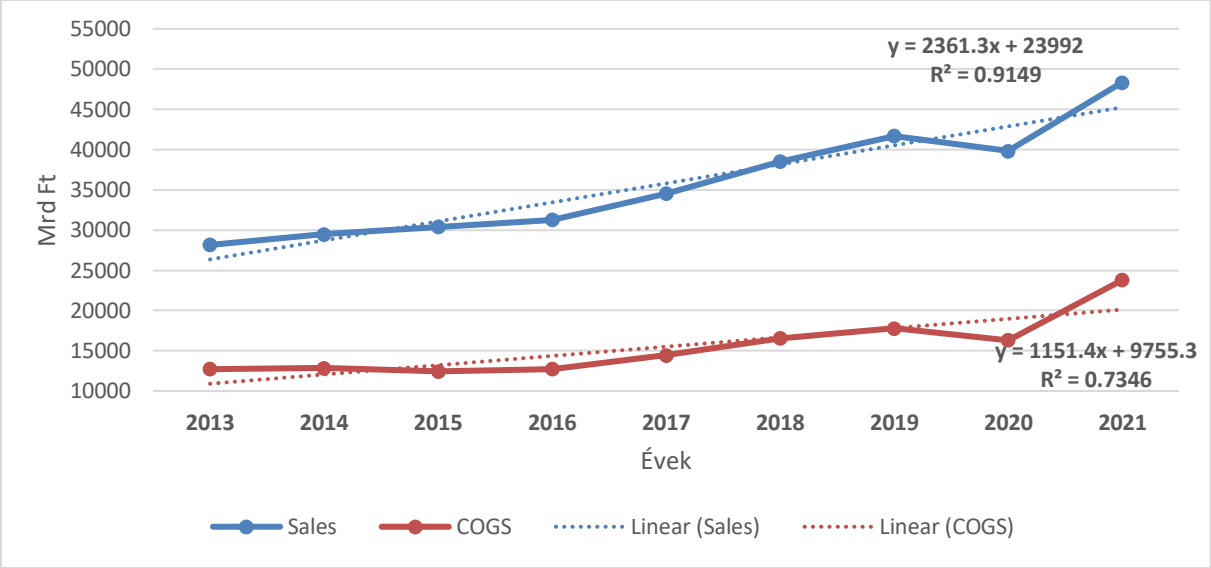
We conducted descriptive statistical analyses, trend calculations, and variance analyses, the latter by industry segments, with the variables examined. We checked for explanatory factors for changes in the EBITDA margins by using regression analysis.

1.4. RESULTS

1.4.1. TOTAL REVENUES (SALES) AND COST OF GOODS SOLD (COGS)

We first look at the tendencies observed in the aggregate sample total of the revenue (Sales) and the cost of goods sold (COGS) in the period of 2013 and 2021, with a sample size of 1,987. Figure 1 shows that the growth rate of the revenue significantly surpassed of the growth rate of cost of goods sold during the period of 2014-2016, when the economy was in recession. This trend changed during the period of 2017-2019, when the cost of goods sold grew at a higher rate than the sales revenue. In 2020, the growth rate of both variables declined due to the pandemic, and in 2021, the growth rate of the cost of goods sold significantly surpassed that of the revenue. This observation is supported by the trendline equation of the cost of goods sold, which has a lower R^2 than the revenue due to the significantly increased growth in the last year. However, these growth rates may be misleading, as shown in Figure 1, where the "gap" between the revenue and the cost of goods sold has been increasing in the period of 2016-2019 and in 2021. The ratio of the two variables reached its highest value in 2021. Although Konczal and Lusiani (2022) and De Loecker et al (2020) mainly focused on the cost of goods sold in their analyses, in the case of Hungarian data, the material costs and services consumed in the material-type cost structure should be considered more important. However, the trends in material costs and services consumed are consistent with those of the cost of goods sold. In this regard, the domestic trends are like those observed in the United States.

1. Figure Total revenues (Sales) and total cost of goods sold (COGS)
(Sample N=1,987, period 2013-2021)

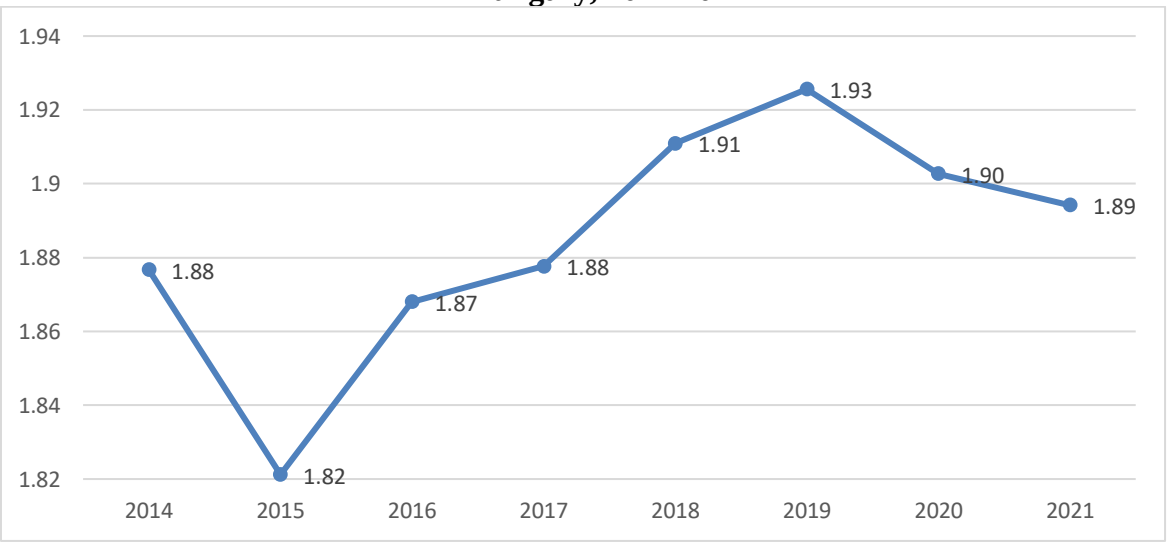


Source: Based on data from Orbis (2023)

