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Buying wine online or offline: Some determinants of buyer intent for French consumers

J.-É. Pelet[1]
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Abstract

This paper aims at determining the reasons why customers prefer to buy wine online or offline, the first comprising both mobile-commerce (m-commerce) and e-commerce platforms. In particular, this research strives to understand effects of social influence and enjoyment on the intention to purchase wine from online and offline touchpoints. Moreover, the goal is to find out about the differences in the behaviour of French wine buyers and explain the choice of channel buyers prefer to use when they purchase wine.

To answer our research questions, data was collected through an online questionnaire. A theoretical model is suggested and tested by the use of SmartPLS3. Online and offline buyers are compared using multi-group analysis (MGA) technique. Wine buyers are compared by the use of one-way ANOVA through SPSS 19.

To date no paper has examined the differences between shopping behaviour in a retail store or on e-commerce or m-commerce platforms considering perceived enjoyment and social influence constructs. Hence, this contribution brings to the fore preliminary results on wine shopping behaviour and reveals what drives consumers to make a decision in favour of buying wine online or offline.

The results show that fun and social influence affect intention to buy wine from offline touchpoints. Enjoyment also strongly and significantly affects the intention to buy wine from online touchpoints.

Keywords: wine marketing, e-commerce, m-commerce, consumer behavior, perceived enjoyment, social influence.

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在线或离线葡萄酒购买：决定法国消费者购买意向的一些因素

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[1] 巴黎先贤祠-阿萨斯大学，LARGEPA（法国）

摘要

本文章指出了消费者喜欢在线或离线购买葡萄酒的原因，后者包括移动平台（移动商务）和电子商务平台。特别是，该研究旨在了解社会对在线或离线购买葡萄酒意向的影响。此外，该研究的目标是了解法国葡萄酒购买者行为的差异，并解释消费者喜欢用什么办法来购买葡萄酒的选择。

为了回答研究问题，作者通过在线调查问卷已收集数据。提出并测试了一个使用SmartPLS3的理论模型。使用多群体分析（MGA）对网上和网下购物者进行了比较。通过使用SPSS 19进行单因素方差分析比较了葡萄酒消费者。

到目前为止，还没有文章调查了考虑到享受和社会影响因素在零售店或在电子商务或移动商务平台上的购物行为之间的差异。因此，该研究强调了关于葡萄酒购买者行为的初步结果，并准确地显示了促使消费者决定在线或离线购买葡萄酒的原因。

结果显示，享受和社会因素影响了线下购买葡萄酒的意向。享受对网上购买葡萄酒的意向也有很大影响。

关键词：葡萄酒营销，电子商务，移动商务，消费者行为，享受，社会影响。

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Introduction

In today's world of streamlined Internet commerce, you can get almost anything delivered directly to your door when shops stay closed – from a wine subscription box to a collectible Cabernet Franc. Often, it only takes a few clicks. That's great news for wine lovers who want access to thousands of wines at their fingertips. But where is the best place to buy wine? Offline or online? Nielsen reports show that during the COVID-19 pandemic, consumers purchased 26.7% more volume of wine via off-premise sources during the period from March through May, 2020, compared to a year ago using their in-store retail measurement[1]. While off-premise sales were increasing during the lockdown, direct consumer sales grew significantly [McGarry Wolf et al., 2020]. 3.2 billion euros of wine was sold online in 2020 in France, a huge increase from 2017 where 194 billion euros had been sold[2]. The online sales of wine thereby amount for more than 3 billion euros, the best figure since 2008.

Nevertheless, shopping for wine online also involves some complexity. With a rich offer of more than 1.7 billion bottles of wine in the French market supply chain[3] and little real-time professional advice provided, wine is a product that is not easy to choose. However, like many other industries, wine retailing is evolving with the universal character of online devices and retailing apps that are empowered by artificial intelligence, touchscreens and voice interactions [Pagani et al., 2019; Pelet et al., 2023]. Wine industry leaders have observed the rapid growth in online wine purchasing and are recommending that wineries should improve their digital capabilities[4]. In order to face the challenges of this growth, Costco, a retail company operating on a membership club-warehouse distribution chain, has purchased a logistics company, Innovel Solutions[5]. In addition, the coronavirus pandemic has fueled Amazon's stock increase of more than 60% this year[6]. The omnipresence and wide accessibility of smart online apps and devices allow retailers to satisfy consumers' needs in diverse ways and enrich consumers experience with a more satisfactory consumer journey [Park, Kim, 2018]. Multi-channel presence can benefit retailers because consumers have dissimilar preferences and seek different benefits [Pelet, Taieb, 2022; Ettis et al., 2023].

Some consumers love spending hours scouring the shelves to find the exact product they need. Others, when shopping online, enter a word in the website's search engine or post a picture or video and find instantly what they were looking for. Retailer apps, online communities and outlets allow consumers to exchange ideas and share their experiences about foods and drinks and shape their preferences and choices [Dörnyei, Gyulavári, 2016]. Vivino, an online wine marketplace that is reachable both as a mobile app and a website, provides consumers with opportunities to scan and upload wine labels. Consumers can use wine labels to discover the prices and places to shop and read the reviews and ratings provided by other consumers [Kotonya et al., 2018].

