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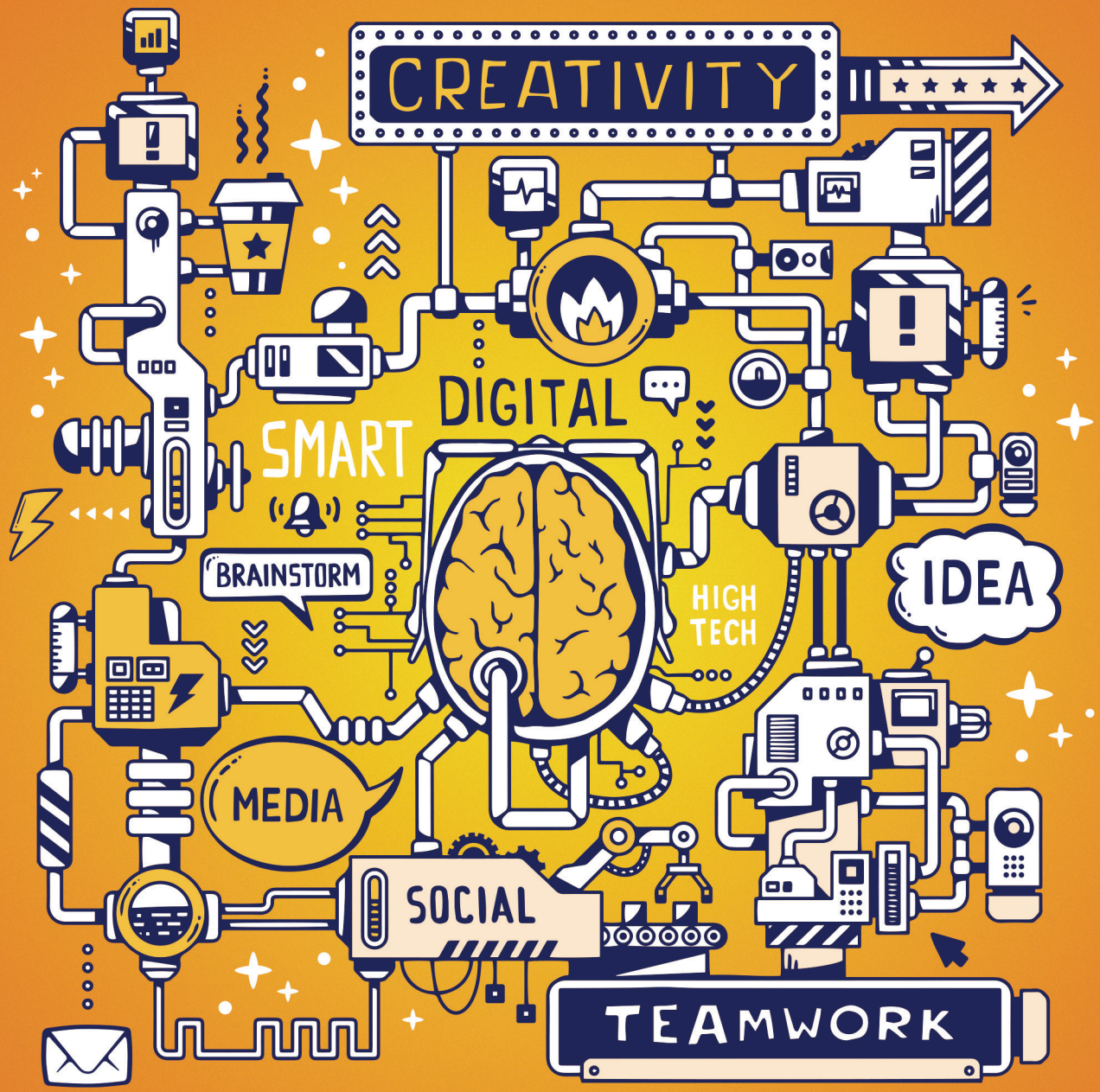

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Dear "e-mentor" readers,

I am delighted to share with you the newest collection of diversified papers illustrating the impact of new technologies on business and education. It is worth pointing out that in this issue we not only present the national perspective, but also that of various countries represented by our authors.

The part dedicated to readers primarily interested in pedagogy begins with an interview with Charles Dziuban – conducted by the former editor of "e-mentor" Maria Zając – analysing the role of adaptive learning as a means of decreasing inequity and improving the quality of education. The discussion on new trends is continued with an article regarding the impact of digitalisation on the development of e-learning. Readers can also find out about muted or silent videos as a tool for creative language learning and the relationship of teachers' sense of efficacy and their organisational commitment.

There are new trends in business and management related to the implementation of Artificial Intelligence, and in this issue readers may learn more about AI and its agenda for management sciences. Other current trends are still related to the consequences of the COVID-19 pandemic, with an interesting example coming from the automotive industry and referring to the business model transformation. The focus on new technologies does not exclude the interest in people and their wellbeing. In this context the PERMA model is discussed and – in another article – individuals' choices regarding tourism. Finally, two other issues are presented: the analysis of key productivity factors in one of the most innovative sectors - in drug discovery and development projects, and a discussion about the relation between companies' profit and the economic value added they deliver.

As mentioned before, in this issue we have a diversity of topics, as well as authors representing different backgrounds. The strategy of internationalisation supported by the Ministry of Education and Science (Poland) with granted funds (RCN/SP/0361/2021/1) has led to cooperation between "e-mentor" and the foreign organisers of scientific conferences. We have observed an increase in the number of manuscripts submitted and, as the current issue clearly illustrates - a growing number of authors affiliated at foreign institutions. Our further efforts are focused on boosting the quality of published articles, increasing international visibility, raising transparency of the editorial process, and modernising the website. I sincerely hope that the planned improvements will satisfy not only our readers, but also authors and reviewers.

At the same time, I would like to cordially invite you to co-create "e-mentor" with us by becoming a reviewer or by submitting articles for publication. "E-mentor" is an open-access journal available for free, both online and in printed form. All scientific papers are peer-reviewed and we provide free proof-reading of papers accepted for publication in our English issues. Every article gets an individual DOI registered in Crossref, and the journal is indexed in several global databases, including Web of Science ESCI and EBSCO. There is no publishing fee for the authors. Further details are available online at http://www.e-mentor.edu.pl/eng/page/8/Info_for_Authors. Should you have any questions concerning publications in "e-mentor", please contact the editorial team at redakcja@e-mentor.edu.pl.

Małgorzata Marchewka
Editor

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Charles Dziuban

Maria Zając

Adaptive learning as a means of decreasing inequity and improving the quality of education

Professor Charles Dziuban from the University of Central Florida, US, shares his expertise in adaptive learning and describes the conditions of its adoption in conversation with Maria Zając

M. Z.: Thank you, Chuck, for agreeing to talk about adaptive learning (AL). Could we start by clarifying what this term refers to? I mean, is it more the technical term used by computer scientists or a pedagogical concept for educators?

Ch. D.: That is a good question. I think the best answer is both. It represents both worlds. Certainly, adaptive learning is not new. We have known about it for many, many decades. An original paper written by John Carroll called A Model of School Learning[1] talked about that. And in that Carroll at Harvard developed a model is built around the notion that if one holds the amount of time that student is able to spend devoted to learning a topic, then her knowledge acquisition will become variable. If learning is the constant, how long they will be engaged in the learning activity will be variable. And interestingly enough, that is not the way universities are set up. In the United States, we put students in semesters that are limited in time, 16 weeks. Students enter a course, all spend a fixed time, so naturally, what they learn in that period is individually different. It depends on their aptitude, ability, motivation, commitment, and willingness to work hard. All of that affects what they learn. So, they come out of the course at different stages of knowledge, which is usually reflected in a final examination. But Carroll said that an effective school learning model should be the amount of time spent devoted to learning, divided by the time needed. Some students simply need more time than others. Some subjects we learn rapidly, some we do not, and need more time to master a topic. So that is the educational definition of adaptive learning.

We have known about adaptive learning for years. Benjamin Bloom wrote the Six Sigma paper that said: individual mentors working with students constitute the best instructional model. However, it has been too complicated and cumbersome. Teachers have never been able to implement an adaptive learning model because it is too costly. Now with the new technology platforms, like *Realizeit* and other platforms, we can make it work.

But the other thing is that adaptive learning really has all of the characteristics of a complex system. It is not only adaptive but interactive, diverse, and interconnected. So, what it is emerges into something entirely different. It is more than in some of the parts, that is, in a sense, what adaptive learning has become, and it is still emerging. It is kind of existential at the moment and developing its effectiveness, its difficulty, and its disappointments. All of those things are coming into play with adaptive learning. There is always this initial enthusiasm as if it is going to solve every problem and it never does. Then there is disenchantment with it. And now, we are in a stage where we are looking at it: how does this integrate into the educational system? How can it change it? How can it impact it? And how can we continue to use this and develop its relationship to learning outcomes and teaching, which is a topic we will discuss later in this interview. In a sense, Maria, it has all the characteristics Susan Lee Star called the boundary object. It is something that holds a community of practice together. It is weak, but is able to hold the

[1] Carroll, J. B. (1963). A Model of School Learning. *Teachers College Record*, *64*(8), 1–9. https://doi.org/10.1177/016146816306400801

community gets together, but they disagree on what it is. But if we go back to the individual constituencies, let us say physics or rhetoric, or chemistry, or mathematics, they know exactly what it is. They know what it is in their scientific, in their specific disciplines. We just have not come to a general term that we can accept. That is very important. Critical thinking is the same thing. Everybody loves critical thinking, but we have difficulties when trying to define it.

M. Z.: You mentioned that the interest is growing in the USA. Do you have any idea how big the interest in adaptive learning has become among school or university leaders? Or is it restricted only to people who are passionate about the idea?

Ch. D.: Again, I think it is both. There are people who absolutely believe that this is the way we should go. But some people are very suspicious of it. Think about this, Maria. If what I just said is true about being in a semester for a fixed time and learning is variable. If you want learning to be a constant, it blows the semester up.

If you go to administrators and say you can no longer have semesters that does not play well, because universities are rigidly fixed in their organization. So, it has great implications. It has the potential to unbundle a university, which is a source of tension. We will see how that develops. I seriously doubt if we are going to dismantle universities. But it should be fun to watch.

M. Z.: And what about learning analytics (LA)? I know you are involved in this subject as well – is LA indispensable for adaptive learning? Or can they exist separately?

Ch. D.: I think they are, once again, bound together. My thinking is that when one looks at the broad construct of adaptive learning, somehow analytics is a subset of it because clearly involved in adaptive learning is this continual assessment of at what stage the student is in the adaptation, where they need to be, in a continuing recycling. So, it is a continuous analytic process that goes on within the context of adaptive learning. But in the broader context analytics is the predictive component for students. For instance, analytics and business: what will they buy? Analytics and literature: what will they read? That is what is involved in analytics and also in education. Adaptive learning is somewhat different because it involves learning as well. But I think this is really the three-body problem. You know when Newton developed his principles of physics he did a marvelous job, and one of the things he showed was - when you had two bodies interacting with each other with their gravity, their trajectories are very predictable. When you add a third body, it is called the third-body problem, and it is unpredictable, and chaotic.

There is a great novel now, by Cixin Liu, a Chinese science fiction writer, called *The three-body problem*[2] about the land Trisolaris that had three suns which interact with each other, making their world chaotic.

And Newton is reported to have said to Haley, who introduced the notion of the three-body problem: you give me a headache. And I think what we have here is a three-body problem: analytics, adaptive learning and big data. And they all interact with each other, and it is creating kind of a chaotic problem. It causes friction in the educational system. Adaptive learning is about removing information friction. That is the problem students have. They have friction, getting information, getting knowledge. Universities often create friction for students. And so that three-body problem is something that we are facing, and that is what we are looking at in this notion of analytics, adaptive learning and big data. When we talked about the unbundled university, we created friction. What has happened to libraries? I do not know what is happening in Europe, but libraries have become unbundled here. Libraries are no more a place to which students have to come. They are outreach, they are electronic. They are platforms. We have in our library an automatic retrieval system where a student goes to an interface, asks for a book and a robot gets the book for them. They no longer wander the stacks, so things have become subsets of each other. I think we are smack dab in the middle of a three-body problem. That's where we are. Yes, I think it is chaos, in a good way.

M. Z.: Sounds interesting. I would tend to think that big data results from learning analytics. We analyze the learning process and get huge amount of data. Without learning analytics such data would not exist. In the educational context of course. So, I did not think that there are three different bodies.

Ch. D.: Yes, that is interesting. There is a great adage: data have no voice of their own, they never speak. And it is our job to responsibly select data, analyze it, and do the best we can with interpreting it. I have worked with big data my whole life. It is a mess. People want clear

[2] Cixin, L. (2016). *The three-body problem*. Macmillan (English Edition).

crisp data, but it never happens. Big data sets are excessively complex. I spend most of my time trying to clean up big data set and get the noise out of them because it causes friction. You have to separate the signal from the noise and that is very important. So, we have some responsibilities here. But big data has impacted what we have learned about traditional statistics. It has changed sampling, hypothesis testing and estimation to the machine learning, modeling and information technology. It has changed completely, for instance, what is the standard error meaning any longer – a statistical notion of a standard error when you have 10 million observations? It loses its meaning in the traditional context.

Why did we have statistics? Because we did not have the technology to deal with big data, but now we do have such technology. We have to integrate the two models in some way so they are all part of each other and interacting in a fascinating way.

M. Z.: Let us get back to adaptive learning. When we read the American papers about LA and AL, one gets the impression that it is mainly aimed at students being at "some sort of risk" – either because of being socially or economically disadvantaged or because of their professional duties, to mention the most common factors. Is that the correct assumption?

Ch. D.: I think it is context, Maria. What is the context you want to apply adaptive learning? In the United States of America, a tremendous inequity exists in our educational system. If you live in the United States in the lowest economic quartile, the chance of your going to and completing a college education is 12%. The odds against you are roughly 9 to 1. It is a horrible inequity. So yes. We want to apply adaptive learning in a context where we can level the playing field.

The other problem we have in the United States, which you do not have in Poland or generally in Europe, is accumulated college debt, which at the present time is 1.7 trillion dollars. If it were a GDP, a gross national product, it would be the ninth largest economy in the world, as published by the World Bank. That is the two-pronged problem we are facing. You do not face that in Poland because your higher education is free, but that creates other problems.

The context of adaptive learning so far has been trying to help students who are at risk, who are in poverty, but that is not the only application. We are back to the notion of: do you really need to spend four years in college? And the answer is no. You could ask me a question later on if students can accelerate through the university and I would say yes, of course they can. Now in the United States, there are many adults who want to get an education. They absolutely cannot afford to give up their lives and jobs and go to university. So, they do it online in adaptive learning formats where they have time for their own pace. They can acquire an education and still maintain their lifestyle. That is another application of it. No, it is not just for people at risk, but at the moment in the United States that is one of our real hopes. Students who are at risk do not have a very good chance of getting an education. That is not acceptable. The inequity in the United States is currently not good and it is getting worse. Those who have money are acquiring more money. Poverty is getting worse in this country. That is where we are.

M. Z.: But on the other hand, at least as far as I know, in the United States, you can earn enough money for a good living not having a university degree. Is that true?

Ch. D.: Oh, absolutely. There is no question about it. We have several programs where we work with students, and they can get a skill-related job in any number of fields and earn a wonderful living. The Wall Street Journal just published the poll, and for the first time in recorded history, the majority of Americans think that getting a college education is not worth it. Almost 60% of the population believes that the cost and difficulty of getting a college education are inhibiting problems. It happened for the first time in our history, but things are changing very, very rapidly. Given Covid and all that we have had to deal with in our universities and our public school system it has shown that the young generation of students is much less enthusiastic about getting a college education. We have always believed in education, and we still believe it is the way to a successful life, the road out of poverty.

I do not know how it is in Europe or in Poland, but those attitudes are paramount in the United States.

M. Z.: Well, in Poland there are no fees for studying at public universities, so the financial factor does not exist. However, we are also noticing a significant shift in attitudes towards higher education. For many years, there was a widespread belief, supported by official propaganda, that obtaining a diploma guaranteed a job, and thus a good life. The demand for higher education was so great that numerous non-public universities were established, especially in the 1990s and at the beginning of this century. Young people took up studies in two or three different fields, sometimes even at other universities - they collected diplomas believing they would help them get a better

job. However, employers quickly noticed that graduates lacked the necessary skills, and the situation turned upside down. When applying for a job, the essential requirement became practical skills and competencies preferably confirmed by experience already possessed, not certificates. So, students started working already while studying at the university. They do not want to "waste" time, I mean, to delay starting a professional career. Of course, this situation causes other significant problems, but that is another issue.

Ch. D.: Educational systems do have to adapt to the changing culture and what is happening in the world. And I think we are going to learn a great deal about what is involved in education. We will get to the role of teachers and what changes, but I think we are beginning to look at a global economy, a global educational system in the world. We are no longer nationalistic, although we have countries. The walls of the classroom are leaking, the classroom in an odd sense is disappearing.

I tell my faculty now, if you really think you teach a face-to-face course you do not. You do not even if you are in a classroom and close the door. Students talk to each other about you. They talk to the world about you. They are on social media talking about you, and I give my faculty examples. If you do not believe it, just go to YouTube and search drunk, terrible, stoned professor, search boring professor. There are hundreds of YouTube videos. The boundaries are gone. There are many people who can be perfectly productive, perfectly happy with their families and their lives without a university education.

M. Z.: And how do you think, at what stage of the adoption of AL we are now? In the US or globally.

Ch. D.: We are in the stage where we are over the initial euphoria. We have now abandoned the phase where we view adaptive learning as a universal solution No, it creates as many problems as other technologies do, and we are at the stage now of careful, reflective looking at what it is, what it is not, what it can do for us, and what it cannot. How will it reduce the learning friction for students? How will it reduce the teaching friction for teachers, and what problems will it create? It is like anything else in a complex system. We really do not know how it is going to ripple through the system. Many of the outcomes will be counterintuitive, and there will be unanticipated side effects that we have to deal with and accommodate.

We are beginning to look seriously at what this can do for us and what it cannot. We need to take it seriously. But now, it is all of us as responsible educators, to examine it carefully. Look at its good, at its bad, look at its ugly. And then make some conscious decisions about where we want to go. We cannot afford now to abandon it because it has great potential. But I think that is the stage we are in at the moment. We have been doing this for 4, 5, 6 years. It is like everything else. It is like the Gartner Hype Cycle. We are going to talk about ChatGPT later on - we are going to experience the same kind of phenomenon, that should not be abandoned because it has immense potential.

M. Z.: I asked this question because I remember, for instance, the research carried out by Peter Brusilovsky. I think about his papers published in the nineties last century or even earlier. So, it is more than 30 years now. I appreciate his work. But when I look at his papers and the research he presents there, I get the impression that there is no significant difference, in some sense, between those first works and where we are now. I remember the attempts of different LMS creators to individualize learning by giving the student the ability to create their own learning path. It has not changed much because, in my opinion, although I may be wrong, there are some systems which allow students to create their learning path but in many others the system decides instead of the students. In that sense, I do not see a big difference after 30 or 40 years, despite the instant development of technology. That is why I am just wondering if we, as scientists, researchers, and educators, have the chance to change it significantly in the nearest future.

Ch. D.: Well, Maria, there is an old adage, the more things change and more just stay the same. You know these ideas are not new. Very little is new. I think you raise a critical question: Are the students designing their own learning path? Or is the platform, technology, or pedagogical system designing their learning path? But that is a critical distinction. There is a huge difference between you doing it for students instead of them doing it for themselves. That is a critical issue. This is what we have encountered, and we encounter time and time again: I get the idea, but how do you put wheels on the idea? How do you make it operational? That is the problem. Well, there are platforms that do it, but it generates other problems, right?

M. Z.: I wonder, is it possible to use AL separately? I mean, without learning analytics and without a dedicated learning platform? In other words, can the teacher individually apply the idea of AL by adjusting the way (s)he teaches? Is it strictly combined with technology? Can we implement adaptive learning in f2f classes?

Well, you have partly answered that because you said that there are now no face-to-face classes, but is the learning platform indispensable for adaptive learning? What is necessary for me as a teacher to offer students adaptive learning?

Ch. D.: I am going back to the notion of friction. I think the critical question is how much friction a teacher can tolerate by doing this. Without some kind of technological support, there is a lot of friction and more than just a lot of work. If you consider even a small classroom with no technology, a teacher working at personalized learning for 30 individual students is overwhelmed. So, there must be a support mechanism for this to happen.

First, it depends on the teacher. And I think what it really involves is how much of the friction associated with adaptive learning can you remove to the point where there is a phase transition. A phase transition is when water turns to steam, or water turns to ice. What are the opportunity costs of doing adaptive learning within my instructional situation? If the costs are too great, I just cannot do it. But if the support mechanisms allow me to do it that I can go ahead. And I think that has to be almost an individual teacher's decision. Look at what is happening on the learning platforms like Blackboard, Canva, and others. They are working toward putting adaptive structures within their learning platforms. You do not have it in Moodle (I think), but Moodle is open source, so sooner or later, somebody will attempt to put adaptive learning structures within Moodle so that it will be available within the context of an LMS. Because, at least in my world, everybody uses LMS now.

M. Z.: What does adaptive learning mean to teachers? Provided we have access to the appropriate platform, does it still require a lot of effort and time from the teacher?

Ch. D.: No question about that. At the front end there is a tremendous amount of work in order to design a course that is adaptive. What is the old model of courses? You have your notes, you get in front of a class, and you lecture. That is the way we teach, we just talk. And now they want to interact with me, they want access to me. So it is an expanded role through my connectivity to students and in my interaction with them. You have to change your way of thinking about adaptivity and interaction, and learning. However, when you establish a classroom that is running adaptively, in some respects you can step back, but that is something where much of that activity is taken over by students, who can teach themselves. They can interact with themselves. They can do many activities like that. I guess the answer to your question is yes and no – at the beginning, it is a lot of work we have to really think about. What is this thing that is called an adaptive classroom? And what does it mean for me? And what does it mean for them? It has to do with this notion of a psychological contract. What is it I want from them? What is that they want from me, and I have to negotiate that. So yes, it changes everything.

M. Z.: So, what could be the motivation to apply adaptive learning in that context? What is the way to convince teachers to get involved in it? You say them, well, in the further perspective, you will have less work, but you have to put in a tremendous amount of effort at the beginning. How will they react? Will they step into that?

Ch. D.: Maria, what are you and I? We are teachers. We are born teachers. That is all that I was ever born to do. And I want to be a good teacher. I am so happy when things go well, and I am crushed when they do not go well. And lots of times, they do not go well. There is virtually no one that I know, who as a teacher goes into a class and says, today, I am going to do a poor job. Everybody goes in and says: I am going to try to do a good job in my class. I think we are all committed to that. And I think the way to convince teachers is: you can be better at your craft. You can do well; here are some tools that will help you. There will be some costs involved, but you will feel better about your profession. You will feel better about what you do. I think that is the way I go about it. I do not think you should shame them. I do not think you should cajole them. And I do not think you should expect everyone to do it. We have some excellent lecturers; we leave them alone. Let them do it. They are wonderful. Why would you have them change? There are some terrible lecturers, and we say, why do not you try this adaptive stuff? Maybe it will help you. Maybe that is the way it will play out. I think you need to convince them: we can help you become a better teacher. We can help you feel better about your craft. That is the way how I always do it, and they respond positively. Not all of them, most of them.

M. Z.: Let us think now about the role of instructional designers in that concept. I have read the article[3] about the Algebra course offered by UCF, which was described as adaptive – you and your colleagues have pointed out that more

[3] Dziuban, C. D., Moskal, P. D., Johnson, C., & Evans, D. (2017). Adaptive learning: A tale of two contexts. *Current Issues in Emerging eLearning*, 7(1), 42–70. https://scholarworks.umb.edu/ciee/vol7/iss1/4

advanced students can skip some pieces of information if they do not need them, while others make use of additional explanations. I am thinking about the instructional design concept of such a course. How to design those different ways of dealing with the course content and not to get lost?

Ch. D.: Yeah, it has tremendous implications for instruction designs, but is only one model. There are lots of models for learning as you know. For instance, deconstructionism, there are a lot of other ways.

M. Z.: Well, you can use this or this model, but anyway there must a general concept behind.

Ch. D.: I will give you our context on how we use it. Students here all have to take college algebra. In order to enter college algebra, you must pass an examination. If you do not pass the examination, you cannot register for college algebra. Instead, you must register for intermediate algebra, which is a non-credit-bearing course that reviews basic algebraic functions and concepts. It prepares students and once they pass intermediate algebra, they can then move on to college algebra and take the course which is required, credit-bearing. So now we have these two populations - those that can go into college algebra and those who cannot. The algebra instructor consolidated those two courses, put them together, designed in an adaptive learning platform *Realizeit* a continuous sequence of algebra skills that transverse intermediate algebra all the way to the advanced concepts in college algebra. This one unified thread of objectives and concepts, things to be learned, were sequenced. Then she integrated it into the adaptive learning platform with contexts for the word problems for the various disciplines, for business, rhetoric, English, education, medicine, engineering. Problems were all in the context of their individual disciplines because they come from all over the university. And then we started. So, what this allowed was those students that could go into college algebra went into college algebra and were evaluated by the platform. If someone understood the quadratic equation and passed an assessment, they did not need to review it. They could move on to the next one, the next one, and the next one. In the intermediate algebra course, as the student began to master these skills and demonstrate his or her mastery and did it rapidly at their own rate and pass an intermediate algebra course halfway through that "semester," they simply transferred to the adaptive college algebra course, and proceeded, at their own rate. And there is a large cohort of students who passed the intermediate algebra went to college algebra halfway through and completed the college algebra on time. Some students who started in college algebra needed more time, so the instructor arranged with the registrar to give those students who did not complete the course in the adaptive learning platform in college algebra four more weeks, an additional month to complete the course. So, this is how it all works together. It is no longer the idea of a course starting and stopping, it is this continuous learning thread, and it works. It can work in any discipline, although it requires a lot of work. But that is the implication for instructional design sequencing the topics.

Now, what some platforms will do, if you give them your syllabus and your objectives, they will integrate it for you. They will sequence them, not perfectly, but it will give you a good start. That is the implication that it can be done in any course. But you understand we are back to the unbundling. It takes a very special teacher and a very special instructional designer to do that.

M. Z.: Should we, therefore, conclude that as long as the unbundling of the university really happens, the broad adoption of adaptive learning may not be possible? That the prerequisite for applying the adaptive solutions, the total change of our approach to education, which is actually needed is not possible unless the real unbundling happens. But I do not know if it ever happens, because, as we both as the teachers know, the universities keep very strong to their tradition, their structure. I think there is a strong resistance among their faculty toward such changes.

Ch. D.: The truth is that if you confine adaptive learning to these things called semesters, there is a limited number of things you can do. There is a restricted capability within these boundaries. But removing defining boundaries can be stressful. I am in favor, but we must be realistic about how many degrees of freedom we can tolerate. Look, most of our growth is online. If you are online, what do you need buildings for? But here we have, multiple billions of dollars invested in university infrastructure. What are you going to do? Come on, you are in Krakow, right? Are you going to not use the buildings of the Jagiellonian University anymore? No, that is not going to happen. Imagine, it is one of the oldest universities in the world, it has been one of the great universities for literally hundreds and hundreds of years. How much of that tradition can you unbundle? You know what I am saying...

Think about you, you were the editor of the journal for years, and the same things are happening in that area. It is all unbundling. It

is all happening virtually. In our early careers we wrote a manuscript and submitted it. Some of those journals still want their information hidden behind a paywall. How long is that going to last?

M. Z.: Let us finish with this last question. Last but not least – since November 2022, there has been a lot of noise around ChatGPT and its capabilities to replace humans in many educational tasks. In fact, we know that many other similar tools are already in use. How do you think – can ChatGPT and its counterparts support adaptive learning? Can we use those tools to better adjust the learning experience to students' needs and expectations? If yes, then how?

Ch. D.: First, GPT it is not artificial intelligence. It is a Large Language Model (LLM). I asked GPT-4 if it was AI or LLM. Here is what he wrote to me:

As an AI language model I am designed to process and understand natural language, generate text, and perform various language-related tasks. However, while I can simulate human-like language abilities to a certain extent, I do not possess true artificial intelligence or consciousness. As a language model I rely on large amounts of pre-existing data and statistical algorithms to generate text that appears to be human-like. I do not have the ability to learn and adapt in a way that humans and true AI systems do. Therefore, it is more accurate to refer to me as a large language model rather than artificial intelligence. While I can perform many language-related tasks, I lack the broader range of cognitive abilities and decision-making capabilities that true AI systems possess.

That is what GPT-4 wrote to me when I asked if it was artificial intelligence, and it self-announced that it was not. However, it has tremendous potential. I ask it things like: can you relate Floridi's theory of friction, the idea of complex system and Mandelbrot set to effective teaching and learning? And it gives me a spectacular answer. It gives an answer that is a function of it scraping trillions of words from the internet. It is wonderful, stimulating and exactly correct. It does things that I possibly never could do. I just do not have the computer power to do those things. And at least gives me some idea, but it is not the be all, end all.

M. Z.: Well, that is interesting. However, should we look at the tools supported by Generative AI as the prospective game changers of education? In some sense, the situation with AI products resembles those with introducing laptops at schools, the internet at schools, the Wikipedia. There was a massive hype around that, many controversies and … not much has changed in education so far. Do you think the same will happen now?

Ch. D.: Yes, it probably will. But on the other hand, as I mentioned, AI-based tools have tremendous potential. I can ask GPT to design a factor analysis course for me, and it does. It does a really good job, not perfect, but a good job in terms of doing, designing a whole course. So, can I use it for adaptive learning? There is no question about it. But if you ask, is there any artificial intelligence in these adaptive learning platforms, the answer is absolutely not. There is no AI. Those systems are rule-based and artificial intelligence can help to change that, but not yet. We are back to when we talked about big data. AI can assimilate and collect for you what it has found in many areas that we are just not capable of doing. It can put them together in a way that helps us think differently, which I like. But it does not generate anything new. It just takes things out there and recombines them in another way you may not have thought about.

M. Z.: Thank you so much for this fascinating conversation and your valuable insights. I strongly believe they will be helpful for those who are considering the adoption of adaptive learning. Thank you also for all those remarks and opinions you shared during our meeting and for your time. I really appreciate that.

We recommend

BPM Symposium, October 23, 2023, Sopot, Poland

The BPM Symposium will be held for the third time in Tricity. The event will take place at Hotel Eureka in Sopot, organized by Gdansk University of Technology (Poland) and University of Gdansk (Poland), under the patronage of the Fahrenheit Universities. The symposium aims to bring together the academic community and practitioners engaged in BPM. Participation in the symposium is free of charge. See you in Sopot!
More information at: **https://event.mostwiedzy.pl/e/III-Sympozjum-BPM**

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The impact of digitalisation on the development of e-learning

Abstract

This paper presents an overview of the latest developments in electronic learning and teaching methods and tools brought about by digital transformations aimed at making education more efficient and effective. A set of general and specific research methods was used to conduct the study, in particular bibliographical and descriptive, chronological, specification, analysis, systematisation and classification, observation, survey and expert interviews, abstraction, analogy and comparison, comparative, modelling, forecasting and argumentation, and logical generalisation. The authors describe their approach to structural organisation of the novel e-learning ecosystem and single out its key components, including technology, learning contexts, and learning outcomes, as well as a set of secondary external factors that determine the quality and effectiveness of education when digitalised. This paper explores characteristics and features of e-learning such as customisation, autonomy, and interactivity with a focus on micro-learning, and presents the findings of an analysis of the most popular open educational resources (OERs), massive open online courses (MOOCs), and online learning platforms, highlighting their major advantages and disadvantages.

Keywords: e-learning, learning ecosystem, digital competence, open educational resources, massive open online courses

Introduction

The modern information society is experiencing an era of digital transformation in the online environment – with more than 60% of the world's population being active users of the Internet (UKRINFORM, 2020). Technological development and digitalisation create a favourable environment for the adaptation of the educational ecosystem to new needs by changing the modes of student-teacher interaction, streamlining the educational process, remodelling the assessment system, and supporting students' performance. This approach is based on the diversification of knowledge and skills, which in turn requires that a balance be maintained in all areas of economic and social life. This balance could not be achieved without taking into account new features and trends of information and communication technologies in all areas of activity that result in accelerated innovation processes and increased creativity in doing business.

The aim of this study is to explore the latest trends in the development of methods and tools in e-learning and e-teaching during digital transformation of society aimed at making the educational process more efficient and effective.

Literature review

There is considerable domestic Ukrainian and international scholarly interest in the issue of application of information technologies during digital transformation. Thus, Batrakova and Lynovetska (2018) suggest that the digitalisation of the national economy is at an early stage and is a volatile and unstable process, with "innovative and digital outbursts" and discoveries based on the new operating principles. The

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authors note that the following components are necessary for the successful development of the digital economy in Ukraine: an appropriate regulatory and legal framework; effective and accountable institutions (infrastructure); relevant digital skills needed by employees, businessmen, and civil servants. In this regard, training highly qualified specialists using digital learning technologies is critical.

In their thorough research, Didukh and Novikova (2020) studied the theoretical processes of business digitalisation in their transition to an inclusive model of development, taking into consideration the COVID-19 pandemic. The authors conducted a SWOT analysis of corporate digitalisation and outlined the advantages of digitalisation in business. The authors found the main strengths to include saving time on operations, flexibility and acceleration of business processes, a high level of quality control, optimisation of costs, and development of additional services. The main weaknesses included complete dependence on electricity and the Internet, the high cost of implementing digitisation, and a lack of qualifications and digital skills among staff. The main opportunities were found to be new areas of cooperation, strengthening of innovation policy, the emergence of new services and sales markets, and increased competitiveness of enterprises. The main threats emerged in the form of power or Internet outages, cyber-attacks and data leaks, and copying of a digital product. The main opportunities were found to be new areas of cooperation, strengthening of innovation policy, the emergence of new services and sales markets, and increased competitiveness of enterprises. The main threats emerged in the form of power or Internet outages, cyber-attacks and data leaks, and copying of a digital product.

The latest trends of the 21st century in the field of education are discussed in a study conducted by Dzvinchuk and Ozminska (2020). The findings of their study suggest that the effectiveness of society depends on the level of advancement of its education system, namely on digitalisation, intellectualisation, and lifelong learning.

Shchyrska (2019) suggests classifying the challenges of digital transformation of the Ukrainian economy into principal categories: institutionalisation, infrastructure development, and systems and technology ("State in a smartphone"). The author emphasises the need to conduct digitalisation in all areas of public life if Ukraine is to achieve its strategic goal – an eightfold increase in GDP by 2030.

A group of Ukrainian researchers – Liashenko et al., contributed to the development of the Digital Agenda of Ukraine – 2020 (Hi-Tech Office Ukraine, 2016), in which it is suggested that modernisation of key areas such as education, health care, transport, etc. through the introduction of digital technologies will lead to greater efficiency and promote creation of new fields of activity. The authors noted that the transformations associated with the transition to digital technologies create new approaches to learning and teaching. Therefore, it is extremely important to develop high-quality educational content and review and update training agendas and professional development programmes, taking into account digital literacy and digital skills.

Studies on the use of Massive Open Online Courses (MOOCs) by educational institutions deserve special attention. Thus, Shalatska (2018) emphasises the effectiveness of the implementation of MOOCs in various teaching specialties and explores the opportunities of their integration into the curriculum through special organisation of students' self-study. The successful implementation of MOOCs into students' independent work can provide learners with new opportunities such as enhancing professional digital skills, increasing foreign language proficiency, and developing critical thinking, decision-making, problem-solving and time management skills. Designing tasks encourage learners to build on existing knowledge and share their experience, motivates them, and provides them with evidence that they can use for their own personal development.

In their study of the current prospects in the development of educational technologies, Myronov, Savchyn, and Myronova (2020) highlight the following trends: distance learning, adapted teaching methods, cloud technologies, artificial intelligence and virtual reality, social networks and "inverted reality", and 3D printing. Researchers suggest that the development of these tools will enable the goals of educating and raising new generations to be attained in full.

Research by a team of authors – Romanovsky et al. (2019), pays close attention to the factors of development and areas of improvement of distance learning in higher education institutions in Ukraine. Authors have examined in detail the state, problems and prospects of the implementation of the MEP in the system of domestic distance education.

In their study, Richards-Schuster, Ruffolo, and Hiltz (2019) suggest that the need to integrate MOOCs into learning will require various resources to be attracted, investment of time, and high-quality organisational support.

Gal, the founder and CEO of GamEffective, considers the introduction of gamification in all educational institutions one of the key trends in modern education. Thus, in his article, Gal (2016) identifies six advantages of using gamification in a professional environment, which could also be applied in the educational environment, namely objectivity, feedback, recognition, mastery, motivation, training, and personal development.

At the same time, despite the rapid development of digital education in the world, insufficient attention has been paid to the features of student-teacher interaction and the use of modern technologies in education, given the transformation of the global educational ecosystem.

This study used the following general – theoretical, empirical, and specific, research methods to identify and analyse the development of e-learning methods when digitalised:

- bibliographical and descriptive – to study and review scholarly, psychological, pedagogical, methodological, and special literature on the development of methods and tools in teaching and learning;
- chronological – to consider the processes of digitisation and digitalisation of all spheres of public life in its dynamics over time;
- specification – to clarify existing approaches to the interpretation of the notions of electronic, online, and mobile learning and to determine their features in the information society;
- analysis and systematisation – to study and systematise international and domestic regulations with regard to the organisation and requirements for education, as well as learning outcomes;
- systematisation and classification – to consider theories of knowledge acquisition, consolidation of skills and abilities, and the formation of general and professional competencies in the process of active learning;
- observation, survey, and expert interviews with representatives of educational institutions, research and teaching staff and students – to clarify the overall architecture of the educational process and its components in terms of digital transformation;
- abstraction, analogy and comparison – to study and recapitulate on international experience in the use of electronic, online, and mobile teaching and learning tools; to explore the capacity of information and communication technologies to improve existing educational and learning technologies;
- integration – to summarise the existing approaches, singling out principal means of teaching and learning, and identifying their advantages and disadvantages;
- comparative – to identify the strengths, advantages and disadvantages of different teaching and learning tools (platforms);
- modelling – to build (shape) and structure the digital learning ecosystem;
- logical generalisation – to identify significant components and structural elements of the digital learning ecosystem; to arrange the findings of the study;
- forecasting, argumentation – to formulate recommendations and outline directions for the development of e-learning and teaching methods in the near future.

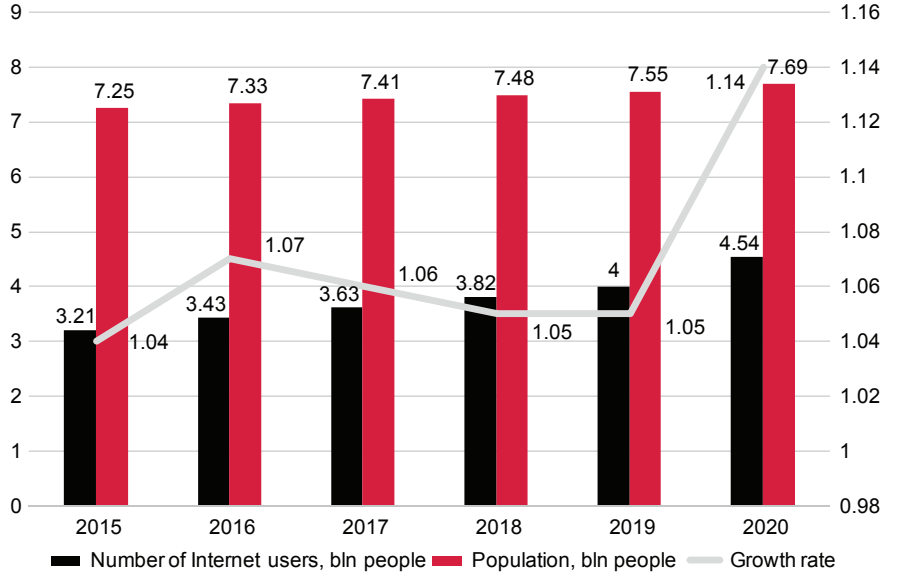
Findings

The modern world has entered the era of the Fourth Industrial Revolution, marked by the massive digitalisation of all spheres of life, as evidenced by the steady growth in the number of Internet users (Figure 1) (Kemp, 2020). Digital transformation is carried out through the gradual rejection of analogue technologies and the introduction of large-scale technical, technological, organisational, and managerial innovations (e-government, e-commerce, e-banking, e-education, etc.).

At the beginning of 2020, the total number of Internet users in the world increased by 7% compared to 2019 and reached more than 4.5 billion people, which accounts for about 60% of the world population. European countries demonstrate an even higher

Figure 1

Numbers of population and Internet users worldwide



Source: authors' own work based on *Digital 2020: Global digital overview*, S. Kemp, 2020, Datareportal (https://datareportal.com/reports/digital-2020-global-digital-overview?rq=2020).

rate of digitalisation: 84% of the European population are Internet users (711.3 million people), which is 1.6% higher than in 2019. Ukraine also demonstrates a positive tendency in this area, with 63% of the population being network users (27.63 million people) at the beginning of 2020, showing an increase of 5.7% compared to the previous year (Kemp, 2020).