1.4.2. AVERAGE VALUES OF THE RATIO OF SALES REVENUE TO COST OF GOODS SOLD (COGS)

The average value of the ratio of sales and cost of goods sold (COGS) is presented in Figure 2. This ratio in the sample dynamically increased between 2015 and 2019, but the growing trend was interrupted by the pandemic, and this trend continued in 2021 as well. Based on this, it can be concluded that the average markup calculated using the methodology of De Loecker et al. (2020) does not show the dynamic expansion observed in the United States between 2020 and 2021 in Hungary. In fact, the previous upward trend turned into a decrease, unlike in the US.

2. Figure The average value of the ratio of sales and the cost of goods sold (COGS) Hungary, 2014-2021

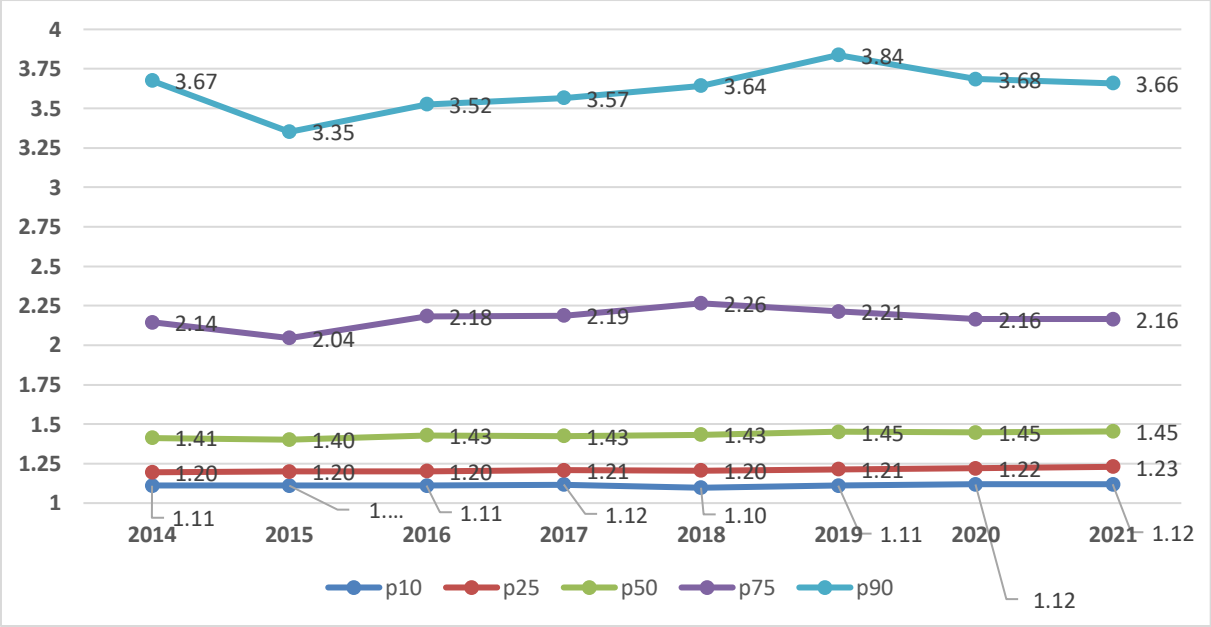


Source: Based on data from Orbis (2023), N=1987 observation.

1.4.3. TENDENCIES OF THE RATIOS IN THE PERCENTILE GROUPING OF THE SAMPLE

De Loecker et al. (2020) found that the markups significantly increased from 2015, and this growth mainly affected companies with the highest markups, identified by the upper percentile (p90). Their studies also found that the highest value was reached in 2021 in all quartiles and percentiles of the sample companies, explaining the phenomenon of market power. Figure 3 presents the result for Hungary in the different groups (percentiles) of companies.

3. Figure Markups in the different percentile segments of the Hungarian sample



Source: Based on data from Orbis (2023), N=1,987 observation.