Although multichannel presence helps retailers communicate with their consumers through multiple touchpoints, retailers recognise the importance of omnichannel presence with integrating the features and facilities of parallel channels and touchpoints to create a unified consumer experience [Shi et al., 2020; Ettis et al., 2023]. As emphasised in [Wagner et al., 2020], distinguishing between a channel and a touchpoint is necessary. A channel represents the hardware alternatives that consumers can use to shop online, while a touchpoint represents the software alternatives that retailers can provide for channels. The various combinations of hardware (desktop, laptop, tablet, mobile, smartwatch, speakers, TV…) and software (apps, websites, web progressive apps, social media…) that consumers can use, will shape online customer experiences differently depending on the fit of the channel and the touchpoint. Omnichannel presence allows a diversity of shopping experiences from showrooming, wherein consumers search and source products on the shelves and buy online, to webrooming wherein they search online and buy from brick and mortar touchpoints [Park, Kim, 2018]. Wine shoppers may move effortlessly back and forth between the physical and digital world to gain product information and purchase online or offline. Hence, wine marketers are required to offer a seamless experience by combining in-store and online experiences using omnichannel strategies [Shi et al., 2020].

As the popularity of m-commerce (mobile commerce) and e-commerce increases, the need to explore consumer preferences for wine brick-and-mortar retailers versus wine e-tailers, and the benefits they seek in each touchpoint, increases. This is especially true when it is difficult to buy in-store, for example during the pandemic: because of rules obliging customers to stay out of the store, because of a tiny space in the shop, or simply because consumers are frightened by the virus and prefer not to go shopping.

Although the wine industry has been adopting online marketing and e-commerce, the research on the decision made by consumers whether to buy online or offline has not yet been sufficiently carried out. This research explores the effects of emotional and reasoned factors on intention to buy wine from touchpoints and the way these relationships are different in online vs offline touchpoints. This study employs an online survey to gain an insight into the drivers of consumers' preferences for buying in a retail environment (wine shop, supermarket etc.) or online (from an e-commerce or m-commerce website or from an application).

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1. Literature review

1.1. Online wine touchpoint

Online touchpoints vary in their functionality, social interactivity and community building potentials. Whereas more functional touchpoints such as websites facilitate information gathering and purchasing the products, socially-oriented touchpoints provide consumers with more opportunities for social interaction and content generation [Hallikainen et al., 2019]. In online environments, consumers' purchase intentions go beyond the attributes of the products. Other factors such as the enjoyability of online environment and the reviews and the influence of other users affect purchase intention [Vanhala et al., 2020]. Online spaces such as social media and interactive apps allow wine tasters and influencers to test and taste wine, and communicate their evaluations with their wine-interested audience [Lam et al., 2019].

Although the adoption of these tools in the United States has been moderate, the autor of [Thach, 2009] found that wine vlogs or wineries featuring videos on their websites are the most commonly used tools and are popular among consumers. Wine is an "experiential good" that consumers enjoy communicating about and sharing either in person or via social interactions in online interactive apps and websites [Pelet et al., 2017b; Ettis et al., 2023]. Prior studies on social media recommend that wine companies need to be involved with and manage the interaction among consumers through social networks [Thach, 2010; Reyneke et al., 2011; Pelet et al., 2017b]. Social media tactics also include providing access to a social network of trusted third-party opinions [Pelet et al., 2023].

1.2. Consumer behaviour and the complexity of choice in touchpoints

For marketers the question arises whether there are particular reasons for wine customers to have an individual or general propensity to shop offline or online. When comparing online and offline purchases of wine, it needs to be noted that the selection of wine in retail stores has become a complex process for consumers [Lockshin, Hall, 2003]. In general, wine consumers are confronted with overcrowded wine shelves, which offer, in many cases, more alternatives to choose from than other supermarket categories [Rocchi, Stefani, 2006]. Moreover, gaining in-store attention is not always sufficient to drive consumer choice. Other factors such as previous brand choices or price comparisons that are readily available via the internet can drive consumer choice [Chandon et al., 2009]. Consumer interest in traditional retail shopping methods is declining compared to the evolving way of shopping online. Online shopping offers practical advantages (temporal and spatial), financial advantages (through the opportunity of comparing prices), and hedonic ways of consuming [Eroglu et al., 2001].

1.3. Wine consumer behavior and touchpoint choice

A number of factors, from retailers' marketing efforts to channel features, social influence and situational factors can drive the preference of consumers for online or offline shopping touchpoints [Neslin et al., 2006; Nakano, Kondo, 2018]. Consumer perceived value is among the most significant determinants of shopping decisions [Hsin Chang, Wang, 2011]. Consumers may perceive functional, emotional, social as well as economic value from shopping experiences [Zhang, 2009; Li et al., 2012; Peng et al., 2019]. Online retailing makes purchases more convenient and gives easy access to information.

However, the sensitivity of consumers to values as in benefits each channel provides might be different across channels. According to [Chu et al., 2008], consumers show lower price sensitivity when shopping online compared to offline. One may theorize that the choice of buying online or offline may be either a reaction of consumer to factors such as price, customer service, and the convenience of buying from home, or simply a replication of their past purchases in the case of habit or behavioural loyalty. Moreover, for the consumer's purchase decision, the social aspect seems very important for wine as an experiential product [Peng Huang et al., 2009]. Consumers tend to adjust their purchase decisions to conform with the attitudes of their social circle [Rodrigo et al., 2019].