The COVID-19 pandemic and the restrictions in physical mobility of the world's population significantly strengthened and accelerated the process of digitalisation in the world in 2020, and led to a staggering 20% increase, compared to 2019, in the time spent online to an average of 6 hours 43 min daily (Kemp, 2020). The e-Learning industry and Mobile Learning Industry Statistics show that under lockdown and working remotely, the BYOD (bring your own device) trend was adopted by 59% of organisations and 67% of employers around the world, thus allowing the use of personal devices for work purposes (Georgiev, 2023; Thakker et al., 2021). In particular, 56% of students used smartphones and / or tablets, and laptops to perform tasks and assignments for their educational purposes (Dhawal, 2020), and 90% of students prefer to study online compared to face-to-face study in the classroom (*Mobile learning*…, 2020). The distribution of traffic between the devices is given in Table 1.

Table 1 shows that in general, users of online services in the world prefer mobile devices and connection with the Internet via smartphones (53%), whereas Ukraine sees a significant advantage in desktop computers and laptops (71%). This situation in Ukraine is due to insufficient development of the network (extremely low number of 3G and 4G broadcasters) and unsatisfactory quality of mobile traffic (speed, availability and quality of communication, etc.). However, in Ukraine and European countries, there was a much higher instance of ownership of mobile devices in 2020 compared to worldwide figures: 139% (60.88 million units), 128% (1090 million units) and 67% (5.19 billion units), respectively to Ukraine, Europe and world (Kemp, 2020; Korzh, 2021).

The closure of educational institutions of various types in 2020 was also a powerful catalyst for a fundamental transformation of the global education system, which, officially, covers more than 1.72 billion learners and students and more than 84.2 million teachers in more than 190 countries. Therefore, we are likely to see even more active growth in the online learning services market in the next few years. As of the beginning of 2020, the market capacity of educational online services worldwide amounted to almost 150 billion US dollars (GlobeNewswire, 2020). Thus, according to estimates (GlobeNewswire, 2020; *Mobile learning*…, 2020), with the projected growth of the online education market of 15–20% annually, it will reach about 300–370 billion US dollars by 2025. Between 20 and 25% of the e-learning market (USD 80 billion) will comprise means, tools and technologies for mobile learning.

Under global quarantine, 100% of students, pupils, and learners practiced e-learning – which covers all types of educational activities carried out using digital devices (computer, laptop, tablet, smartphone, e-book, voice recorder, etc.), multimedia technologies, the Internet and / or other global or local networks. There has been an increase in interest and the number of visits to the most famous open educational site, Wikipedia, both in the world and in Ukraine in particular. Thus, this educational resource moved from 16th place in 2015, to 14th place in 2019 and 5th place in 2020 in the global ranking of search visits (Kemp, 2020). 73% of adults consider themselves lifelong learners, while 63% of working adults are professional students (Finances online, n.d.; Hi-Tech Office Ukraine, 2016).

The authors` collective claim that more extensive digitalisation brings about changes in the educational process and can optimise teaching and learning means and tools, thus forming a new educational ecosystem (Figure 2). Thus, the digital transformation of the educational sphere can be seen primarily, in 1) approaches to student-teacher interaction; 2) optimisation of educational processes using modern technologies; 3) forms of assessing outcomes and supporting student performance.

This newest digital learning ecosystem is much more complex than the traditional binary concept of using online technologies in education based on the availability or absence of network access, which developed in the late twentieth century. It covers internal and external elements and factors that determine the quality and effectiveness of education in the context of digitalisation, including technological aspects, the learning context, students' personal characteristics, and significant external impacts.

Technological aspects affect the learning process, the quality of education, and the results attained. The technological aspects that have the greatest impact are: 1) technological infrastructure, i.e. quality of wired and wireless connection, bandwidth, servers,

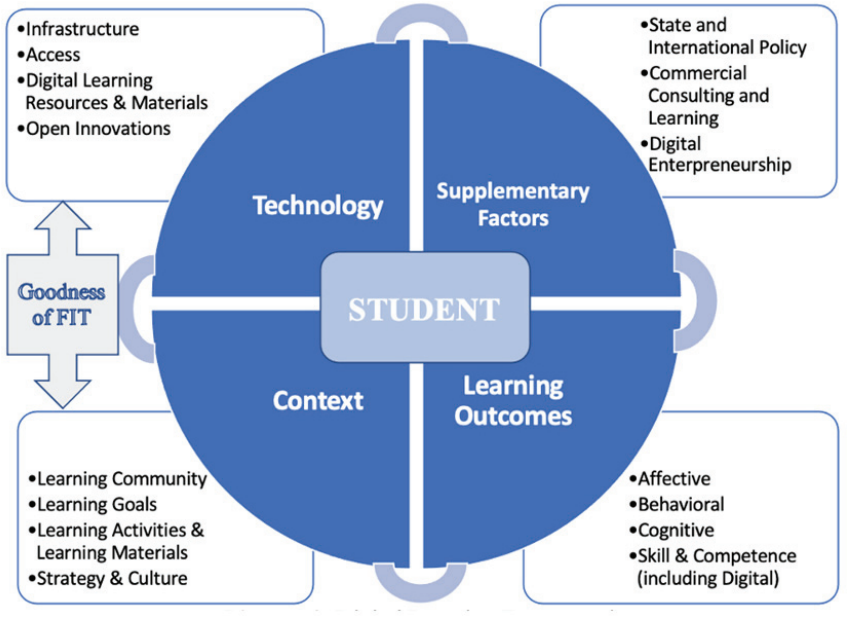
Table 1

Average share of web traffic by device, 2019–2020

Device, share as a percentage	Worldwide	Ukraine
Smartphone	53.3	27.8
Laptop, desktop computer	44	71.1
Tablet, other devices	2.7	1.1

Source: authors' own work based on *Digital 2020: Global digital overview*, S. Kemp, 2020, Datareportal (https://datareportal.com/reports/digital-2020-global-digital-overview?rq=2020).

Figure 2
Digital learning ecosystem



Source: authors' own work based on *Using technology to support at-risk students' learning,* L. Darling-Hammond, M. Zielezinski, & S. Goldman, 2014, Alliance for Excellent Education and Stanford Center for Opportunity Policy in Education (http://dropoutnotes.com/wp-content/uploads/2017/08/scope-pub-using-technology-report.pdf); *From classic offline education – to virtual*, O. Melnik, 2015 (https://www.imena.ua/blog/online-education-ua/).

and data storage hosting; 2) access to technologies – quantity and type of learning equipment, usage, individual devices, stationary or mobile equipment for groups and classes, sharing of devices, BYOD approach, etc.; 3) digital resources and materials, i.e. software, human resources and learning materials, and content; 4) openness of innovations and research – openness and free access to information and research data, and technology transfer based on the concept of open innovation.

The learning context concerns students' perceptions of the course (discipline), teaching and learning requirements. This context comprises the learning community (those with whom the learner studies) as well as aims, nature, and particular aspects of learning activities. General approaches to learning, educational level, pedagogical values, teachers' experience and skills, and the influence of parents, other stakeholders, and social groups close to the student characterise the learning community. In this context, Open Educational Resources (OER), with their unlimited distribution and availability of technology, have significant potential to create a community of users who use, share and continuously enhance the content, thereby improving the quality of education.

Learning objectives may include mastering basic skills; development of higher order skills; improvement, upgrade or modernisation of skills; development of professional competences, skills and abilities; development of digital literacy; influence on student behaviour; creating or building something new; joining a friend (support, common interests), etc.

Learning activities, their content, and features are determined by the scope of knowledge, belonging to the academic or other sectors, and models of interaction (consumption, creation, formation, modelling, exchange and distribution of content). Electronic Performance Support Tools – learning materials, manuals and toolkits designed to help when support is needed, play an important role here. They are suitable both for formal and informal learning, and help increase student involvement and practical focus of the learning process. Such tools facilitate application of what has been learned in practice; digging deeper and studying new concepts of the research topic; explaining details and clarifying uncertain points, etc.

The strategy of the educational institution, its culture, norms, and code of conduct define and shape a unique learning environment, which plays a key role in the quality of education, students' motivation and involvement in the process of acquiring knowledge and skills, and the effectiveness of learning.

Learning outcomes take into account students' individual qualities and include the following characteristics: affective, i.e. related to mood, feelings, emotions, and reactions (e.g. students' interest, motivation); behavioural, i.e. their engagement with the educational process, attention span, curiosity); cognitive, i.e. memory, thinking, abilities to reflect, abstract; etc.; and students' individual skills (hard and soft) and competences (general and professional).

The '4 Cs', the model that defines a student's core competencies with a focus on lifelong learning, play a special role among the learning outcomes in the

information society. The 4Cs are Critical thinking – the ability to navigate information, identify cause-and-effect relationships, filter information, and draw conclusions; Creativity – the ability to assess the situation from different angles, take unconventional decisions and feel confidence in a changing environment, and develop ideas and generate new ones; Communication – the ability to negotiate and establish contacts, listen to others, and convey their point of view; and Coordination and Collaboration – the ability to identify a common goal and how to achieve it, to allocate roles and evaluate results, to work closely as a team.

Technology and context, combined with a student's individual characteristics, determine their learning experience and learning outcomes. Thus, a student's digital competency (or digital literacy) is built at the point where these components converge, i.e. the ability to confidently, critically and creatively use information and communication technologies to achieve goals related to work, employment, education, leisure, and social life (Melnik, 2015). Thus, digital literacy encompasses five main blocks of competencies: 1) information literacy and data skills; 2) communication and interaction; 3) digital content; 4) security; and 5) problem-solving (Ukrainian Institute of the Future, 2020). They enable and facilitate the mastery and development of the system of competencies and skills of the individual.

Additional factors have an indirect, but nonetheless significant impact on the learning process and learning outcomes. Governmental and international policies, as well as society, set new formal and informal rules and requirements for the educational environment, qualification levels and competencies. Private educational and consulting services boost competition in this area and offer students a plethora of new learning tools and resources to choose from. Digital entrepreneurship provides access to the latest technologies for learning and professional development. *Digital entrepreneurship* is a term that encompasses online business created and run by individuals. Online entrepreneurial ventures can be a source of passive income or active sites for selling goods and services.

Fast development of technologies and digitalisation of educational processes create a favourable environment that enables transformation of the global educational ecosystem. This fuels a change in priorities and methods of learning, and a transition from the concept of "know everything" to "know how" with a focus on lifelong learning, self-realisation and customisation.

Learning customisation offers relevant, non-standardised, unique content based on current knowledge and skills, interests, needs, goals and personal characteristics of each individual student. Customisation of the learning process using artificial intelligence helps to compensate for the difference in perception and processes of knowledge acquisition among different students by analysing the pace of mastering learning materials and offering an individual curriculum (Melnik, 2015). At the same time, beneficiaries get full control over what they want to learn, how (which methods to use) and at what pace they want to learn; they also get to practice and polish core skills and master new skills and competencies such as communication and teamwork, inclusive leadership, creative and critical thinking, analytical thinking and evaluation, etc. It is projected that in 2021, 30% of educational analytics will link the effectiveness of learning with the level of knowledge of participants (Finances online, n.d.).

Self-directed learning involves students' self-diagnostics of their needs in relevant skills, their own development of learning objectives, and selection of the required resources and learning strategies. In 2019, 64% of students worldwide considered it important to have access to learning materials via a mobile phone, and 46% of students used mobile learning before going to bed (Finances online, n.d).

Microlearning combines information to be studied into short, focused 'sessions', parts, or blocks that can be applied and used 'on the go'. Such learning is aimed at practice, and each session has a specific learning aim. Compared to traditional e-learning courses, video learning increases student engagement through learning interaction. As video accounts for 80% of online traffic worldwide, video-based learning is growing rapidly, as it is engaging, is easily retained, and can effectively hold attention (Ministry of Education and Science of Ukraine, n.d.). According to Wyzowl (2021) research, 68% of consumers prefer video content to find out about new products and services, and 75% of employees in various sectors prefer video-based learning rather than learning by reading (Designing Digitally, 2019).

Immersive learning is learning that uses virtual, mixed, and augmented reality technologies that help better grasp information by simulating experiments and practical classwork. Augmented Reality (AR) projects digital information (images, videos, text, graphics) outside the screen of the device and combines virtual objects with the real environment. Virtual Reality (VR) uses a three-dimensional image (360°) and takes the student into an artificial or completely transformed environment. The global share of investment in the development of AR and VR in various industries is constantly growing. Thus, over the last five years (2016-2021), investments in AR have increased from 10 million US dollars to 180 million US dollars, whereas investment in VR has grown from 20 billion US dollars to 160 million US dollars (Lenovo Explorer, 2018). Global investment in educational technology more than doubled in just one year – from 7 billion US dollars in 2019 to 16.1 billion US dollars in 2020 (Miroshnikova, n.d.).

Growing interest in virtual reality produced by the corporate sector became a great impetus for the development of technology. According to ABI Research, the market for virtual reality learning will reach 6.3 billion US dollars by 2022. Goldman Sachs Global Investment Research estimates that the AR / VR market will be worth 95 billion US dollars by 2025. AR and VR tools are increasingly used in the following in video games, at an estimated 11.6 billion US dollars

(about 40% of the market); health care with 5.1 billion US dollars (17%); engineering – 4.7 US dollars (16%); video entertainment – 3.2 billion US dollars (11%); real estate – 2.6 billion US dollars (9%); retail – 1.6 billion US dollars (5%); and education – 0.7 billion US dollars (2%) (Lenovo Explorer, 2018; Melnyk et al., 2018).

The development of STEAM (Science, Technology, Engineering, Arts and Mathematics) education is gaining popularity as an area where the natural science subjects are strengthened by the use of innovative technologies (e.g. robotics and 3D-technologies) and become a foundation for research education. As in the future most routine operations are to be automated, people will increasingly need to have the skills and abilities to think outside the box and act creatively, to build new products, and identify areas of deficiency (Kruhlov, 2020). In Ukraine, 2020 was the year of the STEAM approach, with an emphasis on teaching science, innovation, technology, engineering and the arts. According to research, the involvement of only 1% of the population in STEAM-related jobs increases the country's GDP by 50 billion US dollars and the demand for graduates with appropriate skills grows two times faster than in other professions. Hence there is a need to develop skills for research and analysis, experimentation and critical thinking (IMZO, n.d.).

For those who want to gain new knowledge via a smartphone, digital assistants, mobile applications, and chatbots have become indispensable aids in giving prompt answers to typical questions in real time, organising the learning process, and diversifying it by changing formats. The market for learning applications has grown by almost 40% over the last five years and is projected to continue growing (Korotenko, 2020).

The global innovative educational environment constructs knowledge immediately, in real time. A variety of electronic online and offline applications have significantly increased and enhanced the flexibility of education, as learning can now take place anywhere and at any time through formal and informal technologies.

E-learning, and in particular mobile learning, easily adapts the common 70:20:10 model with 70% of experimental, practical learning (including on-the-job training), 20% of shared, collaborative and social learning, and another 10% of formal learning. Remote learning can be carried out in two modes: synchronous – when all participants in the educational process work simultaneously in the online environment, and communicate via audio and/or video conferencing with instant messaging services and immediate feedback) or asynchronous – when the educational process is carried at a pace convenient for teachers and students using educational platforms, e-mail, social networks, messengers, etc.

E-learning has been successfully implemented in different countries around the world, as it provides multiple benefits. It is accessible from anywhere at any time; it enables use of a variety of tools and teaching methods (text, video, tests, etc.); it provides students with the opportunity to communicate with each other and with teachers online outside the classroom; it allows simultaneous access of a large number of students to many sources of educational content; it enables the use of advanced ICT that facilitate the development of digital literacy; it helps vary assessment and evaluation of attained learning outcomes (Khorunzhyj, 2020; Korzh, 2021; Pappas, 2019).

The use of digital tools for interaction with students involves the creation of online platforms for quick and easy access to digitised materials (OERs, MOOCs), communication with teachers, remote interaction between students, project work, remote access to laboratory equipment and research centres, simulations, solving organisational issues, testing, control, etc. Modular cross-platform systems are being developed in which students can independently choose subjects without being tied to an educational institution and receive access to a maximum number of services and materials online (Dhawal, 2020).

Thus, one of the key areas in the development of remote education is massive open online courses (MOOCs) – web-based courses with large-scale interactive participation and open access via the Internet. The main advantages of these courses include free of charge education, the opportunity to study in the world's top educational institutions at a convenient time, and the opportunity to improve the level of spoken and technical foreign language. The drawbacks include insufficient or incomplete content, no feedback from teachers to students, and lack of social interaction. For some subject areas, like medicine or engineering, online laboratory work does not develop practical skills (Dhawal, 2020).

Recent growth in MOOCs reveals several trends: strengthened cooperation between course providers and the world's top universities (Massachusetts Institute of Technology (198 courses developed), Stanford University (178 courses), University of Michigan (167 courses), and Harvard University (153 courses)), a reduced number of new students while the number of courses increases, and growth in the number of self-paced courses that do not have strict deadlines for the beginning and end of learning (Dhawal, 2018). In Ukraine, the introduction of MOOCs in the educational process in the period 2012-2020 saw ninefold increase in funding, a 90-fold increase in the number of course takers, growth in the number of partners from 40 to 950 (an increase of almost 25 times); and growth in the number of courses (from 250 to 16,300) (Dhawal, 2020).

The most popular MOOC providers worldwide include Coursera, edX, Udacity, Khan Academy, and Codecademy.

Coursera is the world's largest online learning platform, offering almost 35,000 courses to 35 million students. It was launched in 2012 (Ministry of Economic Development…, n.d.; Prymachenko, 2020), and is now a leader among platforms due to its rapid development (growing number of partner organisations, courses, and learners); its courses normally last

from one to three months, and have clear deadlines for tasks that are strictly monitored. Before starting the course, every student gets access to information about the content and requirements of the course. Information about course teachers is provided, as well as a list of recommended literature. Upon completion of the courses, successful learners receive a certificate recognised by many organisations.

EdX is a platform offering online courses in 24 areas with video lectures replicating real lectures taught at leading universities in the United States and other countries. Learning is organised by modules and each student must pass an examination to receive a certificate.

Udacity is a privately developed platform with a relatively small number of subject areas and courses focused mostly on computer science and programming. Training is carried out at several levels according to the complexity of the tasks: beginner, experienced, and professional. Upon successful completion of a course, learners receive a certificate, and some employers recognise such certificates as equivalent to a diploma. Upon consent, students' details are shared with companies to help them find employment.

Khan Academy is a platform where training takes place without prior registration. Having a Google or Facebook profile is enough to sign up for a course. Learning takes place through video lessons on various subjects in English and other languages.

Codecademy is an interactive online platform where users can learn one of seven programming languages.

Prometheus is the first MOOC platform in Ukraine developed on the basis of Taras Shevchenko National University of Kyiv in 2014. Platform users have an opportunity to do courses delivered by teachers from leading Ukrainian universities. Upon successful completion of the courses, a certificate is awarded.

Moreover, digital technologies provide an opportunity to learn effectively via remote learning systems known as Learning Management Systems (LMS), which enable the learning process to be organised from scratch and track students' performance by creating online courses or virtual classes available at any time and from anywhere in the world where there is access to the Internet. All learning materials are stored in one place, and are easy to view and edit depending on the learning goals and the scope of organisation. The most popular remote learning platforms include Google Classroom, Zoom, Moodle and Microsoft Teams (IMZO, n.d.; Ministry of Education and Science of Ukraine, n.d.). These platforms are analysed in greater detail below.

Google Classroom is one of the most popular platforms in Ukraine for organising work with groups, and is free of charge for educational establishments and non-for-profit organisations (up to 250 people). Participants have an opportunity to share materials, and the teacher can give students assignments and assess their performance. Since January 2020, the number of daily users of the application has increased thirty times and is currently one hundred million people. Every day more than three million new users register for the service (Cabinet of Ministers of Ukraine, 2018). In 2020, Google added integration with Google Meet so that teachers can have a unique meeting link in each classroom. Features of Google Classroom include:

- use of Google tools (Google Drive, Google Docs);
- a public folder automatically created on Google Drive, which is available to all participants;
- publishing materials, assignments, grading, built-in calendar;
- creating quizzes with Google Forms;
- class feed.

Zoom is a platform for webinars, online classes, and video conferencing. The service has existed since 2013 and requires registration. During the COVID-19 crisis and lockdowns, revenues of this popular video conferencing tool skyrocketed, and profits doubled in the second quarter of 2020. In May-July 2020, the company's revenues increased by 355% (almost 334 million US dollars), exceeding analysts' expectations of 0.5 billion US dollars. Zoom's net profit in 2020 rose to 186 million US dollars, and the number of users grew by 458% compared to the same period in 2019 (BBC News, 2020). For the holidays (such as New Year's Eve) in 2021, Zoom lifted its forty-minute limit for free video conferencing. Zoom's main features include:

- exchanging emails;
- collaboration;
- 40-minute video conferencing for up to 100 people in a free account;
- breakout rooms, enabling discussions in smaller groups by automatic or manual assignment of the conference participants to separate video conferencing rooms, and a waiting room feature in which entrants to the meeting can be monitored;
- passcode-protected meetings;
- chat between participants;
- calendar for planning meetings and reminding participants that the meeting is about to start
- webinar recording;
- integration with calendar and mail.

Moodle is a platform that requires in-depth study of its tools and features. This learning platform supports video conferencing and is designed to bring together teachers, students, and administrators in one reliable, secure, and integrated system, to create a personalised learning environment. For remote learning purposes, Moodle is in demand in more than 30,000 educational institutions worldwide, and has been localised into almost eighty languages, including Ukrainian. As of January 2021, there are more than 250 million users, and the platform is used in 251 countries (Moodle, n.d.). In Europe, two-thirds of educational institutions use Moodle. Moodle is a flexible system, because:

- teachers can independently create and manage remote courses;
- it is possible to create discussion forums;
- remote courses can contain various elements such as lectures, tasks, forum, and chat;

Table 2
Strengths and weaknesses of the world's most popular e-learning platforms

Name/Country of origin	Strengths	Weaknesses
Google Classroom /USA/ up to 250 people	convenient platform, equipped with all basic tools; offline access to information; free of charge; integration with Google Drive, Google Documents, Google Calendar and Gmail; convenient communication (real-time commenting feature)	limited functionality, inconvenient for creating links, no application for online meetings
Zoom /USA/ up to 100 people simultaneously	screen sharing for all participants, free communication through video conferencing, easy to access (link accessible without downloading the application), meeting recording available; planning and scheduling meeting option	limit of forty minutes, security limitations leading to data leaks, whiteboard not convenient for writing down formulas
Moodle /Australia/unlimited number of participants	easy to create content, formats for presenting information (tests, lectures, quizzes), e-portfolio, free-of-charge, supports SCORM, AICC, IMS, easily accessible mobile application Moodle Mobile integration with other systems (CRM, CMS)	need for hosting and domain, multiple tools and features might be confusing for users, in-depth study required, system installation required
Microsoft Teams /USA/ up to 300 people simultaneously	free-of-charge, no installation needed, regular updates, supported by all operating systems and programmes; free access to all Google Drive tools from one account; synchronous and asynchronous working; share file storage option; enables quick collection and analysis of data, creation of quizzes, tests, diagrams, charts; no advertising	limited platform flexibility

Source: authors' own work based on https://osvita.diia.gov.ua/; *Statistics*, Moodle, n.d., retrieved March 12, 2022, from https://stats.moodle.org/; "Polish-Italian virtual exchange. Learners as teachers of their native languages", A. Pieczka, 2020, *e-mentor*, *4*(86), pp. 4–12 (https://doi.org/10.15219/em86.1477); "Zoom received space profits", BBC News, 2020 (https://www.bbc.com/ukrainian/news-53986489).

- the platform's extensive tools simplify the process of assessing students' knowledge, to check outcomes for specific modules (e.g. via testing);
- the system stores grades of every student for all courses, a grading scale can be set and there is a function for semi-automated recalculation of test results.

Microsoft Teams is a teamwork tool in Office 365. It is a simplified version of learning management systems, but it allows a class or study group to communicate and share files. The program combines everything in a shared working environment, which includes chat for discussion, file sharing, and corporate programs.

Table 2 presents a summary of the advantages and disadvantages of the above-mentioned learning platforms.

Discussion

Among the key advantages of using e-learning tools, the authors pay special attention to the following:

- greater access to education for different categories of students (elderly people, people with physical and/or mental disabilities, residents of remote areas, etc.);
- the possibility of using various multimedia (text, audio, and visual) and sources of information (links, sites, blogs, etc.);
- the ability to supplement, update, upgrade and refine software and content;
- ease of communication and giving of fast (instant) feedback, i.e. to provide an evaluation, point of view, vision, etc. in comments, final questionnaires, feedback forms, etc.;
- action-based learning using demos and software trial versions;
- high interactivity, applied, practical nature of learning resulting from rich and diverse content;
- opportunity to create adjusted and customised courses for the needs of different groups of students with personalised tracking of progress in learning and individual evaluation of outcomes;
- variety in methods, forms, and tools of assessment, specifically with regard to non-standard assessments, unusual for the traditional learning process);
- 'just-in-time' learning that can take place anytime and anywhere.

When implementing changes in the educational environment, it is particularly important to consider the weaknesses, possible obstacles, and barriers to this process. Thus, in Ukraine, major challenges include underdeveloped technical infrastructure – access to network, quality of coverage, availability of devices; lack of qualified teachers with relevant experience,

digital skills, and readiness to learn and master new teaching methods; the risk of unauthorised use of devices and networks; high student turnover and dropout rate, leading to a relatively low level of completion of disciplines, courses, sections, modules, etc.; non-acceptance of international practices by domestic educational institutions due to conflicting content and / or technical requirements; general lack of investment in education and e-learning in particular. At the same time, the development of e-learning significantly expands the opportunities to promote inclusion in education. It fosters integration of rural areas and small towns into the development of education, research technology and communications, thus providing more 'social lift' opportunities; it introduces new specialties and professions, and teaching for the diaspora, and Ukrainian studies for scholars abroad (Vuorikari, 2016).

Progress in e-learning technologies (digital, online, mobile), a sufficient level of student training to master new knowledge, and their high overall digital literacy, are prerequisites for successful modernisation of global and national education systems using information and computer technologies. This will ensure versatility, variety, flexibility, and efficiency of the modern learning process and its outcomes.

Thus, digital technology in today's world is not just a tool, but also an environment that opens up new opportunities for lifelong learning – using individual learning offers anytime and anywhere.

Conclusion

As part of global digital transformation, the nature and meaning of education is also being transformed, thus changing the tools and means used. The goals and values of education are undergoing significant revision. In particular, there is a shift toward future needs, emergence of new roles of the educator, building new forms of relations between the teacher and the student, and further growth in learner-centeredness and customisation in teaching and learning.

Therefore, the key challenge today is to improve and upgrade the system of education in accordance with the requirements of the new information era, which must be addressed by joint efforts, taking into account societal needs, the future of professions, and best practices, which will together determine further research in this area.

The integration of digital technologies into the educational process supplements students' independent learning, helps them to personalise learning environments, and invites participants to discuss and debate applicability to their professional contexts.

Creating a new educational environment calls for a thorough revision of the content and forms of education through holistic integration of learning and research, theory and practice, traditional teaching methods and innovative approaches, and fundamental knowledge and specialised skillset, while considering potential challenges and barriers of the digital transformation in education, and supporting this process and adapting it to the conditions, challenges and needs of the information age.

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Language learning using muted or wordless videos – A creativity-based edutainment learning forum

Abstract

From the teacher's perspective, English language enrichment is more applicable and easier when using videos, resulting in a surge in the student's receptivity. This paper attempts to bridge the gap by using silent videos to stimulate creative writing with a constructivism paradigm. Conducted in an Engineering college in the rural part of South India, two classes with 60 students each (both male and female) from first-year engineering (heterogeneous classes) at CEFR B1 level were chosen for the study. The researchers were the course instructors themselves, with fifteen-minute silent sports videos used for both groups. A sports video with audio was used for the controlled group, whereas one without audio was used for the target group. The controlled group tape-scripted the video content as they listened, while the experimental group created the script for the video on their own. The scripts were assessed for language quality based on vocabulary usage, sentence formation, and choice of words. The assessment details demonstrated that the experimental group students had demonstrated better scriptwriting skills compared to the control group students, who had relied on the audio and tried to paraphrase the words they had heard, leading to unclear scripting. This research showed that silent videos also help in grasping the English language by ESL learners, especially in creative writing and script drafting, evidentially proving that silent videos stimulate autonomous writing among students as they do not depend on audio for tape scripting. It further enhanced their writing skills with creative ability, and, further, the students preferred silent videos over audio videos due to better outcomes.

Keywords: muted video, assessment, pedagogy, multimedia, silent video, autonomous learning and monitoring

Introduction

Technology's intrusion into the realm of teaching has now become the most updated teaching methodology adopted in the world. "Technology-integrated classroom systems have become popular for language learning in recent years. Blended learning, virtual classrooms, and learning management systems are all examples of this new era of teaching methodology that leading pedagogical experts are endorsing" (Dexway Communications, Education, n.d.). In this context, the researchers decided to use the technology video-enabled classroom with silent videos as the tool. Many researchers have utilised English videos to enhance the output of their students in listening. Harmer puts forth in his article that videos can provide essential extra benefits for students' learning experiences, and they enrich the students' experience of language in use

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thereby improving cross-cultural understanding with the development of their creativity and motivation in learning (Harmer, 2006). This proves that videos enhance the student's understanding of language and reciprocate by doing so. Adopting this concept, the researchers tried to employ a constructivist paradigm by using silent videos in the classroom to identify the impact it creates on the learners towards language enhancement. Mepco Schlenk Engineering College, Sivakasi, Tamilnadu was the site of the study, with two first-year sections with 60 students in each as the target groups. The research question "How do silent videos enhance the creative writing of language learners?" was largely explored through empirical data. The researchers used sports videos for the analysis, and the impact level of the video was also tested. This paper further investigates the usage of the learned vocabulary by the target group and the controlled group while tape scripting a muted video. The objective of the research is to stimulate learner autonomy and creative thinking using silent videos.

Literature review

Numerous researchers have worked on the usage of videos in an elaborate manner. Lumturie Bajrami and Merita Ismaili (2016) stated that video material could be used as authentic material input and as a motivational tool. In general, students found using video material to be interesting, relevant, beneficial, and somewhat motivating in class. This suggested that both teachers and students could be involved in creative ways to incorporate different video materials in a variety of classroom activities to enhance learning outcomes and provide a positive classroom environment.

Teaching grammar using animation is dealt with by Abdo and Al-Awabdeh, with the following findings: "Students' understanding and the way they perceive the lesson are more efficient than the traditional method where their emotions were driven by the animated videos themselves" (Abdo & Al-Awabdeh, 2017). This study concludes that the use of animations in the classroom impacts the overall achievement of the students by triggering their emotions. Asraf et al. (2018) proved in their study that the strategy of focused free writing was effective in stimulating ideas for writing among students, and helped them to think critically. This was apparent even among students who were not very proficient in the language.

Gulden Ilin et al., (2013) stated that the usage of videos for grammar teaching motivated the students to be engaged in the lesson. Furthermore, they began to watch the videos through social software asking for the teacher to upload new videos for self-study purposes (Ilin, 2013), which showed how videos enhance grammar learning.

Zhaogang Wang (2015) stated that if teachers had clear goals in mind and planned the teaching process and strategies carefully, video materials could improve students' comprehensive linguistic competence, cultural awareness, and aesthetic appreciation skills. Didar Bildebayeva (2013) stated that the methodology of teaching videos should be different from passive television viewing, adding that the teacher should encourage the learners to watch the films actively, using supplementary materials, such as worksheets prepared by themselves or supplied with the films. Further, he insisted that the learners should participate in the activities, and if possible, set up some projects in the target language by recording their activities such as speaking, interviewing, reporting, and so on. The above-mentioned research study exemplifies the usage of videos for improving language competency and an activity-based classroom environment.

ESL learners who spent more time playing video games were less likely to revert to their native language when communicating with classmates. Sports videos can be a useful resource in the language classroom, enhancing vocabulary acquisition, improving pronunciation skills, promoting authentic language usage, enhancing cultural awareness, and motivating language learners. However, educators need to select appropriate sports videos that align with their teaching objectives and the language proficiency level of their students. Though a lot of research work has been done on the usage of videos in English classrooms, the usage of silent videos remains unexplored.

In their survey, Shahani and Tahriri (2015) proved that there were significant differences between the silent viewing and freeze-frame viewing group and the control group in terms of their listening comprehension. The groups were similar regarding the materials, teacher, and amount of instructions, except in the video training that was specifically offered to the experimental groups. The results proved that practicing silent and freeze-frame viewing techniques had significant effects on high school EFL learners' listening comprehension.

Kandybovich (2017) emphasised that the most valuable feature of stories was based on wordless videos that could be narrated in many ways according to the learners' interpretation of the story and their level of proficiency in English, taking the form of a dialogue, narration, comic speech/thought bubbles, as a story told by a particular character, in writing, etc, which is why wordless videos were used to stimulate story-writing practices. Donaghy (2016) stated that silent films were perfect for the language classroom, as they could be used at any level, insisting that the teacher had to adapt the difficulty of the task to match the level of the students.

A reflective teaching (Gangalakshmi & Naganathan, 2019) mechanism would explicitly prove the importance of silent movie usage in a classroom setup. Saranraj et al. (2022) stated that motivational strategies are of paramount importance in the teaching-learning process. Motivation could be achieved by creating interest, especially by using videos in a classroom setup, and although some research is done using silent videos for language simulation, it is still not in the limelight, and even the usage of sports commentaries in the

language classroom is under question. Comments at a higher level of cognition remain unexplored. Researchers have identified this wide gap in research and plan to bridge it by exploring an improvement in interpreting and creative ability when exposed to the usage of silent sports videos in ESL classrooms.

The description of the research

Hypotheses

$\mu 0$ – There is no significant development in language acquisition while using silent videos

$\mu 1$ – There is significant development in language acquisition while using silent videos

$\mu 2$ – Writing autonomy is improved while using silent videos

Acquiring concepts

Lexical

Learning vocabulary, phrases, and adjectives through this task

Pragmatic

Logical arrangement of sentences contextually based on videos

Syntactic

Arrangement of words and choice of right words to depict a scene in a video.

Methodology

Since the researchers are based in MEPCO Schlenk Engineering College, Sivakasi, a premier institution located in the southern rural part of Tamil Nadu, India, they chose the target and control members from their classes, as this pedagogy was formulated by the course instructors. Students with B1 proficiency levels were selected, and the target ESL group were first-year A section students of Mechanical Engineering, while the control group were first-year B section students of Computer Science and Engineering from the academic years 2018–2022, with each class consisting of 60 students, and with Convenient Sampling Methodology adopted. The research task nominated for this research was an extensive syllabus, on top of the regular course syllabus. A survey questionnaire was used as the measuring tool for the research analysis.

Ethical considerations

The students were clearly informed about the methodology, with the option to 'opt in' or 'opt out', meaning that the students were not forced to participate. The students were very interested in participating in the research, as it dealt with sports videos. As this task was carried out during a regular session, the students regarded it as an educational forum in which all 120 students participated. Providing demographic information by the students during the survey was optional, and the students were not forced to participate in the writing or testing part, but they willingly participated as their personal details were not collected anywhere throughout the research, and their results were not revealed to fellow students. They were clearly informed that the final results would be used solely for research purposes, although individually the results would be discussed with the respective students for improvement. There was no conflict of interest identified as the research was conducted solely within a selected group of students inside one institution. Further, as the study is an unexplored concept in the engineering stream, the researchers did not have any conflict of interest with already existing literature.

The teaching of vocabulary, phrases and adjectives

The students were given different exercises to learn 20 words, 15 phrases, and 15 adjectives in the classroom. A challenge faced by the teachers was to make the students comfortable with the above-mentioned vocabulary, phrases and adjectives, which where all entirely related to cricket, and which is why the students were given exercises for learning the vocabulary. The vocabulary was taught together with its meaning, and the students were encouraged to learn the same. The teachers used word games, worksheets, and multiple-choice questions for quick learning, and during the first class 20 words were taught followed by 15 phrases, and revision of the same was done during the second class, followed by 15 adjectives. This teaching process was adopted for both classes, and there were no restrictions as to how the students used the vocabulary, phrases, and adjectives they had already learned. They were also encouraged to use the familiar vocabulary, phrases, and adjectives.

Video usage

Fifteen-minute cricket videos were selected, with the same four videos selected and given to both groups. Since many students are fascinated with Dhoni's cricketing style, the researchers chose a video about this batter as the forum for creating interest. Initially, both teams were allowed to watch videos of Dhoni's cricketing with audio and subtitles. The students were asked to use headsets.

Following this, the control group was given a video with audio but without subtitles, with basic instructions that they had to answer the questions and prepare a sentence about the video as commentators. Each student was given a multimedia system for doing so.

For the target group, the same video of Dhoni's cricketing was played without audio. Here the students were not given headsets as they were not necessary, and there weren't any subtitles. These students were also asked to answer the questions and prepare a sentence about the video clip they had watched.

Assessment pattern

It is very difficult to access the students in the context of reading, which is why after watching the video the students were given the task to fill in the blanks for the lexical context. For the pragmatic context, the students were asked to write fifteen sentences while

observing the videos, and for the syntactic context they were given multiple-choice cloze test questions. Despite being multiple-choice questions, the choice of the right words to identify from the given muted video proved challenging. For the control and target group a new video was played to assess their quality of writing. When assessing the lexical context, the total marks secured out of correct answer writing by both teams were taken into account. In terms of the pragmatic context, the usage of vocabulary, the complexity of sentence construction, usage of sports terms, adjectives, and phrases was analysed. If any three of the above appeared in the written answer, the answer received two points. Thirdly, for the syntactic context, selecting the right option gave one point. The total result in each test was analysed and compared between the two teams. However, the same course instructor needed to have access to all of them to avoid discrepancies in the writing assessment.

Results

T-test analysis

To identify the significance of the study one-sample t-test was done for the control group and the target group, with SPSS software used for the analysis. The reliability and validity of the following data pertained only to the target group specified.

Control group statistics

The one-sample t-test conducted between the pre and post-test of the control group showed that the standard deviation had considerably dropped from 13.76 to 7.23, and the standard deviation error had fallen from 4.59 to 2.41. This is a clear indication of the impact of the usage of the tool.

Table 2 clearly shows that the level of significance attained decreased from 0.307 to 0.072. The rise of the t-value is also significant, as it rose from 1.09 to 2.075 These results are also very significant.

Table 3 represents the statistical analysis of the pre-test and post-test scores of the target group. The standard deviation significantly fell from 12.459 to 3.23, and the Standard Error Mean dropped from 4.15 to 1.07. This shows the significant impact of the teaching tool on ESL students.

Table 4 shows that the t-value considerably increased from the pre-test to the post-test, with a score from 1.204 to 3.624. The level of significance is remarkable, plummeting from 0.263 to 0.007. The mean difference fell from 5.00 to 3.88. This is an interesting phenomenon in the case of teaching methods, as it proves the success of this teaching aid.

By comparing the t-value and significance level of the control and target group, a research hypothesis can be identified. In the control group, the t-value increased from 1.090 to 2.075 in the scores of pre and post-test respectively, while it increased from 1.204

Table 1
Comparison of control group pre- and post-tests

		Statistic	Bootstrap			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
Cont. Pre	*N*	9				
	Mean	20.0000	0.5278	3.9295	12.4657	30.4191
	Std. Deviation	13.75682	–0.31061	1.62298	9.58208	15.74583
	Std. Error Mean	4.58561				
Cont. Post	*N*	9				
	Mean	20.0000	0.2148	2.1351	15.5106	25.3031
	Std. Deviation	7.22842	–0.20772	1.00755	4.07835	9.00006
	Std. Error Mean	2.40947				

Source: authors' own work.

Table 2
Comparison of control group pre- and post-tests (t-test)

	Test Value = 15					
	t	*df*	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Cont Pre	1.090	8	0.307	5.00000	–5.5744	15.5744
Cont Post	2.075	8	0.072	5.00000	–0.5563	10.5563

Source: authors' own work.

Table 3
Comparison of target group pre- and post-tests

		Statistic	Bootstrap			
			Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
TarPre	*N*	9				
	Mean	20.0000	–0.5444	4.2926	11.2222	29.5825
	Std. Deviation	12.45994	–1.27091	2.73475	3.08926	15.10277
	Std. Error Mean	4.15331				
TarPost	*N*	9				
	Mean	18.8889	–0.0611	1.1871	16.2884	20.5792
	Std. Deviation	3.21887	–0.35147	0.97219	1.42004	4.45101
	Std. Error Mean	1.07296				

Source: authors' own work.

Table 4
Comparison of target group pre- and post-tests (t-test)

	Test Value = 15					
	t	*df*	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
TarPre	1.204	8	0.263	5.00000	–4.5776	14.5776
TarPost	3.624	8	0.007	3.88889	1.4146	6.3631

Source: authors' own work.

to 3.624 among the target members in their pre and post-scores. This rise in the t-value represents the significance of the usage of silent videos compared to audio videos in the classroom. Furthermore, the significance level attained in the pre and post-test is from 0.307 to 0.072 in the controlled group. While this is significant in the control group, the target group's significance was reduced, from 0.263 to 0.007, which proves the hypothesis.