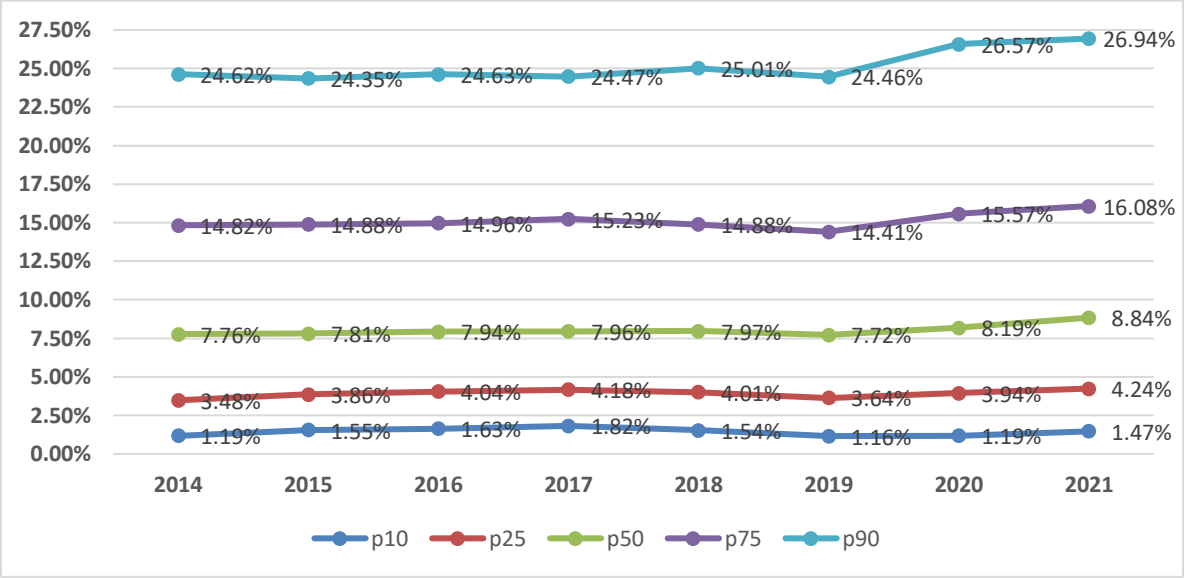
In contrast with the phenomenon observed in the US sample we found that in Hungary markups fell in segments above the median (p75 and p90) due to the pandemic and stagnated at the median. Only a slight increase in markups can be observed in segments below the median (p10 and p25) during the entire period examined. The reason for this may be that the cost of goods sold (COGS) increased in volume more than the companies could pass it through their sales revenue. Since the presence of COGS is quite sector-specific, mainly occurring in the commercial sector, it can be inferred that sectoral characteristics may have influenced this factor.

1.4.4. EBITDA MARGINS IN DIFFERENT SEGMENTS OF THE ECONOMY

In the Hungarian sample for the period examined we found no significant increase in the sales to cost of goods sold markups in the years after the pandemic but looking at total operating level profit margin (EBITDA/Sales) we could find evidence for the increased pricing power.

Using the total operating profit means that, in addition to COGS, it also includes all other operating-level costs and investments, regardless of amortization and other specifics of the accounting structure. The EBITDA margin, or profitability ratio, though it is seldom used in the Hungarian practice, but it is an appropriate measure of operating-level profitability. EBITDA represents the operating-business result that is not adjusted by amortization, divided by sales revenues. This alternative differs from the sales/COGS margin used by Konczal and Lusiani (2022).

4. Figure EBITDA margin in different segments (percentiles) of the Hungarian economy (2014 – 2021)



Source: Own calculations using Orbis (2023) database. N=1,987.

The EBITDA margin has been on an upward trend, and increased significantly even during the pandemic years, reaching record levels in several segments. This was true for all segments, so in this regard, the most successful year in the examined time period was 2021. This fact confirms similar tendencies for the pricing power like the trends observed in the US market, namely that companies used their market power to increase prices to achieve higher profits, even in the lowest profitability segments. This indicates that increasing corporate profit was also an important factor in the inflationary dynamics in Hungary.

We tested the sectoral characteristics by comparing the changes in EBITDA margins between 2021 and 2020, 2021-2020, and between the average values of 2021 and 2014-2019. For the latter variables, we followed the approach proposed by Konczal and Lusiani (2022), where we subtracted the values related to different years from each other to obtain the difference between the average values of 2021 and 2020 and between 2021 and 2014-2019. The conditions for the F-test were met, and the Levene statistic exceeded the critical value for all variables, indicated by the significant F-test values in Table 1.

1. Table Statistical tests confirming the significance of our results.

ANOVA		Sum of Squares	Mean Square	F	Sig.
Marg_EBITDA21	Between Groups	21,373	1,257	3,324	**<,001**
	Within Groups	744,732	0,378		
	Total	766,105			
Marg_EBITDA20	Between Groups	31,51	1,854	7,347	**<,001**
	Within Groups	496,763	0,252		
	Total	528,274			
dEBITDAmarg2120	Between Groups	18,239	1,073	6,306	**<,001**
	Within Groups	334,998	0,17		
	Total	353,237			
dEBITDA,arg21avg1419	Between Groups	19,387	1,14	3,344	**<,001**
	Within Groups	671,539	0,341		
	Total	690,926			

Source: Own calculations using Orbis (2023) database. N=1,987.

CONCLUSIONS

In the Hungarian economy EBITDA margin shows some increses, indicating an increase in the profitability of companies, which may generate inflationary effects.
This is due to the aggregated revenue growth in the sample following the first year of the pandemic.
The EBITDA margin increased in most sectors of the economy, but there was a significant decrease in the electricity sector in both pandemic years. This may explain the drastic price increase in 2022 when there opened an opportunity to increase prices.
Our research proved that the significant increase in EBITDA margin in 2021 and the gradual increase in revenues could have significantly contributed to inflation in 2022-2023. The explosive rise in energy prices was influenced by both external factors as well as the increasing EBITDA margin of the sector.

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Social influences of economic decision making: an identity economics approach

Dr. László Tóth[31], Kende Rados[32]
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Abstract
People make economic decisions not on a purely rational basis but driven by an identity of who they are or desire to become, through motivations and norms. These motivations cause decisions made, to be biased, instead of being based on a logical analysis of all accessible information. Thus, the emerging field of identity economics examines psychological factors to enhance our understanding of the decision-making process of economic actors. Our paper describes how utilizing the concept of social identity as part of identity economics can provide an explanation for the motivation-driven decision-making. We illustrate through case studies how individuals change their decisions based on which dimension of their social identities are salient, influencing their motivations through which social group they are members of or potentially want to belong to at the moment of decision-making. Additionally, there is also the issue of the individual's outlook of the future as a factor of behavior, how they perceive their identity in the future in terms of emotions, determination and their vision of the future. Further research in the field of identity economics will contribute to a more accurate understanding of economic decision-making behavior, since the mainstream economics approach and current alternative approaches are limited in their abilities to fully explain human economic behavior.