Online or offline touchpoints that provide socialisation or challenge can be appealing to consumers because humans experience fun and enjoyment in activities that entail challenge and social interaction [Hwang, Choi, 2019]. Individuals find pleasure and satisfaction in activities that provide them with opportunities for gaining the information they need and experiencing enjoyment in the activity [Kim et al., 2007; Zheng et al., 2019]. In fact, prior research has shown that interactive websites and social media spaces that provide consumers with opportunities to interact with engaging content, with each other and with the marketers, can instigate an enjoyable mental state called flow, through which consumers lose the track of time. Consumers who experience an enjoyable mental state tend to interact with the online touchpoint more often and perceive more fun during the interaction [Hoffman, Novak, 1996; Pelet et al., 2017a].

1.4. Research model and hypotheses

Humans enjoy activities that entail challenge and social interaction [Hwang, Choi, 2019]. Wine is an experiential product [Peng Huang et al., 2009] that people can spend ages searching for on retail shelves or websites [Park, Kim, 2018]. Consumers can also be engaged post-purchase by sharing their consumption stories [Pelet et al., 2017b]. Since people tend to repeat activities that put them in an enjoyable mental state, enjoyment of the touchpoint shopping experience can play a role in wine purchase intention. Thus, we hypothesise that:

H1: Perceived enjoyment positively affects the intention to buy wine from the touchpoint.

As noticed by [Rohm, Swaminathan, 2004; Schneider, Zielke, 2020] argue that physical store-oriented shoppers have a distinct desire for social contact. Recent literature suggests that the service provided in-store, by an oenology or caviste, still has an important role in the shopping process [Brown et al., 2003; Balasubramanian et al., 2005]. However, [Koenigstorfer, Groeppel-Klein, 2012] also found that the lower the desire for social contact, the more likely people are to use a mobile device in-store, which is an important indicator

of competitive showrooming behaviour [Rapp et al., 2015]. However, a desire for social contact could also explain why customers choose to socially interact while purchasing online. Consumers have a willingness to adjust their consumption behaviour in a way that is affirmed by important people in their social circle [Rodrigo et al., 2019]. Influencers in online environments such as wine tasters and reviewers and other buyers or friends in interactive online spaces, who express and share their experiences, influence others' purchase decisions [Lam et al., 2019; Vanhala et al., 2020]. Hence, one can infer that social influence is a factor in the intention to purchase wine. Thus, we hypothesise that:

H2: Social Influence positively affects the intention to buy wine from the touchpoint.

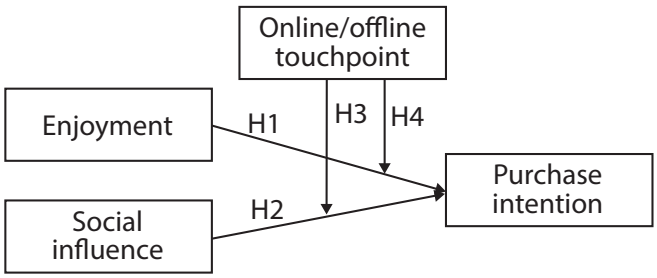
Since the desire for social contact may also differ between offline and online touchpoints, the above hypotheses can be affected by the online-offline environment. Thus, we hypothesise that:

H3: Social Influence differs between online and offline wine buyers.

H4: Perceived enjoyment differs between online and offline wine buyers.

The model suggests that the enjoyment and social influence felt by wine shoppers (whether through an online or offline touchpoint) can have an impact on their buying intention (Fig. 1).

Fig. 1. Research model



2. Methodology

Our quantitative study examined wine shopping of French respondents. France was chosen because it is a major global wine producing country, where citizens use mobile apps and websites to conduct e-commerce activities and also go to stores to shop for wine. In this study, the central phenomenon under investigation is preference for wine purchase channel/touchpoints. Non-probability, criterion-based purposive sampling was used because it allowed the researchers to intentionally select participants who have experience with the central phenomenon being explored.

2.1. Sample description

To gather a representative sample of French consumers, a minimum of 300 surveys was set. The sample was initially screened for legal drinking age, ownership of a smartphone for online access and wine behaviours. Specifically, we screened to ensure participants had already made an online purchase as well as an offline one. We also questioned elsewhere in the questionnaire whether they were members of a wine club or liked a fan page dedicated to wine when they answered they bought wine online.

A total of 322 completed surveys were collected and the final sample dataset consisted of 191 valid respondents after applying selection and completion criteria. 86 respondents were excluded from the question filter because they did not buy wine during the last 2 months so they did not answer the questions. 57% of the sample is female and 43% males, and 47% are 25 years old on average. These figures are consistent with the French wine population. Since each respondent was screened to include prior online purchasing history, the survey further investigated the purchase preferred channel used within the past year, showing a fair balance between social media and emails as a way to discover the wine or share its information.