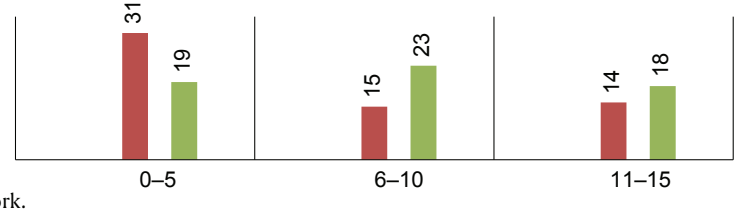
By providing an edutainment forum, the researchers could identify the impact of silent videos on learners. Both silent and audio videos had a significant impact on the students, but the impact is higher with the silent videos.

The measurements shown below are sample sizes converted to numbers to avoid data loss, which applies to all six figures. In Figures 1 to 6, series 1 represents the pre-test and series 2 represents the post-test.

Figure 1 represents the comparative statistics of pre and post-test of the target group in terms of lexical content. It clearly shows that in the target group the number of students who scored between 0–5 is 31 in the pre-test, while this reduced considerably in the post-test to just 19. Similarly, the number of students who secured between 6 and 10 rose significantly. For the pre-test this was 15, whereas for the post-test it rose to 23. In the pre-test, the number of students who scored between 11 and 15 saw a marginal rise from 14 to 18. Overall, the lexical content of the students regarding the usage of vocabulary, phrases, and adjectives is depicted to have a significant impact on the usage of silent videos.

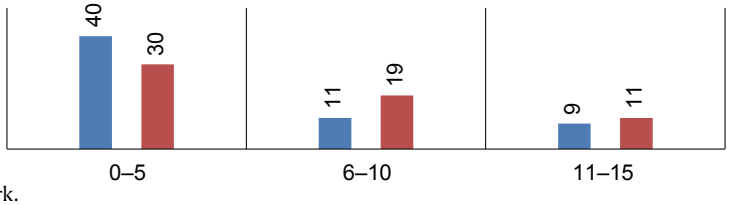
Figure 2 represents the comparative statistics of the pre and post-test of the control group in terms of lexical content. Fig. 2 clearly shows that in the controlled group the number of students who scored

Figure 1
Comparative statistics of pre and post-test of the target group – Lexical



Source: authors' own work.

Figure 2
Comparative statistics of the pre and post-test of the control group – Lexical



Source: authors' own work.

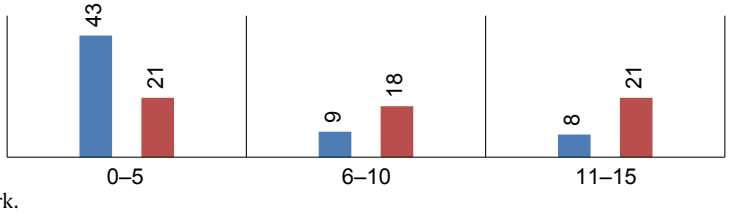
between 0–5 is 40 in the pre-test, whereas it reduced considerably in the post-test to just over 30. Similarly, the number of students who secured between 6 and 10 rose significantly. In the pre-test this is 11, whereas in the post-test it rose to 19. In the pre-test the number of students who scored between 11 and 15 saw a marginal rise from 9 to 11. Overall, the lexical content of the students regarding the usage of vocabulary, phrases, and adjectives is depicted to have a significant impact on the usage of videos with audio enabled, which clearly shows how the students are stimulated to act and write independently while using silent videos in the classroom.

Figure 3 represents the comparative statistics of the pre and post-test of the target group in terms of pragmatic content. It clearly shows that in the target group the number of students who scored between 0-5 is 43 in the pre-test, whereas it reduced considerably in the post-test to 21. Similarly, the number of students who secured between 6 and 10 rose significantly. In the pre-test this was 9, whereas in the post-test it rose to 18. In the pre-test the number of students who scored between 11 and 15 marginally rose from 8 to 21. Overall, the pragmatic content of the students about the usage of proper sentence order to explain the silent video showed a remarkable improvement.

Figure 4 represents the comparative statistics of the pre and post-test of the controlled group in terms of pragmatic content. It clearly shows that in the control group the number of students who scored between 0–5 is 37 in the pre-test, whereas it reduced considerably in the post-test to 27. Similarly, the number of students who secured between 6 and 10 rose significantly. In the pre-test this was 16, whereas in the post-test it rose to 21. However, in the pre-test the number of students who scored between 11 and 15 saw a marginal rise from 7 to 12. Overall, the pragmatic content of the students concerning the usage of proper sentence order to explain the video significantly improved, although less than in the target group.

Figure 5 represents the comparative statistics of the pre and post-test of the target group in terms of syntactic content. It is clearly visible that in the target group the number of students who scored between 0–5 is 33 in the pre-test, whereas it reduced considerably in the post-test to 12. Similarly, the number of students who secured between 6 and 10 rose significantly – in the pre-test it was 16, whereas in the post-test it rose to 21. In the pre-test the number of students who scored between 11 and 15 showed a rise from 11 to 17. Overall, the pragmatic content of the students regarding the usage of appropriate words in

Figure 3
Comparative statistics of the pre and post-test of the target group – Pragmatic



Source: authors' own work.

Figure 4
Comparative statistics of the pre and post-test of the control group – Pragmatic

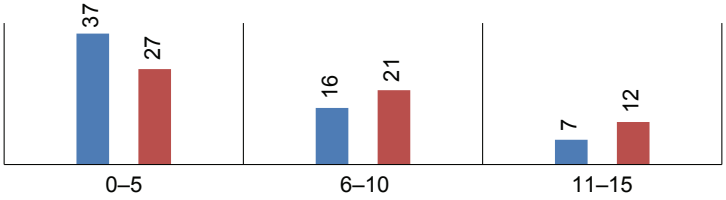


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Figure 5
Comparative statistics of the pre and post-test of the target group – Syntactic

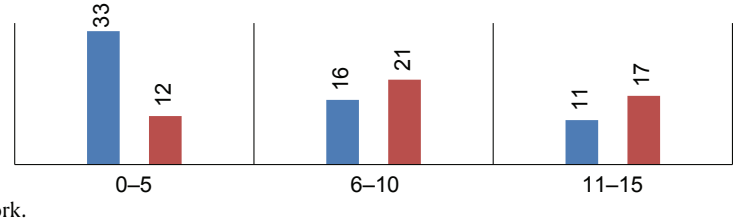

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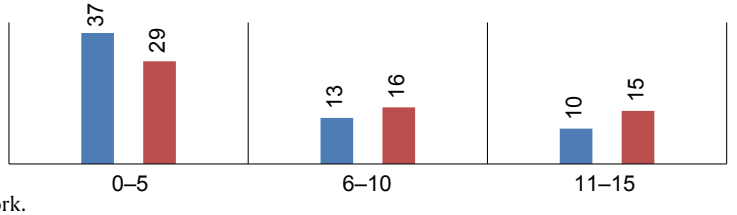
Figure 6
Comparative statistics of the pre and post-test of the control group – Syntactic



Source: authors' own work.

the right context to explain the video was analysed, showing a rocketing trend.

Figure 6 represents the comparative statistics of the pre and post-test of the control group in terms of syntactic content. It clearly shows that in the control group the number of students who scored between 0–5 is 37 in the pre-test, whereas it reduced considerably in the post-test to 29. Similarly, the number of students who secured between 6 and 10 rose significantly – in the pre-test it was 13, whereas in the post-test it rose to 16. In the pre-test, the number of students who scored between 11 and 15 showed a rise from 10 to 15. Overall, the pragmatic content of the students regarding the usage of appropriate words in the right context to explain the video rose significantly, however slightly less than in the target group.

Findings

We performed an analysis comparing the scores of the pre and post-test for the control group as well as the target group (refer to Appendix, Table 5 & 6). In the lexical context, the difference between the pre- and post-test for the range between 0 and 5 is 12 and 10 (refer to Appendix, Table 6). The higher the number in this range, the better the results. As this is the difference between the pre and post-test, the number of students who secured between 0–5 in the pre-test dropped considerably in the post-test. As the numbers between the two tests are high in both groups, the results are also high. Furthermore, this is a great result for the target group, as the difference in number in the score value is high compared to the control group that used the silent video. This is applicable to the pragmatic and syntactic classifications range between 6 and 10, as well as between 11 and 15. The above results show that both methods are good, but it is more significant in the case of the target group. In the range from 6 to 10, it is clear that for all three concepts that the students with the best results are in the target group. It is also clear that both the patterns have an impact, although this is more so in the case of the silent videos. In the range between 11 and 15 the students who achieved maximum scores in all three classifications are from the target group. Although the difference is minimal, a slight upward trend is visible in the target group.

Table 7 (refer to Appendix) represents the difference in students' numbers in terms of the pre-and post-tests in the target and control groups regarding lexical, pragmatic, and syntactic classification. The students who watched the silent videos achieved maximum scores. Table 8 (refer to Appendix) represents the choice of the number of students who opted for the questionnaire survey. Almost 50–60 percent of the class accepted the impact of the silent videos on positive grounds. After following the above procedures, the researchers analysed the control group once again, giving the students in the control group another task, once again with a silent video – to identify their way of answering as well as to sense the degree of comfort comparatively. The control group students provided feedback representing their choice of videos, with another questionnaire to compare audio and silent videos as well as to rate the usage of silent videos. Furthermore, they were also given the same questionnaire as the target students, to get a good understanding of their part. It is interesting that these students also provided favourable comments about the silent videos. The survey (refer to Appendix, Table 9), clearly shows that the majority of the students responded positively towards the usage of silent videos in the classroom. More than 50% of the class in the control group agrees that silent videos enhance their creativity compared to audio. Secondly, the feedback to the second question emphasises the

fact that silent videos are good compared to audio, which is clearly shown by more than 55% of the students. Thirdly, the students agreed that the interest created by silent videos is high compared to audio. Furthermore, the students informed that they feel that they gain a higher confidence level compared to audio. Similarly, more than 25 students agreed that active learning is promoted using silent videos.

Table 10 represents the feedback of the control group (who watched audio videos in the first phase), who watched a silent video as their second task. Their feedback also shows that they are highly interested in using silent videos as a different approach to language learning. From the feedback it can be identified that 21 students praised it to be an excellent method, while 32 students said it was good (refer to Appendix, Table 11). Overall, 88.33% of the target students found this practice to be fruitful. The data derived from the questionnaire shows the students' positive view of the research model. The data in Table 12, derived from the questionnaire given to the control group after watching the silent video, also reflects the positive approach to the research model. The consistency in the development of scores in terms of the pragmatic, syntactic and lexical context also reflects the efficacious nature of this research. The reliability of silent videos in the classroom is very positive from the perspective of the users. Table 12 (refer to the Appendix) shows that the students who opt for good and excellent usage of silent videos are relatively more than those praising the usage of audio materials. The overall comparison shows that both the target and control groups opt for silent videos as an effective language-learning tool.

Hypotheses – proving

From the survey carried out, it is clear that both silent videos and audio are good at incorporating language skills in the lexical, pragmatic, and syntactic concepts, and the analysis clearly shows that language acquisition is done effectively using silent videos, hence the null hypothesis stating that "There is no significant development in language acquisition while using silent videos" is rejected. Furthermore, the survey makes it evident that the students gain language competence using silent videos, thereby the first hypothesis, which says that "There is a significant development in language acquisition while using silent videos" is proved. Additionally, as the silent videos create an autonomous sense of writing, it is stated that the second hypothesis "The autonomy in writing is improved while using silent videos" is also proved.

Limitations

This study is confined to only silent cricket videos, and has not been applied to any movies or talks so far. This experimental study was carried out in a premier institution in the rural part of Tamilnadu, India. The reliability, assessment, and validity are subject to change depending on the cognitive level of the various target groups, as well as the choice of video, and the researchers do not assure that the same results will be gained with other students. The assessment in terms of pragmatic and syntactic acquiring concepts needs more focus, as the same examiner must examine both the target and the control groups' answers to maintain consistency in awarding marks based on sentence formation and choice of words respectively, especially that the assessment of paragraph writing demands more focus from the teachers' side, as it has to be done by the same person in the pre- and post-tests and for the control and target students. However, the results could vary depending on the video usage, listening environment, cognitive level of students, and understanding by faculty and assessment procedures.

Conclusion

Videos are among the best tools used for language development. Students who pay poor attention to lecture delivery are captivated by video usage with minimum digression. Though the videos enhance the audience's attention and understanding, they provide a sluggish environment when the students are forced to write answers for the follow-up questions, hence the researchers identified this gap and analysed and discussed at length the usage of silent videos to enhance the student's language learning ability by responding to silent videos. The research proves through empirical data that the usage of silent videos simulates interest in language learning. Enriched vocabulary, careful and logical arrangement of sentences, as well as choosing the right words, are outcomes of the usage of these silent videos, especially in terms of sports videos. It is clearly shown that audio videos provide a good learning forum for second language learning, and the usage of silent videos is also highly helpful in language learning. Irrespective of the actual video, this research clearly shows that silent videos are among the most effective tools for language learning, and could be used as an assessment tool to test language proficiency, while learning autonomously and creative thinking are outcomes of the usage of silent videos. Furthermore, it provides a forum for creativity among learners. The application of the learned concept without dependency on subtitles and audio impacts their choice of words and enhances their writing skills. The autonomous emergence and self-reliant attitude are salient outcomes of the usage of silent videos. Compulsion on the one hand, and interest on the other, have created a lively forum for language learning using silent videos. However, the application of silent videos has limitations, especially in terms of pragmatic context assessments. If MCQs are given, assessment is very easy. The assessment of paragraphs and sentences demands a lot of instructions for evaluators in order to carefully and eliminate subjective evaluation. Future researchers can work on how silent videos could be used as a stress buster, a self-learning strategy, and shedding

new light on a topic-based curriculum. Additionally, future researchers could explore the opportunity to use animated videos without audio among school children, and could assess their creativity outcome in terms of language acquisition. Researchers can further explore the creative outcome of using silent videos among teacher trainers and young adults in higher secondary schools.

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Appendices are available in the online version of the journal.

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Muhammad Shafiq

The relationship between teachers' sense of efficacy and organizational commitment at Colleges in Pakistan

Abstract

This study explores the relationship between teachers' sense of efficacy and their organizational commitment at colleges in Pakistan. It was conducted on a sample comprising 494 public-sector Pakistani college teachers. Tschannen-Moran and Hoy (2001) developed the teachers' sense of efficacy scale, and John P. Meyer and Natalie J. Allen's developed organizational commitment scale (1991) was applied to collect the data. Hypotheses were tested using the Pearson Product Moment formula. The effects of the factors of the teachers' sense of efficacy on organizational commitment were determined using the Regression Analysis. It was determined that a higher degree of teachers' sense of efficacy enhances organizational commitment, as highlighted by a significant positive correlation between the teachers' sense of efficacy and organizational commitment. There was a significant positive correlation between three factors of the teachers' sense of efficacy scale and three components of organizational commitment of college teachers. It was also established that the teachers' sense of efficacy can predict organizational commitment. The study shows that teachers' sense of efficacy must be considered when selecting and training prospective teachers. To become efficient and effective, teaching organizations must pay considerable attention to monitoring and boosting the positive Sense of self-efficacy among their teaching staff.

Keywords: self-efficacy, teachers' sense of efficacy, affective commitment, continuance commitment, normative commitment, organizational commitment

Introduction

Self-efficacy is determined to be a person's firm belief in their ability to organize and implement actions to reach a specific level of performance. Self-efficacy is the conviction that one has in their capabilities as an impetus for success (Bandura & National Inst of Mental Health, 1986). The construct, sense of teaching efficacy is specific to the domain of teaching and has been defined as the beliefs of teachers about their teaching competence. According to Tschannen-Moran and Hoy (2001), teachers' self-efficacy beliefs guide them to success. While this seems to be deceptive and simple, it is a powerful idea. People who have a higher degree of self-efficacy put their potential faculties into action, try hard to keep pace with the demands of the circumstances, and accept hurdles as challenges, and consequently make a greater effort (Bandura & National Inst of Mental Health, 1986)

As Teaching is a combination of the clusters of tremendous liabilities and responsibilities, it must be assigned to those individuals who not only concur with but also enjoy these obligations and responsibilities. A teacher must believe in themselves and their capacity to incorporate positive differences into the personalities of their students. It is not confirmed to what extent this self-belief will ensure success, but not believing in oneself is certainly an impetus for failure.

The self-belief of teachers (teachers' self-efficacy or teachers' sense of efficacy) is certainly a source of resistance against the difficulties and complexities innate to the teaching profession. Personal belief in one's ability to attain a certain goal defines the choice and course of action to execute a task. A high level of self-efficacy belief is associated with high performance and the level of performance stems from the degree

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of commitment to the organization. Teachers' self-efficacy belief in the teaching profession may predict their level of organizational commitment. A review of literature reveals a positive correlation between occupational efficacy and organizational constructs such as job satisfaction, organizational change, and organizational commitment (Schyns, 2004; Schyns & von Collani, 2002).

Whether in a teaching organization or elsewhere, committed employees are considered valuable assets of organizations. Every year, there is substantial financial investment by organizations in training and developing human resources in organizations just to see the trained and groomed employees turning over their jobs to more lucrative options. A higher level of commitment among employees of an organization helps to bring about organizational efficiency and effectiveness, and profit for the organization. Jamieson and Richards (1996) argue that employees that are more committed to the organization contribute more to the profit-earning and improvement of the system of the organization, and help to reduce the organization's costs, as committed employees actively participate in organizational affairs. Organizational productivity is high due to having committed employees in the organization, and this is a win-win situation for both employees and the organization. The employees enjoy job security, are well trained, own the organization and become part of the organizational team, and feel pride working for the organization. Employees' commitment to the profession also has significant implications for the induction process. By identifying the key factors contributing to the commitment of employees, organizations can establish a checklist of attributes an organization must look for among job applicants during the induction and selection process, to catch and retain a more committed workforce. Jamieson and Richards (1996) further stress that post-induction strategies may be formulated to devise interventions if current development and training schemes do not improve the commitment of employees to the organization.

Self-efficacy is believed to be among the factors affecting employees' commitment to an organization, and therefore specific strategies should be devised to improve belief in self-efficacy. Theoretically, this research is rooted in Bandura's self-efficacy theory, which considers it purely a mechanistic construct. This study explores further Bandura's (1994) idea that persons with a higher level of self-efficacy belief tend to be more committed to their career choices and their employers. This study may contribute on an operational level by highlighting the significance of the constructs of self-efficacy and organizational commitment in the process of training and development.

Meyer and Allen (1984, p. 375) defined organizational commitment as "a multifactor construct that subsumes three factors of commitment in it denoted as affective, continuance and normative commitment. Affective Commitment encompasses the positive feelings of belongingness to the employing organization and its affairs." When a person has an obligation towards the employing organization, they show normative commitment and do not leave it (Allen & Meyer, 1996, p. 253). "When a person is intimidated by loss of benefits and penalties as a result of quitting the organization, he does not think to quit, it reflects Continuance Commitment" (Meyer & Allen, 1984, p. 375). When employees stay attached to the organization because they have common ambitions and goals, this attitude is denoted as affective commitment. This solely depends on their affective ownership of the organization. Those employees who have a higher level of continuance commitment try to remain with the organization because they understand that it is necessary to continue in the organization to get terminal benefits. Some employees remain committed to their employers because of normative commitment resulting from norms and compulsions (Allen & Meyer, 1990).

Employees tend to remain committed to the employing organization when the organization provides them with a conducive environment, handsome salaries, allowances, and other perks and privileges. The employees in such organizations display higher degree of continuance commitment. The reason for employees' display of the higher degree of continuance commitment is the fear of loss of all the facilities on leaving the organizations (Allen & Meyer, 1990). The teaching profession is very demanding, with the utmost level of stress and mental fatigue and a modest income. Teachers must deal with the inappropriate behaviour of students in the class and find a balance between their professional and personal obligations. Resultantly, teachers become dissatisfied and uncommitted to the employing organization. The self-belief of teachers in handling their professional duties and immaculately handling the unusual situations and behaviour of students and colleagues is termed *teaching self-efficacy* and is found to be higher in efficacious teachers. Higher teaching efficacy contributes toward a higher degree of teachers' commitment to a teaching organization. In the following paragraphs, several studies are summarized to support this hypothesis.

Several studies in the domain of industrial and organizational psychology have established a linkage between self-efficacy and organizational commitment. (Meyer et al. (2002) found a significant positive correlation between organizational commitment and domain-specific self-efficacy. Salami (2007) found in the Nigerian context a significant positive relationship between secondary school teachers' self-efficacy and their organizational commitment. Job satisfaction and higher general self-efficacy caused employees to have a higher level of organizational commitment. Furthermore, they were less inclined to quit the organization when compared to employees with a lower level of self-efficacy (Luthans et al., 2006).

A study by Schyns and von Collani (2002) observed a positive correlation between occupational

self-efficacy, job satisfaction, and organizational commitment. Studies such as those by Chan (2004), Gundlach et al. (2003), and Salami (2007) reveal that so far the bulk of the studies focused on general self-efficacy and organizational commitment, while there is a requirement to underpin occupational self-efficacy to organizational commitment. Schyns (2001; 2004) and Schyns and von Collani (2002) dwell upon the significance of the notion of domain-specific self-efficacy for organizations.

Rathi and Rastogi's (2009) study evaluates interconnections between occupational self-efficacy, emotional intelligence, and organizational commitment in Indian organizations. They observed a significant positive correlation between emotional intelligence and self-efficacy. There was a positive interdependence (not significant) between emotional intelligence and organizational behavior. A low positive correlation was observed between organizational commitment and occupational self-efficacy.

Ming-Ten Tsai et al. (2011) addressed the relationship between leadership style, emotional intelligence, self-efficacy, and organizational commitment in the banking sector of Taiwan. The study found a significant positive influence on a supervisor's emotional intelligence and leadership style. Supervisors with a higher level of emotional intelligence are able to exercise better leadership skills to elevate employee self-efficacy, and self-efficacy has a significant positive influence on organizational commitment.

Agu (2015) is a review-based study on work engagement, organizational commitment, self-efficacy, and organizational growth. The study concluded that if organizations want to increase the level of employee engagement, they should work to create an environment where employees want to engage, and this will lead to an increase in their self-efficacy. Human accomplishment and personal well-being are strongly associated with a sense of self-efficacy.

Akhtar Bibi et al. (2019) identified that there is correlation between various work attitudes, namely perceived organizational support, organizational commitment, and job satisfaction of teachers at special education institutions in Pakistan. They discovered a positive correlation between job satisfaction and normative and affective commitment yet noted a negative relationship between job satisfaction and continuance organizational commitment.

Osei et al. (2017) is a study conducted in Ghana which attempted to judge the mediatory effect of organizational commitment among nurses' individual mechanisms i.e., trust, ethics, justice, and self-efficacy. It was found that individual mechanisms directly affected nurses' organizational commitment and as a result organizational commitment had a significant positive effect on the self-efficacy of nurses in Ghanaian hospitals.

Erli Liu and Jiatao Huang (2019) found a positive correlation between organizational commitment and occupational self-efficacy of postgraduate students of business administration in China. Their results endorsed the understanding that the self-efficacy belief of individuals has a positive effect on their work-related attitudes, including organizational commitment.

Jordan et al. (2017) explored the interconnections of psychological empowerment, job satisfaction, and organizational commitment. The study concluded that Slovenia had higher rates of affective organizational commitment, while Germany had a low rate of affective organizational commitment. The rates of continuance organizational commitment were higher in Croatia and lower in the Czech Republic. The normative organizational commitment had higher rates in the Czech Republic and was lower in Austria.

Muhangi (2017) explored the relationship between self-efficacy and a variety of work attitudes, including job satisfaction and job commitment of secondary school teachers. As a result, he found a significant interconnection between self-efficacy, job commitment, and job satisfaction among secondary school teachers. The study recommends improving job commitment among secondary school teachers, and that aspects of professional competence i.e. self-efficacy and job satisfaction, should be enhanced. Khan (2017) found a significant positive correlation between self-efficacy and organizational commitment. According to his study, there is a significant positive correlation between self-efficacy and organizational commitment.

Chung (2019) found that collective self-esteem partially mediated the relationship between teacher efficacy and organizational commitment. He concluded that "teacher efficacy translated into a higher organizational commitment among teachers that perceive relatively higher degrees of social support in both the indirect effect through collective self-esteem and the direct effect without collective self-esteem" (p. 1).

Demir (2020) carried out a study to underscore the correlation between teachers' self-efficacy and commitment to their employing organization. He found that when teachers' self-efficacy increases, organizational commitment and job satisfaction also increase. There is a positive relationship between organizational commitment, motivation, job satisfaction, and teachers' self-efficacy. He suggested that strengthening teachers' self-efficacy perception would develop a positive attitude towards organizational commitment.

Mokhtar et al. (2021) evaluated the relationship between teachers' commitment, self-efficacy, and job satisfaction. They found that:

> self-efficacy significantly mediated the relationship between primary school teachers' commitment and job satisfaction, both teachers' commitment and self-efficacy had significant and direct impacts on the job satisfaction of primary school teachers and the presence of self-efficacy enhanced teachers' commitment and improved the job satisfaction of primary school teachers. (p. 1)

There are fewer studies relating teachers' self-efficacy with organizational commitment in the Pakistani context. Therefore, to address the issue with empirical evidence on this very topic, the present study explored the relationship between college teachers' sense of efficacy and organizational commitment in Pakistan.

Methodology

Research objectives

The study objectively focuses on the following points:

1. To explore the role of college teachers' self-efficacy beliefs in the promotion of organizational commitment to the teaching organization.
2. To investigate the relationship between the teachers' sense of efficacy and organizational commitment.

Research hypotheses

The devised null hypotheses to achieve the objectives were as follows:

1. There is no significant relationship between teachers' sense of efficacy and the organizational commitment of teachers at colleges in Pakistan.
2. There is no significant relationship between teachers' sense of efficacy and the three factors of organizational commitment of teachers at colleges in Pakistan.
3. There is no significant effect of teachers' sense of efficacy on the organizational commitment of teachers at colleges in Pakistan.

Conceptual framework of the study

Based on these hypotheses, this study was planned to underpin the relationship between teachers' self-efficacy beliefs and organizational commitment at Pakistani colleges. This relationship is best narrated in the figure below as it was explored in the study.

Research design

The study was designed as a survey and there was no manipulation introduced; the findings were narrated as were found resultantly.

The population of the study

The study took male and female teachers at public sector colleges in the Pakistani Punjab province as its population. These teachers taught at Intermediate, Bachelor, and Post-graduate colleges.

Study sample

The sample contains 494 college teachers, both male and female, of Intermediate, Bachelor, and Postgraduate colleges of the provincial government of the Punjab Province of Pakistan. These colleges were in ten major cities in Punjab, Pakistan. The sample comprised 256 men and 238 women. The sample was selected using a convenient sampling technique. A total of thirty colleges were earmarked to collect data, which included fifteen colleges of men and the fifteen colleges of women. Twenty teachers from each college were asked to fill in questionnaires, and in total 600 sets of questionnaires were floated to these teachers. 494 questionnaires were collected filled which include 256 men and 238 women teachers.

Research instruments

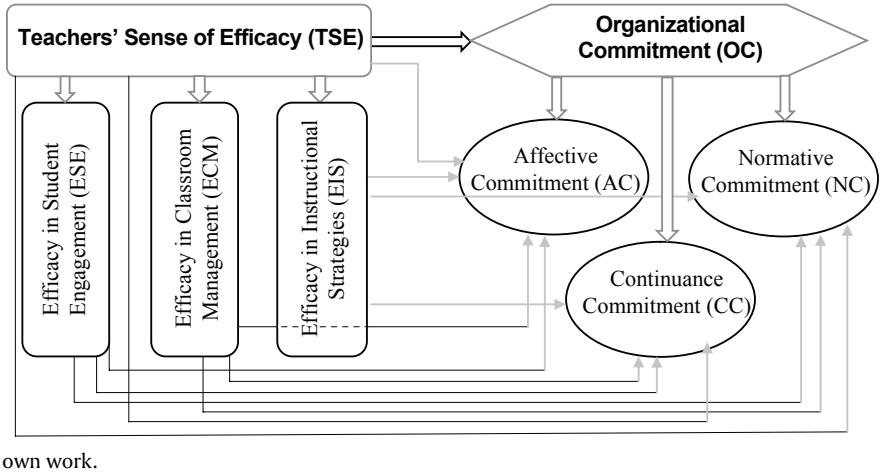
The following instruments were administered to measure teachers' sense of efficacy and their organizational commitment to the organization.

Teachers' Sense of Efficacy Scale (TSES)

There are many measures of self-efficacy available, but the researchers adopted the teachers' sense of efficacy Scale developed by Tschannen-Moran and Hoy (2001). This scale is comprehensive, reliable, and easy to administer. It is also denoted as the "Ohio State

Figure 1

Relationship between self-efficacy factors and organizational commitment factors



Source: author's own work.

Teacher Efficacy Scale (OSTES)." This scale has a long (24 items) and a short version (12 items). In this study, the long form was applied. Every item in the scale is gauged on the 7-point Likert scale and the responses are ranged from 'nothing' to a great deal. Three different types of factors were identified by the authors of the TSES, including efficacy in student engagement, efficacy in instructional strategies, and efficacy in classroom management. Each sub-scale contains eight items. This scale attempts to cover the multifarious nature of efficacy beliefs of teachers comprehensively and does not become too specific or too general. The total reliability reported by Tschannen-Moran and Hoy (2001) was calculated at 0.88 using Cronbach's alpha. This scale was adopted and used for the study with the permission of Dr Anita Woolfolk Hoy.

Scaling the organizational commitment

The organizational commitment scale comprising three components was developed by Meyer and Allen (1991; 1997). In this scale, there are three types (components) of commitment, which are affective, continuance, and normative commitment. They defined affective commitment as an emotional connection of an employee to their organization. When an employee is intimidated due to fear of losing their job, they remain with the organization, which results in their continuance commitment to the employing organization. When an employee considers the norms of society and profession and feels that they have an obligation towards the organization, they are referred to as a normatively committed employee of that organization, and this is labelled as normative commitment. The organizational commitment scale measures three factors of commitment. This scale was adopted with the permission of the authors of this study. This contains eighteen items in total, with six items dedicated to measuring each component of the commitment and measuring the accumulated organizational commitment of an individual. Allen and Meyer assessed the scale, and the reliability alpha indices they reported were 0.87 and 0.84 on two different occasions.

Data collection

In-person visits were paid to each college for the administration of questionnaires to teachers in ten major cities of the Punjab Province of Pakistan. Prior permission was sought from the college administration to conduct the study. The aims and objectives of the study were communicated to the participants and the colleges' administration. The completed questionnaires were made part of the data. The data used in this study comes partially from the author's broader research, conducted to identify the relationship between college teachers' emotional intelligence and organizational commitment at colleges in Pakistan (Shafiq, 2013; Shafiq & Rana, 2016).

Data analysis and interpretation

The Pearson Product-Moment Correlation Coefficient Formula was administered on data to determine the correlation between the teaching self-efficacy of teachers and their organizational commitment. To further determine the magnitude of the difference that the self-efficacy of teachers made with regard to the three factors of organizational commitment, Regression Analysis was used. Table 1 shows the statistics obtained when the above-mentioned tests were performed.

A moderately significant positive correlation value of $r = 0.539$ is noted as shown in Table 1 between overall teachers' efficacy beliefs and the overall organizational commitment. Therefore, the null hypothesis that there is no significant relationship between sense of teaching efficacy and organizational commitment of teachers at colleges in Pakistan is rejected.

The hypothesis "there is no significant relationship between teachers' sense of efficacy and the three factors of organizational commitment of teachers at colleges in Pakistan" is also rejected because the relationship between self-efficacy and the affective commitment factor of organizational commitment was found to be significantly positive, with a value of $r = 0.459$. Teachers' efficacy beliefs in teaching were

Table 1

Matrix of correlations among the variables and their factors

Variables	1	2	3	4	5	6	7	8
1. TSE_Total	1.00	0.951**	0.945**	0.946**	0.539**	0.459**	0.215**	0.451**
1a. ESE	0.951**	1.00	0.848**	0.852**	0.531**	0.444**	0.220**	0.448**
1b. EIS	0.945**	0.848**	1.00	0.838**	0.504**	0.451**	0.187**	0.412**
1c. ECM	0.946**	0.852**	0.838**	1.00	0.495**	0.410**	0.204**	0.421**
2. OC_Total	0.539**	0.531**	0.504**	0.495**	1.00	0.710**	0.602**	0.781**
2a. AC	0.459**	0.444**	0.451**	0.410**	0.710**	1.00	0.013	0.431**
2b. CC	0.215**	0.220**	0.187**	0.204**	0.602**	0.013	1.00	0.249**
2c. NC	0.451**	0.448**	0.412**	0.421**	0.781**	0.431**	0.249**	1.00
Mean	173.56	91.63	57.60	58.33	57.62	32.04	28.35	31.23
SD	30.57	13.74	10.87	10.76	10.63	7.07	6.67	6.02

Note. $N = 494$, SD = Standard Deviation, $^{**}p < 0.01$.

Source: author's own work.

also determined to be significantly positive concerning normative commitment with $r = 0.451$.

The relationship between teachers' efficacy in teaching beliefs and continuance commitment was found to be significantly positive, with a value of $r = 0.215$, a little lower than the value for affective and normative commitment factors.

There were three factors on the teachers' sense of efficacy scale denoted by Efficacy in Student Engagement (ESE), Efficacy in Classroom Management (ECM), and Efficacy in Instructional Strategies (EIS). There were also three types of organizational commitment, namely Affective Commitment (AC), Continuance Commitment (CC), and Normative Commitment (NC). Correlations were also found between the factors of teachers' self-efficacy and the types of organizational commitment; the results are given in Table 1. There was a significant positive correlation between all the factors on the teachers' self-efficacy scale and three types of organizational commitment, and the corresponding values of Pearson "r" are given in Table 1.

To test the third hypothesis of the study, which was "there is no significant effect of teachers' sense of efficacy on the organizational commitment of teachers at colleges in Pakistan, regression analysis was used. The regression analysis confirmed the extent of the effect that the self-efficacy beliefs of teachers had on each factor of their organizational commitment and the magnitude of the effect on overall organizational commitment was determined.

More than 29% of variance was identified in teachers' self-efficacy beliefs in their overall organizational commitment to teaching organizations. It was also found that self-efficacy can influence the affective commitment of college teachers with a variance of more than 21%. Variance of only 4.6% was found when conducting the regression analysis, which shows that teachers' sense of efficacy can only marginally predict their continuance commitment to the employing organizations. A significant effect of self-efficacy beliefs of college teachers on their normative commitment was observed as the magnitude of variance calculated using the regression analysis was more than 20%. The results of the regression analysis are given in Table 2.

The regression analysis shows that the independent variable i.e., self-efficacy, is effective in making a significant difference to the dependent variable i.e., the organizational commitment of teachers. However, the magnitude of the effect of self-efficacy on overall organizational commitment and two of its factors (affective and normative commitment) was medium. The effect of teachers' self-efficacy on continuance commitment was determined to be weaker, i.e., 4.6%.

Discussion

The findings revealed a significant positive relationship between college teachers' sense of teaching efficacy and their organizational commitment in the Pakistani context. It is evident from the results that there is a positive and significant relationship between the self-efficacy of teachers and their commitment to employing organizations. Teachers possessing a higher sense of teaching efficacy are found to be more committed to the teaching organization, and thus the hypothesis "there is no relationship between college teachers' sense of efficacy and organizational commitment" was rejected. The results of the study are in line with Agu (2015), Bibi et al., (2019), Chung (2019), Coladarci (1992), Demir (2020), Jordan et al. (2017), Judge and Bono (2001), McDonald and Siegall (1992), Mokhtar et al. (2021), Muhangi (2017), O'Neill and Mone (1998), Osei et al., 2017, Rathi and Rastogi (2009), Rosenholtz and Simpson (1990), Tsai et al. (2011), and Trott (1996). The findings of this study are evidently aligned with the idea that teachers with a higher sense of teaching efficacy focus on the subject matter more and attain proficiency and command which leads to better choices and application of teaching methods and strategies. These types of teachers better understand students' demands and needs and control them well and are found to be more committed to the teaching organization. All of the above-quoted studies supported the notion that teachers who had better teaching efficacy beliefs displayed a higher degree of commitment to an employing organization and the job of teaching. They do not leave when faced with negative circumstances in performing the job of teaching because they believe in themselves and that they can overcome challenging situations posed by the profession of teaching. Teachers with positive self-efficacy enjoy facing challenging situations as they have the potential to overcome the challenges. They are confident people with the self-belief to produce the desired effects and are capable team members able to drive organizations toward the attainment of organizational objectives.

Table 2

Effect of self-efficacy on organizational commitment and its three components

Model	B	t-value	Sig	Model R Square
Effect of self-efficacy on total organizational commitment of teachers	0.242	14.178	0.000	0.290
Effect of self-efficacy on affective commitment	0.106	11.473	0.000	0.211
Effect of self-efficacy on continuance commitment	0.047	4.887	0.000	0.046
Effect of self-efficacy on normative commitment	0.089	11.206	0.000	0.203

Note. $N = 494$.

Source: author's own work.

Furthermore, a positive relationship has been demonstrated between factors of teachers' sense of efficacy and the corresponding commitment factors, namely an affective, continuance, and normative commitment. A moderate relationship was found between factors of teachers' sense of efficacy and the affective and normative commitment of college teachers. Whereas there was a weak relationship between factors of teachers' sense of efficacy scale and continuance commitment of college teachers, the null hypothesis "there is no significant relationship between factors of self-efficacy and the three components of organizational commitment of college teachers" was rejected based on the findings.

It is pertinent to discuss other variables which might mediate the relationship between self-efficacy and organizational commitment of teachers as highlighted by Osei et al. (2017): these are trust, ethics, and organizational justice. These individual and organizational mechanisms and many others like them are not studied in the present study. If the above-identified variables had been studied here in combination with the variable of teachers' self-efficacy, the Model R Square values in Table 2 against total self-efficacy and teachers' overall organizational commitment and its three factors might have been much improved from a medium to a stronger degree. Future studies are recommended on the variables which effect organizational commitment to fill the gap in understanding the mechanics of organizational commitment in teaching organizations.

Conclusions

The findings of the study show a significant positive relationship between teachers' sense of efficacy and teachers' organizational commitment. The teachers' sense of efficacy also effects their organizational commitment to employing organizations, i.e., colleges. teachers' sense of efficacy also effects the three components of organizational commitment, namely affective, continuance, and normative commitment. engagement of students, which is a factor of teachers' sense of efficacy, increases teachers' organizational commitment. Teachers who have a greater sense of teaching efficacy will be able to devise and adapt effective instructional strategies and methods of teaching which may have a positive effect on their organizational commitment. Teachers who believe that they can manage their classes well will be more effective and organizationally committed, and their greater sense of teaching efficacy in classroom management skills reflects a higher degree of commitment to the organization.

Because teachers' greater sense of teaching efficacy is a vital aspect of their professional and personal motivation, and it has a positive effect on their organizational commitment, it must be considered as one of the vital aspects of a teacher's personality during the selection process as well as in gauging their organizational commitment after joining the organization. To attain efficiency and effectiveness by retaining organizationally committed teachers in educational organizations, self-efficacy beliefs of teachers should never be weakened and the administration should take positive steps in monitoring and inculcating a positive sense of efficacy among the teaching staff.

Suggestions for further studies

As the results of this study underpin the significant positive relationship between self-efficacy and organizational commitment of college teachers in Pakistan therefore, further studies are recommended to investigate various ways and means to inculcate positive Self-efficacy beliefs in prospective and in-service teachers of different education levels, countries, and cultures, to minimize the high turnover of employees of the teaching organizations of modern times.

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Applying the PERMA model in employee wellbeing

Abstract

The aim of this study is to define the essence of wellbeing in employee management, and present the functionality of the PERMA model in positive psychology. The first part of the study describes the multidimensionality of the concept of wellbeing and the difficulties in defining it. An important element of the conducted analysis is the presentation of the positive effects of the implementation of wellbeing in organisations, including elements of wellbeing dimensions and activities affecting wellbeing, while the most important part of the article is the diagnosis of the applicability of the PERMA model in the study of employee wellbeing and positive education. Different elements of the model are described and the latest solutions with regards to its improvement are presented. An analysis of the literature showed that a model with four additional dimensions – physical health, mindset, work environment and economic security – may be the most useful for analysing employee wellbeing. The next part of this publication is devoted to the use of the PERMA model in the classification of interventions, where we show that the model not only enables diagnosis of the weaknesses of wellbeing, but even facilitates the assigning of specific interventions. These solutions make it possible to build wellbeing that positively impacts employee behaviour, with the authors indicating discrepancies in the activities undertaken by organisations and the needs of employees with regards to wellbeing. The findings suggest that employees expect activities related to the development of their mental dimension and economic security, not necessarily related to physical health, which are most commonly implemented by organisations.