Keywords**:** identity economics, social identity, decision-making, transaction cost, social environment

> "Economists view economic actors as self-interested - And when the definition of the self changes, so does self-interest" (Shayo, 2020, p. 356.).

INTRODUCTION

Would anybody give more tips while on a date or when they are dining with their business clients as opposed to when they dine alone? According to empirical research, (Conlin, Lynn and O'Donoghue, 2003) tipping behavior depends on internalized social norms and thus such behavior varies across cultures and across social settings, such as who the people are around us. But why would anyone tip a waitress differently dependent on who is joining them for a meal

[31] BBS FIMB Department of International Economics, toth.laszlo@uni-bge.hu
[32] Independent Researcher, radoskende@gmail.com

in a restaurant? Attempting to answer such questions calls for the inclusion of the social environment, as an explanatory factor into our analysis of economic decision making. In this paper, we will show the newly emerging field of *identity economics* and how it can help us linking the internal (cognitive) world of the decision maker with the social environment and its influence on the economics actors' behavior. The aim of this short essay is to highlight a possible direction that might foretell a conceivable future development path of economics as a science.

A brief history

As early as the late 19th century, Veblen (1899) pointed out the peculiar behavior observed in the newly forming consumer society, where the members of the so-called leisure class, with the ability to accumulate disposable income, would engage in conspicuous consumption. Veblen emphasized that people are willing to spend resources to enhance or to maintain their social standing or status. Accordingly, it seems that people's economic choices are greatly influenced by who they are or who they desire to become. Of course, Veblen's observation was only one of the first signs of realizing the socially embedded nature of economic decisions.

It is well known that models of mainstream economics consider human beings as rational individuals, who maximize their own utilities without considering other people's payoffs. This restrictive view of economic decision makers is based on the homo economicus model. According to this portrayal of economic agents, economic decisions are made by the individual agent themself, without considering the exchange environment and its changes at all. In other words, economic decisions seem to be made in a "vacuum". Such an approach has been criticized by many from outside of economics and from within as well.

Behavioral economics was developed to challenge the unrealistic assumptions of rational choice and expected utility theories by pointing out that the erroneous decisions often observed when studying economic agents' behavior cannot be considered as simple random instances of irrationality. Behavioral economics was able to establish that there is a pattern in our irrational behavior. These advances were greatly influenced by the findings of cognitive psychology. However, cognitive psychology itself also mainly focuses on internal processes, while excluding the consideration of the influence of external factors on our economic decisions.

In economics, another school of thought has developed, alongside with behavioral economics, which emphasizes the role of the external environment and the embeddedness of economic transactions. This stream of research has united under the rubric of institutional economics. Researchers of institutional economics claim that to properly analyze economics transactions, we need to recognize the importance of institutions, understood as the "*rules of the game*" (North, 1992). According to institutionalists, both formal and informal rules can significantly influence economics outcomes. Only by describing and analyzing the institutional environment, can we truly understand economics agents' behavior.

Clearly, both behavioral economics, with its focus in the internal cognitive processes, and institutional economics, with its emphasis on the external environment, raise valid claims and concerns about the traditional, mainstream approach of economics. From this observation, the question arises: Can we combine or link these approaches without overcomplicating our analysis? In other words, in what direction will economics as a science develop in the future? Will it remain within the confines of mainstream economics and its methodological approach? Will one of the newer schools steer economics towards new directions and even new methodological approaches? In our paper, we will call attention to a relatively new approach, namely: *identity economics*, which we believe will be able to link the internal world of the decision maker with the external environment, while paving the way for a new direction in economics for the future.

The aim of our paper is not to enumerate the possible directions of the future

development of economics as a science, but to outline one of a likely direction, as we see it now. In our current work, we set out to introduce and review some of the main approaches to identity economics, and through the description of some notable empirical cases we plan to establish the rational for considering this approach as a valid alternative to current approaches.

Since identity economics is a relatively new field, there is no unified theory or coherent literature present, hence our paper will begin by reviewing the most important approaches to the topic. Such a review is important, as it is apparent that these attempts to include identity into economic analysis are very convoluted. As it will be shown, this area of research is strongly characterized by diverging paths, lack of attempt of building on each other's work, and no coherent definitional basis for the basic concepts. Yet, the review could be valued as an enumeration of diverging approaches within a new field that in the future might lead to a synthesis, resulting in a coherent field or school.

1.1. REVIEW OF THEORETICAL APPROACHES TO IDENTITY ECONOMICS

In this section, we will provide a description of the main approaches to identity economics. We are beginning our review with the works of George Akerlof and Rachel Kranton, who are credited with bringing identity economics to the forefront of attention.

Akerlof and Kranton – identity as part of an individual's utility function

Identity economics introduces psychological and sociological concepts as factors which influence how individuals make economic decisions. Akerlof and Kranton (2000) introduce the person's identity or sense of self – who they are and who they want to be – into economics. The new viewpoint sees a person not as a singular individual without connections to the environment, but as a member of society. They argue that the rational utility maximization theory is inadequate to accurately explain how individuals make economic decisions. To remedy the problem, a new utility function was developed to incorporate social identity as an extension.