2.2. Data collection

Data was collected between January 1 and March 15, 2022, using both personal and online questionnaires until we achieved our minimal quotas for specific demographics, i.e., gender, age, education, and income. Personal questionnaires were administrated to consumers who were invited to participate in a paper-and-pencil survey. The questionnaire is available on appendix A. Online surveys were distributed on social media (Facebook, Twitter and LinkedIn) and via emails on a balanced basis, 50% – 50% in order to target our respondents using main channels. A survey link was distributed to a list of potential respondents composed of students, workers, and representative people of the nation. Panellists could voluntarily enter the survey if they met the legal drinking age.

2.3. Survey instrument

Core questions were measured with four items using a 7-point Likert type scales, where 1 means "strongly disagree" and 7 means "strongly agree." These items were used to evaluate preferences to buy wine on channels such as online (apps, websites, web progressive apps, social media) or offline (supermarkets, wine growers, wine merchants, during wine events or in restaurants). 12 experts from marketing and information science fields critically evaluated all the items in the research instrument to assess content validity, representativeness, dimensionality, comprehensibility and unambiguity. In order to avoid a lassitude bias, due to fatigue or boredom, the questionnaire was shortened prior to implementation.

2.4. Data analysis

SmartPLS3 is used to test the conceptual model of the research. SmartPLS allows for measuring small sample sizes, it is less sensitive to the normality of the data and suits exploratory studies [Gyau, Spiller, 2009]. One-way ANOVA is used to compare the means of the responses between different groups. LSD analysis is used to understand the detailed differences between the latter. In order to compare the intent to buy wine online or offline, 4 items have been analysed (Table 1).

Table 1
Analysed items of comparison between online and offline groups

		Feeling	
		Enjoyment	Social influence
Channel/Touchpoint	Online	Online Enjoyment	Online Social influence
	Offline	Offline Enjoyment	Offline Social influence

3. Results

3.1. Structural model

Cronbach's alpha of the intention to purchase from the touchpoints are 0.611, 0.770 and 0.623 for offline buyers, online buyers and the combined group, respectively. Factor loadings are significant and above 0.5. The construct reliability (CR) and average variance extracted (AVE) of intention to purchase from touchpoints for the combined group are slightly less than the recommended threshold values (i.e. 0.64 and 0.47 respectively). Other variables are single indicator. The combined group shows a good model fit with NFI = 0.982 and SRMR = 0.003.

SmartPLS3 was used to test the conceptual model of the research. Multi Group Analysis is performed through conducting bias-corrected and accelerated bootstrap at a significance level of 0.5. Table 2 represents the path coefficients of the combined sample as well as online vs. offline groups. The first two hypotheses are validated for the combined group as well as the offline buyer group. The only path hypothesis that was validated for the online group was the effect of "enjoyment" on "intention to purchase." The results show that the effect of "social influence" on "intention to purchase" is significantly different between the two groups of online and offline buyers ($F = 61.77$, $p < 0.01$).

3.2. Comparison tests

Non-parametric independent-samples tests were performed to compare perceived enjoyment and social influence among online and offline wine buyers. The Mann – Whitney and Kolmogorov – Smirnov tests indicate that social influence differs significantly between the two groups with $M_{online} = 3.20$ and $M_{offline} = 5.51$ (Table 3). Hence H3 receives a statistical support. As indicated in Table 3, the results show no significant differences of perceived enjoyment between online and offline wine buyers. Thus, H4 is not supported. We also conducted t-tests to compare perceived enjoyment and social influence among genders, and the results show no significant differences between men and women ($t_{enjoyment} = -0.39$; $p = 0.69$ and $t_{social\ influence} = 1.83$; $p = 0.07$).

4. Discussion

4.1. Theoretical findings

The results show that both "enjoyment" and "social influence" affect the intention to purchase for offline wine buyers and "enjoyment" influences intention to buy for online buyers. This could be due to the fact that buying wine is supposed to be a pleasurable activity. The effect of "enjoyment" on "intention to purchase" is significantly higher for online buyers in comparison to offline buyers. It is the single, significantly strong factor among those we studied for buying wine from an online touchpoint. Thus, buyers who prefer to buy wine online, do so mostly because of the pleasure inherent in the activity of online wine buying.

The results also indicate significant differences for social influence between online and offline buyers. Hence, buyers who prefer to buy wine offline, they are looking for the social contact, for example, to perceive a better advice from wine growers.

The results of this study are in line with previous research. Scholars, e.g. [Hoffman, Novak, 1996; Pelet et al., 2017a] argue that websites that provide opportunities for social interaction and for interaction with engaging content can grab

Table 2
Results of multi group analysis

	Path coefficient			Path diff
	Combined	Online	Offline	
Enjoyment > Intention	0.37***	0.78***	0.28***	0.506***
Social Influence > Intention	0.16*	0.19(ns)	0.18**	0.009(ns)

Notes: 1. *** – correlation is significant at the 0.01 level, ** – correlation is significant at the 0.05 level, * – correlation is significant at the 0.10 level. 2. (ns) – not significant.