Keywords: dimensions of wellbeing, effects of wellbeing, dimensions of the PERMA model, positive psychology, positive education, wellbeing activities

Introduction to wellbeing

The concept of wellbeing (well-being) has become a permanent feature in human resource management (HRM), as well as the subject of many analyses, comments and concepts, and has been given a special status in the proper implementation of HR tasks, such as performance management, motivating or building commitment. Wellbeing can manifest itself in three different aspects: evaluative wellbeing, hedonic wellbeing and eudemonic wellbeing (David & Ali, 2021; Esteban-Gonzalo et al., 2020; Steptoe et al., 2015). Evaluative wellbeing is associated with a general sense of life satisfaction based on evaluating and benchmarking one's own situation with that of others or with a situation from the past (Angel & Gregory, 2021; Deaton & Stone, 2014). Hedonic wellbeing is considered in terms of positive and negative experiences in everyday life related to happiness, anger, stress and pain (Deaton & Stone, 2014; Disabato et al., 2016; Henderson & Knight, 2012; Ilska & Kołodziej-Zaleska, 2018; Zuo et al., 2017). Eudemonic wellbeing refers to the realisation of life purpose, meaning of existence, self-realisation and sense of fulfilment (Dolan & Metcalfe, 2012; Fancourt & Steptoe, 2020; Luna et al., 2020; Marshall et al., 2014; Steptoe et al., 2015). Research into wellbeing has gained in importance since the late 1990s and is moving in two directions – subjective wellbeing (SWB) and psychological wellbeing (PWB). The issue of these two types of wellbeing is described in detail by Keyes et al. (2002), indicating that subjective wellbeing reflects the hedonic aspect, and psychological wellbeing reflects the eudemonic aspect. Diener (1984) used three components to measured

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subjective well-being: frequent positive affect, infrequent negative affect and cognitive evaluations of life satisfaction. In his research he concluded that people make evaluations of their life, and assessment occurs by comparison of their current situation with their aspirations. This evaluation consists of, among other things, living conditions, social relationships and the possibilities to function in a healthy way (Tov & Diener, 2013). Psychological wellbeing, on the other hand, was defined by Ryff (1989) in his investigations by six dimensions: self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, personal growth.

One of the frequently cited definitions of wellbeing is the definition of health proposed in the Constitution of the World Health Organization (WHO), which states that "health is a state of complete physical, mental and social wellbeing and not merely the absence of disease or disability" (WHO, 2014, p. 18). Simons and Baldwin (2021) reviewed the definition of wellbeing, undertaking a critical approach to the meaning of the term. They conclude that the proper definition of wellbeing should include all three of its aspects: evaluative, hedonic and eudemonic. When researching the literature, one can see a growing interest in the science of managing the concept and research on wellbeing, and issue that was previously explored by doctors, psychologists and sociologists. Employee behaviour researchers and their determinants noticed over a decade ago that a well-functioning organism, such as a company, needs physically and mentally "healthy" employees.

The aim of this study is to integrate the wellbeing concept in employee management, along with determining the usefulness of the PERMA model for measuring and proposing activities to ensure wellbeing. An important element of the paper is also the construction of the concept of using the PERMA model in positive education closely related to wellbeing, with another aim of the study being to present recommendations containing the proposed direction of changes in the field of building wellbeing programmes.

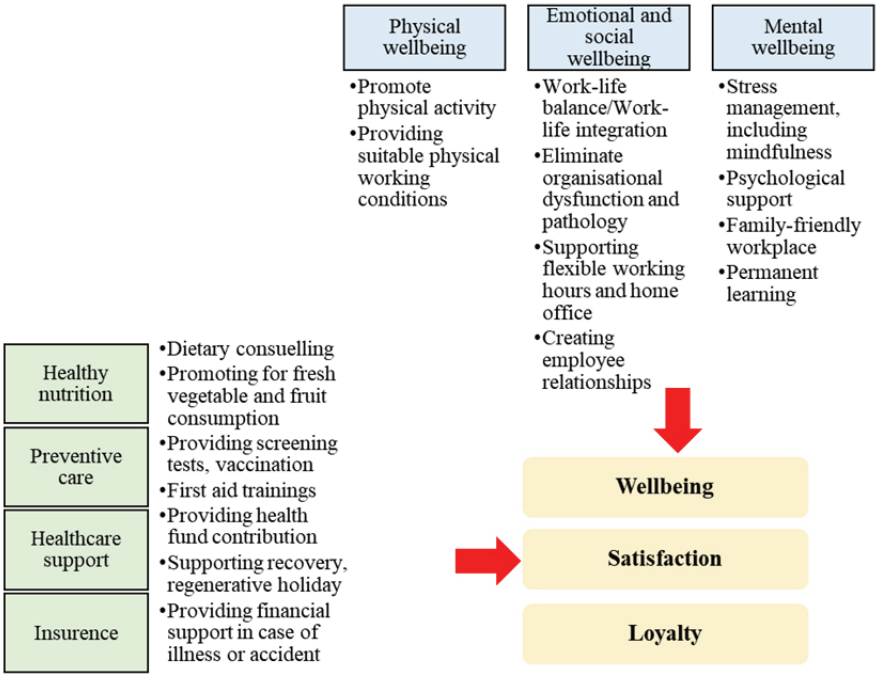
Definition, dimensions and benefits of employee wellbeing

The wellbeing of employees is defined inconsistently and refers to the general definition of wellbeing. It is difficult to find a concise definition of this term in the literature dealing with this issue, but it is worth pointing out that employee wellbeing is considered in two categories of physical and mental health (Bayhan Karapinar et al., 2019; Ernst Kossek et al., 2012; Gorgenyi-Hegyes et al., 2021; Pradhan & Hati, 2019; Rasool et al., 2021; Zhou et al., 2020). They consist of a psychological dimension, an emotional dimension (affects), a social dimension, and Gorgenyi-Hegyes et al. (2021) add a fourth dimension, referred to as spiritual. The psychological dimension of employees' wellbeing includes, among others, self-acceptance of their weaknesses, having goals in one's private life that translate into goals in one's professional life, striving to achieve perfection (master) in activities, positive relationships, high autonomy, and personal development (Pradhan & Hati, 2019). The emotional and social dimensions include promoting balance (co-existence) between professional and personal life (work-life balance, work-life integration), appreciation and recognition, supporting flexible working hours and lack of pathologies in the workplace, such as discrimination, harassment, and mobbing (Gorgenyi-Hegyes et al., 2021). The least space in the literature on organisations is devoted to the separately analysed social dimension (Walia & Nishtha, 2018), although its value should be appreciated due to the fact that the quality of short-term interactions and long-term relationships affects the creation of a work environment based on respect and trust, which allows the employee to grow and flourish. The social dimension includes satisfaction with contacts as well as satisfaction with mutual relations with leaders. The last dimension, that is the spiritual dimension, is based on the feeling of personal job satisfaction. Also worth noting is that the dimensions presented above closely follow the model proposed by Tom Rath and Jim Harter from Gallup, Inc., who distinguished five dimensions: career wellbeing, social wellbeing. financial wellbeing, physical wellbeing, community wellbeing (Rath & Harter, 2010).

Figure 1 presents selected activities affecting the wellbeing of employees. The presented dimensions are always related to the organisation's strategy in the field of human resources management, and the process of their introduction should be preceded by a thorough assessment of needs and implementation possibilities. The activities on the left side of the figure are those most often carried out by organisations, and aim to build employee wellbeing, satisfaction and loyalty (Gorgenyi-Hegyes et al., 2021). Figure 1 also shows that only a combination of long-term programmes and operational activities develop the wellbeing of employees.

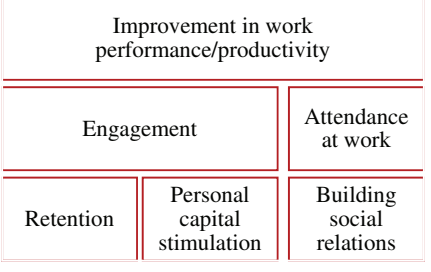
Figure 2 shows that including employee wellbeing in HR processes results in many positive behaviours. Pradhan and Hati (2019), conducting a meticulous analysis of the literature, showed that the use of appropriate tools and solutions in the field of wellbeing supports the process of employee performance management, which translates into making "extra miles" at work. Behaviours that affect productivity increase employee engagement and reduce employee absenteeism as a result of a high level of physical fitness and the impact on employee happiness. The next group of benefits includes reduced employee turnover resulting from, among others, greater productivity caused by better wellbeing and higher wages dependent on higher work performance. An important effect of wellbeing is the stimulation of personal capital and the creation of social relationships that result in increased creativity and the desire to possess social and knowledge resources (satisfying needs).

Figure 1
Dimensions and activities affecting employee wellbeing



Source: authors' elaboration based on „Workplace health promotion, employee wellbeing and loyalty during Covid-19 pandemic–large scale empirical evidence from Hungary", E. Gorgenyi-Hegyes, R. J. Nathan, & M. Fekete-Farkas, 2021, *Economies, 9*(2), p. 9 (https://doi.org/10.3390/economies9020055); „Employee wellbeing: Evaluating a wellbeing intervention in two settings", A. Keeman, K. Näswall, S. Malinen, & J. Kuntz, 2017, *Frontiers in Psychology, 8*, pp. 2–3 (https://doi.org/10.3389/fpsyg.2017.00505).

Figure 2
Employee wellbeing benefits



Source: authors' elaboration based on „The measurement of employee wellbeing: Development and validation of a scale", R. K. Pradhan, & L. Hati, 2019, *Global Business Review, 23*(2), p. 390 (https://doi.org/10.1177/0972150919859101).

The PERMA model in measuring employee wellbeing

The model of employee wellbeing reflects its multidimensionality and can be described by a set of factors creating wellbeing with methods of measuring individual dimensions. One of the most widespread and developed wellbeing models is the PERMA model (Positive emotion – P, Engagement – E, Positive Relationships – R, Meaning – M, Accomplishments – A), which was defined by Martin Seligman (2011), disseminating and promoting the direction of positive psychology in which wellbeing is located. The subject of this article is not the study of the concept of positive psychology, but its operationalisation. However, it should be mentioned that there is also a critical approach to the positive psychology promotion, which can be found in the studies of Gable and Haidt (2005), Kwiatek and Wilczewska (2015), Linley et al. (2006), Mercer and MacIntyre (2014), Tucholska and Gulla (2007), Wong (2011). As mentioned earlier, the PERMA model is the most frequently used model in wellbeing research, and its basic approach and subsequent developments are presented in Table 1.

Based on the work of Seligman (2011) **positive emotions** provide a feeling of hedonic happiness, they are associated with fun, enjoyment and pleasure, and they lead to induced engagement. They are also a balance for the emergence of stressful situations and allow us to overcome everyday adversity. The term **engagement** is used to describe a state of increased energy, dedication, and increased intrinsic interest, which translates into overcoming difficulties, feeling that work matters in life and is a source of inspiration and pride, increased creative efforts and striving to achieve something (Pezirkianidis et al., 2019). A person feels a strong internal need for contact with other people, hence their wellbeing is also influenced by building relationships with other people (**positive relations**). Consequently, this affects the emergence of a sense of belonging in the workplace, and interaction with co-workers shapes employee experiences

Table 1
PERMA model with modifications

PERMA – BASELINE MODEL (wellbeing measurement tool: PERMA-Profiler with 23 items)			
Positive emotion (P)			
Engagement (E)			
Positive relationships (R)			
Meaning (M)			
Accomplishments (A)			
PERMA+ (wellbeing measurement tool: PERMA-Profiler+Health Omnibus Survey HOS)	PERMA+H (wellbeing measurement tool: PERMAH Workplace Survey)	PERMA+V (concept only)	PERMA+4 (wellbeing measurement tool: Positive Functioning at Work PF-W)
(+) Optimism, Physical Activity, Nutrition and Sleep	Health (H)	Vitality (V)	Physical Health, Mindset, Work Environment, Economic Security

Source: authors' elaboration based on *Flourish: A visionary new understanding of happiness and wellbeing* (pp. 21–22), M. E. Seligman, 2011, Simon & Schuster; „Measuring PERMA+ in South Australia, the state of wellbeing: A comparison with national and international norms", M. Iasiello, J. Bartholomaes, A. Jarden, & G. Kelly, 2017, *Journal of Positive Psychology and Wellbeing, 1*(2), pp. 54–55; „A multidimensional PERMA-H positive education model, general satisfaction of school life, and character strengths use in Hong Kong Senior Primary School Students: Confirmatory factor analysis and path analysis using the APASO-II", M. K. Lai, C. Leung, S. Y. C. Kwok, A. N. N. Hui, H. H. M. Lo, J. T. Y. Leung, & C. H. L. Tam (2018), *Frontiers in Psychology, 9*, pp. 2–3 (https://doi.org/10.3389/fpsyg.2018.01090); „PERMA+4: A framework for work-related wellbeing, performance and positive organizational psychology 2.0", S. I. Donaldson, L. E. van Zyl, & S. I. Donaldson, 2022, *Frontiers in Psychology, 12*, pp. 4–7 (https://doi.org/10.3389/fpsyg.2021.817244).

that ensure their physical and mental health (Kun et al., 2016). **Meaning** generates motivation and gives life value, and consequently affects the sense of fulfilment. Giving meaning to life leads to the avoidance of pointless efforts, and thus reduces negative emotions, the emergence of stress, and depression. **Accomplishments** reflecting the fulfilment of daily ambitions, or the achievement of a set goal, allow for an increase in the level of wellbeing through psychological flourishing, which can be supported by the use of strategies of sharing personal achievements with others (Pezirkianidis et al., 2019).

Seligman (2018), referring to Goodman's study, indicates that the correlation coefficient between the elements of PERMA model is 0.61, which is a moderate correlation. He concludes that the PERMA model contains elements of wellbeing, as people who possess one of these elements tend to possess the other elements of wellbeing. It should also be added that Seligman (2018) himself states that the list of elements that create wellbeing goes far beyond the PERMA model, which can be the basis for building an excellent model of wellbeing.

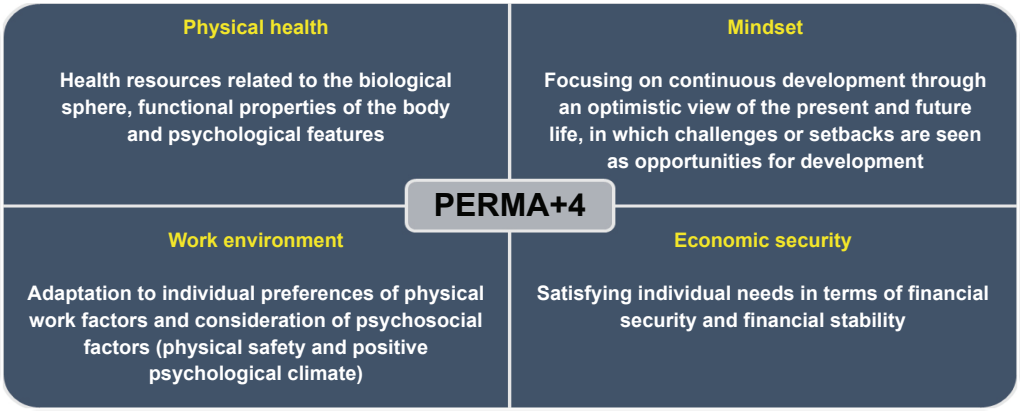
Table 1 also includes extensions of the PERMA model corresponding to Seligman's postulate of model enrichment. Considering factors strongly correlated with resilience and psychological wellbeing (PWB), the PERMA+ (PERMA plus) model includes optimism, physical activity, nutrition and sleep (Iasiello et al., 2017). The PERMA+H (PERMA-H) model is a more holistic view of the concept of wellbeing, as it considers the dimensions of positive physical and mental health (Morgan & Simmons, 2021). Another element qualified to the PERMA model is Vitality, which consequently led to the creation of a model called PERMA+V (PERMA-V), covering the fullness of internal energy associated with improving the body's efficiency and lifestyle, including contact with nature (Petersen et al., 2021).

Donaldson et al. (2022) found that the PERMA model should be additionally equipped with four blocks closely related to the working environment, wellbeing in the workplace and affecting work performance. These include Physical Health, Mindset, Work Environment, and Economic Security, which led to defining the PERMA+4 model presented in Figure 3.

Detailed information on each of the additional elements included in the PERMA+4 model can be found in the paper by Donaldson et al. (2022), in which the authors ensure that each element is directly related to wellbeing, is independent and is not a function of another element.

Research on individual dimensions of wellbeing included in the PERMA model is carried out using the PERMA-Profiler questionnaire developed by Butler and Kern (2016). The authors started with a bank containing over 700 items, which after rejecting some repetitive items and following discussion by positive psychology experts, was later limited to 109 questions. Apart from the main, 11-point Likert scale, other scales were also tested, giving a total of 199 items, which were answered by over 3,700 respondents. As a result of the complex research, it was found that 15 items exhibited psychometric properties. The final version of the PERMA-Profiler contains 23 questions with an 11-point scale. The creators of the tool themselves admit that it is not perfect and finding the perfect tool to measure wellbeing could take a lifetime. The

Figure 3
Components of the PERMA+4 model



Source: authors' elaboration based on S. I. Donaldson, L. E. van Zyl & S. I. Donaldson, 2022, *Frontiers in Psychology, 12*, pp. 4–7 (https://doi.org/10.3389/fpsyg.2021.817244).

PERMA-Profiler has shown acceptable psychometric properties in a large, diverse, international research sample (Butler & Kern, 2016).

Classification of positive psychological interventions with the PERMA model

A term grounded in positive psychology is flourishing, which includes the concept of optimal wellbeing as a multidimensional and holistic concept encompassing both hedonistic (positive emotions) and eudaimonic (self-worth, development and a sense of being a highly influential and meaningful individual) aspects (Norrish et al., 2013). Only an approach based on a combination of hedonistic and eudaimonistic aspects can ensure positive psychological (mental) health. Therefore, organisational interventions should use the concept of flourishing. Tetrick and Winslow (2015) classified interventions in organisations according to three levels: primary, secondary and tertiary. The primary level aims to eliminate stressors and is preventive. The secondary level refers to employees at high risk of illness or injury, with the intention to identify illness or injury at an early stage before full symptoms appear. The tertiary level of intervention refers to those who have suffered an illness or injury, and the role of the intervention is to slow or stop the illness and injury, and quickly return to work (Keeman et al., 2017). Table 2 summarises the most frequently used interventions in these three areas.

Table 2
Selected organisational interventions according to their three levels

Primary level of interventions	Secondary level of interventions	Tertiary level of interventions
• Reduction of risks arising from working conditions • Flexible working hours • Work-life balance training • Access to training on self-care • Access to psychological support • Support for employees working online • Training in mental and physical health care • Building relationships between employees • Recognising employees for their positive behaviour • Encouraging employees to share ideas on stress reduction • Providing redundancy alternatives (job-sharing, additional holidays) • Transferring funds from realised projects to maintain retention	• Reduction of working time for workers at risk of illness or injury • Offering voluntary and free health testing • Reducing workload • Support for reducing family workload (childcare, elderly care) • Offering additional time off • Providing free therapies • Providing training to allow employee rotation • Rewarding employees for reporting and identifying potential health risks • Involving workers in workplace safety and security teams • Mindfulness training	• Assistance for employees with a work-life conflict • Providing additional financial resources to mitigate the effects of work stoppage • Providing additional health insurance • Offering paid leave • Sharing positive stories about people who find themselves in a similar situation • Providing professional psychological support • Involving the employee in the decision to return to work • Providing clinical trials • Organising support groups

Source: authors' elaboration based on „Workplace interventions in response to COVID-19: an occupational health psychology perspective", C.-H. Chang, R. Shao, M. Wang, & N. M. Baker, 2021, *Occupational Health Science*, *5*(1–2), pp. 1–23 (https://doi.org/10.1007/s41542-021-00080-x).

Table 3
Interventions and techniques building wellbeing in individual components of the PERMA+H model

Component of the PERMA+H model	• Types of intervention	• Techniques
Positive emotions (P)	• Taking care of enjoyment, pleasure and satisfaction in the learning process • Building awareness that the learning process consists of both pleasant and negative experiences	• Expressing gratitude and accepting mistakes • Building relationships to obtain feedback • Emphasizing the positive aspects of the learning process
Engagement (E)	• Stimulating intrinsic motivation • Highlighting strengths and using individual strong points	• Setting educational goals • Searching for projects and tasks in line with the learners' strengths • Creation of individual development plans
Positive relations (R)	• Sharing and reliving experiences • Conducting discussions with learning partners	• Conducting constructive conversations with learners • Celebrating achievements • Use of mentoring
Meaning (M)	• Defining the goal of development, including enhancing competences • Opportunity to use the acquired competences for the benefit of the local community	• Freedom to choose the competences to be acquired and developed • Identify opportunities to influence the lives and work of others • Arousing interest in exercises and tasks (searching for elements of novelty, shaping new and useful competences)
Accomplishments (A)	• Building and helping to achieve perseverance in the learning process • Using praise and encouragement in the development process (feedback)	• Setting and visualising the achievement of specific and realistic goals • Implementation of a system of rewards for learning progress • Permanent feedback
Health (H)	• Learning related to the exploration of the natural environment through physical activity • Supporting the learning process with the use of relaxation and problem-solving techniques	• Promoting a culture of health • Mindfulness trainings

Source: authors' elaboration based on „An applied framework for positive education", J. M. Norrish, P. Williams, M. O'Connor, & J. Robinson, 2013, *International Journal of Wellbeing, 3*(2), pp. 152–155; Flourishing interventions: A practical guide to student development, L. E. van Zyl, & M. Stander, 2014. In M. Coetzee (Eds.), *Psycho-social Career Meta-capacities* (p. 268), Springer (https://doi.org/10.1007/978-3-319-00645-1_14); „Emotion regulation in adolescent wellbeing and Positive Education", L. Morrish, N. Rickard, T. C. Chin & D. A. Vella-Brodrick, 2018, *Journal of Happiness Studies, 19*(5), pp. 1547–1555 (https://doi.org/10.1007/s10902-017-9881-y).

In addition to the functionality of the indicated PERMA model, it also allows for building a typology of interventions used in employee leadership practice. A variant of the model that has been used in this classification is the PERMA+H model, which was applied in the research by Duan et al. (2020), Lai et al. (2018), Morgan and Simmons (2021). The classification of the interventions and their activities with the techniques used are in Table 3.

The activities undertaken in the process of positive psychology, together with the techniques that ensure their implementation, must be used together. Their inseparable nature is intended to lead to employee wellbeing and thus support high engagement, retention and performance. As pointed out by Lai et al. (2018) positive psychology can flourish only by providing ecologies training (Learn), modifying training programmes (Teach), inducing activity and interaction (Embed) and applying positive psychology interventions to personal and work life (Live).

Conclusions and recommendations

The conducted analyses of the concept of employee wellbeing led to the conclusion that this concept should be interpreted multidimensionally. Most often, however, they include activities related to the physical dimension in their programmes, which is confirmed by research conducted by the Activity team (Activity, n.d.), where over 75% of initiatives concerned this dimension, and the smallest amount concerned financial security and mental health. In the results of global research presented by AON (AON, n.d.) we can also find information that the largest number of wellbeing programmes used in organisations, as much as 70%, concerns the physical dimension. There is a discrepancy between the organisation's offer and the needs and priorities defined by employees, and further results of the AON Global Survey show that the five most important activities creating wellbeing include: work-life balance (65%), mental health (46%), working

environment/culture (44%), physical health (35%) and burnout (34%). This means that the emotional, social and mental dimensions dominate in this comparison, rather than the physical one. At the same time, it shows the direction which organisations should follow when building wellbeing strategies.

Before an organisation decides to take any action, it should measure wellbeing. The PERMA model is a helpful and constantly developed measurement tool. This determines its usefulness in the study and identification of wellbeing dimensions, thanks to which benefits such as: increased work efficiency, maintaining or improving the level of commitment or building the right organisational climate while maintaining a high level of employee retention can be obtained. The analysis of the models developing the PERMA model showed that the PERMA+4 model, which takes economic security into account, is of interest when examining the wellbeing of employees. AON research on wellbeing shows that this is the greatest challenge for organisations, since as many as 76% of the surveyed organisations do not have any plans to help employees overnight. In addition, 83% do not have plans related to savings that can be used by employees in case of an emergency. On the other hand, the lack of financial security for employees in the form of e.g. cash benefits or special budgets to help employees in the event of a sudden illness will become one of the basic reasons for considering leaving an organisation.

The extended PERMA model, PERMA+H, is not only useful in the research of employee wellbeing, but its use in the classification of positive psychology interventions is more and more often observed. There are a growing number of studies confirming that the wellbeing of people who increase their competences has a fundamental impact on the course and success of the learning process, with the knowledge, skills and attitudes of the teacher (trainer) playing a fundamental role. The basis should be the training of all those involved in the process of developing competences in the field of positive education, starting from theoretical considerations to how to measure wellbeing and techniques that can be used in the individual components of the PERMA+H model. Research using this model shows that a special place in shaping wellbeing should be occupied by identifying strengths that allow you to make informed learning and career choices. Investing in positive psychology programmes and incorporating wellbeing training and courses into human resource development are a response to stressful situations, illness and psychological injury for employees.

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Szymon Jarosz

Artificial Intelligence – an agenda for management sciences

Abstract

Nowadays, the need for digitisation and digitalisation of enterprises, as well as the use of solutions based on Artificial Intelligence (AI), are coming to the fore. The use of intelligent systems in organisations is not a strictly technical issue, and is also important in the management of modern enterprises. The aim of this article is to provide a theoretical analysis of the phenomenon of Artificial Intelligence in management sciences by means of a systematic review of the literature using Scopus database records. Bibliographic analysis of Artificial Intelligence in management sciences in this article points to this topic as something relatively new in the case of management sciences, although rapidly developing. As part of the bibliographic analysis we propose an agenda regarding the issue of AI in management sciences, consisting of thematic clusters related to technologies based on and complementary to AI, the goals of using AI in organisations, human-AI relations and issues related to ethics and sustainable development.

Keywords: Artificial Intelligence, management, literature review, agenda, keywords analysis

Introduction

Companies are currently subject to constant internal changes, as well as changes related to the external environment. Dealing with them requires not only an appropriate response, by adapting to new conditions, but also a pre-emptive, anticipatory response, and even creating changes through innovative processes in the company. Current market characteristics provide innovative companies with a big chance of success by gaining an advantage over their competition, with staff at all levels characterised by a high level of competence, tailored to that required at specific workplaces.

Not only is this topic important today, but the literature analysis shows that the importance of using Artificial Intelligence for management sciences will continue to grow – along with the increasing involvement of such technologies. AI can play a role in management by helping managers make better decisions. For instance, AI algorithms can be used to analyse data and provide managers with insights and recommendations that they might not have come across themselves. AI can also be used to automate certain tasks, such as scheduling and data entry, which can free up managers to focus on more strategic and important work (Walsh, 2017). Additionally, AI can be used to improve the efficiency of a business by streamlining processes or identifying areas for improvement. Overall, the use of AI in management can make business more effective and efficient, and provide managers with the necessary tools to make better decisions (Rathore, 2023). According to predictions of the World Economic Forum (2015), we must be ready to accept that in the future machines with Artificial Intelligence will sit on company boards of directors, and audits will be carried out by artificial intelligence. In addition, researchers predict that by 2050 firing employees through specially programmed robots will become the norm, and managers will be able to spend the time saved on tasks related to strategic and long-term aspects of the business (Walsh, 2017). Research has revealed emerging trends in AI in management science, with an interesting fact being that over time the attention of scientists will shift from technical issues to social issues, such as the ethics of using AI or supporting such technologies in the field of sustainable development.

The aim of this article is a theoretical analysis of the phenomenon of Artificial Intelligence in management sciences, as well as discuss which AI-related topics have

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occupied the attention of management researchers in recent years. To achieve this goal, a systematic review of the literature on the issue using Scopus database records was used.

Justification for addressing the topic of trends related to Artificial Intelligence in management sciences

Dynamic changes in technology and society caused by the disruptive consequences of the Fourth Industrial Revolution are causing profound changes in our reality, both socially and economically. One of the most important pillars of technological change is the increasingly common and perfect use of solutions based on Artificial Intelligence (Schwab, 2016). The increasing impact of these solutions is also reflected in the growing interest in the subject of AI on the part of scientists of various fields. Figure 1 shows how the number of scientific publications on Artificial Intelligence in the Scopus database has been developing over the years.

An analysis of the number of publications on Artificial Intelligence over the years leads to a conclusion that this topic has seen a constant, growing interest of scientists, which confirms the importance of this issue and the need to consider this topic when analysing trends, which is the aim of this paper. Also worth emphasising is the huge increase in the number of publications that took place after 2000. This also demonstrates the novel nature of the topic of AI.

Such conclusions can be reached by analysing the distribution of fields (Figure 2) when it comes to publications on AI.

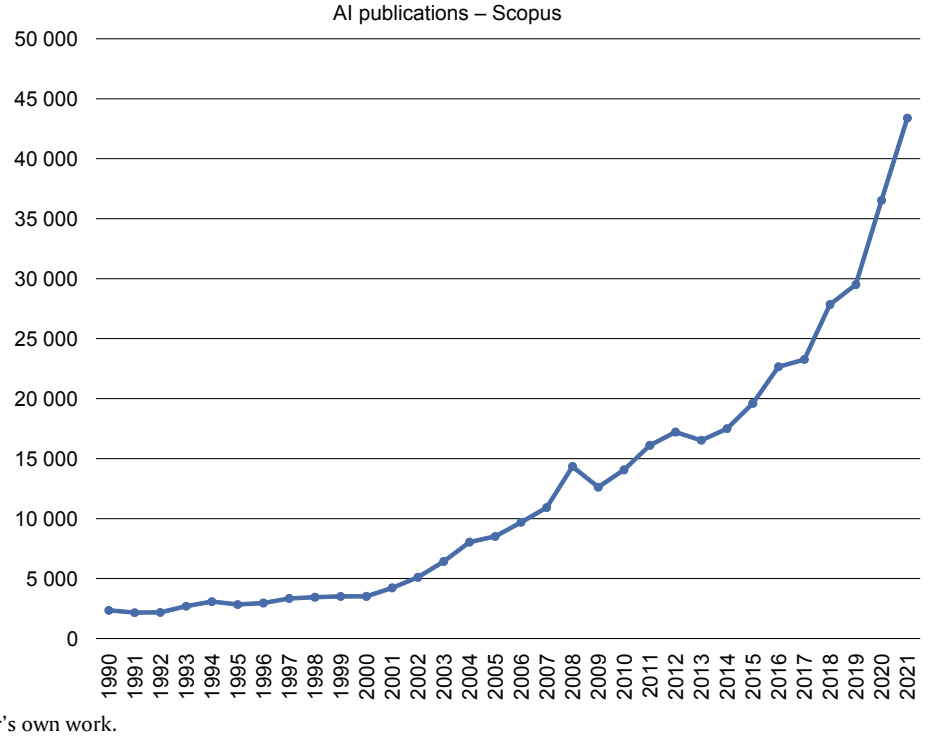
Technical and mathematical sciences largely dominate in the fields in which papers on Artificial Intelligence are published. *Computer Science* shows over 300,000 publications, while *Engineering* and *Mathematics* over 121,000 papers. Texts assigned to social sciences only account for 22.7 thousand papers, while the equivalent of management sciences, i.e., *Business Management and Accounting,* is covered in only 12.6 thousand publications. Figure 3 shows the development of the number of scientific publications over the years in the field of management in the Scopus database.

A compilation of all this data shows that there is a research gap in the description of the issue of the impact of AI on social sciences, especially on management issues in organisations. A very interesting outcome of the analysis of the total number of publications and the number of publications in the field of management is the fact that the topic of AI reached this area rather late. In the overall ranking, a sharp increase in the number of publications can be observed since 2002, while in *Business Management and Accounting Area* since 2008. This emphasises the importance of the subject of this paper, with the topic of Artificial Intelligence in management sciences proving to be essential, innovative, and novel.

Based on the above considerations, a bibliometric analysis of keywords and abstracts was made, as an introduction to a further deeper analysis of scientific

Figure 1

Number of publications on Artificial Intelligence in the Scopus database (1990–2021)



Source: author's own work.

Figure 2
Number of publications on Artificial Intelligence in the Scopus database broken down by areas

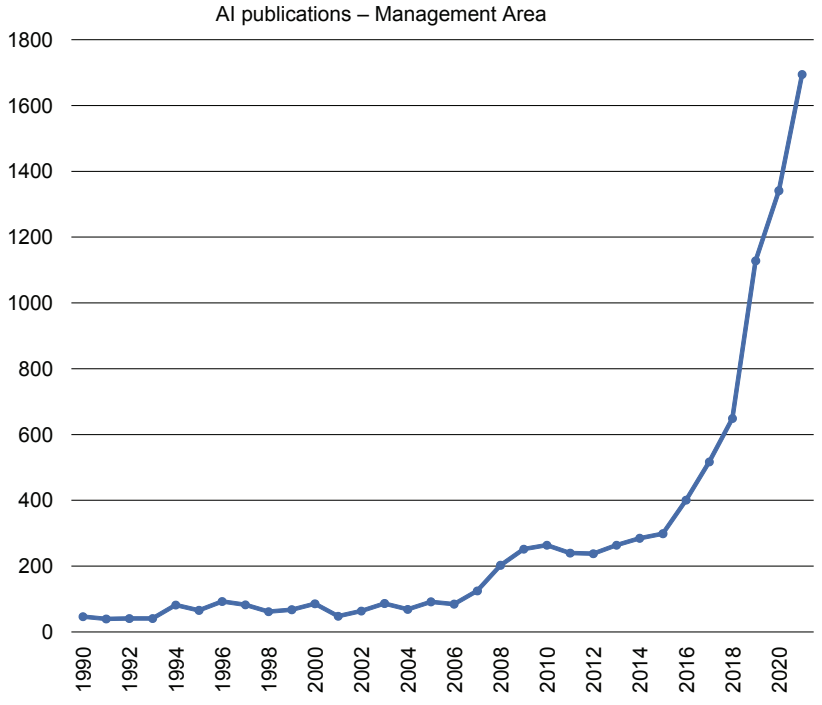


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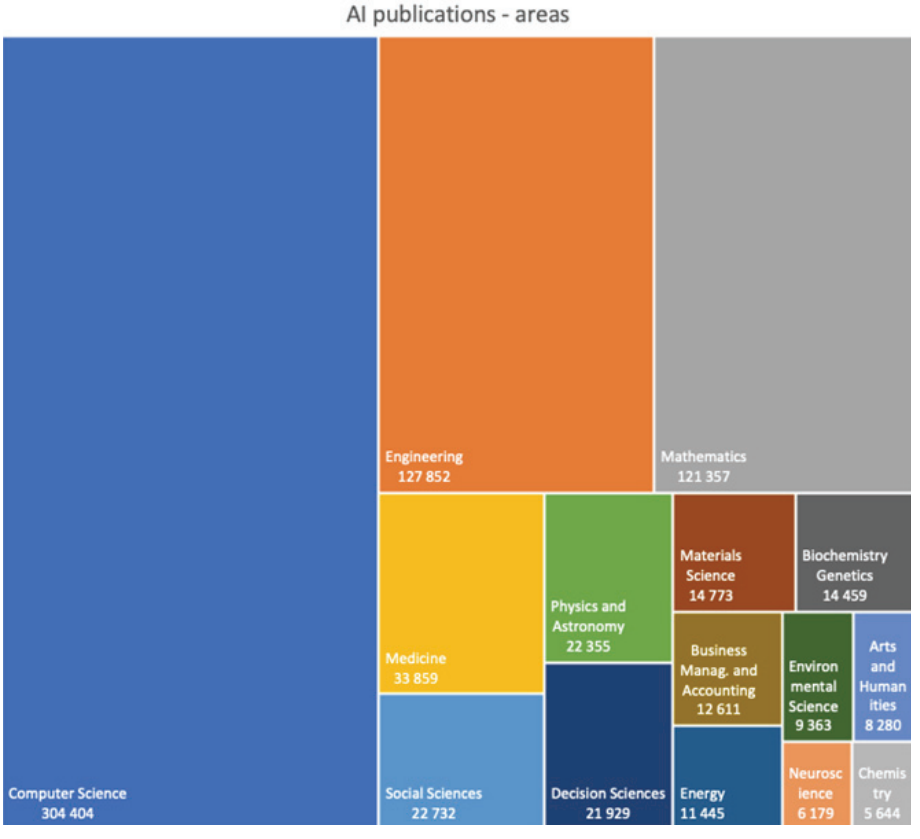
Figure 3
Number of publications on Artificial Intelligence in the Scopus database in the field of management



Source: author's own work.

texts, which enabled the identification of trends in the description of AI technologies in management sciences.

Methodology of trend research in describing the issue of AI

A systematic literature review was conducted to present research describing the use and impact of AI technology on management sciences. The first phase of the research used bibliometric analysis, a method with a long history of use in business research (Smith, 1977) that can be helpful in assessing trends (Xie et al., 2018). Systematic literature review is a frequently used tool in management and quality science papers (Bramer et al., 2017; Kosch & Szarucki, 2020).

The first step was to run a query in a selected databases, the choice of which is crucial when it comes to the search strategy. This analysis was carried out using the Scopus database, a scientific database maintained by Elsevier, which is one of the most renowned and popular among scientists, and most importantly one of the most extensive databases in the world.

A significant step in systematic literature review and classification methods is the selection of categories that will be used to organise the data, in order to avoid omitting categories or works that are unknown to the researcher or treated as less important (Wawak et al., 2020; Xiao & Watson, 2017). Therefore, on 12 February 2022 the following search was carried out in the Scopus database:

- **TITLE-ABS-KEY (artificial AND intelligence) AND (EXCLUDE (PUBYEAR, 2022)) AND (LIMIT-TO (SUBJAREA, "BUSI"))**

In the titles, keywords and abstracts, the phrase *Artificial Intelligence* was searched, limited to the field of *Business Management and Accounting*. It should be mentioned here that the year 2022 was excluded, as during the research process it was still not over. The search in the Scopus database came up with 11,576 results.

On the basis of the obtained results and quantitative analysis of keywords, the author developed a proposed agenda as a set of individual thematic clusters in the description of the SI issue. The next step was an in-depth qualitative analysis of selected texts from individual thematic clusters, making it possible to understand in detail which issues are discussed within individual thematic clusters.

Analysis of AI trends in management

A keyword analysis made it possible to determine the trends that prevail among scientists when it comes to the broadly understood concept of Artificial Intelligence in management sciences. The bibliographic analysis of the literature enabled an extraction of 24,038 keywords from the Scopus database, among which we determined the keywords with the highest occurrence rate.

Table 1 shows an aggregate of the most popular keywords along with the number of their occurrences in the years 2000–2020.

Table 1

A collection of the most popular keywords with the number of their occurrences in the years 2000–2020 – Scopus

Keyword	Occurrences
Machine Learning	731
Decision Support Systems	692
Big Data	237
Neural Networks	196
Internet of Things	185
Data Mining	155
Deep Learning	153
Simulation	137
Industry 4.0	129
Expert Systems	125
Knowledge Management	100
Automation	98
Blockchain	96
Optimization	94
Decision Making	88
Sustainability	82
Ethics	80
Digitalization	77
Natural Language Processing	76
Innovation	75
Forecasting	72
Digital Transformation	72
Active Learning	72
Robotics	70
Cloud Computing	65
Supply Chain Management	64
COVID-19	57
Social Media	56
Scheduling	55
Artificial Neural Network	55
Trust	52

Source: author's own work.

The largest number of occurrences is related to keywords related to the technological aspects of Artificial Intelligence and other related technologies, e.g., *Machine Learning, Big Data, Neural Networks, Deep Learning, Blockchain, Natural Language Processing, Cloud Computing*. This further suggests that much of the work stems from the technological aspects of the operation or implementation of AI, while soft aspects, e.g., the impact of AI on employees, competence preparation or sustainability, are less often undertaken.

Keywords appearing in the general overview such as: Decision Support Systems, Data Mining, Simulation, Automation, Digitization, Innovation, Scheduling, and Forecasting indicate in which areas organisations can use AI-based solutions, the most popular being a decision support system based on the analysis of large amounts of data that can be processed based on AI technologies. AI can also support an organisation's innovation and efficiency by automating processes. In addition, the collection and analysis of a large amount of data can be used to forecast, as well as predict, trends in the economy, which with the current level of volatility is crucial for an organisation to adapt and actively take advantage of a market situation.

In the general overview you can also find (less common) keywords that indicate the trend of describing AI technologies and the changes caused by them from the "soft" side. Words such as Sustainability, Ethics or Trust prove that such breakthrough technologies as AI should be considered from the technical, technological, and (equally important) social perspective.

The occurrence of keywords in particular years is not homogeneous, as there are similar keywords occurring in certain years, but you can see that the trends in the description of AI in management sciences are progressing and changing over time – trends are not homogeneous.

An analysis of the most popular keywords in particular years shows throughout the years the key topics related to AI were the issue of machine learning or a decision support system, with strictly technical trends dominating in the earlier years. It was only in the subsequent years that the emergence of the social side of the changes caused by artificial intelligence was observed.

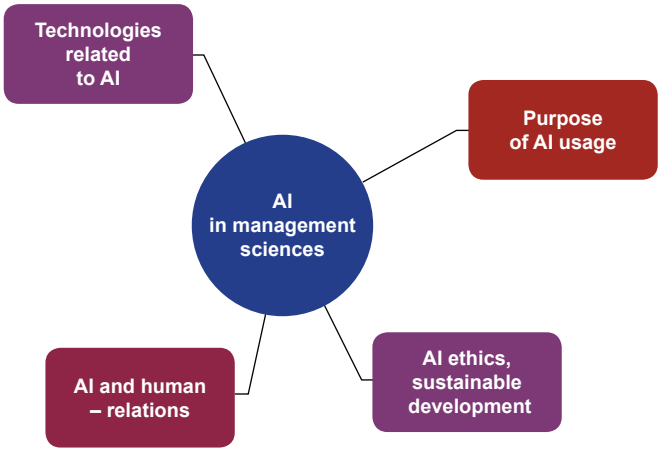
The next stage of the literature analysis was the author's clustering of individual trends into similar thematic classes, and then an in-depth analysis of selected texts included in individual clusters. The individual thematic clusters are presented in Figure 4.