In the model, a person's sense of self determines how they should behave, dependent on the associated social categories. Social difference is an important factor, which relates to how a person answers the question of who they want to be. Salient identity can provoke detrimental, non-utility maximizer behavior, with the goal of conforming to a norm or to salve a damaged identity. Gender is one such aspect of identity which illustrates; how in a society, the assigned identity of a "man" or a "woman" has social norms and ideal physical attributes associated to it, that individuals strive to conform to. Violating the criteria generates negative emotions like anxiety and discomfort, both in the person and in others.

The authors also discuss externalities stemming from social identity. As an example, they argue that, from a social expectations point of view, dresses are associated with femininity and men are not supposed to wear them. If a man wears a dress, it causes negative externalities for other men, whose identities are threatened by the act, causing further externalities due to responses from other men. Overall, the authors consider the choice of identity to be the most important economic decision to be made. That is, a person chooses who they want to be, whether consciously or unconsciously. There are limitations to this choice, which alter the person's wellbeing as influenced and dictated by the social environment.

Akerlof and Kranton (2010) further elaborate on their concept of identity economics by detailing that individuals value goods depending on the relational proximity to their social identities. Goods, compatible with the salient identity, give positive utility when acquired, while unideal goods, unsupported by the effective social norms, are avoided due to their negative association with utility. For example, smoking in the 20th century was an encouraged, socially

acceptable activity for men, while female smokers were looked down upon. These social norms changed when media campaigns started to appear, showing women partaking in smoking with positive connotations. The change of the media portrayal, had a behavioral effect, where women started striving to fit the new social norms by smoking alongside men. In the socially unaccepted period, a woman smoking would incur a loss in identity utility, whereas, she would gain identity utility from smoking post social norm shift.

Additionally, the authors argue that identity economics is also applicable to the economics of organizations. There is a positive relationship between work effort and remuneration, which is complicated by the existence of social categories. In this context there are the in-group members, those who identify with the values of the organization, and the out-group members who do not. The membership in these groups determines whether utility is gained or lost by exerting work-related effort. In-group members gain utility by putting in work to do their job to the best of their abilities, while out-group members lose utility by having to work too hard. In order to create an equal utility environment within the workforce, insiders would need to be paid less and outsiders paid more. The costs associated can be reduced by converting outsiders into insiders through changing their intrinsic motivations.

Education is another area where social identity is present and influences behavior. As an example, a student who only gets accepted into a university that was last on their list might not be enthusiastic about studying there, and as such have a low desire to conform to the requirements and the norms associated with it. This behavior would be demotivating, leading to low performance and, potentially, self-destructive behavior, wasting the opportunity to study and learn. This student would be considered as an outsider, who loses utility from doing school work.

On the other hand, a student who gets into their most desirable university would most likely be very enthusiastic about studying there, and would adopt the school's norms. In this case, that person would exhibit positive behavior, both for themselves and for the other people sharing the social identity. As the authors argue, the best schooling is where the student wants to be a student. Students identifying with the university and having the salient identity of being a student of the given university, directly correlates with the social status of the professors, as motivational professors are seen as successful, which success is reflected by the student's good academic performance. The enthusiastic student would be considered as an insider, who gains utility from doing school work with care. Schools can also influence students to become insiders. Putting in effort and earning academic achievements are the social norms associated with the students, meaning that students who conform to these standards are more likely to identify with the insider social group to gain utility instead of losing it.

In the job market, identity economics explains how gender segregation, in different jobs, is influenced by what jobs are socially expected of which gender. The segregation can be reduced by changing the responsible social norms to make it accepted and encouraged for both genders to take the jobs they want to, as opposed to what is acceptable for them. Racial differences are similarly affected in the job market, where identity dictates how different groups are viewed in terms of working or non-working. A discriminated-against minority would be disadvantaged in the insider working group as they are not expected to be there. Thus, if that person remains an outsider but also works, they would lose utility over not working. To change this issue, the insider identity needs to be changed to accommodate the racial groups eliminating utility loss.

Amatya Sen – identity as the basis of conflict

Sen (2007) looks at social identity from the conflict-generating perspective; how different salient identities and social groups can clash. Identity is formed based on a sense of history or cultural affiliation towards the members. This identity can be inclusive, but can also exclude others who do not share the group's values and cultural ties. Although an individual can have

multiple identities, a strong bias towards one of them can lead to conflict and neglect of the others. From Sen's example, there is a person who is a Hutu, a laborer, from Kigali, a Rwandan, an African and a human being. These are all identities the person has, but not all are salient at once. That person can be persuaded to feel strongly about the identity of being a Hutu, who are hostile to Tutsis, an out-group, at the detriment of other possessed identities. They would conflict with each other, even though they have more social groups in common with the other as both being from Kigali, being Rwandan, African, laborers, and human beings.

The author argues that culture and communities have an identity fostering effect on group members that encourages a singular view on group membership, instead of embracing heterogeneity. This has the inherent effect on individuals to be more susceptible to conflict with other groups due to the focus differences, even if they share many common traits and cultural ties. Sen (2007) makes a distinction of two ways how cultural diversity exists. On the one hand, there is a view of society in a federation that prioritizes different communities and religions as separate groups under a collective, such as a nation. This view is criticized as conflict generating. On the other hand, there is an inclusionary multiculturalism where there is freedom of choice and action. Overall, encouragement is needed for freedom of choice and reason in regards to what groups to be members of, while it is important to be critical of historical and cultural fundamentalist influences which lead to emphasizing the differences as opposed to the similarities of the groups.