Table 3
Results of non-parametric tests

		Means (SD)	$U_{Mann\text{-}Whitney}$	*p*-value	$Z_{Kolmogorov\text{-}Smirnov}$	*p*-value
Perceived enjoyment	Online	4.70 (0.92)	705.50	0.241	1.15	0.141
	Offline	4.44 (0.78)				
Social influence	Online	3.20 (1.75)	234.50	0.000*	2.02	0.001*
	Offline	5.51 (0.84)				

* Significant at the 0.01 level.

the attention of consumers and cause an enjoyable mental state. Previous studies [Li et al., 2012; Peng et al., 2019] also provide evidence that emotional, economic, and functional value positively affect the intention consumers to purchase.

4.2. Practical implications

This study has implications for marketers and managers. Marketers who are interested to promote their online touchpoints and attract consumers to their applications, may consider the elements that can make wine purchase an enjoyable experience [Pelet, Taieb, 2022]. Websites and applications that can provide consumers with interesting information about wine, its consumption, production process and varieties, can make a WOW effect among consumers and increase enjoyment.

In order to increase the challenge through interactivity that leads to enjoyment, wine marketers can utilise a combination of online and offline tools. Marketers can establish digital searching and sourcing gadgets or kiosks in the in-store environments to give information about their wine stock and provide an access to online communities. Wine marketers can also launch online campaigns that increase fun and interactivity and encourage consumers to visit their brick and mortar wine stores. Offline environments can also play the role of a showroom, where showrooming is not only possible but suggested. Consumers that visit the physical store may receive hot links sent to their smartphones through which they can select and purchase the wine they desire and have it sent to their address.

When consumers visit an online page through a laptop/desktop or handheld device and are satisfied with the initial experience, they can easily open another tab on their browser and see more options and consider choosing another bottle of wine. The possibility to compare offerings, prices, and particular information, thanks to multiple tabs opened at the same time in the browser, can induce buying intention. However, this is not the case when using a smartphone where the mentioned multitasking is not as easy. However, users who connect to a social media page through a smartphone can comment on the page's contents and engage in interaction with other users and marketers synchronically. Social media allows users to know whether someone is connected or not, which enables them to ask questions about a comment, for example.

Additionally, online wine marketers provide opportunities for consumers to interact with each other and with the engaging content to increase the enjoyment and in turn the purchase intention. Since social influence affects the intention to purchase, brand communities and vloggers can further shape the intention to purchase wine. However, wine buyers may be influenced online and purchase their wine offline. This is called webrooming. That is why omnichannel management is of significant importance.

4.3. Limitations and future research

This research focused on enjoyment as well as social influence provided by channel/touchpoints selling wine and their effects on behavioural intention such as purchase intention. The findings of this research extend existing knowledge about the effects of User Experience (UX) with online User Interface (UI) on the user satisfaction and behavioural intentions. Prior researchers have highlighted the diverse ways devices differ from one another such as screen resolution [Yan et al., 2019]; and size [Carvalho et al., 2018]; and processing speed and quality [Albert, Tullis, 2013; Yan et al., 2019]. Different characteristics and features of online touchpoints and interfaces affect UX that subsequently impact user satisfaction and behavioural intention [Albert, Tullis, 2013]. A research which would focus on the UX and UI of websites and apps selling wines might bring relevant information. Other psychological and contextual factors affecting satisfaction and intention are not considered. Future research can study the effects of other psychological factors such as subjective wellbeing and emotional balance, on intention to recommend or share, as well as intention to come again for loyalty purposes.

The role of occasion where drinking wine seems also an important variable to control: the supply chain management of wine can be drastically important if the quantity of ordered bottles increases (as for an event) and there are obvious differences between buying wine online or offline for that aspect. A retailer might not deliver its merchandise at all, whereas an online seller has a delivery role, on top of selling. The winery access to distributors or retailers could also influence how wine is distributed, thus, measuring such variables could bring interesting new results. Other occasion issues, e.g., buying wine for own use vs. gifting, might impact the shopping act.

The variables of the atmospherics vary between online and offline, and the agent (seller) influence varies accordingly. Advice given in the physical shop can play in favour of a choice to buy one brand rather than another, and the merchant can also have some interest to "push" a slow-moving or more expensive bottle rather than another. The winery size and the number and density of shelves, paired with the way bottles are promoted, can have an effect that the tiny interface of an app or website will never equalise. Nevertheless, many new opportunities such as the soft replacement of video with Three.js and WebGL animations (see for example https://threejs.org/) to enrich digital users with action levers helping to rotate, zoom, and see differently the product, will surely change habits, as they are dedicated to enjoyment. With the help of qualitative or mixed methods, researchers can dig into the ways each channel/ touchpoint is unique.

Conclusion

This research takes a quantitative approach with the use of a questionnaire adapted from past research. Findings showed that enjoyment is an important factor in shaping consumers' purchase intention regardless of touchpoint type. The results show that some buyers are more likely to buy wine from wine growers and less likely to buy from either supermarkets, events or restaurants. However, results of this study showed that some users preferred online touchpoints as opposed to in-store shopping or via on-premise purchases. The results also showed that French online wine buyers perceived online offers to be lower-priced. Future research can show if the prices are objectively different. More research, utilising qualitative methods and in-depth interviews or experimental research can dig into the reasons behind these findings.

1 Appendix A

Questionnaire on wine: Retail, websites and apps

We kindly ask you to read and answer the following questions. These questions concern your purchases of wine. It will take about 6 minutes of your time. This questionnaire is completely anonymous. Thank you very much for your participation!