Analysis and description of thematic clusters from literature research

When discussing technologies based on or related to Artificial Intelligence that are used in organisations **(cluster 1 – technologies)**, mention should be made of *Machine Learning*, which is a branch of Artificial Intelligence technology that describes techniques and mathematical formulas that enable a system (machine) to independently generate knowledge from experience (Bell, 2014). Machine learning algorithms detect patterns in input, learn from mistakes, and can correct themselves (Canhoto & Clear, 2020).

In the modern economy, organisations, thanks to solutions such as the Internet of Things, have access to an infinite amount of data in real time. An example of how machine learning works is AlphaGo Zero, which mastered the Go board game by repeating the game against itself and learning from its mistakes (Silver et al, 2017). It is worth noting that nearly 90% of the developed patents of intelligent technologies use *machine learning* (WIPO, 2019), and machine learning technologies are driving the automation of business processes in an increasing number of areas **(cluster 2 – purpose of use)**. The literature gives applications ranging from, for example, the calculation of optimal transport loads to a quick assessment of the applications of people applying for a loan. The popularity of machine learning technology is rooted in a much lower cost intensity than in the case of using human labour (Castelli et al., 2016). Research among senior managers shows that the areas in which machine learning is most often used are *optimisation* and automation of business processes, core business activities, improvement of business models and *forecasting*) (Paschek et al., 2017). AI algorithms can be used to analyse data and provide managers with insights and recommendations that they might not have been able to see on their own. AI can also be used to automate certain tasks, such as scheduling and data entry, which can free up managers to focus on more strategic and important work (Hoffman, 2016).

Figure 4
AI in management sciences – thematic clusters



Source: author's own work.

Deep learning is a special type of machine learning technique that can learn from unlabeled data (LeCun et al., 2015). Many companies base their data management on *Deep Learning* technology. Apple, Google, Facebook and Microsoft collect a large amount of data every day through applications such as Siri, Google Translate, or Bing voice search and use this technology to analyse them to provide a number of other services, such as reminders, weather forecasts, personalised recommendations or advertisements (Munappy, 2019).

The use of machine learning, i.e., learning from a huge amount of data, is related to the concept of *Big Data*, which has also been a frequent topic of consideration for scientists, given the conducted keyword analysis and the work of other scientists (Sheng et al., 2017). *Big Data* is a huge amount of data generated in real time from an increasing number of sources, including, for example: online clicks, mobile transactions, user-generated content, and social media, as well as intentionally generated content through a network of sensors (e.g., real-time production data from factory 4.0 devices) or business transactions, such as sales inquiries and purchase transactions (George et al., 2014). *Big Data* resources are characterised by (McAfee & Brynjolfsson, 2012):

- *Variety* – resulting from the fact that the company generates huge amounts of data from various sources, m.in sensors, systems, applications, machines and devices and communication processes between them.
- *Velocity* – data is delivered and analysed in real time.
- *Veracity* – information generated from real data facilitates making the right decisions.

Big Data is crucial when it comes to management (Sheng et al., 2017), and collecting and properly analysing data (using technologies supported by AI) is necessary with regards to proper optimisation of processes in an organisation **(cluster 2 – purpose of use)**. For example, *Big Data* can be used to analyse employee behaviour, using sensors or badges to track people while they work, move around the workspace, or spend time interacting with others or assigned to specific tasks (George et al., 2014). In marketing activities, *Big Data* analytics can help track and predict customer behaviour and needs, while in the context of management accounting or management, the data obtained, and the information processed through AI, can help generate relevant and useful information to support decision making (*Decision Support System, Decision Making*) (Gärtner & Hiebl, 2018; Gupta et al., 2022).

A significant volume of communication between sensors and devices gave rise to the *Internet of Things*. The Internet of Things is the contact between objects and people, which is "a dynamic global network of physical objects, systems, platforms and applications" (Furmanek, 2018, p. 58). The detectors and sensors installed in production equipment make it possible to predict a failure or possible manufacturing defects in advance. Data (*Big Data*) obtained through Internet of Things (IoT) solutions plays a key role in all kinds of technologies such as, for example: public safety, *smart houses*, logistics and traffic control, protection and prevention of environmental degradation, intelligent fire control, the monitoring and control industry, etc. (Li et al., 2017). The great emphasis on data analytics and their use is also confirmed by the frequent occurrence of *data mining* as a keyword in publications, which means looking for relationships, patterns, or dependencies in the acquired data, for which solutions based on Artificial Intelligence can be used.

An interesting observation is the frequent occurrence of the keyword *blockchain* in connection with AI. *Blockchain* is a decentralised, public, explicit, and distributed ledger, located in a distributed network infrastructure, a kind of electronic letter on which all transactions between many users are chronologically recorded (Swan, 2015). The use of *blockchain* technology means that Artificial Intelligence will be able to process data obtained in real time and in huge amounts from various organisations cooperating with each other. The significant costs of preparing and submitting documentation (GATF, 2021) will reduce *the* blockchain-based digital identity of exchange participants, goods, and places in supply chains, which will make it possible to verify the origin of products and track their path. Digital representations of real assets would make it possible for relevant data to reach stakeholders without the need to store it in the data warehouses of individual companies, while supplementing the blockchain-based system with Artificial Intelligence would improve the exchange of data and information. For example, if algorithms detected a high probability of bad weather conditions, they would recommend changing a ship's route. Another example is the transport and storage of refrigerated goods or fast-moving consumer goods (FCMG), where if a sharp increase in air temperature is detected in a specific place, refrigerated vehicles or refrigerators in warehouses would be instructed to turn on additional cooling (Treat et al., 2018).

An important element of management researchers' reflections on AI is the relationship between Artificial Intelligence and humans **(cluster 3 – relationships)**. A literature review confirms that the Fourth Industrial Revolution brings with it profound changes in the characteristics of work and the requirements for individual employees (Jarosz et al., 2020). The new digital reality requires us to quickly adapt to the ever-changing technological reality and gain "*digital trust*". Digital trust can be referred to the level of confidence that people have in the security, reliability, and integrity of digital systems and technologies (in this paper this would be Artificial Intelligence). Digital trust is crucial when it comes to implementation of AI technologies, because it helps people feel secure when using technology, which is increasingly prevalent not only in the workplace but also in our daily lives (Sołtysik et al., 2022).

The challenges faced, especially in Poland, are considerable. Despite the increase in the "digital engagement" of the public during the COVID-19 pandemic, general digital skills regarding computer and Internet use (searching for information on the web, digital

communication using online mail or instant messaging) remain at a low level in Poland compared to other European Union countries. In 2021, the proportion of people who had at least basic digital skills was 79% in the Netherlands and Finland (which were the highest rates), which the lowest scores were recorded for the citizens of Romania (28%), Bulgaria (31%) and Poland (43%) (Eurostat, 2021).

The need to improve their digital competences was also noticed by the employees themselves. According to a TOP CDR report – Digitally Responsible Company Survey (2019), 40% of respondents consider an organisation that conducts training in the field of increasing digital competences to be a digitally responsible company – not downsizing because of automation. One in three respondents are of the opinion that work automation with the use of robots will force them to retrain or change jobs in the next 10 years, while the same number of people indicate that in the last 3 years the implementation of modern technologies has led to a reduction in employment. In the U.S., the level of fear of automation is even greater, and according to a *PewResearch* study (2022) as many as 72% of respondents are afraid of automation, with the vast majority more concerned than excited about the increased use of Artificial Intelligence in everyday life (Rainie et al., 2022). Those more concerned than excited cite their concerns about potential job loss, privacy risk considerations, and the prospect that the development of Artificial Intelligence could make it surpass human abilities. Some also argue that AI will lead to the loss of interpersonal ties. Those who are "more excited than anxious" point to aspects such as the time savings that AI can bring to everyday life. Respondents also pointed to the fact that Artificial Intelligence systems can be helpful in the workplace: they will automate routine activities and improve cyber security (Rainie et al., 2022). Interestingly, the approach to AI differs depending on the level of education. A higher percentage of people with secondary education or lower say they are more anxious than excited (40%), compared with those with a university degree (32%). This shows how important it is to properly educate people about Artificial Intelligence when it comes to approaching such technology.

The last separate thematic cluster is the trend related to sustainable development **(cluster 4 – sustainable development)**. Companies operating in the current economic and social conditions face not only increasingly extensive legal regulations related to environmental protection or ensuring employee rights, but also the expectations of consumers and other stakeholders in the field of sustainable *development*.

In addition, in a world struggling with climate and energy crises, sustainable development is posed as a response to global challenges (Jarosz et al., 2022, Zakrzewska et al., 2022) caused by degrading human activity in both developed and developing countries (Bombiak & Marciniuk-Kluska, 2018). Furthermore, the growing popularity of the concept of sustainable development is also preceded by the growing awareness of societies in the field of ecology and economic processes consistent with the principles of *ethics* and corporate social responsibility (Jerónimo et al., 2020). The basic motivation of companies regarding sustainable development is the desire to reduce the negative impact of the organisation on the environment and increase social involvement (e.g. activities for the benefit of local communities) while improving (or at least not affecting) the company's financial results (Baumgartner & Rauter, 2016). Researchers suggest that such environmental intelligence can be a powerful tool supporting global efforts to promote sustainable economic development, while at the same time sustainably counteracting the negative impact of production and consumption on societies, management systems and the environment (Goralski & Tan, 2020). For example, optimisation methods using Artificial Intelligence can be used to better manage water resources (Goralski & Tan, 2020) or renewable energy resources (Vinuesa et al., 2020), reducing the impact of noise from various sources, such as road and rail transport, construction, and operations. etc. (Mrówczyńska et al., 2019).

The trend towards sustainable and ethical use of AI technologies is being promoted by scientists as one of the most important current and upcoming developments in such technology. Interviewing experts in the field of AI, Velarde (2021) argues that among the "ideal" SI trends are the flowing aspects: ethics, data use, human-machine interaction, learning along with a deep understanding of Artificial Intelligence in theory and practice, its regulation, explainability, reproducibility, trust, and security. It should be essential for organisations to both be and stay up to date on the latest security technologies and best practices, and to be transparent and responsive in their handling of, for instance, security issues related to Artificial Intelligence (Dhingra et al., 2016).

Conclusions

Artificial Intelligence already significantly impacts virtually every area of our lives, and its importance, especially in the context of the development of modern enterprises, will be growing.

The current characteristics of a highly-digitised market are forcing enterprises to constantly implement new technologies, with innovative companies having a greater chance of success and gaining an advantage over the competition, due to their staff showing a high level of competence, tailored to the profile required in each case.

This article contributes to the understanding and discussion around the incorporation of Artificial Intelligence in management, and also organises the knowledge and topics dealt with by scientists with regards to artificial intelligence in management. A bibliographic analysis of AI in management sciences for this paper has shown that this topic is relatively new for management sciences, but is developing at a rapid pace, with an agenda for the issue of AI in management sciences proposed, consisting of thematic clusters related to

technology based and complementary to AI, goals of using AI in organisations, human-AI relations and issues related to ethics and sustainable development.

Summarising the above considerations and research on trends with regards to AI in management sciences, it should be stated that analysis on this topic is characterised by a large thematic range and variability over time.

Initially, experts' efforts focused on the technical aspects of AI, but over time the issues of using such technology to improve decision-making or optimise processes in organisations came to the fore. The latest trends in Artificial Intelligence are topics related to the social consequences of AI technology, its impact on and relation with humans, the ethics of use or the impact on sustainable development. AI can help with sustainability in several ways (Goralski & Tan, 2020). For example, AI algorithms can be used to analyse data and identify patterns and trends that can help to identify areas where a business or organisation is not sustainable, where such information is then used to make changes that can help to reduce waste and improve efficiency. Additionally, AI can be used to automate certain tasks, such as monitoring and controlling energy use, which can help to reduce a business's carbon footprint. Furthermore, it can be used to develop new technologies and solutions aimed at addressing environmental challenges, such as renewable energy sources and sustainable transportation. Overall, the use of AI in sustainability efforts can help businesses and organisations operate in a more sustainable way and help protect the environment. Future considerations of scientists should focus on empirical solutions regarding the impact of Artificial Intelligence on the development of sustainable organisations and the attitude of employees working with intelligent systems in organisations towards these technologies.

To summarise, Artificial Intelligence is a very important issue for management sciences, both in terms of technology (implementation of systems) and the attitude and belief of employees in the changes and transformations taking place in enterprises.

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Anna Młynkowiak-Stawarz

Do Polish tourists want wellbeing tourism? Preferences for wellbeing tourism versus the psychological wellbeing of individuals

Abstract

This paper is part of a study on the impact of tourism experiences on the psychological wellbeing of individuals. Integrating the approach of positive psychology and research on tourists' behaviour within the field of marketing, Caroll Ryff's concept of psychological wellbeing and the concept of wellbeing tourism were used for this purpose. The aim of the research was to investigate differences in the level of perceived psychological wellbeing by tourists preferring different types of wellbeing tourism, and the article presents theoretical and practical premises for defining wellbeing tourism. Wellbeing tourism can be defined as a specific type of tourism based on six pillars that ensure a sustainable approach to travel and leisure – simultaneous care for the body, soul, and mind of the tourist, as well as the environment, society, and economy of the destination area. Through analysis of variance, it was found that these differences are significant for those preferring natural and cultural wellbeing tourism, and they are also influenced by the perception of one's financial situation. Applying the results of the study will enable tourism enterprises to design an offer for tourists that will increase their sense of psychological wellbeing.

Keywords: wellbeing tourism, psychological wellbeing, preferences of tourists, nature tourism, cultural tourism

Introduction

The global health crisis related to the COVID-19 pandemic, the climate crisis and the international military crisis caused by the war in Ukraine all have a huge impact not only on the global economy, but also on the psychological wellbeing of individuals (Bolotnikova et al., 2023; Chudzicka-Czupała et al., 2023; Koole & Rothermund, 2022; Ng & Kang, 2022; Pilar Matud et al., 2022). The conducted research indicates that external events that have affected entire communities in recent years significantly impact an individual's sense of wellbeing. It is a truism to say that everyone wants to experience the highest possible level of wellbeing and thus be happy, but research on the psychological wellbeing of individuals, considered as one of the indicators of happiness, demonstrates that nowadays, during different periods related to global health and security crises, people show a general deterioration of perceived wellbeing (Bassi et al., 2022; Daly et al., 2020; Koole & Rothermund, 2022; Lewis et al., 2022, p. 28; Vanaken et al., 2022). This condition influences the decisions that individuals make in relation to many aspects of their lives, including choices related to the fulfilment of tourism needs (Buckley, 2022; lo & Peralta, 2022).

Despite the recovery in tourism-related travel observed in 2022, tourists still travel less than they did it prior to the pandemic crisis (UNWTO, 2022). Buckly notes that the simple relationship regarding the impact of psychological wellbeing, as perceived by individuals, on their tourism behaviour aptly captures the need to link research on individuals' psychological wellbeing with their tourism preferences. Decisions related to spending money on travel is linked to the expectation of experiencing pleasure. Pleasure is linked to wellbeing, and wellbeing has an impact on various elements of a person's health, which in turn has significant economic value (Buckley, 2022). In

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addition, the preservation of psychological wellbeing is one of the motives for undertaking tourism activities during a crisis period (Aebli et al., 2022).

Due to the co-occurrence of global pandemic, military, economic and climate crises, individuals are changing their behaviour and preferences in the field of tourism (Bęben et al., 2021; Hannan et al., 2021), which implies the need for continuous research on these issues. Moreover, research linking issues of tourism and psychological wellbeing leads to the development of different types of psychological therapies used to improve the mental health of individuals, as well as opportunities for the tourism industry to create new offers, e.g. in the area of outdoor tourism (Buckley, 2019) and nature tourism (Buckley, 2020; Lück & Aquino, 2021).

The tourism industry, especially with regard to wellbeing tourism, is trying to meet the expectations of individuals related not only to interesting and enjoyable leisure activities, but also to the improvement of their overall psychological wellbeing. The study carried out focuses on finding an answer to the question "Is there a relationship between the sense of psychological wellbeing experienced by individuals and their preference for choosing a wellbeing tourism destination?", and thus fits into the stream of research related to non-economic areas affected by tourism development (Berbekova & Uysal, 2021).

In exploring the issue of the relationship between the overall psychological wellbeing of individuals and preferences for choosing wellbeing tourism, a research question was formulated:

Between which groups that preferring a certain type of wellbeing tourism are there differences related to the average level of mental wellbeing?

Interest in this issue requires us to identify what contemporary wellbeing tourism is and how the psychological wellbeing of individuals can be defined and studied. As Smith and Diekmann note, the term wellbeing is present in all areas of the social sciences, including philosophy, sociology, psychology, management and quality sciences (Smith & Diekmann, 2017), to name just the most popular ones. When typing this term into scientific and popular search engines we come up with thousands of texts, so a comprehensive view on wellbeing, therefore, requires addressing its various aspects. This paper focuses on the concept of the eudaimonistic, psychological wellbeing of individuals, as well as the types and kinds of wellbeing tourism.

To present the concept of wellbeing tourism, inter alia, the findings of a project titled 'Wellbeing Tourism in the South Baltic Region – Guidelines for good practices & Promotion' were used. The project was financially supported by the Interreg South Baltic Programme 2014–2020 with co-financing by project partners – Linnaeus University (project leader – Sweden), EUCC Baltic Office (Lithuania), Klaipeda State University of Applied Sciences, Agencja Rozwoju Pomorza S.A. (Poland), Tourism Association 'Vodelparkregion Recknitztal' (Germany), Energy Agency for Southeast Sweden Ltd (Sweden), County Administrative Board of Kalmar (Sweden), Professor Bruno Synak Scientific Institute (Poland), and Danish Tourism Innovation (Denmark). In turn, the Polish adaptation of an abbreviated version of the Caroll Ryff wellbeing questionnaire (Karaś & Cieciuch, 2017) was used to examine individuals' psychological wellbeing.

The study was conducted among Polish respondents, taking into account the situation of the Polish society, which, due to geographical reasons, is more exposed to the wide-ranging effects of the war in Ukraine. Furthermore, as previous studies have indicated, respondents from Poland also showed less acceptance of pandemic restrictions and more negative attitudes towards them (Bęben et al., 2021). The questionnaire survey was conducted in October/November 2022 among the participants of the research panel, with respondents invited for testing based on quota selection to reflect the population of adults in Poland in terms of age, gender and place of residence. In addition to this, a filter question on the use of paid tourist accommodation in the last year was used, as the aim of the survey was to test the relationship between the general psychological wellbeing of individuals and the wellbeing tourism preferences of those active in tourism. The survey was conducted using the CAWI method on 600 respondents. The UNIANOVA one-way procedure for analysis of variance was used to answer the research questions.

The theory of psychological wellbeing in tourist behaviour research

A multidimensional model of psychological wellbeing was proposed by Caroll Ryff (1989) already in the 1980s, when she developed an instrument to measure the psychological wellbeing of individuals, the Psychological Well-Being Scale, which consists of 84 statements distinguishing six dimensions of wellbeing: coping, positive relationships, autonomy, personal development, self-acceptance and life purpose. To date, it has been translated into more than 35 languages and its reliability and validity have been confirmed by some 750 studies (Kállay & Rus, 2014; Ryff, 2013; 2017).

Ryff's concept was based on the classic definition of mental health proposed by Maria Jahoda (1958), according to which it is complete physical, mental and social wellbeing, and it is consistent with the assumptions of positive psychology, integrating the good life, gratification and developmental character traits (Seligman, 2005). It also draws inspiration from the philosophical tradition of Aristotle, according to which happiness is defined as eudaimonia (Ryff, 2017), the realisation of an individual's potential, in contrast to the hedonistic context of wellbeing, which sees happiness as experiencing pleasure and satisfaction. In the context of psychological wellbeing research, the hedonistic approach is present as a measurement of subjective wellbeing (Diener, 2000).

Mental wellbeing influences various aspects of individuals' functioning (Manchiraju, 2020; Vázquez et al., 2009), and research on this issue has found, among

other things, that maintaining a stable and reasonably high level of psychological wellbeing, and thus remaining engaged in various developmental activities and human connections, is associated with better somatic wellbeing and a less frequent occurrence of symptoms of chronic conditions (Heszen-Cielińska & Sęk, 2020). However, it is difficult to unequivocally say which dimension of wellbeing, hedonistic or eudaimonistic (Ryan & Deci, 2001), has a greater impact on an individual's positive functioning, especially in the context of a variety of tourism experiences, which themselves can be considered as more or less hedonistic or eudaimonistic (Voigt et al., 2010). The papers of Keyes et al. (2002) opened discussions on a holistic model of human wellbeing considering its three aspects – emotional (hedonistic), psychological and social (eudaimonistic), and have served as a basis for the design of educational and therapeutic interventions that promote individual wellbeing (Heszen-Cielińska & Sęk, 2020), also taking into account life satisfaction, positive affect, subjective physical health, absence of depression, anxiety and stress (Bhullar et al., 2013; Lee et al., 2015).

McMahan and Estes (2011), using regression analysis, developed a model in which it was the eudaimonistic approach to wellbeing that had a relatively greater impact on an individual's overall positive psychological functioning than the hedonistic one. Eudaimonistic wellbeing is also positively correlated with the realisation of activities that require challenges, skills, and are linked to self-realisation, effort and participants' interests (Waterman et al., 2008), which may characterise, among other things, tourism activities, for which the motives for undertaking them are, for example, self-realisation or the deepening of interests.

Given that individuals' tourism activities are among the behaviours that shape their perceptions of quality of life (Dolnicar et al., 2013; Kim et al., 2015; Li et al., 2022), which is relevant to a holistic view of individuals' wellbeing (Uysal et al., 2016), psychological wellbeing has also attracted the attention of tourism researchers as part of this construct (Zins & Ponocny, 2022). In research on the impact of tourism experiences on tourists' psychological wellbeing, the reference to hedonistic and eudaimonistic experiences related to different aspects of travel (Fakfare et al., 2020; Yu et al.,

Table 1

Application of theories related to psychological wellbeing in research on tourists

Theory related to psychological wellbeing	Research	Issues related to tourism
Self-determination Theory	Cini et al., 2013; Ng et al., 2012; Ntoumanis et al., 2020	• The impact of intrinsic motivation on a more authentic, satisfying and fuller enjoyment of the tourism experience
The self-congruity Theory model in travel and tourism	Chon & Olsen, 1991; Sirgy et al., 2018	• The relationship between the self-concept fit and destination image • The impact on feelings of happiness
Self-expressiveness Theory	Bosnjak et al., 2016	• The relationship between self-expression, hedonic pleasure and the choice of specific activities • Research in the context of the impact of sports tourism on hedonic pleasure and personal wellbeing
The bottom-up spillover theory of life satisfaction	Luo et al., 2018; Neal et al., 2007	• Life satisfaction is partly determined by satisfaction with specific important aspects of an individual's life, while satisfaction with these aspects is determined by the problems comprising the aspect • The impact of tourism experiences on life satisfaction is dependent on the duration of stay and the age of the respondents • The use of wellness tourism in research
Theory of leisure wellbeing	Lee et al., 2018	• The effect of benefits perceived in the context of the tourism experience on the sense of wellbeing, e.g. benefits of using smart technology can affect a tourist's happiness
Goal Theory	Kruger et al., 2015	• The relationship between the achievement of life goals and the achievement of tourism experience goals • Their impact on the achievement of positive wellbeing
Need Hierarchy Theory	Lee et al., 2014	• The impact of meeting different types of individual needs through tourism experiences on wellbeing
Broaden-and-build Theory	Kim et al., 2016	• An individual's positive attitude during the tourism experience can lead to greater engagement and a positive interpretation of ambiguous events

Source: own study based on "Promoting quality-of-life and well-being research in hospitality and tourism", M. J. Sirgy, 2019, *Journal of Travel & Tourism Marketing, 36*(1), 1–13 (https://doi.org/10.1080/10548408.2018.1526757); *Tourist health, safety and wellbeing in the new normal* (pp. 221–242), J. Wilks, D. Pendergast, P. A. Leggat, & D., Morgan (Eds.), 2021, Springer. https://doi.org/10.1007/978-981-16-5415-2_9.

2021) and activities undertaken (Bosnjak et al., 2016; Luo et al., 2018) is particularly noteworthy. However, the significance of the relationships that occur between the different dimensions of psychological wellbeing, quality of life, personal development and the role of tourism experiences in an individual's life is still not clearly defined (Filep et al., 2022). Joseph Sirgy (2019) proposes a number of theories and concepts in the context of which the study of the relationship between an individual's psychological wellbeing and their tourism experience may yield results relevant to the design of appropriate tourism offers that affect not only a customer's short-term experience but also their long-term wellbeing, especially considering tourism experiences of a eudaimonistic nature (Smith & Diekmann, 2017). A summary of concepts and theories related to psychological wellbeing is presented in the table below.

The examples in the table above show that research on the relationship between an individual's tourism experiences and their holistic wellbeing is firmly grounded in psychological theories and produces results that can contribute to improving the quality of different types of tourism services. They also show consumer/tourist behaviour and decisions in a broader context.

Review of the concept of wellbeing tourism in literature

With increased public interest in the topic of wellbeing, including mental wellbeing as well as its role in the holistic concept of health, there has been increased interest in the implementation of this concept in universally understood tourism activities, which has entailed increased interest from tourism researchers. Smith and Diekmann (2017) developed the Model of Integrative Wellbeing Tourism Experience, which includes pleasure and hedonism (i.e. having fun), rest and relaxation, altruistic activities and sustainability (e.g. being environmentally friendly of benefiting local communities) and meaningful experiences (e.g. education, self-development or self-fulfilment). This model is also referred to by Pope (2018) when describing the relationship between wellbeing, sustainable tourism and tourists' behaviour.

Taking into account the duration and type of tourism experience, Smith and Diekmann distinguished four areas of wellbeing in tourism. In the short-term, the level of subjective hedonistic wellbeing is influenced by tourism experiences built, for example, while relaxing on the beach, at the seaside or while attending various events, such as stag or hen parties. Medium-term effects on levels of hedonistic and eudaimonistic wellbeing are influenced by, for example, a combination of cultural tourism and participation in more hedonistic experiences, e.g. at night parties, or a combination of volunteer tourism and relaxation on the beach. Long-term effects on the level of eudaimonistic wellbeing come from tourism experiences that lead to existential authenticity, e.g. volunteer tourism, retreat tourism, spiritual pilgrimage. In contrast, permanent and optimal effects on the level of wellbeing, maximising quality of life and achieving authentic happiness are, according to the researchers, influenced by tourism experiences that are based on a sustainable, ecological and ethical approach to tourism. Smith and Diekmann's concept is a model aimed at better understanding wellbeing tourism.

This approach is also the foundation of 'The six pillars wellbeing tourism concept' (Lindell et al., 2021), to the development of which the project *Wellbeing Tourism in the South Baltic Region – Guidelines for good practices & Promotion (SB WELL)* contributed. Wellbeing tourism within this concept is based on six foundations – Soul, Society, Body, Environment, Mind and Economy. The authors also formulated a definition of wellbeing tourism, on which this study, among others, is based, defining it as a specific type of tourism intended to promote and maintain positive health of the body, mind and soul, composed of products and services drawn upon a sustainable interaction with the surrounding environment and community (Lindell et al., 2021), a definition that has become the basis for understanding wellbeing tourism in the conducted study. As part of the soulful foundation of wellbeing tourism, the tourism offers focuses on building an experience of beauty, joy, attentiveness and emotional balance. The mindful aspect relates to shaping an offer geared towards relaxation and tranquillity, but also creativity and creative activities. Bodily wellbeing is related to tourism focused on nourishing one's body, movement and relaxation, and the economic dimension is based on operating principles that also benefit the hosts, and is related to fair dealing, supporting the local community, and sustainable economic principles. Also the societal dimension refers to the local community, especially the principles of equal treatment, building positive relationships and cooperation. The environmental dimension refers to caring for the environment, striving for decarbonisation and eliminating waste in tourism activities (Lindell et al., 2022). According to the quoted definition of wellbeing tourism, this type of tourist can be considered as someone who, when making a travel decision, is guided by established indicators of wellbeing related to the destination, activities undertaken, and the impact of the journey on oneself and the environment.

The wellbeing tourism experience can take many forms. Initially, research on wellbeing tourism focused on specific tourism activities (Hartwell et al., 2018), wellness tourism (Kessler et al., 2020), health tourism and natural tourism (Farkic et al., 2021; Lück & Aquino, 2021; Willis, 2015). Among the main preferences of wellness tourists are physical activities and exercise, food experiences, sensations of the elements, sensations of the elements, peace and relaxation and togetherness (Lück & Aquino, 2021).

However, when considering the issue of wellbeing in the broader tourism context, it can be considered to concern the shaping of a tourism environment and experience, providing physical and psychological benefits, both for tourists and host communities, with

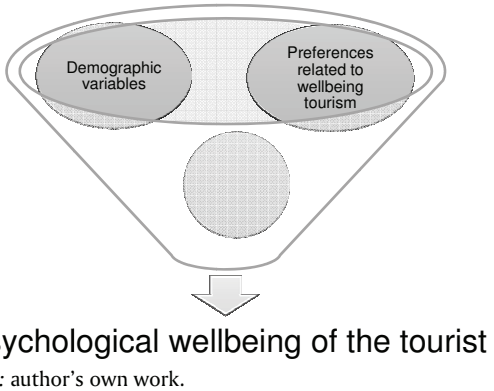
sustainability in the operation of tourism destinations, and is based on its eudaimonistic dimension, which is expressed in the holistic construction of wellbeing. Within the different kinds of wellbeing tourism, seven basic types can be distinguished, with different tourism offers based on the above six dimensions (Lindell et al., 2022) and focusing on a specific activity. These include original and luxurious places, places focused on spiritual development, on taking care of physical health and the body, on discovering and enjoying nature or cultural goods, on outdoor activities and places targeting ecologically-oriented tourists.

Methodology

Research model and hypotheses

The model of the study is most clearly expressed by the metaphor of a funnel (Figure 1), in which different areas that influence mental wellbeing, being a complex construct, come together. To answer the research questions related to the differences between tourists declaring different levels of mental wellbeing and preferring a specific type of wellbeing tourism, the UNIANOVA one-way procedure for analysis of variance was used. The explanatory variable was eudaimonistic psychological wellbeing, defined using a shortened version of the C. Ryff Psychological Well-Being Scale, while the other explanatory variables were wellbeing tourism preferences, measured separately on seven dimensions, and demographic variables: gender, age, place of residence, education and perception of one's own financial situation. The analysis was conducted using IBM SPSS software.

Figure 1
The concept of research on the mental wellbeing of tourists



Source: author's own work.

The effects of these variables on wellbeing are generally minor, but together they are of considerable importance, contributing to shaping wellbeing. To examine the results using analysis of variance, the following research hypotheses were formulated:

H1: The level of demonstrated psychological wellbeing of tourists varies according to their stated preferences in the area of wellbeing tourism.

H1a: The level of demonstrated psychological wellbeing of tourists varies according to gender.

H1b: The level of demonstrated psychological wellbeing of tourists varies according to age.

H1c: The level of demonstrated psychological wellbeing of tourists varies according to the place of residence.

H1d: The level of demonstrated psychological wellbeing of tourists varies according to the level of educational.

H1e: The level of demonstrated psychological wellbeing of tourists varies according to the perception of one's own financial situation.

The hypotheses formulated are alternatives to the hypotheses in the analysis of variance, which state that there are no differences in the study groups due to the mentioned factors.

Data collection

Responses to the survey questionnaire were collected in October/November 2022 using the CAWI method, with respondents recruited on the *poznaj.to* research panel owned by the PBS Research Agency. Only respondents who declared that they had taken part in a paid tourism trip in the year preceding the survey qualified. Respondents were asked three filter questions about their different activities and payments to avoid suggestive answers. A non-random quota selection method was used to select respondents, taking into account their gender, age and place of residence in Poland in 2021 (GUS, n.d.). The demographic structure (by gender) of the study group is presented in Table 2.

There were slightly more women among the respondents, and the largest age group consisted of those aged 30–39 years. The largest proportion of respondents lived in medium cities with up to 100,000 inhabitants and had secondary education. In addition, respondents were also asked to provide an opinion on their own material situation, characterised by four different statements. The percentage distribution of responses to this question is shown in the table below.

Respondents most often selected the answer indicating that they live frugally in order to have enough money for everything they need, while the least frequently chosen statement was that they did not have enough money for all their basic needs. Women assessed their material situation worse than men. Among the residents of cities with more than 100,000 inhabitants, the most frequent answer was that there is not enough money for all their basic needs. Those from the age groups 18–29 and 30–39 and with higher education rated their material situation the highest.

Given the nature of tourism activity, which requires involvement and often entails social interactions, as well as the long-term impact of eudaimonistic tourism activity on wellbeing, in order to study psychological wellbeing a questionnaire claiming its origin in eudaimonistic concepts was chosen. Due to the scope of

Table 2
Demographic structure of the study group

Question		Women		Men		Total	
Age	18–29	74	22.8%	50	18.1%	124	20.7%
	30–39	98	30.2%	97	35.1%	195	32.5%
	40–49	70	21.6%	63	22.8%	133	22.2%
	50–59	46	14.2%	45	16.3%	91	15.2%
	60–69	33	10.2%	17	6.2%	50	8.3%
	>70	3	0.9%	4	1.4%	7	1.2%
Total		324	54%	276	46%	600	100.0%
Place of residence	Village	121	37.3%	99	35.9%	220	36.7%
	City with up to 100,000 inhabitants	94	29.0%	76	27.5%	170	28.3%
	City with more than 100,000 inhabitants	109	33.6%	101	36.6%	210	35.0%
Education	Primary and vocational	9	2.8%	7	2.5%	16	2.7%
	Secondary	194	59.9%	178	64.5%	372	62.0%
	Higher	121	37.3%	91	33.0%	212	35.3%

Source: author's own work.

Table 3
Distribution of respondents by perception of their own financial situation

Self-perception of financial situation	% of answers
I can afford everything without making special sacrifices.	22.67%
I live frugally and thus have enough money for everything.	49.67%
I live very frugally in order to have money for more significant purchases.	21.17%
I do not have enough money for all my basic needs.	6.50%
Total	100%

Source: autor's own work.

the study we used the Polish adaptation of C. Ryff's Psychological Well-Being Scale, prepared by Karaś and Cieciuch in 2014. An abbreviated, 18-item version of the questionnaire was also validated to explore the general sense of wellbeing, without considering its 6 dimensions in detail, and this version was used in the current study. Respondents were asked to comment on the statements quoted, selecting answers from a 6-point Likert scale ranging from 1 ('strongly disagree') to 6 ('strongly agree'). The overall score was calculated using a method counting the average of all questions, with eight questions considered after inverting the scale. To check the reliability of the questions selected to create the questionnaire, we used the internal consistency coefficient Cronbach's alpha. As in the Polish adaptation of the questionnaire, the coefficient obtained was quite high, at 0.815, indicating a satisfactory reliability of the tool used. All scale items also showed satisfactory reliability of approximately 0.80.

To investigate tourists' preferences regarding wellbeing tourism, we used a breakdown into seven different segments distinguished in this area, developed within the *Wellbeing Tourism in the South Baltic Region – Guidelines for good practices & Promotion* project. We selected a question consisting of seven descriptions, characterising the chosen wellbeing tourism destinations, to determine tourists' preferences related to a specific type of wellbeing tourism. Respondents were asked how likely it was, if their friends unexpectedly won a voucher for a 7-day holiday, that they would encourage them to choose a specific type of wellbeing tourism. Responses were given on a non-metric 10-item scale, with the question formulated based on the principles of the Net Promoter Score (NPS) (Baehre et al., 2022). Framing the question in this way enabled the elimination of the influence of season and available financial resources on a respondent's preferences. The Cronbach's reliability coefficient for this part of the questionnaire was also satisfactory, at 0.84. By using a 10-item scale, it was possible to operationalise the variables through the declared level of intention to recommend a particular type of wellbeing tourism destination (Beahre et al., 2022). The respondents were divided into three groups, as shown in Table 4. Those who answered from 0 to 6 were considered to disregard the place in question when recommending it, while those who answered 7 to 8 were identified as expressing a neutral stance towards a particular type of wellbeing tourism. Only those who answered 9 to 10 were identified as preferring a particular type of wellbeing holiday.

Table 4
Breakdown of survey participants by their preference for a particular destination typical for a particular type of wellbeing tourism

Wellbeing tourism	Description of the destination	Disregarding tourists	Neutral tourists	Preferring tourists
Luxury	An original place with a natural balance, where you can pamper your senses and enjoy the benefits of local culture at the same time.	17.2%	27.7%	55.2%
Nature	An interesting place to experience something new and unexpected while exploring the local countryside using the opportunities available.	15.0%	26.0%	59.0%
Health	A safe place where you can take care of your health thanks to professionals.	22.2%	28.7%	49.2%
Outdoor	A naturally challenging place to prove yourself, pursue your passions and meet like-minded people.	27.3%	28.7%	44.0%
Harmonic	A soulful place to slow down, disconnect from an unhealthy lifestyle, and find peace and harmony.	41.8%	22.5%	35.7%
Cultural	A culturally interesting place to focus, read a book, observe the beauty of local nature or monuments.	19.7%	30.2%	50.2%
Ecological	A place to travel to while maintaining the principles of sustainable living and respect for local culture.	21.3%	33.5%	45.2%

Source: autor's own work.

To simplify the description, a separate name was given for each preference, as shown in the table above. The largest proportion of respondents were willing to recommend nature and cultural tourism, while the least interest was shown in harmonic tourism, which was also disregarded by the largest proportion of respondents.

Analysis

The UNIANOVA one-way procedure for analysis of variance was used to answer the research questions and verify the research hypotheses (Francuz & Mackiewicz, 2012), with the explanatory variable being the level of wellbeing declared by the respondents. The characteristics of the level of wellbeing reported by the respondents are shown in the table below.

The Polish adaptation of C. Ryff's Psychological Well-Being Scale, prepared by Karaś and Cieciuch in 2014, was used to measure the level of self-reported psychological well-being. The average well-being score was calculated based on the respondents' indications, using a 6-point Likert scale ranging from 1 ('strongly disagree') to 6 ('strongly agree') for 18 items. The mean level of psychological wellbeing recorded in the study group was $M = 4.42$ ($SD = 0.56$) points, while the lowest level of wellbeing of 2.39 points was reported by only 0.2% of the subjects. Similarly, the highest level of wellbeing of 6 points was achieved by only 0.2% of the subjects. The 25% of respondents with the lowest scores showed wellbeing of less than 4.06 points, and 25% of those with the highest level of wellbeing in the study group scored higher than 4.83 points. The distribution of wellbeing scores in the study group is left-skewed, meaning that there are more scores above the mean in the group than in normal distribution. The kurtosis value takes on a negative result, which means that the graph is platykurtic, i.e. the scores related to the subjects' wellbeing level show less concentration around the mean than is the case in normal distribution, which is consistent with the predictions for the study of psychological wellbeing and with measurements of wellbeing in different populations.

Table 5
Level of psychological wellbeing among the study group

N	Important	600
Mean		4.42
Median		4.44
Dominant		4.56
Standard deviation		0.56
Skewness		–0.13
Standard error of skewness		0.10
Kurtosis		–0.18
Standard error of kurtosis		0.20
Minimum		2.39
Maximum		6.00
Percentile	25	4.06
	50	4.44
	75	4.83

Source: autor's own work.

Considering the results of the UNIANOVA one-way procedure (Bedyńska & Cypryańska, 2013) for analysis of variance, it should be noted that statistically significant effects in shaping levels of psychological wellbeing were only recorded for the natural and cultural preferences of wellbeing tourism and for the

Table 6

Results of a one-way analysis of variance on differences in wellbeing levels

Source	Type III sum of squares	*df*	Mean square	*F*	Significance	Partial Eta squared
Corrected model	37.988[a]	27	1.407	5.289	0.000	0.200
Constant	1260.355	1	1260.355	4737.943	0.000	0.892
Sex	0.076	1	0.076	0.287	0.593	0.001
Age	2.086	5	0.417	1.568	0.167	0.014
Place of residence	0.892	2	0.446	1.677	0.188	0.006
Education	0.202	2	0.101	0.381	0.684	0.001
Financial situation	12.255	3	4.085	15.357	0.000	0.075
Luxury tourism	0.389	2	0.195	0.731	0.482	0.003
Nature tourism	6.061	2	3.030	11.392	0.000	0.038
Health tourism	0.195	2	0.098	0.367	0.693	0.001
Outdoor tourism	0.163	2	0.081	0.306	0.737	0.001
Harmonic tourism	0.751	2	0.375	1.411	0.245	0.005
Cultural tourism	2.448	2	1.224	4.601	0.010	0.016
Ecological tourism	0.702	2	0.351	1.320	0.268	0.005
Error	152.160	572	0.266			
Total	11890.389	600				
Total (corrected)	190.148	599				

Note. a. R square = 0.200 (Adjusted R square = 0.162)
Calculated using alpha = 0.05

Source: autor's own work.

perception of one's financial situation (Table 6). The other variables tested were not significant when differentiating levels of wellbeing.