Bénabou and Tirole – identity as the basis of morality

Bénabou and Tirole (2011) argue that the existence of the economic man is disproven because of how people tend to behave morally even in interactions where their identity is hidden, with no concern for what others think about their behavior. However, what replaces the model is not clear, because, when framed differently, using weak arguments, morally right behavior can change to selfish behavior. The authors develop a model of moral behavior, which seeks to explain how moral identity influences decision making. On what they call the "demand side" are aspects that drive an individual to make a decision, these fulfill utility expected from economic or social assets, self-esteem increases, or a moral sense preventing or facilitating certain decisions. On the "supply side", there are the identity investments, which are derived from the notion that the individual is not aware of all of their motivations, they judge themselves, or their own identity, by their own actions. This provides a dilemma where they need to factor in how each decision would reflect on them from a moral viewpoint and whether it would portray them in a positive or negative way.

The behavior of morality is explained by arguing that individuals are not in possession of all available information about themselves. This way, individuals are likely to exercise behavior that is aimed at improving their identity and exploring their deep preferences of generosity, loyalty and faith. They can be affected by subtle changes in salience regarding cues and reminders of personal responsibility. These investments in self-exploration are dependent on how strongly a person feels about their identity, influenced by previous conclusions of information gathering. If a person has a weak connection to their identity, manipulations to that identity can create an effect of being more receptive to changing their identity towards the manipulation. Conversely, a person with a strong sense of identity would be firmer about staying true to their stance and not be as easily influenced by manipulations.

The identity preferences of individuals are also linked to others in social groups, which influence what actions are acceptable, based on whether they conform to or deviate from norms and morals. The behavior of in-group members also has an impact on identity, as they are in a shared group due to shared values. However, if the group members commit actions that are in violation of a group's standards, the existing identity of the individual or the future investments in it will lose value. On the other hand, a deviant action by the individual would cause other in-group members' actions to now be seen as threatening to the individual's identity. The same

agent might act selfishly or selflessly depending on the current situation and how they relate to the individual's values, that is, if there is a way to frame a choice as being compatible with the desired identity an otherwise immoral choice can be seen as the right choice.

The model also offers an explanation for why people make escalating commitments, which are when the marginal benefits of continuous investment are too small to rationally justify. To explain it, take as an example the accumulation of wealth by means of working. A person might work because they see the accumulation of wealth as the means to happiness and the advancement of social status. This can lead to overdoing it to such a degree where the person continues to work until late evening every day, minimizing their free time and doing it to the detriment of their own health. At that point, the marginal gains of wealth are rationally not worth the sacrifices involved, but investment in the identity taken too far causes an imbalance. This is further compounded by the effect of oppositional behaviors, where an investment into one identity, for example, a wealthy social status, would make investment in another identity, for example, a hobbyist climber, seems less desirable, further emphasizing the accumulation of wealth to the detriment of everything else.

Davis – introduction of the social individual

Davis (2011) argues that economic rationality needs a rethinking centered on the individual and identity. Human rationality is shaped by the informational structure of the environment, while the individual's identity is shaped by the social environment. This rethinking should be applied in the behavioral economics space too, as related research mostly neglects the explanatory study of the identity of individuals, instead focusing on mental processes that influence decision making. The focus on the heuristics and biases approach, along with prospect theory, (Kahneman and Tversky, 1979) and libertarian paternalism focusing on nudge interventions (Thaler and Sunstein, 2003) is pointed out as the line of research focused on mental processes, which treats the rationality of people and their individuality as separate issues. These approaches forego the issue of identity to focus on uncovering cognitive errors influencing judgement, processes and anomalies in decision making.

Additionally, Davis (2011) critiques Akerlof and Kranton's (2000) approach to identity economics as being too conservative about how it deals with transforming the atomistic individual into a social individual. The model shows a person with a collection of multiple, disunified selves, but fails to consolidate it into a realistic portrayal of a distinct single person with multiple selves. The atomistic individual conceptions can only treat individuals as distinct and independent based on their own identity characteristics. However, these identities are separate from each other, which makes the models unable to explain how these identities create a functional person who acts as a single agent, rather than separately acting selves.

The author argues that atomism, as a basis to explain social economic decision making, is not the right approach, as it ignores the relationships between individuals. As such, further research should focus on this link between individuals, which factors in the external environment and the social relationships. Individuals are distinct and independent because social interaction in the world works in an intertwined way, where individuals are influenced by their interactions with other social groups. This view is in opposition of the previous internal-focused models which assign identities to individuals in an abstracted, isolated way, not explaining the interplay between those identities to create the entirety of a person.

Garai – identity as relationship

Previous approaches to identity economics have taken an internal cultural-biological certainty point of view. For example, these identities include nationality, gender, religion, and race. This has resulted in an atomistic model of an individual who has multiple identities assigned to them, but in a disjointed way, not presenting an image of a coherent individual who is influenced by the social environment and relationships with others. Garai (2017) presents an

approach that shifts the focus for the internal environment to the external environment, with a social categorization-based identity point of view. In this theory, a person's social identity is influenced by relationships between individuals. This means that individuals are interconnected through their social interactions, which social groups they are members of, what the relationships are with other individuals and social groups, and the saliency of social identities regarding these relationships.

The internal sociological categories can be classified as mostly static attributes, in the same way a certain animal is a squirrel by nature. Meanwhile, Garai (2017) looks at identities as "historically generated". Instead of attributes, identities are classified as *relations* that develop and evolve over time, through various interactions between the individuals and their social groups. These relations are always expressed in regards to another relation. Conflict is possible, in these cases, and can be mediated by social categorization or the creation of a new, alternate category.