Filtering question

1. Have you bought wine in the last 2 months?

Filtering question to compare online/offline consumers' responses.

2. Do you mainly buy wine online (website/applications) or offline (in supermarkets, from wine growers or wine merchants, during wine events, or in restaurants)?

Online

Listed below are the statements that refer to the purchase of wine ONLINE (websites/applications). Please think about the following statements and mark your level of agreement between: 1 and 7 (1 – strongly disagree; 7 – strongly agree).

3. Buying wine online saves time compared to shopping for wine in supermarkets, from wine growers or wine merchants, during wine events, and in restaurants.
4. Buying wine online is fun.
5. Searching for wine on the Internet is easy.
6. Using websites or applications is a modern way of purchasing wine.
7. When I buy wine online, I get lower prices than in retail stores.
8. The large majority of my family members and friends buys wine online.
9. I have the technical knowledge to buy wine online.
10. I also buy other products, for example, clothes, food, computers, etc., online.
11. I get quickly bored when searching for wine online.
12. Websites and applications are generally quite user-friendly.

Offline

Listed below are statements that refer to the purchase of wine offline (in supermarkets, from wine growers or wine merchants, during wine events, or in restaurants). Please think about the following statements and mark your level of agreement between: 1 and 7 (1 – strongly disagree; 7 – strongly agree).

13. Buying wine off-line is more time-consuming compared to buying wine online (websites/applications).
14. Searching for wine in supermarkets, from wine growers or wine merchants, during wine events, and in restaurants is fun.
15. When buying wine off-line, I do not have to pay for home-delivery when I take the wine with me.
16. When buying wine off-line, I do not have to pay for home-delivery when I take the wine with me.
17. When buying wine from wine growers you get good advice from the wine grower.
18. When buying wine from wine merchants you get good advice from the merchant.
19. When buying wine during wine events you get good advice from the seller.
20. When buying wine in restaurants you get good advice from the waiter/waitress.
21. When I buy wine off-line, I get lower prices than online.

22. The large majority of my family members and friends buys wine offline.
23. I generally prefer buying wine in supermarkets.
24. I generally prefer buying wine from wine growers.
25. I generally prefer buying wine from wine merchants.
26. I generally prefer buying wine during wine events.
27. I generally prefer buying wine in restaurants.

Socio demographics

27. What is your gender?
28. How old are you?
29. What country were you born in?
30. What country do you normally reside?
31. What is your education level?
32. What is your current main occupation?
33. Gross monthly household income.
34. Do you want to receive information regarding this study?

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Introduction of digital platforms by industrial companies as a source of competitive advantages

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Abstract

This paper examines the impact of digital platforms on the development of industrial companies, their role for the development and formation of sustainable competitive advantages by industrial enterprises. It is investigated how digital platforms affect efficiency and what negative network effects industrial companies experience. As a method of empirical research, the case method of eight Russian industrial companies is used, the number of which varies from 38 to 996 people. All the industrial companies included in the sample have been working on digital platforms for more than 5 years. The results of the study were the conclusions that digital platforms are used as an opportunity to enter foreign markets only by small industrial companies, large and medium-sized companies use other sources of internationalisation; digital platforms are not used as a source of innovative development. Digital platforms serve as an ecosystem to create a better offer for customers. Digital platforms are also a source of sustainable competitive advantages due to the formation of relationships with partners and obtaining information about consumers and markets.

Keywords: industrial enterprises, digital platforms, competitiveness, network effects, access to foreign markets, innovative development, ecosystem.

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采用数字平台作为工业企业竞争优势的来源

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摘要

本文章研究了数字平台对工业企业发展的影响，它们在工业企业发展和形成独特竞争优势中的作用。作者调查了数字平台如何影响效率和工业公司经历的负面网络效应。采用的实证研究方法是对8家俄罗斯工业公司进行案例研究法，这些公司的规模从38人到996人不等。所有被抽中的工业公司都在数字平台上运营了5年以上。研究结论是，数字平台只被小型工业公司用作进入外国市场的机会。大中型公司使用其他国际化方法，他们不使用数字平台作为创新的来源。数字平台是一个创造更好的客户主张的商业生态系统。通过与合作伙伴建立关系并深入了解消费者和市场，数字平台也是独一无二的竞争优势的一个来源。

关键词：工业企业、数字平台、竞争力、网络效应、进入国际市场、创新发展、商业生态系统。

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Introduction

Modern research digital platforms are considered as one of the key factors of competitiveness [Evans, 2008], which not only has a significant impact on the formation of partnerships and the search for new customers but also makes it possible to create new value for customers [Evans, Schmalensee, 2007]. For example, according to a study [Best practices.., 2010], interactions between companies within a platform create more value than traditional interactions between a seller and a buyer [Gawer, Cusumano, 2012] by reducing the costs of market research, searching the market for business partners, suppliers and buyers. They reduce transaction costs, which are shared by all user groups when participating in a platform business model.