Considering the results of the analysis of variance, it can be concluded that the effect of preference for nature tourism $F(1.572) = 11.39, p < 0.001, \eta_{\epsilon} = 0.04$, cultural tourism $F(1.572) = 4.60, p = 0.010, \eta = 0.02$, and one's financial situation $F(1.572) = 15.36$, $p < 0.001$, $\eta = 0.08$, which, given the strength of effect measure η, explained the largest part of the variation in wellbeing, were comparable to the other significant variables. In order to test the differences in levels of perceived psychological wellbeing between those preferring a particular type of wellbeing tourism in more detail, a Bonferroni post hoc test was conducted, chosen because of the number of groups compared and its conservative approach. The results of the comparisons are shown in the table below.

For those expressing a certain stance towards nature wellbeing tourism, the post hoc test revealed that there are significant differences in the level of perceived wellbeing between all groups. The level of perceived wellbeing of those disregarding nature wellbeing tourism in their decisions ($M = 4.09, SD = 0.57$) is significantly lower than the level of perceived wellbeing by neutral ones ($M = 4.32$, $SD = 0.50$), $p = 0.002$, and those preferring nature wellbeing tourism ($M = 4.54, SD = 0.55$), $p < 0.001$. The difference between those neutral and those preferring nature wellbeing tourism is also significant ($p < 0.001$).

For those expressing a certain stance towards cultural wellbeing tourism, the post hoc test revealed that there are significant differences in the level of perceived wellbeing between those disregarding and those preferring it, as well as between those neutral and those preferring this type of tourism. The level of perceived wellbeing of those who disregard cultural wellbeing tourism in their decisions ($M = 4.31$, $SD = 0.55$) is significantly lower than the level of perceived wellbeing of those who prefer it ($M = 4.55$, $SD = 0.54$), $p < 0.001$. Neutral persons ($M = 4.27$, $SD = 0.56$) also experience significantly lower levels of perceived psychological wellbeing than those who prefer cultural wellbeing tourism, $p < 0.001$. In contrast, there was no significant difference in the level of perceived psychological wellbeing between disregarders and neutrals, $p = 1.00$.

The Bonferroni post hoc test was also carried out to examine in more detail the differences in levels of perceived psychological wellbeing between those perceiving their financial situation in a particular way (Table 8).

The post hoc test revealed that there are significant differences in the level of perceived wellbeing between those with different perceptions of their financial situation. Respondents who believe that they can afford everything without special sacrifices (1) achieve significantly higher levels of wellbeing ($M = 4.58$, $SD = 0.57$) than respondents from group 3 – those living very frugally ($M = 4.24$, $SD = 0.52$),

Table 7

Results of the Bonferroni test showing differences in wellbeing among those who disregard, are neutral and prefer certain types of wellbeing tourism

Nature tourism		Difference in means (I–J)	Standard error	significance	95% confidence interval	
					lower limit	upper limit
disregarding	neutral	–0.2327*	0.06827	0.002	–0.3966	–0.0688
	preferring	–0.4518*	0.06089	0.000	–0.5979	–0.3056
neutral	disregarding	0.2327*	0.06827	0.002	0.0688	0.3966
	preferring	–0.2191*	0.04956	0.000	–0.3381	–0.1001
preferring	neutral	0.4518*	0.06089	0.000	0.3056	0.5979
	disregarding	0.2191*	0.04956	0.000	0.1001	0.3381
Cultural tourism		**Difference in means (I–J)**	**Standard error**	**significance**	**95% confidence interval**	
					lower limit	**upper limit**
disregarding	neutral	0.0397	0.06102	1.000	–0.1068	0.1862
	preferring	–0.2354*	0.05602	0.000	–0.3699	–0.1009
neutral	disregarding	–0.0397	0.06102	1.000	–0.1862	0.1068
	preferring	–0.2751*	0.04851	0.000	–0.3916	–0.1586
preferring	disregarding	0.2354*	0.05602	0.000	0.1009	0.3699
	neutral	0.2751*	0.04851	0.000	0.1586	0.3916

Note. Created based on observed averages/means. The error component is the mean square (error) = 0.266.

*. The difference in means is significant at the level of 0.05.

Source: autor's own work.

Table 8

Results of the Bonferroni test showing differences in wellbeing among those who perceive their financial situation differently

Perception of one's own financial situation		Difference in means (I-J)	Standard error	significance	95% confidence interval	
					lower limit	upper limit
1. I can afford everything without special sacrifices.	2	0.1162	0.05337	0.180	–0.0251	0.2575
	3	0.3300*	0.06364	0.000	0.1616	0.4985
	4	0.5188*	0.09368	0.000	0.2708	0.7668
2. I live frugally and thus have enough money for everything.	1	–0.1162	0.05337	0.180	–0.2575	0.0251
	3	0.2139*	0.05466	0.001	0.0692	0.3586
	4	0.4026*	0.08783	0.000	0.1701	0.6351
3. I live very frugally in order to have money for more significant purchases.	1	–0.3300*	0.06364	0.000	–0.4985	–0.1616
	2	–0.2139*	0.05466	0.001	–0.3586	–0.0692
	4	0.1888	0.09442	0.276	–0.0612	0.4387
4. I do not have enough money for all my basic needs.	1	–0.5188*	0.09368	0.000	–0.7668	–0.2708
	2	–0.4026*	0.08783	0.000	–0.6351	–0.1701
	3	–0,1888	0.09442	0.276	–0.4387	0.0612

Note. Created based on observed averages/means.
The error component is the mean square (error) = 0.266.
*. The difference in means is significant at the level of 0.05.

Source: autor's own work.

$p < 0.000$ and group 4 – those who do not have enough money for all their basic needs ($M = 4.06$, $SD = 0.57$), $p < 0.000$. There was no significant difference in the level of perceived wellbeing between group 1 and group 2, i.e. respondents who can afford everything thanks to frugal living ($M = 4.46, SD = 54$). Significantly higher levels of perceived wellbeing are experienced by respondents from group 2 compared

to respondents from group 3 ($p < 0.001$) and group 4 ($p < 0.000$). In contrast, there was no significant difference in the level of perceived psychological wellbeing between respondents living very frugally to put aside/have money for more significant purchases (group 3) and respondents from group 4.

Results

The research hypotheses were verified using analysis of variance, with the first hypothesis, formulated as "the level of demonstrated psychological wellbeing of tourists varies according to their stated preferences in the area of wellbeing tourism", partially confirmed. The level of perceived psychological wellbeing differed significantly for two types of wellbeing tourism – nature tourism and cultural tourism. Out of the hypotheses from H1a to H1e, only hypothesis H1e was confirmed – "the level of demonstrated psychological wellbeing of tourists varies according to perception of one's own financial situation". A significant factor differentiating the level of perceived psychological wellbeing is the perception of one's own financial situation, while psychological wellbeing was not significantly statistically related to the other variables examined – gender, age, place of residence, educational level of the surveyed individuals.

When answering the posed research question "between which groups preferring a certain type of wellbeing tourism are there differences related to the average level of mental wellbeing?", it is also necessary to refer to the results of the analysis of variance. A graphical representation of the differences in the level of psychological wellbeing, taking into account estimated marginal means of the level of wellbeing among the disregarders, neutrals and those preferring natural and cultural wellbeing tourism, is presented in Figure 2.

Significant differences in the respondents' levels of psychological wellbeing only occurred when they were divided within the natural and cultural wellbeing tourism preferences, while the preferences revealed towards the other types of wellbeing tourism were not significant in differentiating the respondents' levels of psychological wellbeing.

Discussion

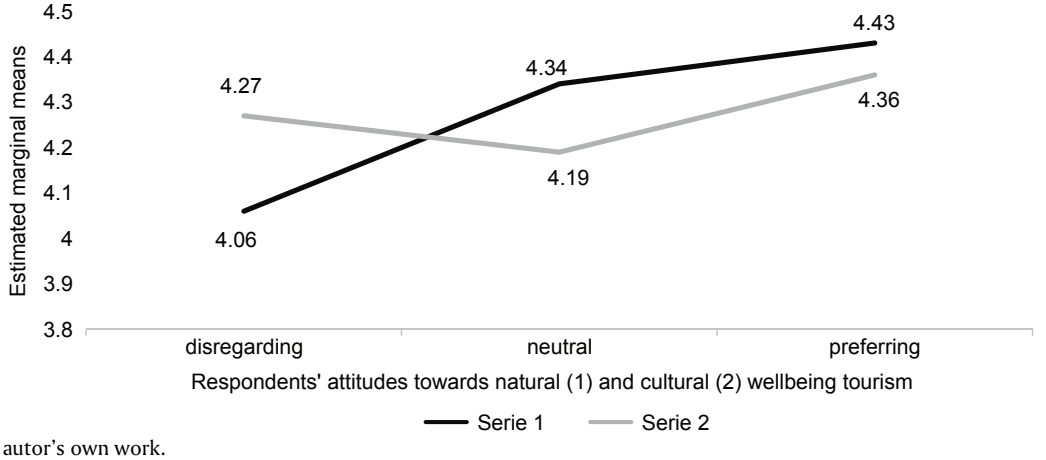
Tourists' awareness, expectations, attitudes, fears and behaviours in the post-covid and war reality are changing. This also calls for a paradigm shift in tourism research, and an increased interest in research areas that arise from changes in the psychological condition of individuals. The results of such research can form the basis for changes in the work of the tourism industry, and modifying tourism offers to take into account the impact of specific factors supporting psychological wellbeing can result in increased tourist engagement, satisfaction and motivation to enhance their tourism experience.

Differences between the groups of individuals preferring natural and cultural wellbeing tourism were found to be significant in terms of their levels of psychological wellbeing, which may be due to the applied division of wellbeing tourism and the popularity of both constructs among tourists, based on their greatest familiarity and liking (Fennis & Stroebe, 2021).

The detected effects of preferences within natural and cultural wellbeing tourism and the importance of perceptions of one's own financial situation in shaping tourists' sense of psychological wellbeing explain the small area of variation in wellbeing, which makes us wonder about further variables that influence the level of the eudaimonistic psychological wellbeing of tourists. However, due to the scale of tourist activity, which, according to Statistics Poland (GUS), concerned 22,198,972 tourists in Poland in 2021, this variability may involve hundreds of thousands of people (GUS, 2022).

Figure 2

A comparison of the estimated marginal means of the level of wellbeing among the disregard, neutral and preference groups of natural and cultural wellbeing tourism



Source: autor's own work.

Conclusions

Do Polish tourists want wellbeing tourism? – a clear answer cannot be given to the question posed in the title of this article. Wellness tourists, as observed in the study, prefer two types of tourism, referred to as nature tourism and cultural tourism, and the descriptions of both types relate to experiencing specific situations. Tourists preferring nature tourism look for interesting places where they can experience something new and unexpected while exploring the local countryside, taking advantage of the available opportunities. On the other hand, tourists preferring cultural tourism desire culturally interesting places where they can focus, read a book, observe the beauty of local nature, or admire monuments. Taking into account these two most popular indications, it is necessary to determine what other aspects of wellbeing tourism are important for tourists seeking such experiences.

The study aims to explore the relationship between psychological wellbeing and choices related to wellness tourism, as wellness tourism offers significant opportunities for shaping an individual's mental well-being. This research can serve as inspiration for entrepreneurs operating in the wellness tourism industry to incorporate information about the impact of such leisure activities on mental wellbeing into their marketing communication, and could also encourage them to seek and create services within the realm of wellness tourism that contribute to the enhancement of well-being among tourists.

Limitations

The main limitation of the study was the use of a quota sampling approach among participants of the research panel, which prevents us from applying the results to the total population of Polish tourists. Another limitation of the study was also the use of an abbreviated version of the Ryff psychological wellbeing questionnaire, which this was for practical reasons, although using the standard version with 84 items would have allowed for a more in-depth examination of tourists' psychological wellbeing across its six dimensions and relating specific dimensions of wellbeing to preferences for specific types of wellbeing tourism, and would also have been important in the context of the psychological wellbeing of individuals to address the tourism experience as a whole, which is certainly a broad area for research.

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Business model transformation during the COVID-19 pandemic – example of the automotive industry

Abstract

This article explores the impact of the COVID-19 epidemic on the business models of automotive-sector organizations, specifically authorized passenger car dealerships in Poland. The research aims to determine how business models were transformed during the pandemic. The research methods used include a literature review and opinion polls. The article begins by discussing the significance and evolution of business models and changes in the automotive sector. The results focus on how the pandemic brought about change in business models in the automotive sector, and the conclusion includes information as to limitations and further areas of study.

Keywords: business model, business model transformation, dealership, automotive industry, COVID-19

Introduction

The ability to adapt and operate flexibly determines the survival of modern businesses. Running a business involves constant questioning, seeking new solutions, and learning from experience to avoid repeating mistakes. The VUCA world is volatile, uncertain, complex, and ambiguous. Volatility means frequent and unpredictable change, while uncertainty means the lack of knowledge about the impact of an event. Complexity involves creating an elaborate network of interconnected information and procedures, and ambiguity means the lack of knowledge as to 'the basic rules of the game'. This means that the cause-and-effect relationship is not recognized and there is no precedent that indicates what to expect (Bennett & Lemoine, 2014). M.T. Lepeley has stated that in the global VUCA environment of the 21st century, crises are the norm rather than anomalies. People, organizations and nations will face entropy, should they maintain the dysfunctional status quo. The global crisis caused by the SARS-CoV-2 virus has revealed a deficiency of hard skills. According to Lepeley, during critical times, hard skills seem to hamper the currently developing economic crisis and expose gaps in communication, critical thinking, coordination, and problem-solving (Lepeley, 2021). What is more, many socio-economic implications have tightened-up, such as the issue of social inequality (Munir, 2021), growth of entrepreneurship (Shepherd, 2020), or the understanding and acceptance of the risk of and the ways of dealing with crises (Rouleau et al., 2021). In the VUCA world, leaders do realize that a sustainable future is only possible if organizations are able to sense, adapt, and respond to change. They also unveil the business challenges to reveal the organization's learning gaps associated with individuals and teams, as well as the practices, processes, and systems (Raghuramapatruni & Rao Kosuri, 2017).

The pandemic, and thus the increasing incidence of COVID-19, has affected all areas of human activity, starting from the fundamental issues associated with the protection of human health and life, through the social, demographic, technological, cultural, educational, legal, political and economic spheres. In macroeconomic terms, the pandemic-induced crisis, the effects of which are perceptible worldwide, has resulted in a sharp decline in aggregate supply and aggregate demand. The efforts to inhibit the spread of the Sars-Cov-2 virus, through reduced business activity, have resulted in a sharp decline in aggregate demand. The decrease in consumption and investment has, in turn,

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caused a decrease in aggregate supply (Seetharaman, 2020). The restrictions on free movement of goods in international trade contributed to a significant economic slowdown, which has affected companies from all sectors, regardless of their size. This global socio-economic crisis of such an unprecedented scale has additionally induced consumer panic and changed the existing purchasing habits. Under these circumstances, the global financial market has also been experiencing market anomalies, leading to significant drops in global stock indices (McKibbin & Fernando, 2020, p. 45). Numerous scientific studies indicate the impact of the COVID-19 pandemic on the development of individual sectors, including the tourism sector (e.g. Carrillo-Hidalgo, 2023; Romagosa, 2020; Sigala, 2020; Uğur & Akbıyık, 2020), the associated aviation sector (Gultekin & Acik Kemaloglu, 2023; Forsyth et al., 2020; Tuchen et al., 2023) as well as the pharmaceutical sector (Almurisi et al., 2021; Asad & Popesko, 2023; Ayati et al., 2020), the energy sector (Eroğlu, 2020; Ha, 2023; Klemeš et al., 2020), the educational sector, including higher education (Aristovnik et al., 2020; Bansal, 2023; Mielke et al., 2023), and the automotive sector, in particular the emerging problems with disruptions of supply chains (Hojdik, 2021; Jankovic-Zugic et al., 2023; Kazancoglu et al., 2023; Klein et al., 2021). In the unfavorable environment hindering the development of entrepreneurship, many companies have faced the question of how to foresee the pandemic's further impact on the economic situation, mitigate the effects of the global crisis, find new solutions for running family businesses (e.g. De Massis & Rondi, 2020; Sahut et al., 2023), search for creative ideas to overcome the crisis induced by the COVID-19 pandemic (e.g. Agarwal & Audretsch, 2020; de Lara González et al., 2023), and implement new strategies in international businesses (e.g. Rahbari et al., 2023; Verbeke & Yuan, 2021). To this end, scenarios of how Sars-Cov-2 will spread are being developed on a global scale, considering its impact on the economic crisis, the results of which include decreased labor supply, rising costs of business operations, or decreased consumption in various sectors (McKibbin & Fernando, 2020).

The socio-economic crisis caused by a factor of an exogenous nature encourages the companies wishing to maintain their position on the market to reflect on the current manner of customer value development and stakeholder relationship building. From this perspective, the important questions are the following (RQ):

RQ1: What impact does the crisis exert on the manner in which automotive-sector companies conduct business?

RQ2: How does it affect these companies' relations with their stakeholders?

RQ3: What short-term initiatives have the companies undertaken in terms of the existing manner of conducting operations?

RQ4: Striving to maintain their internal consistency, while ensuring flexibility of operation, have the companies changed the architecture of their business, that is have they changed their business model?

RQ5: What actions have the company managerial personnel taken in terms of internal and external stakeholder relation management?

This research problem has developed along with the difficulties concerning a changing business environment that affect dealerships' business architecture. The main aim of this paper was to identify the components of dealerships' business models that required changes due to exogenous and unpredictable factors such as the COVID-19 pandemic, in order to ensure companies' position and stability on the market. The designed research tool – a questionnaire – enabled the authors to conduct research on car dealerships in Poland.

The paper is structured as follows. The first section presents a literature review on business model reconfiguration, followed by a description of methodology of the study. This study methodology exposes the designed research tool – a questionnaire, research procedure, and the structure of the respondents – surveyed dealerships. The results of the conducted research are then presented, organized in the same order as in the questionnaire, showing which elements of dealerships' business models have changed due to an exogenous factor such as the COVID-19 pandemic. Finally, the last section illustrates the principal conclusions that can be drawn from our work. In particular, it addresses the research questions posed at the beginning of this paper, implications for further research outlined based on the authors' analysis, findings enhancing to seek for flexible systemic and structural solutions that will secure dealerships against unexpected environmental changes, and managerial implications.

Literature review

The theoretical research began with a bibliometric analysis carried out using two knowledge databases, Web of Science (WoS) and Scopus[1]. Identification of

[1] In this theoretical research study, the authors made a deliberate choice to utilize only the Web of Science (WoS) and Scopus databases, despite being aware of other knowledge bases such as Google Scholar (Publish or Perish). The identification of relevant publications in their investigation relied on titles, keywords, abstracts, and content obtained through publication queries. While both WoS and Scopus enable comprehensive bibliometric analysis and provide valuable data, the structure of the Publish or Perish database poses limitations, making it unsuitable for generating certain information such as abstracts. Furthermore, the authors prioritized the identification of publications from recognized international journals and conferences, which led them to rely solely on the WoS and Scopus databases. WoS and Scopus are renowned for their extensive coverage of high-quality peer-reviewed journals and reputable conference proceedings, ensuring the inclusion of publications that meet the rigorous standards of the research. Additionally, the research was conducted based on the identified literature during the exploratory phase and questionnaire construction, further supporting the authors' decision to utilize the Web of Science and Scopus databases.

Table 1
List of the studies identified in the Web of Science and Scopus databases

Category	Database	
	Web of Science	Scopus
Publication years	2006–2020	2008–2021*
Citations years	2006–2020	2009–2021*
Documents	46	61
Citations	786 / 775*	828
Cities per paper	17	13,57
h-index	12	12

Note. *W/o self-citations.
** Two studies with the publication date of 2021 were identified in the Scopus database, and were included in the analysis.
*** Search query: ('business model' OR 'business model innovation') AND ('reconfiguration' OR 'transformation' OR 'evaluation' OR 'change approach').

Source: authors' own work based on the data contained in the knowledge databases used, as of: August 23, 2020.

the publications dealing with the issue of business model reconfiguration began with a search for indexed scientific articles and monograph chapters in post-conference materials. For this purpose, the keywords ('business model' OR 'business model innovation') AND ('reconfiguration' OR 'transformation' OR 'evaluation' OR 'change approach') were proposed.

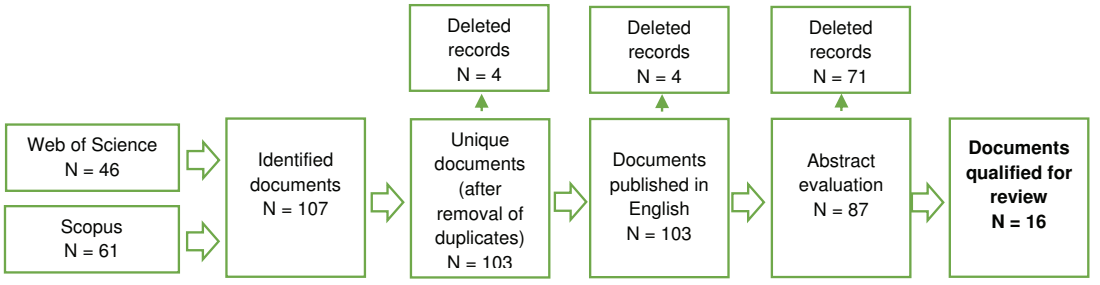
Table 1 summarizes the results obtained from the two knowledge databases.

Based on the data generated, the publications identified were evaluated for repeated articles, language, and type of publication, including the results of abstract and entire publication analyses. This part of the research process is shown in Figure 1.

Based on the data presented in Table 1, Figure 2, in turn, shows interest in the issue of business model transformation, expressed in the number of publications indexed in the Web of Science and Scopus databases.

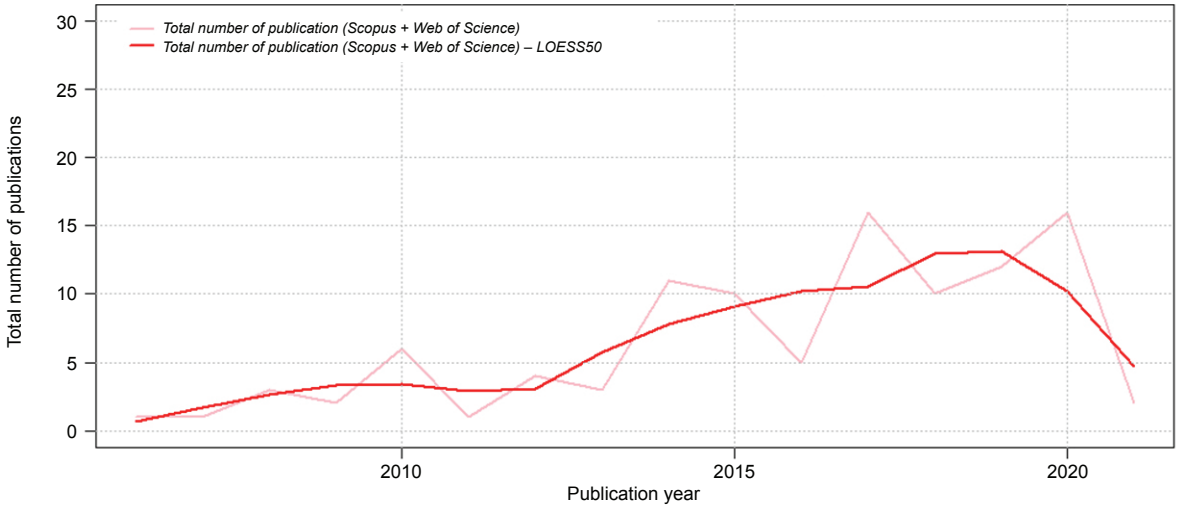
As a result of the bibliometric analysis, sixteen publications dealing with the issue of business models in the context of model transformation were identified. The results of the analysis additionally outlined the cogni-

Figure 1
The process of identifying the publications to be used for the systematic literature review



Source: authors' own work based on the data from the Scopus and the Web of Science databases.

Figure 2
The number of publications indexed in the Scopus and Web of Science databases



Note. *LOESS50 – regression at base of 50.
** Search query: ('business model' OR 'business model innovation') AND ('reconfiguration' OR 'transformation' OR 'evaluation' OR 'change approach').

Source: authors' own work based on the data from the knowledge databases.

Table 2
Characteristics of the business model evaluation parameters

Evaluation parameter	Authors
Factor implying generation of business model changes	Bocken et al., 2015; Sewpersadh, 2023
Activities of improving character	Chesbrough, 2010; Demil & Lecocqe, 2010; Gassmann et al., 2014
Identification of stakeholders	Bocken et al., 2015; Froud et al., 2009
Impact of customer needs and expectations	Magretta, 2002
Types of contact with customers	Chesbrough, 2010; Gassmann et al., 2014
Identification of the dominant source of profit (customer value proposition)	Demil & Lecocq, 2010; Dubosson-Torbay et al., 2002; George & Bock, 2011; Johnson et al., 2008; Magretta, 2002; Morris et al., 2005, Schaltegger et al., 2016; Wirtz et al., 2010
Identification of key resources	Chesbrough, 2010; Johnson et al., 2008
Cost structure	Chesbrough, 2010; Gassmann et al., 2014
Profit structure	Dubosson-Torbay et al., 2002; Gassmann et al., 2014; George & Bock, 2011; Johnson et al., 2008
Identification of customer segments	Dubosson-Torbay et al., 2002; Magretta, 2002; Morris et al., 2005, Osterwalder et al., 2005
Distribution channels	Chesbrough, 2010

Source: authors' own work based on the literature specified in the table.

tive gap caused by a lack of publications describing the business model reconfiguration resulting from the exogenous factor of the COVID-19 epidemic. A subsequent research question was presented accordingly.

Much attention has been devoted in the literature on the subject to business model changes. Numerous studies addressing this issue contain various expressions that are used to reflect the essence of the phenomenon of change, such as "reinventing business model" (Johnson et al., 2008), "business model renewal" (Doz & Kosonen, 2010), "business model adaptation" (Saebi et al., 2017), or "business model development" (Andries et al., 2020).

The systematic review of the literature on the subject enabled the business model elements propounded by various researchers to be identified. Some of these elements, such as *customer value proposition* (Bohnsack et al., 2014, p. 288; Boon & Lüdeke-Freund, 2013, p. 16; Schaltegger et al., 2016, p. 6; Yunus et al., 2010, p. 311), or resources/*key resources* (Hienerth et al., 2011, p. 346; Provance et al., 2011, p. 5630; Yunus et al., 2010, p. 311) are mentioned in many business model canvas templates. The theoretical model propounded in this work (Table 2) is based on the business model concept developed by A. Osterwalder and Y. Pigneur (2010). It has been modified to allow for the specific nature of the automotive sector under examination, based on the definition proposed by the authors of the article.

Methodology

Theoretical model

Based on the theoretical research presented in the first section of the article, a research tool was designed which enables the research questions formulated to be answered and, consequently, the objectives set to be achieved. It should be emphasized here that the survey questions and answers were modified to allow for the specific nature of the automotive-sector organizations under examination. This means that the undertaken attempt to assess business model transformation necessitated identification of business model elements, followed by identification of the factors that might shape those elements. Subsequently, a research tool was designed in the form of a questionnaire containing twelve closed questions and respondent's particulars (Appendix 1).

Research procedure

The empirical procedure was carried out in July and August 2020, on a non-probabilistically selected sample of dealerships. The non-probability sampling of the entities surveyed was determined by the criterion possession of a new vehicle dealership license and a permit for servicing and sale of parts and accessories. A particular organization was additionally selected according to its size, expressed as the number of employees and the number of new vehicle dealership licenses. It should be emphasized here that small organizations, employing less than nine persons, were not invited to take part in the research. The study was carried out using an opinion poll and in CAWI (Computer-Assisted Web Interview) form. Forty invitations were sent, and twenty correctly completed questionnaires were received (response rate = 0.5).

Structure of the respondent group surveyed

The survey questionnaire was addressed to the management personnel and the specialists employed in functional areas of an organization, such as management, sale of new and used cars, and after-sales service (servicing and/or sale of spare parts). Consequently, twenty correctly filled in questionnaires were received from respondents employed in executive (4),

Table 3
Structure of the organizations surveyed in distribution by the number of employees

Dealership size by the number of employees	Number of car brands sold (number of licenses/permits)			
	Less than 3	3	more than 3	Total
10–49 employees	13			13
50–249 employees	5	1		6
over 250 employees			1	1
Total	18	1	1	20

Source: authors' own work.

managerial (13) and specialist/expert (3) positions. More than one answer could be given to the question concerning the area of functioning. Accordingly, the employment structure, in distribution by functional areas, was as follows: management department (8), sales cars department (4) and after-sales department (servicing and/or spare parts) (12). The ratio of the company size structure, expressed by the number of employees, regardless of the form of employment, to the number of the licenses/permits held by the entity is presented in Table 3.

For the purpose of this article, the number of the licenses/permits held is identifiable as the number of the car brands which the entity surveyed is licensed to sell and for which it can provide after-sales services.

Results

Based on the review of the literature on business model elements, questions were incorporated into the research tool designed to allow identification and intensification of the impact exerted by exogenous and endogenous changes on the entities under examination.

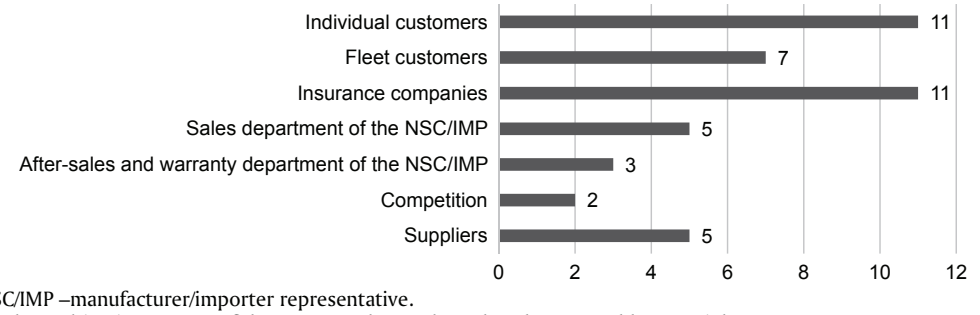
In the first question, the respondents were asked whether reconfiguration of the existing manner of functioning within the stakeholder and competitor sphere had been noticed in the organization prior to the outbreak of the COVID-19 epidemic in Poland[2]. The answer distribution is shown in Figure 3. It should be emphasized here that out of the twenty organizations surveyed, in two cases the respondents did not state that the organization had not projected such reconfiguration, therefore, the results presented concern eighteen organizations.

As Figure 3 indicates, the dealerships under examination recognized the need to change the business model elements. The responses obtained show that with regard to the first element, more than half of the respondents declared the need for a change in relations with individual customers (private users, small enterprises) (11) and fleet users (fleets, leases, car rental companies, etc.) (7). By contrast, with regard to the key partners segment, insurance companies as well as the importer's sales department and the suppliers were taken into account. It is worth emphasizing here that in only two cases was there a recognized need for changes with regard to competition, which includes various types of authorized service stations (dealerships, and authorized entities that sell original and non-original spare parts) as well as organizations selling and providing maintenance services as independent entities (unlicensed).

In the next question, the respondents were asked to identify the areas in which the dealerships generated improvements in the periods before (bC-19) and during (dC-19) the COVID-19 epidemic. The question was intended to identify when improvement measures began in selected areas of an organization. The results are shown in Figure 4.

The data obtained demonstrated that, in the group of the organizations surveyed, changes of a streamline nature were triggered by an exogenous factor identified as the COVID-19 epidemic. The changes mainly concerned the area of car sales, servicing and

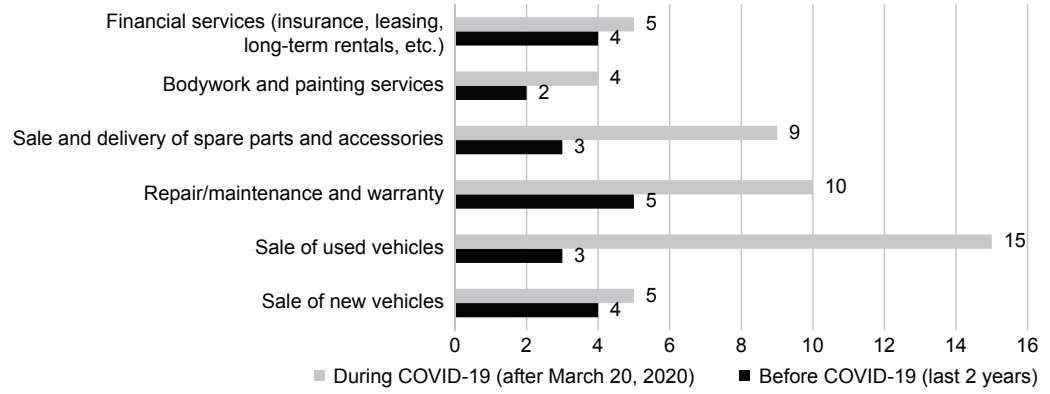
Figure 3
Stakeholder relationships in the dealerships surveyed (N=18) in 2018–2020 (prior to the COVID-19 pandemic)



Note. *NSC/IMP –manufacturer/importer representative.
** Due to the multivariate nature of the answers, the total number does not add up to eighteen.
Source: authors' own work.

Figure 4

Breakdown of the answers provided to the question regarding the areas identified as those requiring activity improvements during the bC-19 and dC-19 periods (N=20)



Note. Due to the multivariate nature of the answers, the total does not add up to eighteen.

Source: authors' own work.

warranty, as well as the sale and delivery of certain accessories.

Subsequently, the respondents were asked about customer segmentation in the entities surveyed during the bC-19 and dC-19 periods (Figure 5).

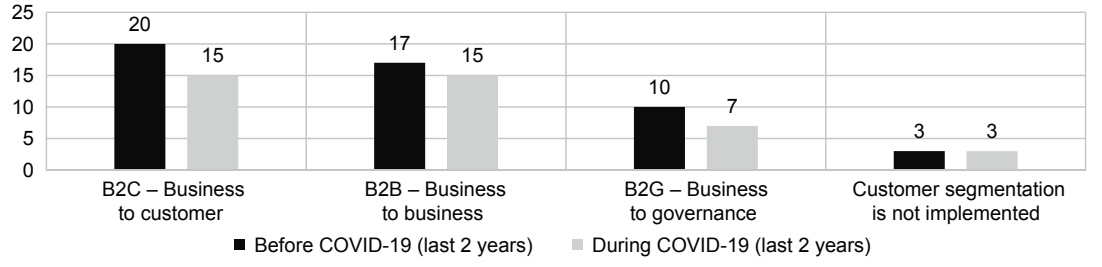
The responses in the research questionnaire were divided into three customer segments: business to customer (B2C) (e.g., individual customers, companies with < 2 vehicles), business to business (B2B) (e.g., fleets), and business to governance (B2G) (e.g., state authorities, state institutions), with an additional answer that the organization does not group the customers by the categories presented in the answers. Based on the results obtained, apart from the noticeable shift from B2C to B2B, the beginning of the COVID-19 epidemic did not have any significant impact on customer segmentation in the organizations surveyed.

The next stage was to identify the transformation of the business model element identified in the approach presented by A. Osterwalder as value proposition. For this purpose, the respondents were asked about the changes associated with transformation of product range, relative to satisfaction of customer needs and expectations regarding expansion of the product/service range in the sales, repair and maintenance, spare parts, and financing departments. The results are shown in Figure 6.

The authors of the article classified the business model element under examination as distribution channels. The changes in the dealerships' product and service range as well as their method of reaching customers should be considered in terms of both the surveyed entities' responses to the changing geometry of customer needs and expectations as well as the conscious discounting of the benefits associated with identification of those expectations/needs, including implementation of solutions enabling their materialization within the structure of the products and services offered. In the long term, this might have a positive effect on car dealerships' competitive position on the market. By extending the results obtained, it can be observed that in the last two years of bC-19, the digitization of vehicle presentation, sale and financing was of marginal interest in the group of the organizations surveyed, with a clear increase in the reaction during the epidemic. With regard to after-sale services, a *door-to-door* service was, in turn, implemented by eight entities during the bC-19 period and 14 during the dC-19 period, while it was stated that it was only implemented by small organizations that function as licensed dealerships offering sales

Figure 5

Breakdown of the answers provided to the question regarding the types of customers with which the organizations surveyed did business during the bC-19 and dC-19 periods (N=20)

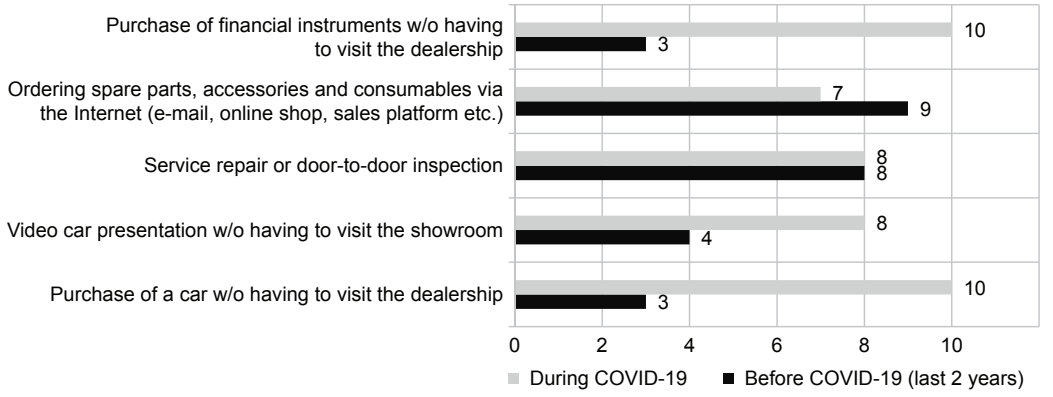


Note. Due to the multivariate nature of the answers, the total does not add up to eighteen.

Source: authors' own work.

Figure 6

Breakdown of the answers provided to the question regarding changes in the surveyed organizations' product and service ranges



Note. Due to the multivariate nature of the answers, the total does not add up to eighteen.

Source: authors' own work.

and after-sale services for a single car brand. Similar interdependencies were observed in the digitization of the car parts and accessories sales process.

The respondents were further asked about the customer communication methods used in the organization during the bC-19 and dC-19 periods. A breakdown of the answers provided to this question is presented in Figure 7.

The results presented in Figure 7 indicate that no significant changes occurred in the area under examination. Notably, during the epidemic, the entities surveyed followed the automotive industry trends regarding the sale of vehicles via the Internet, with a clear decline in direct contact. The second area entails the search for new sales channels using online platforms, with regard to both the sale of vehicles and the sale of parts and accessories.

Figure 8, in turn, provides a breakdown of the responses provided to the question regarding the customers' impact in relation to adjustment of external processes to customer needs and expectations. Similar results were observed in this research area, with a focus on the monitoring and implementation of changes, based on observation of customer needs and expectations.

It is worth highlighting the results of the research carried out on a sample of car dealerships in Poland. 91.36% of these dealerships declared that improvements were planned based on customer requirements. (Sliż, 2016, p. 538); similar conclusions were drawn based on a study of process maturity in dealerships and their automotive-industry partners (Sliż, 2016a).

The respondents were further asked to state the areas identified as the main sources of profit in the organizations surveyed during the two periods under analysis (Figure 9).

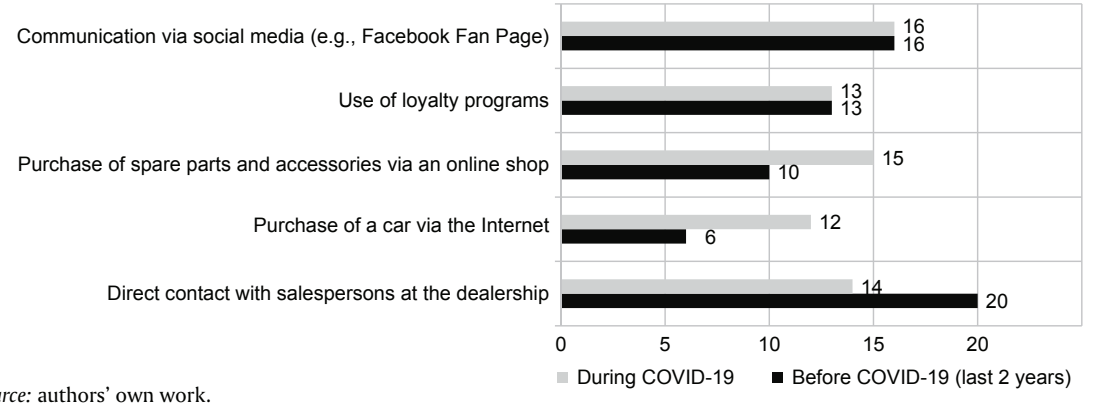
The results obtained reveal that the greatest decline in profit was observed in the genotypic activity of the dealerships selling new cars, including the sale of genuine parts and accessories. A slight increase in the sale of used cars as well as in repair/maintenance and warranty services was observed (Figure 9).

Figure 10, in turn, provides a breakdown of the respondents' answers to the question regarding the use of key resources during the bC-19 and dC-19 periods.