The interactions between the social groups, created by social categorization, are based on differences and similarities of the individuals' group memberships. To explain it, Garai (2017) provides an example about three individuals in the early 1930's Germany. All three individuals are German, which, in the internal categorization, is a common social group between them. However, there is the external context, which can modify this common relationship. In this example, the first person is a German proletarian. This assigns two social categories to the person, German and proletarian in equal measure. The second person is a German bourgeois. These two individuals share only the German social category, their second group membership is defined by difference instead of similarity. The third person is a German proletarian, who is also a Jew. In this person's case, German and proletarian are social groups they share with the first person, although, how the relationship will be classified depends on further external factors. If we consider the example's historical setting as a hostile political climate towards Jews, that hostility, an emphasized difference in social categorization, would take precedence over the other shared categories, causing them to be understated. Meanwhile the proletarian and bourgeois individuals would have their commonality getting emphasized in being both Germans acting for the benefit of the German leader, while their differences become insignificant.

This historically generated identity of the three individuals also has an impact on their economic transactions. The transaction costs between them change depending on the relationship of their currently salient social identities. In the example, if the Jewish proletarian person wanted to purchase a cabbage from the German proletarian, they would likely incur extra costs, due to the risks taken for conducting the transaction in opposition to the political system, and due to the hostilities driving up the price for the particular transaction. Meanwhile, from the perspective of the German proletarian, their social status is higher than the Jewish proletarian's, which drives their transaction costs down, to the detriment of the trading partner, whose transaction costs are rising, as other Germans are more likely to transact with the former than the latter partner.

Social actors, meaning individuals, groups, states, organizations, and other conglomerates are also willing to spend resources, including money, to increase their social status, thus enhancing their desired identities. This craving for social status elevation is not a function of equating utility value gained from the consumption of goods, but rather from the acquisition of the goods or the monetary transaction conducted and what they symbolize in terms of the specific social group membership attained or strengthened. This phenomenon may be rational, as the higher social status gained allows for the decrease of transaction costs, due to the social status difference between the transacting actors being greater leading to more a favorable position when competing for finite resources.

1.2. A REVIEW OF THE EMPIRICAL EVIDENCE

In this part of our paper, we set out to present a variety of empirically tested cases where social identity influences economic behavior. As we have shown above, there are several differing approaches to identity economics from a theoretical perspective, this lack of cohesion in the field will be further exposed by the various cases presented in the followings. However, the review of such studies will also help us to establish the validity of various possible methodologies when studying the phenomenon and show the importance and applicability of identity economics in various areas of economic behavior and in the studying of economic transactions.

Henkel and Zimpelmann (2022): Proud to Not Own Stocks: How Identity Shapes Financial Decisions

Financial decision making is influenced by identity, the perception of what individuals think about another social group, and how that affects their choices. A study, by Henkel and Zimpelmann (2022), uses large-scale survey data from the United States and the Netherlands to find what people's perceptions of stockholders as a social group are. The authors document that there is a widespread negative sentiment towards stockholders, in which case people view them as greedy, selfish and gambler-like individuals. In the paper, the authors develop a conceptual framework to explain the relationship between perceptions of stockholders and financial decision making.

In order to test the hypothesis, participants were presented with simple incentivized investment decisions, where the investments' association with the stock market is varied between subject groups. In one group, participants were endowed with $30 and given the choice to invest into the stock market as a risky option and a safe investment option not associated with the stock market. In the other group the same investment options were presented, but the wording was changed from stock market association to neutral terms. The experiments were repeated with obfuscated wording with switched groups to observe individuals' preference changes while avoiding consistency effects. The results show that using the stock market wording, 38% chose the risky option, while using the neutral wording, 52% chose the risky option, which means it is 27% less likely for a participant to choose the negatively associated option based on perception alone in otherwise financially identical situations.

Barasinska and Schäfer (2018): Gender Role Asymmetry and Stock Market Participation – Evidence from Four European Household Surveys

Social norms play an important role in financial decision making, aside from an individual's risk preferences. Barasinska and Schäfer (2018) published a study to measure how social norms associated with genders and the corresponding gender role prescriptions influence stock market participation in the four countries of Austria, Italy, the Netherlands and Spain. The gender roles are measured by household surveys, which indicate the socioeconomic characteristics and the degree of risk tolerance and stock investment volume and amount. Gender equality is also measured by the corresponding index for the studied countries. The Netherlands, Spain and Austria rank in the top-quarter, while Italy ranks in the bottom third for gender role prescriptions.

It is found that in Italy, the country with high gender role prescriptions, women's risk-taking behavior corresponds to the environment that expects them to not be active in financial markets. The data shows that while Italian women have higher risk tolerance levels, they under-invest in stock market instruments due to social norms and the social identity associated with them. Meanwhile in the other three measured countries with low gender role prescriptions, there is no significant effect of women foregoing stock investments below their reported risk tolerance levels. Additionally, it is found that regardless of the countries' gender role divergence, women who do invest into stocks hold the same portfolio share of investments in stocks as do their male counterparts. That is, the risky assets held in a portfolio are gender-independent. These findings suggest that social identity and the expected role of an individual

influence financial decision making.

Rao, et al. (2000): Embeddedness, Social Identity and Mobility: Why Firms Leave the NASDAQ and Join the New York Stock Exchange

The influence of social identity is applicable also to organizations, as they are led by individuals who possess ties to other organizations and their leaders. Rao, et al. (2000) found that organizations strive to maintain a positive social identity that depends on their relationships and memberships with formal and informal groups. The authors measured the migration of organization from the NASDAQ stock market to the New York Stock Exchange during the timeframe of 1987 to 1994. Group members receive discrepant cues about their social identity when an in-group member exits the in-group and joins an out-group. In the present case, the in-group is the NASDAQ stock market, and the out-group is the New York Stock Exchange. The affiliation and ties of an organization to the social group defectors influences the response, and how the social identities of the remaining in-group members change.