Platforms provide the contacts and information needed to operate in the market and to secure new contracts and funding. Digital platforms are particularly important for small industrial enterprises, which, due to limited resources and lack of market power, are forced to rely more on digital platforms and personal contacts in the course of their activities [Hagiu, Wright, 2011]. In addition, by participating in the platform business model, industrial companies receive benefits that they could not otherwise achieve (e.g. access to information, the ability to establish business relationships with people, communities or companies of interest to the user). Ultimately, the consumer receives more value at a lower cost. For this reason, management issues related to the organisation and management of platforms are considered by many to be one of the most important and highly-demanded new areas of research in economics and management [Roson, 2005; Evans, 2008; Hagiu, Wright, 2011].

Significantly, the platform business model is not a completely new phenomenon. The first studies in the field of multilateral platforms appeared in the early 2000s in the works of European and American researchers (for example, in the works of Tyrol, Parker, Eisenman, Rochelle, Van Alstayan). They mainly aimed to studying pricing issues for users of platform solutions, for example [Rochet, Tirole, 2006], success strategies, such as [Eisenmann et al., 2008], recruitment of a critical mass of users necessary for the platform to function, as in the work of Rochelle and Tyrol.

The second wave of research on platforms is related to their digitisation and use of the Internet and mobile networks. Research on digital platforms has two directions: the first is what benefits and advantages actors can find for successful operation; the second is how digital platform providers can strengthen their position and respond to threats.

In recent years, studies have begun to play an important role in addressing issues related to the strategic management of digital platforms: pricing, description and measurement of the added value created by this type of intermediation, quality management in a digital platform, etc.

This study aims to identify how digital platforms can help Russian industrial companies to compete and develop.

1. Theoretical overview

Significantly, there are many definitions of platforms. The existence of a platform requires the existence of a multilateral market and the presence of two or more groups of users served by the organisation. At the same time, a multilateral market is understood as 'the presence of two or more participants (users), the presence of an intermediary to ensure the interaction of the participants, the increase in value for the users with the increase in the number of these users. Participants are typically permanent members who transact with other multilateral market participants' [Brynjolfsson, McAfee, 2014].

In the work of A. Hugo and J. White, a platform is defined as 'an organisation that generates profit primarily by providing direct interaction between two or more different types of affiliated groups of participants' [Hagiu, Wright, 2011]. T.K. Koh and M. Fishman define digital platforms as 'a multilateral network... that facilitates interaction between different but interdependent groups of users, such as buyers and suppliers' [Koh, Fichman, 2014].

Table 1 describes two approaches to platform research and provides their definitions.

The user's participation in the platform must be accompanied by his affiliation to it: the participant himself must decide to join the platform and be aware of how and with whom he will have to interact. Awareness is also expressed by the participant's willingness to pay for membership (e.g. entry fee, registration on the site, etc.). Such a requirement makes it possible to avoid the erroneous attribution to platforms of suppliers of trading platforms, equipment and services that are not related to the business processes of the functioning of the platform. In order to distinguish the platform from intermediary organisations that buy goods or services and then resell them to the final consumer, the researchers proposed to classify only those organisations that allow participants to communicate directly with each other while retaining control over the basic conditions of the joint activities of the participants.

The basis of a digital platform is a digital network: a computer network, a network of mobile devices, etc. Users of the network join it to interact with each other.

According to the consulting agency 'Accenture', digital platforms are 'a set of technologies that are used as a basis for creating a specific and specialised system of digital interaction'[1].

The Massachusetts Institute of Technology offers a definition that a digital platform is 'a high-tech business model that creates value by facilitating exchanges between two or more interdependent groups of participants'[2].

[1] https://www.accenture.com/_acnmedia/PDF-80/Accenture-Winning-Digital-Platforms.pdf.
[2] http://ebusiness.mit.edu/research/papers/296_parker_vanalstyne_adigitalpostalplatformdefinitionsandaroadmap.pdf.

ANO 'Digital Economy', created by leading high-tech companies in Russia with the support of the Administration of the President of the Russian Federation and the Government of the Russian Federation, presented its approach to the definition of digital platforms as part of the implementation of the National Digital Economy Project. According to it, 'a digital platform is a system of algorithmic mutually beneficial relationships between a significant number of independent participants in an economic sector (or field of activity) carried out in a single information environment. It leads to a reduction in transaction costs through the use of a package of digital technologies for working with data and changes in the division of labour system'[3].

Digital platforms consist of several components: hardware and services, the World Wide Web, content users, content creators (developers). The architecture of digital platforms depends on their size. Typically, digital platforms are modular architectures that include core and plug-in modules and associated management [De Reuver et al., 2018]. The architecture of digital platforms is based on networks of data centres or data processing centres (DPCs) [Tiwana, 2014)]. The platform architecture allows organisations to achieve both scalability, by centralising and integrating common functions in core modules, and evolvability, by reconfiguring pluggable modules [Wareham et al., 2014]. In particular, platform users can share and use common resources and knowledge, while exploiting unique resources by creating new complementary modules.

The classification of platforms is described in many studies [Katz, Shapiro, 1986; Shapiro, Varian, 1999; Roson, 2005; Rochet, Tirole, 2006; Rysman, 2009; Anderson, 2010; Evans, Schmalensee, 2010; Eisenmann et al., 2011; Evans, 2011].