As indicated in Figure 10, the greatest change can be observed in the area of relational resources, the importance of which decreased during the epidemic. What is more, there is a notable growing importance

Figure 7

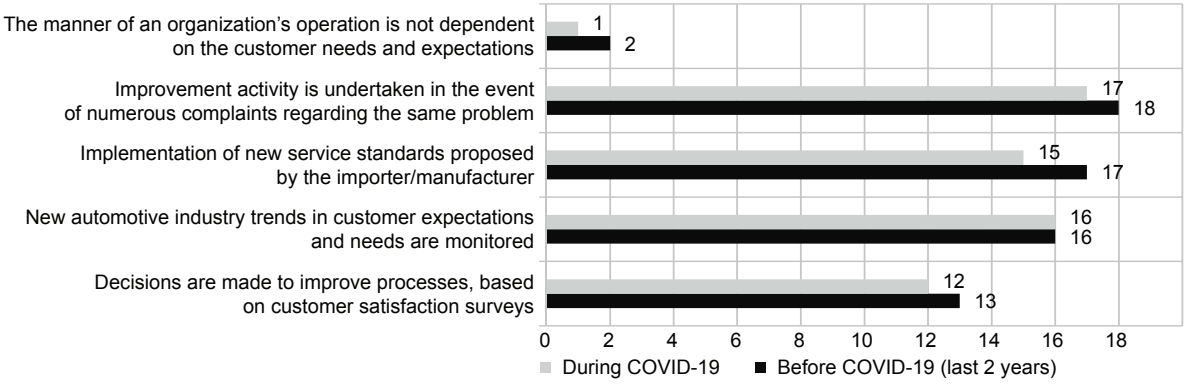
Types of customer communication methods used in the entities surveyed during the bC-19 and dC-19 periods (N=20)



Source: authors' own work.

Figure 8

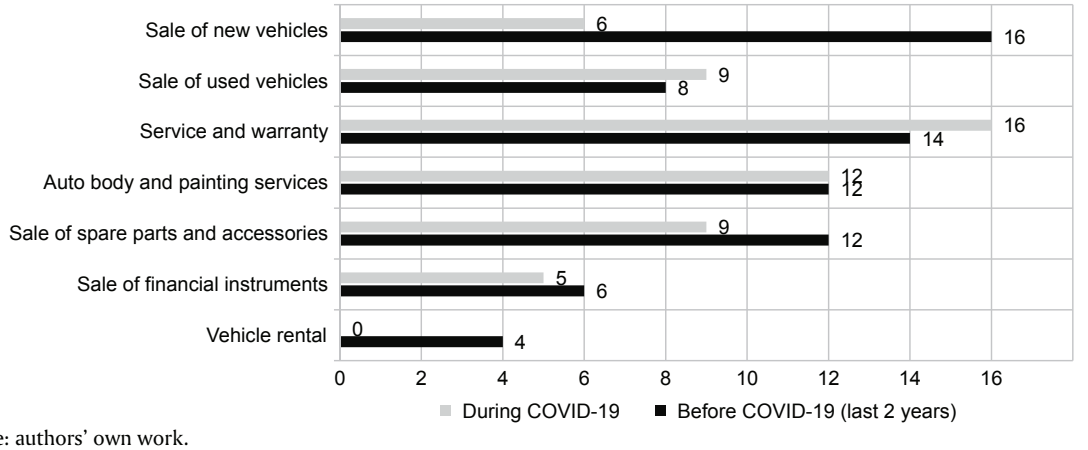
The impact of customer expectations and needs on the manner in which dealerships operated during the bC-19 and dC-19 periods (N=20)



Source: authors' own work.

Figure 9

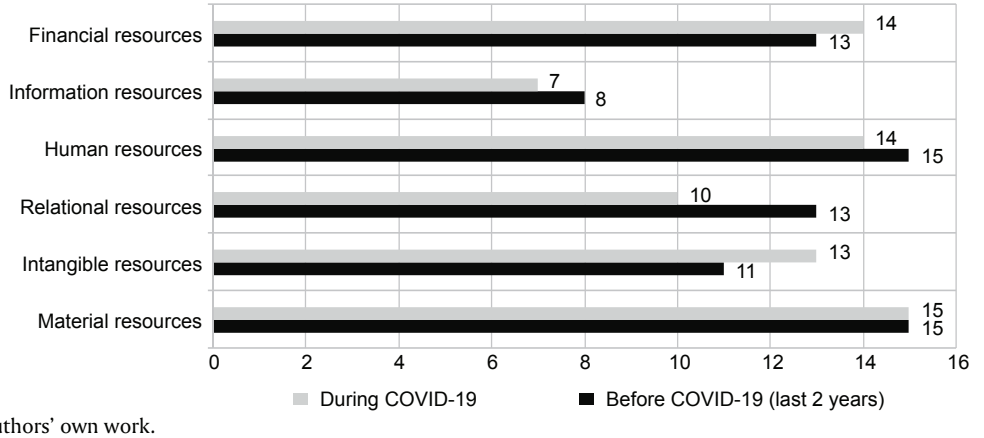
Areas responsible for generating dealerships' profit during the bC-19 and dC-19 periods (N=20)



Source: authors' own work.

Figure 10

The dealerships' use of key resources during the bC-19 and dC-19 periods (N=20)

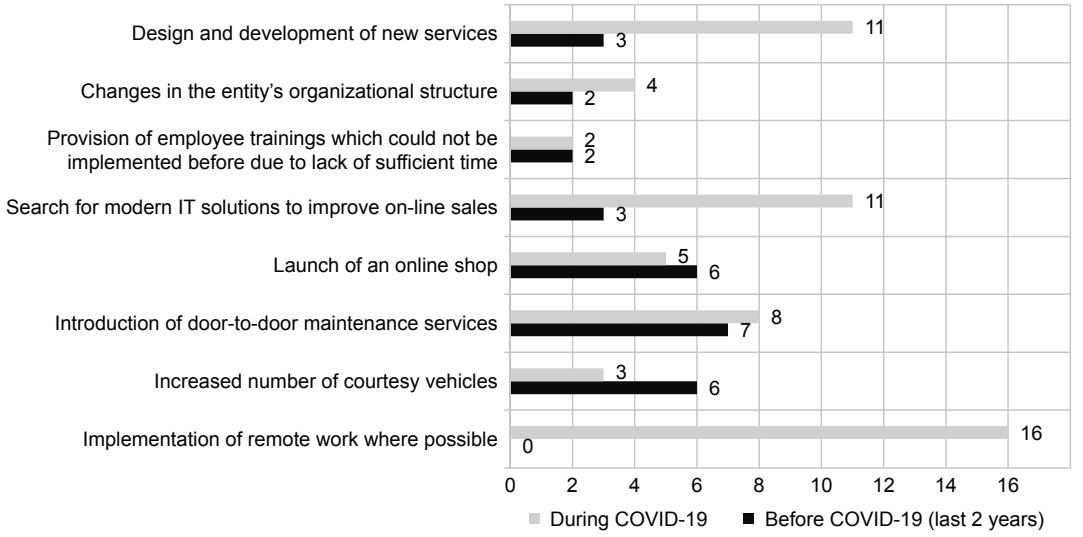


Source: authors' own work.

of intangible resources. Also, from the perspective of the dealerships surveyed, tangible and financial resources play an important role.

Considering an analysis perspective focused on the changes in the business models of the entities surveyed, the category of improvement activity was adopted as a significant one. In this respect, the respondents were asked which of the above-mentioned types of activity had been implemented in the organization during the two periods under analysis (Figure 11).

Figure 11
Improvement measures during the bC-19 and dC-19 periods (N=20)



Source: authors' own work.

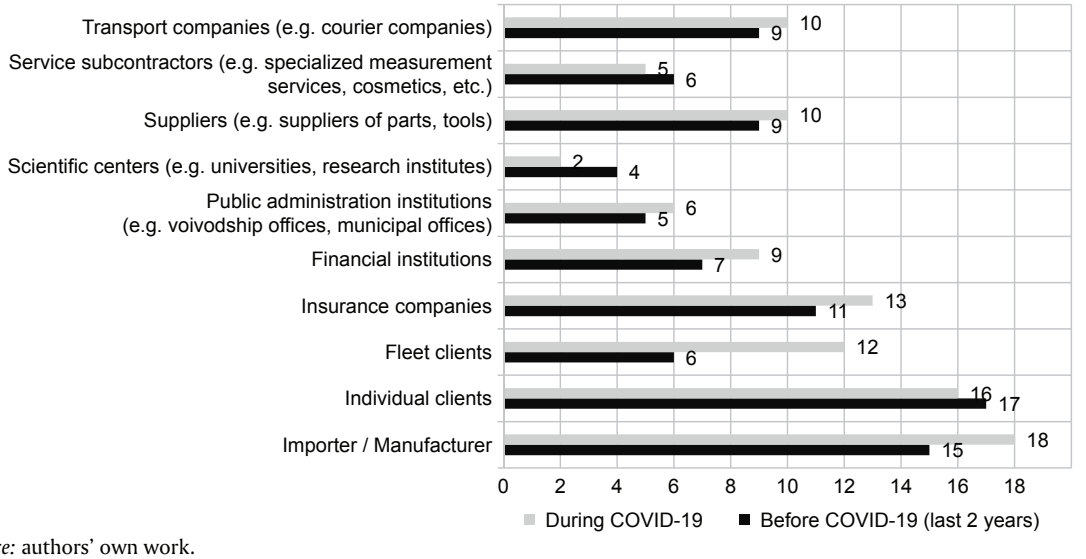
The results obtained clearly indicate that the form of work has changed, and thus measures have been taken to implement remote work (teleworking) during the dC-19 period. Also, an external factor necessitated the search for new types of services (11) and IT solutions enabling Internet sales (11), and caused changes in the organizational structure (4). In many of the organizations surveyed, improvement measures were taken during the bC-19 period, which possibly enabled the dynamic response to changes during the onset of the epidemic in Poland.

With regard to identification of the surveyed group of organizations' key stakeholders, the respondents were asked about their recognition of stakeholders within the category of key partners. It is worth emphasizing here that the structure of the answers is similar, highlighting the growing importance of the role the license-granting authority (importer) as well as the insurance companies and financial organizations play. The significant increase in the importance of fleet customers is noteworthy as well.

Figures 13 and 14 provide a breakdown of the answers to the questions regarding the change in the levels of costs and income in the group of entities under examination.

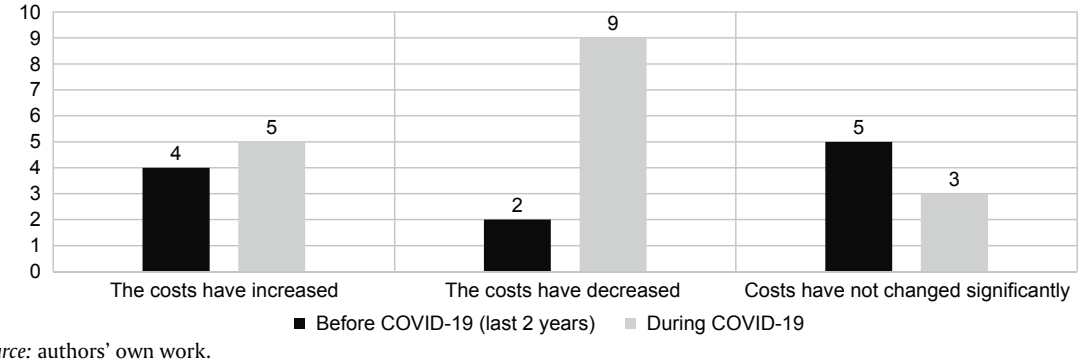
In this regard, in five cases, an increase was observed in the dealerships' costs of running their business during the COVID-19 pandemic, whereas in nine cases – there was a decrease. During this period, none of the dealerships recorded an increase in revenues.

Figure 12
Identification of the dealerships' key partners during the bC-19 and dC-19 periods (N=20)



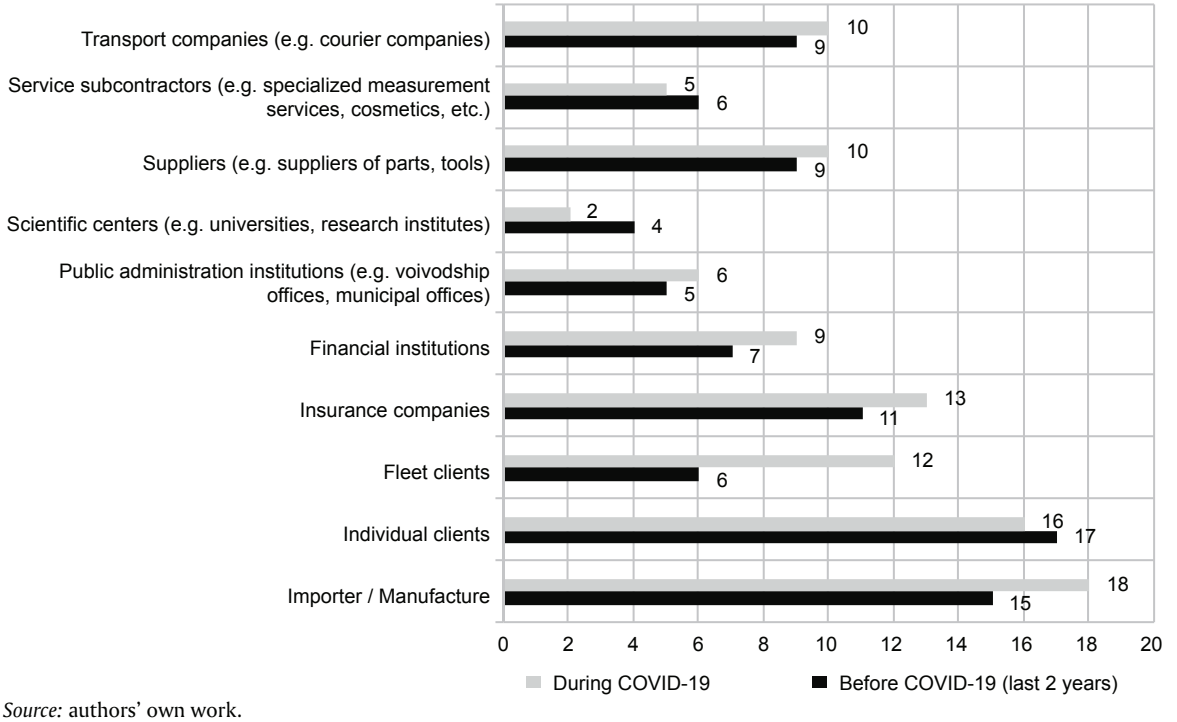
Source: authors' own work.

Figure 13
Assessment of the change in the level of costs in the group of the dealerships surveyed



Source: authors' own work.

Figure 14
Assessment of the income level change in the group of the dealerships surveyed



Source: authors' own work.

Based on the above, it is worth considering in further research whether this increase resulted from the need to introduce organizational changes to businesses.

Discussion

When attempting to assess business model flexibility in the group of the dealerships under examination, it is worth taking a look at the results from a summary perspective. The authors based their presentation of the results on the business model developed by A. Osterwalder and Y. Pigneur, adjusting its elements to the specificity of the automotive sector. Following the answers most frequently provided by the respondents, the key business model elements applied by the dealerships surveyed in their economic practice for the two years prior to the Sars-Cov-2 pandemic outbreak are presented in Table 4.

When comparing the basic business model elements used by the dealerships under examination, it should first of all be noted that there was a significant change with regard to value creation for customers. Before the outbreak of the COVID-19 pandemic, the dealerships surveyed primarily sought their sources of profit in the sale of new vehicles and in the provision of repair/maintenance and warranty services. After the outbreak of the COVID-19 pandemic, servicing and warranty became the most important source of the profit generated. The impact of customer needs and expectations on dealerships' operations did not change significantly after the outbreak of the COVID-19 pandemic. The improvement measures undertaken by

Table 4

Summary of the business model elements used in the dealerships surveyed prior to the COVID-19 pandemic

<table>
<tr><td colspan="5">Factor implying generation of business model changes
Individual customers
Insurance companies
Fleet customers
Sales Department of the NSC/IMP
Suppliers</td></tr>
<tr>
<td rowspan="2">Stakeholder identification
• Individual customers (17)
• Importer/ manufacturer (15)
• Insurance companies (11)</td>
<td>Improved areas
• Repair/maintenance and warranty (5)
• Financial services (insurance, leasing, long-term rentals, etc.) (4)
• Sale of new vehicles (4)
Improvement measures
• Introduction of door-to-door maintenance services (7)
• Increased number of courtesy vehicles (6)
• Launch an online shop (6)</td>
<td rowspan="2">Impact of customer needs and expectations
• Improvement measures are undertaken in the event of numerous complaints regarding the same problem (18)
• Implementation of new service standards proposed by the importer/ manufacturer (17)
• New automotive industry trends in customer expectations and needs are monitored (16)
Sources of profit
• Sale of new vehicles (16)
• Service and warranty (14)
• Auto body and painting services (12)
• Sale of spare parts and accessories (12)</td>
<td>Types of customer communication
• Direct contact with salespersons at the dealership (20)
• Communication via social media (e.g., Facebook Fan Page) (16)
• Use of loyalty programs (13)</td>
<td rowspan="2">Identification of customer segments
• Business to customer (17)
• Business to business (15)
• Business to government (10)</td>
</tr>
<tr>
<td>Identification of key resources
• Tangible resources (15)
• Human resources (15)
• Relational resources (13)
• Financial resources (13)</td>
<td>Distribution channels
• Ordering spare parts, accessories and consumables via the Internet (e-mail, online shop, sales platform etc.) (9)
• Service repair or door-to-door inspection (8)
• Video car presentation w/o having to visit the showroom (4)</td>
</tr>
<tr>
<td colspan="3">Cost structure
• Costs have not changed significantly (5)</td>
<td colspan="2">Profit structure
• Income has decreased (11)</td>
</tr>
</table>

Source: authors' own work.

the dealerships surveyed prior to March 2020 mainly involved servicing and warranty, financial services (insurance, leasing, long-term rentals, etc.), and sales of new vehicles, whereas in the period from March to July 2020, improvement measures concerned servicing and warranty, with additional implementation of improvements with respect to used vehicle sales, spare parts, and supply of accessories. At the same time, the number of the indicated improvement measures with regard to implementing remote work increased significantly after the outbreak of the COVID-19 pandemic. Greater emphasis was placed on electronic communication with customers, which translated into a change in the service distribution channels, from direct sales to online sales, without the customers having to visit showrooms. However, this did not reduce dealerships' operating costs. Several business model elements showed no significant changes after the outbreak of the COVID-19 pandemic, which include the key stakeholders, the customer segments, and the key resources used by the dealerships under examination to provide services (Table 5).

Table 5

Summary of the business model elements used in the dealerships surveyed during the COVID-19 pandemic

<table>
<tr>
<td rowspan="2">Stakeholder identification

• Importer/ manufacturer (18)
• Individual customers (16)
• Insurance companies (13)</td>
<td>Improvement measures

Improved areas
• Sale of used vehicles (15)
• Repair/maintenance and warranty (10)
• Sale and delivery of spare parts and accessories (9)

Improvement measures
• Implementation of remote work where possible (16)
• Design and development of new services (11)
• Search for modern IT solutions to improve online sales (11)</td>
<td rowspan="2">Impact of customer needs and expectations

• Improvement measures are undertaken in the event of numerous complaints regarding the same problem (17)
• New automotive industry trends in customer expectations and needs are monitored (16)
• Implementation of new service standards proposed by the importer/ manufacturer (15)

Sources of profit

• Service and warranty (16)
• Auto body and painting services (12)
• Sale of used vehicles (9)
• Sale of spare parts and accessories (9)</td>
<td>Types of customer communication

• Communication via social media (e.g., Facebook Fan Page) (16)
• Purchase of spare parts and accessories via an online shop (15)
• Direct contact with salespersons at the dealership (14)</td>
<td rowspan="2">Identification of customer segments

• Business to customer (15)
• Business to business (15)
• Business to government (7)</td>
</tr>
<tr>
<td>Identification of key resources

• Tangible resources (15)
• Human resources (14)
• Financial resources (14)</td>
<td>Distribution channels

• Purchase of financial instruments w/o having to visit the dealership (10)
• Purchase of a car w/o having to visit the dealership (10)
• Service repair or door-to-door inspection (8)
• Video car presentation w/o having to visit the showroom (8)</td>
</tr>
<tr>
<td colspan="3">Cost structure

Costs have increased (9)</td>
<td colspan="3">Profit structure

Income has decreased (1)
Income has not changed significantly (1)</td>
</tr>
</table>

Source: authors' own work.

The influence of the COVID-19 pandemic on the automotive industry is noticeable in literature. Recent studies concentrate on the fragility of the international supply chain caused by exogenous factors. The COVID-19 pandemic outbreak has strengthened the use of digital services in the supply chains of manufacturers and suppliers in the automotive industry. Scholars stress that digital solutions could be a trigger for new business models in the automotive industry. The combination of digital technologies and product-related makes it possible to create a stronger relationship between manufacturers and suppliers in the manufacturing ecosystem. These relationships support the manufacturing ecosystem in surviving the influence of different environments (Jankovic-Zugic et al., 2023). Moreover, problematic areas related to sustainable and resilient supply chains pre-COVID-19 and during COVID-19 are examined. These areas concern supply chain traceability, demand planning and production management, purchasing process planning, optimization in logistics operations, inventory management, and top management support. Based on the findings, it is recommended AI technologies be matched as a solution to these problematic areas in the automotive industry to increase resilience and sustainability in operations (Kazancoglu et al., 2023). Some scholars highlight that disruption of supply chains is just one of the occurring problems in the

automotive industry. The COVID-19 pandemic might have had a significant negative short-term impact on investment capacity, while the transition to alternative powertrains and the digital transformation of the automotive industry require large investment and restructuring. The long-term impact is highly uncertain and will depend on the capacity to maintain a comparative advantage (Klein et al., 2021). Literature also highlights the impact of the COVID-19 pandemic on automotive industry development, concentrating on global innovative trends that have become dominant for the future direction of this industry, especially the development of electromobility and alternative drives, integration of Industry 4.0 elements into production processes or the growing pressure on the educational level of employees, and digitization (Hojdik, 2021).

The presented and selected studies do not examine exhaustively the research problems arising from the COVID-19 pandemic in the automotive industry. In unpredictable environment conditions, managers should seek value-creation opportunities. In the short term, this results in business model transformation, while in the long term it entails adaptation by managers of strategies in a disruptive business environment in order to be competitive on the market and to deal with global challenges, for example search for solutions aimed at building resilient supply chains.

Conclusion

The authors' research focuses on the impact of previously unencountered exogenous factors on changes in the dealership business model. The global socio-economic crisis caused by the outbreak of the COVID-19 pandemic poses a significant challenge for management, as benchmarking solutions for crisis management are no longer available. The main transformation in dealerships' operations has been in customer value creation, with a shift from new vehicle sales to servicing and warranty as the primary source of profit. Furthermore, there has been a significant change in stakeholder relations, with a decline in direct contact in favor of IT tools, doubling the number of dealerships offering online vehicle purchases. In response to the socio-economic crisis, car dealerships have made substantial operational changes within a short time frame. This includes the establishment of remote work positions and the exploration of modern IT solutions to enhance online sales. Dealerships have also focused on verifying the scope of services provided and expanding their product and service range. They have sought flexible solutions to adapt to changing external conditions and ensure business continuity and financial stability during crises. Importantly, dealerships have always made meeting customer needs and expectations a priority, and this allows a creative approach to be adopted in solving crises, such as improving used vehicle sales. The research conducted in this study primarily examines the short-term effects of the COVID-19 pandemic and the flexibility of the business model. However, it is important to consider the long-term effects of the global crisis on dealerships' strategies and operations. Future research could extend the study to include other authorized dealerships in Central and Eastern European countries to compare research results and explore systemic and structural solutions that work best in a global socio-economic crisis. The findings of this study are significant for managerial personnel, providing insights into the impact of external factors on organizational functioning. The research demonstrates how the COVID-19 pandemic has shaped contemporary organizations, particularly within the automotive sector. It highlights the importance of aligning products and services with customers' current needs and expectations. Managers in the automotive sector can learn about business model transformations during the pandemic and might be motivated to seek highly flexible systemic and structural solutions to react proactively and dynamically to emerging factors in the organizational environment.

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Notes

[1] In this article, a *dealership* is understood as a trade and service organization operating based on a concession agreement, in which the concession grantor is a car manufacturer or importer, and the concession operator is an enterprise. A dealership can operate under three different concessions: for the sale of new cars, after-sales and warranty services, and the sale of original parts and accessories.

[2] The start date of the pandemic in Poland was March 20, 2020.

Appendices are available in the online version of the journal.

The full list of references is available in the online version of the journal.

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Robert Zenzerović

Do companies that generate profits make economic value added?

Abstract

This paper focuses on determining the differences between economic value added (EVA), net operating profit after tax (NOPAT), earnings before interest and taxes (EBITDA), and net income or loss for non-financial business entities operating in the Republic of Croatia in the period 2002–2021. The main objective of this paper is to determine whether non-financial activities create economic value added, and rank them according to selected indicators based on EVA. Research results indicate that there were only 27 out of 309 cases where EVA was positive, indicating that only the information and communication sector generated, on average, positive EVA during this twenty-year period. Positive EVA was generated in certain years in companies conducting human health and social work activities, education, mining, and quarrying, as well as in wholesale and retail trade activities, but the average EVA for this twenty-year period in these sectors was negative. At the same time, net income was achieved in 246 cases, and NOPAT in 285. Meanwhile, EBITDA was positive in all cases, demonstrating an obvious discrepancy between EVA and other financial performance measures. Correlation analysis results indicate that there is a statistically significant moderate correlation between EVA and net income/loss, although the correlation is generally stronger between EVA and EBITDA-based indicators. According to research results, the answer to the question in the title of this paper is negative, emphasizing the possibilities of intensive introduction of EVA as a financial performance indicator.

Keywords: economic value added (EVA), EVA per business entity, EVA/total assets, EVA/capital employed net income/loss, NOPAT, EBITDA, net income/loss

Introduction

Financial performance indicators had their beginnings in individual financial ratios which are calculated using the variables contained in financial statements. Their further development was based on the development of quantitative analysis techniques which were used to develop complex models that contained several non-financial, that is qualitative, variables. Recently, the emphasis in the reporting system has been placed intensively on non-financial variables that show the interaction of business entities with their surroundings as well as with the internal business environment. These include elements such as leadership, employee satisfaction, etc. Even though corporate social responsibility has become intensively analysed in the scientific community, the basic driving mechanism in the private sector remains the maximization of the wealth of entities involved in economic activities.

Economic value added is a contemporary measure of financial performance that shows the economic profit available to owners. It is a category that provides information on the residual profit above the costs of the sources of financing, and as such represents the extension of classic financial performance measures such as net operating profit after tax (NOPAT), earnings before interest, tax, amortization and depreciation (EBITDA), and the accounting result i.e. net income or loss. The purpose of this paper is to highlight the importance of economic value added (EVA) in relation to classical financial performance indicators using data from the population of non-financial business entities operating in the Republic of Croatia. The objective of this paper is to determine whether non-financial activities create economic value added and to rank them according to selected EVA-based indicators. The stated goal was realized by determining the average level of EVA per business entity and the indicators EVA/total assets and EVA/capital employed. In this way, the activities that have generated economic profit over the last

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twenty years, i.e. profit that exceeds the costs of others as well as companies' sources of financing, have been identified. According to the author's knowledge, it is the first time a ranking of non-financial activities in the Croatian economy has been conducted using EVA-based indicators. In this way, the activities that contribute to the creation of wealth for their owners above the required rate of return have been identified. At the same time, economic policyholders have a basis for identifying the most successful activities, but also the most problematic ones. This could be used as a starting point for taking corrective actions in activities of strategic interest.

EVA is an analytical tool that was commercially developed in 1982 by Joel Stern and G. Bennett Stewart as a result of several years of research started in the 1970s (Grant, 2003). The use of the total cost of financing dates back to the beginning of the twentieth century, and was first mentioned by the famous British economist Alfred Marshall. Just a few years later, EVA was first applied in economic practice by General Motors.

EVA is a measure of the dollar surplus value created by an investment or a portfolio of investments. It is computed as the product of the excess return made on an investment or investments and the capital invested in that investment or investments (Damodaran, 2012, p. 897).

Equations 1 and 2 show the calculation of EVA.

$$EVA = (ROI - WACC) \times CI \quad (1)$$

$$EVA = (NOPAT - (WACC \times CI) \quad (2)$$

where:
EVA = Economic value added
ROI = Return on capital invested
WACC = Weighted average cost of capital
CI = Capital invested represented by a sum of capital and reserves and financial liabilities
NOPAT = Net operating profit after taxes.

The weighted average cost of capital calculation is shown in Equation 3 (Dobrowolski et al., 2022).

$$WACC = \left(\frac{E}{V} \times \mathrm{Re}\right) + \left(\frac{D}{V} \times Rd \times (1 - Tc)\right) \quad (3)$$

where:
WACC = Weighted average cost of capital
E = Market value of the company's equity
D = Market value of the company's debt
Re = Cost of equity
Rd = Cost of debt
Tc = Corporate tax rate

EVA methodology is the one measure that properly accounts for all the complex trade-offs involved in creating value, and therefore the right measure to use for setting goals, evaluating performance, determining bonuses, communicating with investors, and for capital budgeting and valuations of all sorts (Stewart, 1991, p. 136). It is used as a system of strategic planning, awarding system, and value-based management system, which directs the organizational behaviour of the company. Many companies use EVA to determine managerial bonuses and as a measure of financial performance. In 2010, state-owned companies in China introduced the EVA index for evaluating performance (the EVA index represents a combination of EVA and accounting profit with an EVA weighting of 40%). The introduction of the EVA index as a performance indicator resulted in an increase in the level of money in companies and a reduction in excessive investment activities (Shen et al., 2015). While the introduction of EVA as a performance measurement tool is generally considered consistent with mitigating agency costs and therefore increasing shareholder value, these same actions can also be associated with sub-optimal decisions (e.g., reducing investment in positive NPV projects to avoid the now explicit capital charge) (Wallace, 1997). Therefore, EVA needs to be viewed in a broader context along with other financial performance indicators, because managers may continue the practice of pitting their short-term goals against the long-term goals of the owners.

Although there are many benefits of EVA, it is still a financial performance measurement tool. The problem with these kinds of tools is that accounting earnings fail to measure changes in the economic value of the firm, and the reasons for this include (1) Alternative accounting methods may be employed: different methods for depreciation, inventory valuation, goodwill amortization, and so on; (2) Both business risk (determined by the nature of the firm's operations), and financial risk (determined by the relative proportions of debt and equity used to finance assets) are excluded; (3) Accrual-based accounting numbers differ from cash flows from operations; (4) Dividend policy is not considered; (5) The time value of money is ignored (Sabol & Sverer 2017, p. 21). Cinotti also emphasizes additional disadvantages of EVA, such as: (1) Ignoring investment in business continuity; (2) Ignoring the aspect of financial stability; (3) Excessive complexity and implementation problems; (4) Problems with determining the weighted average cost of capital, and (5) Focus on short-term objectives (Cinotti, 2023, p. 49).

The number of publications that dealt with EVA rose exponentially from 1995 to 2005, and over the last twenty years it has varied between 25 and 45 per year, except for the pandemic period, when the number of papers increased significantly (Tripathi et al., 2023). EVA-related research is emphasized more at universities in the US and China than in the rest of the world. The focus of EVA-related research is mostly related to accounting and management themes. Three broad themes emerged from an analysis of the cluster related to the use and application of EVA: residual income and valuation, financial performance, and performance management (Tripathi et al., 2023, p. 14). The approach used in this paper is focused on the

level of activities or sector that makes it challenging. Namely, most of the research is focused on a sample of companies which makes the calculations easier to perform and results more reliable.

Methodology

The data from the financial statements of all non-financial entities based in the Republic of Croatia in the period from 2002 to 2021 has been used to perform this research. The financial statements were collected from the Financial Agency, the body responsible for collecting data in the Republic of Croatia. The period covered was from the beginning of financial statements' systematic collection to the last available period. NOPAT, EBITDA, net income/loss total assets, and capital invested were calculated using the data collected. For the research, the data was aggregated at the level of each non-financial activity and the level of all non-financial activities, and thus the variables were calculated based on aggregated inputs. One of the central challenges in the research was the cost of capital estimation. The weighted average cost of capital was estimated by Damodaran using the data available (Damodaran, 2023a). In the first step, the data on the cost of capital across the sectors in the US economy was collected for each particular year from 2002 to 2021. It was assumed that the US had the lowest country risk according to the rating agencies' estimates. In the second step, the country risk premium for Croatia was added to each of the US sector's cost of capital estimating the Croatian costs of capital for a particular economic activity, i.e. sector. Risk premium rates were collected for each year from 2002 to 2021 using the available data from Damodaran (Damodaran, 2023b). The cost of capital for companies operating in the Republic of Croatia was estimated for each particular year for each sector included in the research (Appendix 1). The third step included the calculation of EVA, EVA per business entity, EVA/total assets and EVA/capital employed as well as their NOPAT, EBITDA and net income/loss counterparts. EVA was calculated using the Equation 2 formula and included the calculation of capital invested that comprised capital and reserves and financial liabilities.

According to the sectorial classification of institutional units, the non-financial sector includes institutional units whose distribution and financial transactions differ from those of their owners and which are market producers, and whose main activity is the production of goods and non-financial services. The group of non-financial entities includes all bodies recognized as independent legal entities, which, in addition to companies, also include cooperatives, non-profit institutions, and associations (Zenzerović et al., 2023, pp. 465–479). The data collected over a twenty-year period were structured into sixteen non-financial sectors according to national classifications of economic activities as follows: A – Agriculture, forestry and fishing, B – Mining and quarrying, C – Manufacturing, D – Electricity, gas, steam and air conditioning supply, E – Water supply, sewerage, waste management and remediation activities, F – Construction, G – Wholesale and retail trade; repair of motor vehicles and motorcycles, H – Transportation and storage, I – Accommodation and food service activities, J – Information and communication, L – Real estate activities, M – Professional, scientific and technical activities, N – Administrative and support service activities, P – Education, Q – Human health and social work activities and R – Arts, entertainment and recreation. Agriculture is an exception, as the period of analysis includes periods from 2013 to 2020, considering the unavailability of data for all years. Other service activities under section S were also not analysed due to the unavailability of data. The population of non-financial entities whose data was included in the analysis ranged from 61,674 in 2002 to 137,436 entities in 2021. In the twenty years of analysis, they employed between 745,000 and 920,000 employees, generating between 52 and 113 billion euros in revenues, and between 15 and 29 billion euros in value added. The analysis was conducted based on 309 cases, where one case represents the value for all companies in a particular year and a particular non-financial sector.

Descriptive statistics analysis, as well as correlation analysis, was conducted to draw appropriate conclusions on the relationships between EVA and other financial performance indicators, and explore the question asked in the title of the paper. At the end of the research, the correlations between EVA and other financial performance measures were tested. Because the Pearson correlation coefficient assumption related to outliers was disrupted, a more conservative approach was used and a non-parametric test was performed. Horvat and Mijoč (2019, p. 439) suggest that if the Pearson correlation assumptions are violated, another non-parametric test is recommended (ex. Spearman coefficient).

Results

Research results achieved among non-financial entities operating in the Republic of Croatia indicate that there were only 27 out of 309 analysed cases where EVA was positive, indicating that only the information and communication sector generated, on average, positive EVA over the twenty-year period. Positive EVA was generated in certain years in companies conducting human health and social work activities, education, mining, and quarrying, as well as in wholesale and retail trade activities, but the average EVA for the twenty-year period in these sectors was negative. At the same time, net income or accounting profit was achieved in 246 cases, NOPAT in 285, while EBITDA was positive in all cases, demonstrating an obvious discrepancy between EVA and other financial performance measures. If the analysis is focused only on the cumulative data for all non-financial activities, it is noted that the business entities do not generate EVA in any of the years analysed. At the same time, they

Table 1

Descriptive statistics for all non-financial activities in the period from 2002–2021 in euros

Variables	Minimum	Maximum	Mean	Std. Deviation
EVA_per_subject	–125.949	–28.256	–77.911	24.441
EVA_to_total assets	–0.0102	–0.0031	–0.0074	0.0018
EVA_to_capital employed	–0.0272	–0.0076	–0.0183	0.0055
NOPAT_per_subject	16.654	41.223	28.017	7.129
NOPAT_to_total assets	0.0014	0.0045	0.0027	0.0008
NOPAT_to_capital employed	0.0035	0.0111	0.0067	0.0020
EBITDA_per_subject	63.306	97.139	79.118	9.318
EBITDA_to_total assets	0.0058	0.0100	0.0077	0.0011
EBITDA_to_capital employed	0.0146	0.0248	0.0188	0.0028
NET_IN(LOSS)_per_subject	–3.816	40.219	20.792	12.598
NET_IN(LOSS)_to_total assets	–0.0003	0.0044	0.0021	0.0013
NET_IN(LOSS)_to_capital employed	–0.0009	0.0109	0.0049	0.0031

Source: author's own work.

generate positive NOPAT and EBITDA, while net loss was generated only in 2010 as a consequence of the delayed effect of the global economic crisis.

Table 1 shows the descriptive statistics for all non-financial activities. EVA measures are negative, with significant variations during this period. On average, the business entities operating in non-financial activities did not generate EVA for their shareholders. On average, they generated net income of 20,792 euros, NOPAT of 28,017 euros, and EBITDA of 79,118 euros.

Appendices 1, 2 and 3 show the descriptive statistics for business entities performing each of the sixteen non-financial activities. There are significant differences between average financial performance indicators among the activities. These results are expected according to the different levels of assets the business entities use, as well as the level of capitalization and sources of financing used. Differences among activities could be addressed by other factors specific to each of them, such as legislation, economic cycle, and many others.

In the next step, the activities were ranked according to each financial performance indicator analysed in the research. Rankings are shown in Table 2. In the twenty-year period, information and communication activities (J) had the highest EVA-based indicators, followed by human health and social work activities (Q) and education (P). These activities also had the best NOPAT-based indicators, which is expected, due to the fact that this indicator is used in EVA calculation. The NOPAT ratio per business entity is an exception, where electricity, gas, steam and air conditioning supply activities (D) and mining and quarrying (B) outperformed the other activities mostly due to the lower number of entities. Similar findings are related to EBITDA and net income (loss)-based ratios. Business entities operating in education scored low ratios of NOPAT per subject and EBITDA per subject, but outperformed the other activities in the other two financial performance indicators based on NOPAT and EBITDA due to the low-value assets and capital employed. The lowest EVA-based ratios were achieved by accommodation and food service activities (I), real estate activities (L), construction (F), and water supply, sewerage, waste management and remediation activities (E). The lowest EVA per business entity was achieved in electricity, gas, steam and air conditioning supply activities, and this is due to central/local government ownership in most significant entities and consequently ineffective corporate governance. Similar findings apply for other financial performance indicators, except NOPAT per subject and EBITDA per subject, where the lowest score was achieved in education activities.

Research results that deal with correlations are shown in Appendices 5, 6, 7, and 8. Analysis performed on the population of all business entities operating in non-financial activities showed a positive correlation between EVA-based financial performance indicators and other ones, except correlations between performance indicators per business entity, which were not proven for any variable analysed. Correlations were statistically significant and the strongest between EVA to total assets and EBITDA to total assets, and could be estimated as strong as they outperformed the level of 0.7. EVA to capital employed had a strong correlation with EBITDA to total assets as well. Correlations between EVA and other indicators measured per unit of total assets and capital employed were moderate and varied between 0.469 and 0.686.

Correlations were calculated for each activity as well. The correlation coefficient varies significantly among activities, although significant correlation between EVA-based indicators and EBITDA to total assets and EBITDA to capital employed was identified in almost all of them.

Table 2
Non-financial activities ranking according to financial performance indicators

RANK	EVA_ per_subj	EVA_to_ TA	EVA_to_ CE	NOPAT_ per_subj	NOPAT_ to_TA	NOPAT_ to_CE	EBITDA_ per_subj	EBITDA_ to_TA	EBITDA_ to_CE	NET_IN_ L_per_ subj	NET_IN_ L_TA	NET_IN_ L_CE
1.	J	J	J	D	J	Q	D	J	P	D	J	P
2.	P	Q	Q	B	Q	P	B	Q	N	B	Q	Q
3.	Q	P	B	J	P	J	E	P	Q	J	P	J
4.	N	B	P	C	B	G	J	B	J	E	B	G
5.	G	G	C	E	R	B	C	R	B	C	M	B
6.	M	E	E	R	G	R	H	N	G	H	G	R
7.	R	C	R	A	C	N	R	C	R	R	C	M
8.	A	D	H	H	M	C	A	G	C	G	R	C
9.	C	R	A	G	A	A	F	H	D	M	D	D
10.	I	A	D	Q	D	M	I	M	L	Q	H	N
11.	B	N	G	F	N	D	G	D	H	P	N	E
12.	L	H	M	M	H	H	L	I	A	F	E	H
13.	H	M	F	I	I	L	Q	A	M	A	A	A
14.	F	L	I	L	F	I	N	E	E	N	F	F
15.	E	F	N	N	L	F	M	L	I	I	I	I
16.	D	I	L	P	E	E	P	F	F	L	L	L

Source: author's own work.