The organizations' social identity is derived from stock exchanges, where ties to in-group and out-group members influence the status of that social identity. It is found, through interviewing representatives of relevant organizations, that when an organization leaves the NASDAQ stock market in favor of the New York Stock Exchange, the remaining organization suffers adverse symbolic damage to its image. The NASDAQ Stock exchange is viewed as a high-growth environment, while the New York Stock Exchange represents organizations with established history and tradition. If an organization that has positive ties to a migrant organization, for example if a technology company from the same sector defects, a new stock market will be associated with the sector. The remaining company, within the previous stock market, would feel pressured to follow suit because its social identity is in peril, as it is no longer part of the sector-associated stock market. Meanwhile, if the remaining organizations possess strong ties to each other, they will negatively view the defectors and positively stereotype the in-group members, mitigating the discrepant cues and their negative effect on their social identity.

1.3. FUTURE RESEARCH AND CHALLENGES

On the theoretical progress

An individual becomes an economic agent by engaging in economics transactions with other agents. Hence, the inherent nature of economic action implies that it is embedded into the external environment that is made up of other individuals, who may or may not form various groups. This social environment and its effects, including the future outlook of individuals and its effects on social identity in the present have been largely missing in the analyses of mainstream economics. Even behavioral economics, a field that challenges the mainstream, based on human psychology, has only relatively recently arrived at the recognition that people exhibit social preferences (Fehr and Fischbacher, 2002). According to this approach, agents, when making decisions, care about other agents' payoffs or well-being. This observation was further expended by the introduction of the notion of social identity into economics, theorized by the above-mentioned notable authors.

Stemming from social psychology, the concept of social identity allows researchers to unite three streams of social scientific research, when applied to the analysis of economic transactions: economics, psychology and sociology. Social identity, as described above, can be viewed as an outcome of social interaction with others in society. Our identities will entail our group membership in various social categories, while at the same time limit our choices by ascribing what rules (i.e.: norms, conventions, morals etc.) we need to adhere to, in order to acquire or maintain a given group membership. According to identity economics, agents will dedicate resources to maintain, to acquire, or even to distance themselves from certain

categories of group membership.

By the ability of linking the social environment to individual cognition, identity economics, at least theoretically, makes a significant step towards a more unified view (from a social science perspective) of economics transactions, where we simultaneously consider the dynamic changes of our social environment with the rather static nature of our cognition. In this view, cognitive biases and heuristics, as uncovered by behavioral economists, may not lead to erroneous decisions, if the individual agent is able to match those decision shortcuts to the regularities of the social environment (Gigerenzer et al., 1999). A salient social identity dimension will direct the agent towards the acceptable behavior, set out by the group membership, entailed within the salient social identity dimension.

As the above review showed, there has been a considerable effort made to theoretically describe this process, to capture the dynamics of negotiating along various social identity dimensions. However, one must also recognize, from the main approaches, that when attempting to combine our understanding of the workings of the social identity concept, the biggest difficulty stems from matching these findings with the peculiar nature of mainstream economics methodology. Based on our review and analysis, we believe that one of the biggest difficulties will be adequately capturing the dynamic processes of social identity through the current, static economic modeling approach. Of course, one can conceive another theoretical development, as well. We could imagine a departure from the standard modelling methodology of economics towards the development of capturing this rather complex phenomena with a new approach, perhaps more in line with the experimental nature of social psychology.

On the empirical testing of identity economics

In the previous sections, we have established that the theoretical progress is uneven at best in the emerging field of identity economics. What makes it difficult to foretell the possible development paths of this approach is that, besides the theoretical difficulties apparent in the literature, the problems associated with empirical testing pose an even more difficult challenge to researchers. The relevant variables at play are numerous. Even in a laboratory social psychologists have a hard time designing experiments that meet the requirements of scientific rigor, while still capturing and isolating the mechanism associated with the individual's maneuverings around a multitude of social identity dimensions. This recognition predicts an increase in the complexities of experimental design.

Currently, there is only scattered empirical evidence in the literature that links the concept of social identity to various economics transactions, behavior, and applications. The current task is to design empirical tests, mainly laboratory tests, to further establish the validity of the theoretical approach of identity economics. However, in the future, a more coherent methodology should be developed with or without including current methodologies of mainstream economics and social psychology.

CONCLUSIONS

In this current essay, our goal was to introduce one of the possible development paths of economics, namely identity economics. We have reviewed the most notable theoretical approaches to this emerging field of study. We have arrived at the recognition that aside from the fact that among the authors of these prominent works in the literature there are 3 Noble-prize winning economists, this approach promises a possible linking of the external social environment (including the associated rules of the game through norms, conventions, morals, etc.) to individual cognition, an important future step sought by many researchers in social sciences.

Following the review of the main theoretical approaches, we introduced several

examples, with empirical evidence, on how social identity might influence economic behavior and decisions. With the description of such works, we aimed to show the variety of possible applications of the identity economics approach to economic transactions. Of course, when reviewing an emerging field, we expected to find a lack of systematic testing of the phenomenon or a lack of unified methodology. However, instead of looking at these as shortcomings of the approach, we consider it as a future opportunity to achieve the often-coveted goal of unifying social scientific approaches to economic transactions by recognizing their embedded nature into social interactions, and the individual's and social groups' emotional and deterministic look of the future as factors.

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