Discussion and conclusions

Do companies that generate profits make economic value added? If non-financial activities as a whole are analysed, the answer is negative. A broader analysis showed that there were some differences among the activities the companies performed. In only 27 out of 309 casesthe sector generated positive EVA. The most successful activities were information and communication, which generated on average positive EVA over the twenty-year period. Companies conducting human health and social work activities, education, mining and quarrying, and wholesale and retail trade activities achieved an average positive EVA in particular years, but their average EVA over the twenty-year period was negative. Research results have proven that traditional financial performance measures like NOPAT, EBITDA and net income or loss should be broadened with EVA-based indicators when analysing the companies or sectors from the existing or potential investors' point of view. Inclusion of the cost of capital in EVA expands the basis for decision-making, allowing investors to detect above-average opportunities for investment. EVA-based indicators could be an appropriate tool that changes or expands existing management award systems, and decrease the possibility of manipulation of performance indicators. Research has specified benchmarking for using EVA-based indicators. Although the total value of EVA and EVA per subject should be considered carefully due to the fact that capital-intensive sectors use more assets, resulting in higher costs of capital and lower EVA, EVA to total assets and EVA to capital employed show the relative value of EVA per unit of assets or capital employed. These ratios expand traditional ratios allowing comparison across activities that can be useful for various stakeholders.

One limitation in the research was the cost of capital calculation approach, where the starting point was a cost of capital from the economy with different business and legal environments. Another limitation was a population of non-financial business entities which included information from unaudited financial statements as well as information from the non-profit sector (but not budget users). In future research, these limitations could be overcome by calculating costs of capital more precisely for each activity and by including only profit sector entities. The paper opened some new research questions, particularly relating to why some activities generate positive or negative EVA. Future research could be focused not only on the relations between EVA and different accounting-based performance measures, but also the strength of the impact of negative EVA on the market value of Croatian firms, investors' decision-making processes, and risk perception.

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Appendices are available in the online version of the journal.

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Magdalena Marciniak

Key productivity factors in drug discovery and development projects

Abstract

The field of health care is an important element of the economic and social life of every country in the world combining demographic, economic and epidemiological, ethical and social challenges. Spending on the development of new therapies has been increasing over the past two decades, and the amount of drugs approved by regulatory agencies has remained stable (FDA, 2023). Literature does not provide adequate knowledge about the reasons of the productivity drop that impacts the competitive advantage of the companies taking part in the project's race to the market (Schuhmacher et al., 2022), and it therefore seems crucial to analyse the factors determining high productivity of the pharmaceutical industry to adjust further actions ensuring the highest quality of health care systems, focusing on the wellbeing of the patient and the development of increasingly safer medicines. To address this need the author performed systematic literature review followed by structured interviews with 14 experts working globally in the field of drug development to determine productivity factors in drug discovery research and development projects, with the goal of answering questions related to which factors play a key role in the productivity of scientific organisations and the relationship between the factors, providing an insight into which parts of drug discovery ecosystem can increase a chance to address highly unmet medical needs of patients waiting for novel, safe and effective forms of treatment. As a result of the research 22 key productivity factors were defined and clustered into 4 categories: scientific, managerial, business, environmental and relations between the factors were discussed.

Keywords: drug discovery, drug development, innovation, productivity, R&D, project management

Introduction

The field of healthcare is an important element of the economic and social life of every country in the world. Pharmaceuticals account for a significant portion of total healthcare expenditure in developed countries, and for this reason Western European countries, the United States, Canada, Japan, Australia, New Zealand, Israel, Singapore and South Korea annually spend a significant portion of their GDP (gross domestic product) on investments in research and development projects – a figure ranging from 2.5% to 4.5% (Mikulic, 2021). Entities operating on the healthcare market are subject to numerous and variable regulations aimed at responding to the needs of the physical and mental safety of patients, respect for the dignity of people and animals, as well as the potential long-term effects of the use of therapy for future generations. In addition, the functioning of these entities takes place on the principles of free competition aimed at maximising profits, developing innovation and minimising resource losses. Over the past two decades, spending on the development of new therapies has been increasing, while the amount of drugs approved by regulatory agencies has remained stable. An observed decrease of productivity in the pharmaceutical industry led to the need to analyse factors influencing the process of medicine development and defining key success factors in drug discovery and development projects (Bode-Greuel et al., 2008, Bukowski, & Gierczyński, 2019). High competition on the market makes companies reluctant to share know-how and methods of drug development, so the literature does not provide adequate knowledge about the productivity of drug development projects. It therefore seems crucial to analyse the factors determining the productivity of the pharmaceutical industry to adjust further actions ensuring the highest quality of functioning of the components

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of the healthcare system, focusing on the wellbeing of patients and the development of increasingly safer medicines. To address this need the author performed a deep literature review followed by structured interviews with 14 experts in the field of drug development in order to determine productivity factors in research and development projects in the field of biotechnology and pharmacy.

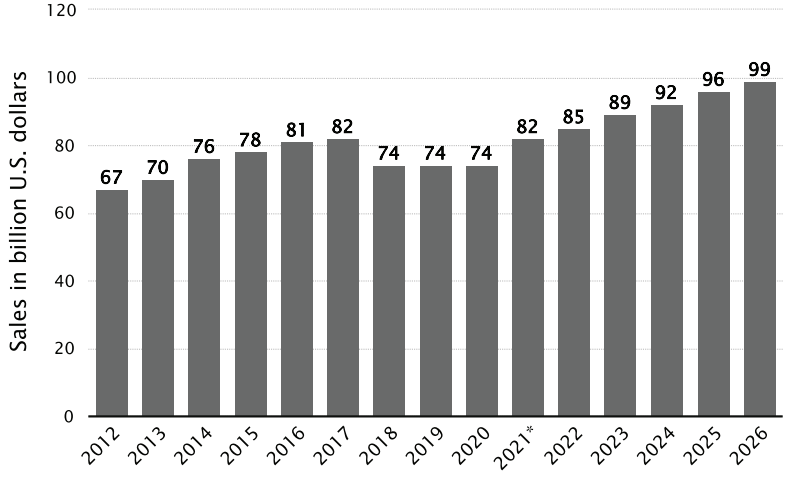
Productivity of pharmaceutical R&D

R&D productivity can be defined as the relationship between the value created by a drug – commercial and medical – and the investments required to generate the medicine. In the literature R&D productivity is defined as the ability of R&D to translate input, such as investments, into output, such as the number of approved drugs or other defined milestones (Paul et al., 2010).

In the literature there is emphasis on the decline in revenues owing to the expiration of patents, a phenomenon correlated with the lowering number of truly innovative molecules (both small molecules and biologics) recently approved by the Food and Drug Administration (FDA) (FDA, 2023). On the one hand more demanding requirements of regulators driven by safety and efficacy can be observed, while on the other – issues related to the transparency of the data and reproducibility, which cause higher requirements of the agencies. These two aspects are strongly correlated to each other and reflect a decrease in the quality of robust data in the drug discovery and development industry (Schuhmacher, 2022, Stalder, 2022). A lower number of novel drugs with a long patent life is reflected in the statistics and predictions shown by Statista.com, visualising the total global generic prescription drug revenue from 2010 to 2024 (in billions of US dollars) and predicting an increase in the sales of generic drugs (Figure 1). It suggest that a limited number of new medicines will be available and the current market standard will play a key role in the treatment of patients (Mikulic, 2022; Mullard, 2023).

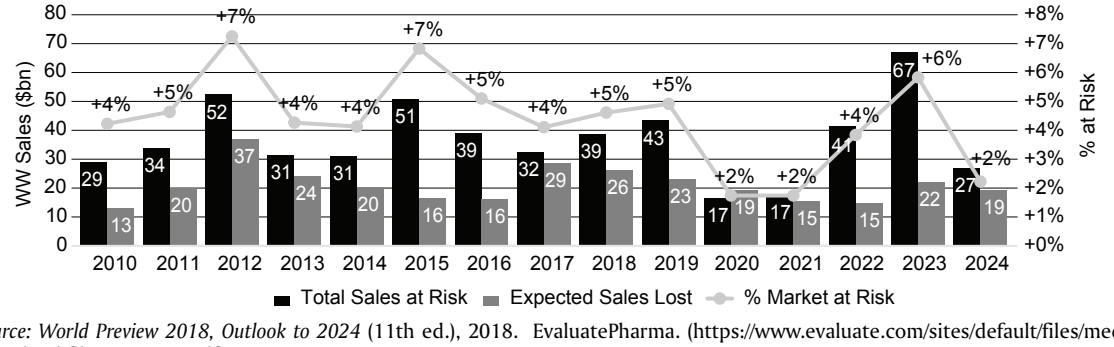
Additionally, in the Evaluate report from 2018 the authors present sales at risk caused by the expiration of patents for the years 2010–2024, shown in Figure 2.

Figure 1
Total worldwide generic prescription drug revenue 2012–2026



Source: Worldwide generic prescription drug sales 2012–2026, M. Mikulic, 2022 (https://www.statista.com/statistics/309411/global-total-generic-prescription-drug-revenue/).

Figure 2
Worldwide sales at risk from patent expiration (2010–2024)



Source: World Preview 2018, Outlook to 2024 (11th ed.), 2018. EvaluatePharma. (https://www.evaluate.com/sites/default/files/media/download-files/WP2018.pdf).

These statistics depict the total generic prescription drug revenue worldwide from 2010 to 2024. By 2024 the global prescribed generics market is expected to grow to 100 billion US dollars. The loss of profits from generic drugs, and the resulting relatively lower investments in R&D, highlight the need for the industry to improve productivity and maintain risk management of R&D divisions to replace old treatments with new, more effective medicines approved by the FDA and other regulatory agencies operating worldwide (Stalder, 2022).

Productivity and investments are correlated with the number of projects performed by drug discovery companies and project management models used to deliver drugs to patients (Schuhmacher et al., 2021).

A project is defined as a temporary effort to create a new product or service that cannot be achieved through standard processes and operations, with a definite beginning and end. It is an unusual activity, burdened with uncertainty, and therefore bears increased risk compared to typical, everyday operations (Mingus, 2002).

Project management is the use of specific knowledge, methods, skills, tools and techniques aimed at delivering an outcome to a project client (Project Management Institute, 2021, p. 12).

Research and development projects aimed at the development of therapeutics have a high degree of complexity and variability, long duration, difficult-to-determine product profile and unknown target audience. In such projects, there is work underway in parallel on the product – the drug, and on the research methods needed to create it (Schuhmacher, 2022).

R&D drug discovery budgets and spending

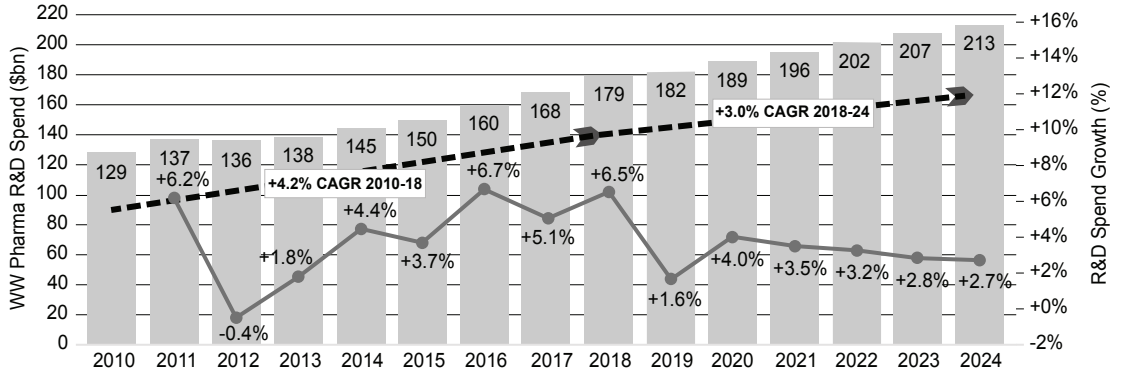
A report published by The EvaluatePharma in 2018 presents data suggesting a worldwide increase in R&D spending in the pharmaceutical industry (Figure 3). Global R&D spending in 2017 increased by 3.9% to 165 billion US dollars compared to 2016. As calculated, in 2017 the top 20 pharma companies spent a total of 97.2 billion US dollars, with Roche as the top spender with 9.2 billion US dollars investment in R&D in 2017. As in previous years, R&D intensity remains highest in the United States, with more than half of the global R&D expenditure utilised by US pharma giants. The authors of the report also state that overall R&D spending is expected to grow by 3% year-by-year, and predict it will reach around 204 billion US dollars by 2024 (EvaluatePharma, 2019).

The results of this investment are visible in the number of new FDA approvals – in 2016 the FDA approved 27 new molecular entities, followed in 2017 by 46 drugs, then 59 in 2018, 48 in 2019, 53 in 2020, 55 in 2021, and 37 in 2022 (FDA, 2023; Mullard, 2023).

The high number of drugs with ongoing late-stage development and approval phases contribute to the increased average cost of drug development over the last years. Therefore, although the number of new drugs is relatively stable (Figure 4), the cost of discovery and development is much higher, and paradoxically – the productivity of the market is decreasing (Schuhmacher et al., 2022). The authors of the Evaluate report also conclude that despite an initial peak of investment in 2019, the proportion of R&D spending compared to pharmaceutical revenue decreased significantly in subsequent years. An increased number of drugs in late-stage development and the number of approvals contribute to an increased average cost of drug development, as Phase 3 trials remain the costliest step (Ng, 2015). Nowadays, in the discovery and development process researchers are able to use various tools aimed at more detailed and reliable data, and it is common practice to confirm data in different and more sophisticated assays or models to avoid misinterpretation and increase the probability of success. This also leads to higher investments in the earlier stages of development and, as a consequence, increase spending on R&D. Despite more available tools for early stage discovery and the higher number of molecules reaching clinical trials, the number of approved drugs remains stable (Kiriiri et al., 2020; Yeung et al., 2021).

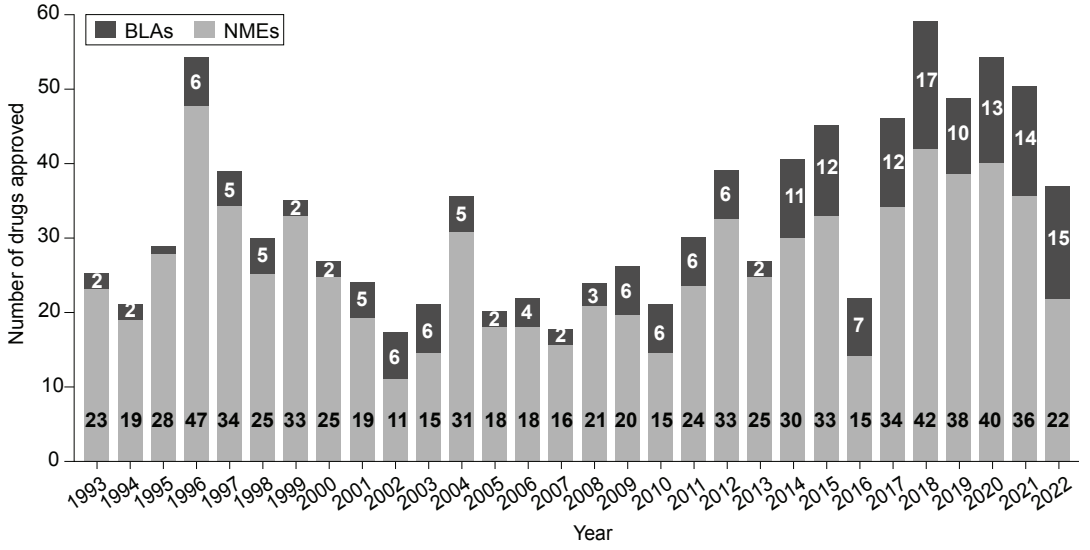
Figure 3

Worldwide total pharmaceutical R&D spending in 2010–2024



Source: World Preview 2019, Outlook to 2024 (12th ed.), 2019. EvaluatePharma. (https://info.evaluate.com/rs/607-YGS-364/images/EvaluatePharma_World_Preview_2019.pdf).

Figure 4
Novel FDA approvals since 1993



Source: "2022 FDA approvals", A. Mullard, 2023, January 3. *Nature Reviews Drug Discovery, 22*, p. 83 (https://doi.org/10.1038/d41573-023-00001-3).

In a 2014 paper, together with colleagues Cook presents findings on the main scientific and technical determinants of project success and the high quality of the Astra Zeneca pipeline defined as the five Rs, listed below (Cook et al., 2014):

- **the right target** – defined as a solid understanding of biology and confirmation of the link between the selected target and a disease of interest,
- **the right tissue** – the candidate molecules developed must exhibit exposure and pharmacological activity in the selected tissue or organ,
- **the right safety** – the right safety profile in the selected indication is one of the key success factors for the drugs. Additionally, any safety issues should be analysed at each, even very early, stage of development,
- **the right patient** – selection of the right patient profile is based on an understanding of the current standard of care and how certain aspects of the patient's condition may affect their response to the drug, bearing in mind drug-drug interactions, gender or other diseases,
- **the right commercial potential** – this is understood as fast delivery of medical differentiation after the drug reaches the market, in consequence securing commercial value.

The authors emphasise the need for scientific curiosity confirming the research mindset and avoiding a "volume-based" approach, therefore promoting transparency by asking and answering "killer questions" when deciding whether to move assets to the next stage.

The literature points to several potential issues that may cause a decrease in the productivity of R&D drug discovery work (Antonijevic, 2015; Cook, 2014; Czech, 2022; Schuhmacher et al., 2022):

- easy-to-make drugs have already been discovered, and the current structures of the drugs are more challenging,
- the broad patenting culture of companies, blocking other players from developing drugs
- the industry is working on more complex and sophisticated disease mechanisms, which require more detailed work,
- frequent changes of regulations and the reserved approach of regulators to the risk related to new drugs approval. This leads to increased costs of clinical trials due to the regulations of agencies and the increased number of patients enrolled during each phase,
- a challenging reimbursement and payer environment also escalates the cost of clinical trials.

The above all show that the mindset of R&D research has shifted and become more commercialised or industrialised. Bearing in mind that only 1 out of 10 projects that reach clinical trials will meet the market, the industry is under pressure to increase the number of projects under development. As a consequence an increase in the number of projects can be observed, but with a stable number of approved treatments. Due to market needs, business models and financial costs, scientists are more focused on corporate goals to deal with the amount of projects that end up in the clinics, and are not or cannot be strongly focused on the quality of the assets, including knowledge of the issue at hand, its relation to specific diseases and its therapeutic potential.

To better understand the complexity and risk associated with development of new drugs it is good to take a general look at the process of drug discovery and development.

Overview of the drug discovery process

Innovative and new drugs that fulfill unmet medical needs are the key value drivers of research-oriented companies from the pharmaceutical industry (Schuhmacher, 2016). Each drug research and development (R&D) programme can be considered as a long-lasting and highly complex process that requires cooperation between multiple disciplines. The typical work-flow of the drug research and development process is illustrated in Figure 5 and consists of the following stages (Chen et al., 2018):

The general drug development process can be divided into several steps (Chung et al., 2015; FDA, 2018; Ng, 2015; Poduri, 2021; Rydzewski, 2008):

Step 1: Target Identification & target validation – The first step in the drug development process involves discovery work, and is where drug development companies choose a molecule, such as a gene or protein, to target with a drug.

Step 2: Hit identification – This is the stage where compounds that may be able to reach the target are identified.

Step 3: Hit to lead (H2L, hit confirmation) – This step is related to confirmation of the compounds found, using several methods and ways to confirm that the company can work on the compounds.

Step 4: Lead optimisation – At this stage compounds are tested in animal models to translate and confirm results generated *in vitro*. If necessary, the chemical structures of the lead compounds can be altered to improve their selectivity and specificity towards a given target.

Step 5: Preclinical testing – Here work is performed on the compound(s) selected as potential clinical candidates. Aspects related to chemical parameters of the active compound and formulations are tested. Advanced *in vitro* and *in vivo* testing has to be performed.

Step 6: Investigational New Drug (IND) application filing – The third step involves submitting an Investigational New Drug application to the FDA prior to beginning human clinical trials.

Step 7: Phase 1 clinical studies – The first phase of human clinical testing involves a relatively small group of patients (healthy volunteers or with developed diseases) and focuses entirely on safety.

Step 8: Phase 2 clinical studies – The patient pool widens to 100 or more patients, and the patients are afflicted by the disease. Safety remains a big focus of phase 2 studies, with short-term side effects closely monitored, although increasing emphasis is starting to be placed on whether or not a drug is working as expected and if it is improving the condition of the subjects under study.

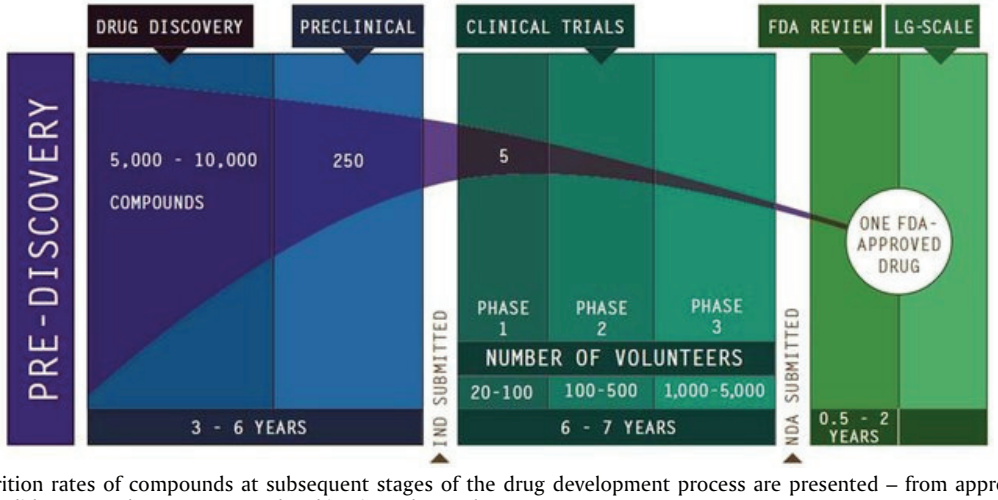
Step 9: Phase 3 clinical studies – Safety remains a priority here, but efficacy also plays a big role. Phase 3 studies are designed by drug developers but approved by the FDA, with guidelines for a clearly defined primary endpoint to determine the success or failure of a tested drug. Phase 3 trials involve even more patients, perhaps a few hundred to maybe thousands, and are by far the longest and costliest components of the drug development process.

Step 10: New Drug Application filing – This step focus on filing a New Drug Application with a chosen regulatory agency, and contains all research and safety data examined during the prior steps. If approved, the drug becomes immediately available for commercial production.

Step 12: Phase 4 clinical studies – Following approval, agencies can request long-term safety studies to be undertaken whereby drug developers are required to submit regular reports detailing any adverse events with the drug to the agency.

Figure 5

Stages of the drug research and development process



Note. Attrition rates of compounds at subsequent stages of the drug development process are presented – from approximately 10,000 candidates to only one compound making it to the market.

Source: "Pharmaceutical R&D", D. W. Light, 2012. *The Politics of Medicines* (e-Encyclopaedia), p. 8 (https://haiweb.org/encyclopaedia/pharmaceutical-research-and-development/).

Pharmaceutical R&D risk management

The drug discovery and development programme is a long-term, high-risk, high-cost but also high-benefit type of business activity (Chen et al., 2018). On average, it takes over 12 years for the programme to get from target identification to marketing approval (DiMasi, 2000) at an overall cost of about 2.6 billion US dollars. As summarised in more detail in Figure 6, the lengthy duration and high costs of programmes are accompanied with the high probabilities of drug candidate attrition throughout the entire process. Despite the high-risk and high-cost attributes, from the business perspective drug R&D programmes should still be considered as high-reward initiatives.

The overall failure rate in drug development is over 96%, while at the clinical trial stage, when the drug is administered to humans, the figure is 90%. The rates are highest for drugs developed for new disease entities or for diseases that are currently incurable (Hingorani et al., 2019). The average cost of introducing a new drug to the market is 2 billion US dollars (Sagar, 2017). New medicinal substances were traditionally obtained from natural products, but with the development of chemical knowledge, technology and the growing demand for medicinal substances, industry interest has been redirected to high-performance synthesis and development based on chemistry, biochemistry and combinations of various sources of potential medicinal substances (Berdigaliyev et al., 2020; Schuhmacher et al., 2021). High competition in conducting research and development work forces companies to patent early, even when the first results appear, indicating the therapeutic potential of the compounds under development, i.e. at the stage of discovery work. This reduces the freedom of action of scientists in terms of the possibility of developing already patented compounds (so-called freedom to operate), hence the competition and pressure for rapid development and patent protection of potential drugs is still growing (Antonijevic, 2015; Stalder, 2022).

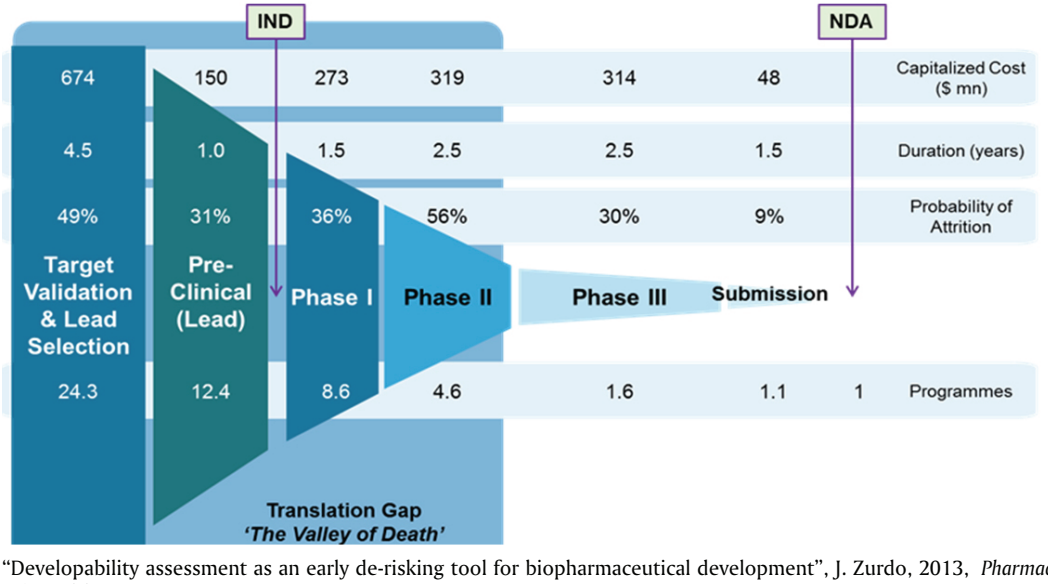
In order to increase the chances of introducing a drug to the market, companies simultaneously implement many research and development projects and invest in technologies supporting their development, which additionally increases the average cost of drug development. However, as previously discussed, the increase in the research budget, the development of new technologies, and a better understanding of molecular biology do not correlate with the number of newly registered drugs (Liberti et al., 2010; Petro & Gardiner, 2015; Wallmark, 2016).

Methodology

In order to define the main risk areas and productivity factors in projects focused on drug discovery and development, an in-depth systematic literature review was performed. For the literature review in the Scopus database the following key words were used: *drug discovery, drug development, productivity, project management*, taking into account the areas of pharmacy, biotechnology, medicine, business and economics, and 3187 articles were obtained during the research. Selected articles were reviewed in order to define key areas of research project management and practices in biotechnology and drug development. This approach is in line with the general principles of systematic literature review (Tranfield et al., 2003). Industry guidelines in biotechnology, drug development and registration were also analysed, taking into account: guidelines of leading regulatory agencies; good practices: GLP

Figure 6

The drug development lifecycle with (i) duration of stages, (ii) capitalised costs (in 2010, in US dollars) and (iii) probability of failure



Source: "Developability assessment as an early de-risking tool for biopharmaceutical development", J. Zurdo, 2013, *Pharmaceutical Bioprocessing, 1*(1), p. 30.

– Good Laboratory Practices, GMP – Good Manufacturing Practices, GCP – Good Clinical Practices; legal acts related to the development of medicines, including but not limited to patent law, drug registration processes and guidelines of bioethics committees.

Based on the outcome of the literature review, the author prepared a list of 37 questions and conducted structured interviews with 14 experts in the scientific and managerial areas of drug discovery and development, e.g. key areas of drug development, necessary information needed for decision-making, tools used to identify risks, and the decision-making process in the company, with interviews conducted online and in person from May 2022 till August 2022. Interviews as a research method were chosen in order to learn about the project management system in more detail, elucidate data available in the literature and draw on many years of experience of the responders from various R&D projects. The interviews were than transcribed and coded. The author defined 22 factors influencing the productivity of drug discovery projects and grouped them into four categories: scientific, managerial, business and environmental.

Results

During the literature review and interviews, 22 key factors influencing risk and the success rate of projects in the area of new drug development were recognised and analysed. Factors were grouped as scientific, managerial, business and environmental, and presented in Table 1 according to the frequency and importance given in the literature review and interviews.

Scientific factors:

Complexity of diseases and pathophysiology – despite the rapidly developing science, we still no little about most disease and pathophysiological processes taking place in the human body. Even in well-known areas, such as infectious diseases, where the knowledge of disease development is quite broad and detailed, new diseases and mechanisms of disease development appear, posing challenges for modern pharmacology. Understanding the disease process is an important success factor in rational drug discovery and development. New disease entities are often multifactorial, which entails the body's compensatory defense mechanisms and, consequently, the appearance of side effects.

Molecular target selection – the molecular target is selected on the basis of available data confirming its role in the development of the disease. Basic research data is often incomplete, meaning the decision to choose a target and start a project is based on uncertainty. At the same time, the competitive environment is analysed, which often defines whether work on even an interesting and adequate molecular target will be undertaken.

Selection of a compound for further development – the development of drugs is very expensive, hence companies can afford to develop few or only one compound that has a chance of becoming a drug. Thus, the choice of the molecule to be developed simultaneously determines which compounds will not have a chance to be used by patients.

Selection of patient populations – patient populations are often conditioned by the properties of the compound that has been developed, a decision that is made a few years after starting work on the compound, and one that is defined by its pharmacodynamic properties. The larger the population of patients who respond to therapy, the greater the likelihood of a return on investment. The development of drugs for rare diseases is therefore burdened with a high investment risk, and often abandoned.

Novel methods and design strategies – the development of technologies supporting the characteristics of the drugs under development, reducing the cost of the initial stages of drug discovery and development, and accelerating the entire process, has resulted in many companies choosing to simultaneously deal with mul-

Table 1

Groups of key productivity factors in drug discovery and development projects

1. Scientific factors	2. Managerial factors
• Complexity of diseases and pathophysiology • Molecular target selection • Selection of a compound for further development • Selection of patient populations • Novel methods and design strategies • Biomarkers availability	• Involvement of key stakeholders in project initiation decisions • Appropriate preparation for project management • Career paths for researchers • Scientific cooperation • Outsourcing • Appropriate, complete and clear project documentation • Consultation with clinicians and clinical centres • Selection of a comparative compound (benchmarking)
3. Business factors	**4. Environmental factors**
• Ensuring a long-term and flexible financing strategy • Market ownership structure • Creation of biotechnology companies and start-ups • Expiring blockbuster patent protection • Early differentiation from competing projects	• Lifestyle of the populations • Diagnosis and response to unmet medical needs • Patient-friendly dose and route of administration

Source: autor's own work.

tiple innovative molecular targets, increasing the pool of potential compounds from which the most promising for further development are then selected.
Biomarkers availability – responders emphasise the need to start work on biomarkers early, already at the stage of the lead compound or, if possible, even earlier in order to increase the probability of success of the projects. This approach affects both the comfort of study participants and the staff involved in conducting research, but also allows for minimising the number of errors that may affect clinical results.

Managerial factors:

Involvement of the main stakeholders when making decisions regarding initiation of the project – the study indicates a multidimensional analysis of the project assumptions as an important aspect affecting the success of the project. When making a decision to start work on a selected drug, it is important to involve people with knowledge of various areas of drug development – including those who will actively participate in the project in a few years, e.g. the regulatory department, clinical department, business development department, marketing.

Appropriate preparation for project management – experts emphasised the need for substantive preparation and experience of people related to project management, including project managers and people from senior management, with many of them particularly emphasising the impact of the project manager's competence on the effectiveness of communication, enforcement of tasks in the project, structuring of work on the project, and the preparation of appropriate and transparent project documentation that will be an appropriate source of information for years to come. Respondents emphasised the many years of work on the project to come, and the need to refer to results generated several years earlier, which are no longer legible and understandable after the this amount of time.

Career paths for scientists – drug development is driven by scientists working in laboratories, who set the pace and direction of work in the course of their daily duties thanks to their commitment, knowledge and motivation. A lot of the knowledge and understanding of the relationships between the different areas of the project being developed is in their minds, hence responders recognised the need to shape appropriate scientific career paths supported by an appropriate level of wages and prestige satisfaction in order to maintain the pace and proper direction of drug development. In many organisations it is more highly rewarded and prospective to take on an administrative or managerial position than a scientific one. In addition, managerial development paths are often the only possible opportunities for promotion for researchers, which changes the possibility of substantive involvement in the project. An important aspect raised by the respondents was the fact that scientists were promoted too quickly, especially in small biotechnology companies. Inexperienced scientists are given higher, decision-making positions, as it is difficult for biotechnology companies to compete for resources with large pharmaceutical companies. People with little experience then face the need to make important decisions related to the project, while lacking the experience to do so.

Scientific cooperation – the pharmaceutical market is inherently very competitive, since any company that manages to be the first to introduce an innovative drug to the market receives exclusive sales. Cooperation on new drugs seems reasonable, allowing to reduce costs incurred for high-risk projects, increase the resources and pool of competences involved in the development of new medicines, and diversify risks and invest in other projects. The pharmaceutical industry uses many models of cooperation based on the relationships of companies, research centres and academia, as well as public-private partnerships in various configurations.

Outsourcing – companies can outsource the whole process, selected stages or specific tasks that aim to accelerate, reduce costs or access new competences and technologies. The field of outsourcing in the pharmaceutical industry has grown significantly in recent years in China and India, where several contract research organisations (CROs) are based, supported by cheaper labour, cheaper land and extensive laboratory infrastructure. There is also a phenomenon of strategic outsourcing based on the long-term, often exclusive, cooperation of drug development companies with selected service providers.

Appropriate, complete and clear project documentation – during drug development, not only is a therapeutic compound created, but also a wealth of information necessary or useful for clinicians and regulatory agencies to decide whether to start clinical trials or authorise them for use. An important aspect of the work on the drug, therefore, is to conduct accurate, transparent and complete design documentation, which is, in a way, a second outcome of research work.

Selection of a comparative compound (benchmarking) – early comparison of our potential drug to other leading therapeutics used as a standard form of treatment, as well as to competing compounds at the discovery stage developed by other research groups, allows us to verify the benefits of using our therapy.

Business factors:

Ensuring a long-term and flexible financing strategy – appropriate resources and a research budget adequate to the stage of development and the competitive environment allow for appropriate planning and decisions related, among others, to the number of diseases for which the potential drug is being developed, the clinical trial plan, but also about the forms of cooperation with foundations, academic centres or other companies. The drug development market benefits from numerous forms of financing such as research grants, sale of shares in a project or company, loans, support from foundations and many others. An important aspect from the project development perspective is also a decision on the exit strategy, i.e.

whether and at what stage of project development do the owners aim to commercialise a project and on what financial or ownership terms.

Market ownership structure – Drug discovery and development requires a long-term, passionate and believing view of the investment being undertaken, which is a long and risky process, hence the discussion on whether the current form of market ownership is appropriate to maintain an appropriate level of involvement, resistance to the changing market situation and accept lower margins in the long run. Over the last 20-30 years, a decrease in the productivity of large pharmaceutical companies has been observed, resulting in numerous acquisitions and mergers. At the same time, organisations with different structures, such as foundations, private companies or non-profit organisations, were and are better able to adapt to periods of reduced profits or unstable factors of the market environment.

Creation of biotechnology companies and start-ups – these two forms of scientific organisations are often a solution for people who do not have the right career paths in large pharmaceutical companies or subsidiaries. Smaller organisations tend to be more flexible and more agile in decision-making, allowing for faster progress in the implementation of scientific ideas. Biotechnology companies and start-ups usually focus on a narrow therapeutic area or on selected technologies, which is dictated by a smaller scale of operation, limited budget, but also limited research infrastructure and reliance on external suppliers (outsourcing).

Expiring blockbuster patent protection – many drugs that dominate the market of selected therapeutic areas, so-called blockbusters, lose patent protection, which prompts companies to work on generic drugs that are more likely to be registered and marketed, reducing the number of drug developments.

Early differentiation from competing projects – maintaining competitiveness in long-term and risky projects is a difficult process, one that requires not only focusing on project work, but also tracking and verifying data received in competitive projects. Early implementation of differentiation strategies increases the chances of quickly spotting errors in the design, changing the strategy if possible, and defining the chances of success and maintaining competitiveness in relation to other projects from the market developed for the same molecular purpose

Environmental factors:

Lifestyle of the populations – the concept of the Western way of life appeared in connection with the development of agriculture and industry. A more sedentary mode of functioning, with a less varied diet and in a more polluted environment significantly affects the functioning of the human body. In the context of drug development emphasis is placed on the impact of change on the development of civilisation diseases, such as cardiovascular diseases, obesity, type 2 diabetes, osteoporosis or certain forms of cancer. These diseases are largely associated with a sedentary lifestyle, excessive consumption of food or stimulants, and pose a challenge in the development of drugs, because during the design and development of therapies environmental factors and the interaction of potential therapeutics with substances delivered to the body with food should be taken into account. In addition, the influence of external factors on the human genome, the changes occurring in it and the inheritance of these changes is another dimension and challenge in the development of drugs – an area of science called epigenetics.

Diagnosis and response to an unmet medical need – this area of diagnostics is still developing, allowing for the recognition and isolation of new disease entities. Drug development targeting diseases for which there are no available treatments are more likely to succeed, as there is less competition in these areas, and regulatory requirements are often more lenient. This is to allow the introduction of forms of therapy to the market for patients with unmet medical needs who have no other chance to improve their health situation.

Patient-friendly dose and route of administration – the form of the drug and its dosage should be user-friendly – if possible without the need for additional medical devices to administer them, allowing for matching doses to the patient and intuitive. This is important from the point of view of the production process of the drug, but also important for people who are sick, lonely, disabled or elderly, and for people caring for patients, so as not to cause difficulties in the treatment process. Difficulties in using the drug may result in abandonment of its use or improper use, which affects the appearance of side effects or lack of effectiveness of treatment.

Conclusions

The drug discovery field influences various areas of daily life – starting from the condition of the patients, through the health care system condition, economy of the regions and creation of life style habits of societies. On the other hand, the same factors impact the productivity of drug discovery research. During evaluation, relationships between the factors were recognised, and it was observed that *Complexity of disease and pathophysiology* is correlated with *Molecular target selection*, *Biomarkers availability* and *Selection of patient populations,* while knowledge about the disease and its progression provides the basis for the project design and approach. This, in many cases, is correlated with the network of *Scientific cooperations* performed by an organisation. Pathophysiology and new diseases are related to the *Lifestyle of the population* and often driven by the daily choices of patients.

A relation between the *Selection of a molecular target, Selection of a compound for further development* and *Selection of patient populations* can be seen when these three factors influence the overall process of developing new therapies. It is the choices made in these three areas that define the further path of development of a new drug and, consequently, define the probability of successful registration of the drug. Many months,

and often years, pass between the decision on the selection of the molecular target and the selection of the lead compound, or later – the selection of the patient population, where significant investments are made. This decision requires the *involvement of key stakeholders in the project initiation decision* followed by *Appropriate preparation for project management,* bearing in mind the long drug discovery process. As a result, companies working in the industry have to introduce remediation and risk reduction strategies using a platform approach, introducing *Novel methods and design strategies* and *Early differentiation from competing projects* into the ways of working. Companies need also to select projects that they are capable to perform, which is related to *Ensuring a long-term and flexible financing strategy* as well as *Expiring blockbuster patent protection* and the *Market ownership structure,* as well as the way in how companies and research are financed. The market structure is driven by the number of big and small companies defined as *Creation of biotechnology companies and start-ups*. As discussed above, small companies are mainly created by scientists who are employees not satisfied with the available *Career paths for researchers* in existing companies.

In terms of scientific cooperation, it was observed that this factor is highly related to *Appropriate, complete and clear project documentation,* which influences *Consultation with clinicians and clinical centres* supporting projects with knowledge on the disease mechanisms, patients' conditions or samples from the patients needed in laboratory research.

Multidimensional relations between the recognised factors give insights into the valuation and decision-making process related to the field of drug discovery, and also supports the adjustment of project management and the business approach to address globalisation of the markets, competitiveness and needs of patients waiting for new and safe forms of treatment. The results of the study also suggest that further work on defining key factors and their correlations is required to address the needs of the multidimensional ecosystem of drug discovery research projects.

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Magdalena Marciniak is a specialist with a wealth of experience in the pharmaceutical industry. Currently serving as Director of Business Development and Alliance Management, she has demonstrated expertise in cultivating strategic partnerships and driving successful collaborations. With nearly 10 years of dedicated focus on drug discovery business development, she has built a track record of forging international alliances with leading pharmaceutical, biotechnology and academic partners. Her ability to identify and capitalise on opportunities has resulted in numerous cases of fruitful collaboration resulting in research and development initiatives in this field. In addition to her extensive industry experience, she is currently pursuing a Ph.D. in Project Management in Drug Discovery and Development at the Cracow University of Economics. Her research delves into the intricacies of project management within the pharmaceutical landscape, aiming to uncover innovative strategies and best practices optimising the drug discovery processes.

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