Table 1
Definitions of digital platforms in foreign literature

Approach	The definition of a digital platform	Authors
Technical (platform as a software environment)	A building block that performs the entire function of a technology system and enables the development of complementary products, technologies or services.	[Spagnoletti et al., 2015, p. 364]
	A set of components common to the entire product family, whose functionality can be extended by applications.	[Ceccagnoli et al., 2012, p. 263]
	The extensible code base of a software system that provides the core functionality, the common modules that interact with it, and the interfaces through which they interact.	[Tiwana et al., 2010, p. 676; Ghazawneh, Henfridsson, 2013, p. 3]
	A set of subsystems and interfaces that form a common framework for which derivative applications can be developed and distributed	[Xu et al., 2010, p. 1305]
Non-technical (platform as an intermediary in the provision of economic transactions)	A commercial network of suppliers, manufacturers, intermediaries, customers and producers of complementary products and services, called complements, linked by a formal contract and/or interdependence.	[Tan et al., 2015, p. 249]
	Multilateral networks that facilitate interaction between different but interdependent user groups, such as buyers and suppliers.	[Koh, Fichman, 2014, p. 977]
	A multi-stakeholder platform exists when a company brings together two or more different groups of customers (parties) who need each other in one way or another, and when a company creates an infrastructure (platform) that creates value by reducing the costs of finding, distributing and executing transactions together.	[Pagani, 2013, p. 625]
	Value created by facilitating interaction between two or more interdependent groups of customers	[Ye et al., 2012, p. 211]

Source: compiled by the authors.

[3] https://files.data-economy.ru/digital_platforms.pdf.

Participants in the implementation of the Digital Economy of the Russian Federation Programme led by B.M. Glazkov also propose a classification that identifies three types of digital platforms:

1. Instrumental digital platform, which is based on a software or hardware-software complex that can be used to create applied software solutions. The users of the digital platform are the developers of these solutions. Examples of this type of platform are Java, Apple iOS, Android, MS Azure, etc.
2. The main function of the infrastructure digital platform is to provide IT services and information for decision-making in business activities. The purpose of this type of digital platform is to support the accelerated market introduction of solutions for automating the activities of various consumers. Examples: Era Glonass, Public Services, CoBrain.
3. The applied digital platform ensures the implementation of market transactions between various market entities, as well as the exchange of certain values. Examples: Yandex.Taxi, Booking.com, Avito, etc.

The identification of these types of digital platforms is based on several characteristics: (1) the main activity of the digital platform, (2) the result of the platform's activity, (3) the level of information processing, (4) the main beneficiaries and their requirements.

Based on the definitions discussed above, we conclude that digital platforms serve as an evolutionary form of markets, where the interaction between the seller and the buyer is ensured and benefits such as reduced transaction costs, increased consumer awareness of existing products and increased trade intensity are achieved. Digital platforms contribute to the intensification of economic relations between agents by improving the main mechanism of traditional marketplaces. Digital platforms link the two sides of the market into a single network, making it easier to find, match and conduct transactions using online tools, and increasing the efficiency of the market by coordinating supply and demand. At the same time, the concept of a digital platform can encompass both a technological design, a business model and an ecosystem.

At the same time, digital platforms have unique characteristics that clearly distinguish them from traditional trading platforms. There are two main characteristics of platforms [Tiwana et al., 2010].

The first feature is that multilateral platforms favour direct interaction between two or more types of economic actors, which improves the situation of all users. From this point of view, they act as intermediaries, providing a common (real or virtual) meeting place for organisations to carry out transactions or other operations. As an example, four different types of two-way platforms (the simplest form of multi-sided platforms) can be mentioned: exchanges for relevant activities (e.g. dating services, employment services and e-commerce sites such as Avito), advertising-supported media (magazines, newspapers, free TV, etc.), software platforms (video games) and transaction systems (e.g. payment methods such as Google Pay).

The second feature is that most multi-party platforms are also characterised by cross-group network effects or cross-group externalities between two or more groups of customers participating in the platform. A cross-group network effect means that the utility of users in at least one group depends on the number of users in another group that join the platform. In most cases, cross-network externalities are positive, but negative network effects can occur. Negative network effects can manifest themselves in the number and quality of other users of the platform. For example, the number of advertisers on the platform may negatively affect user satisfaction. In another case, a decrease in the overall quality of users of the platform can affect its usefulness for other users.

In Russia today, conditions are being created for the development of digital platforms and the expansion of their user base. It should be noted that significant progress has been made in the physical and virtual factors of digital technology use. There has been a steady increase in the proportion of households and the population using the Internet for both commercial transactions and government and municipal services. Thus, according to data provided by the All-Russian Gfk Omnibus [De Marc et al., 2019], in 2019 the number of Internet users in Russia over the age of 16 was 90 million people/, or 75.4% of the adult population. Compared to the previous year, the number of users increased by 3 million people.

In the context of the dissemination of COVID-19, an increasing number of businesses and citizens began to actively use digital platforms. It is particularly noticeable that in a number of areas digital platforms have become the dominant participants in economic relations, leading to the transformation of industries, a change in the configuration of economic actors and the creation of potential for economic growth. A striking example is the growth in demand for the services of companies using digital platforms. For example, the work of taxi aggregators in 2019 showed that Moscow residents made 324 million trips, in terms of value, their total revenue amounted to 157.3 billion rubles. At the same time, according to analysts, without the use of aggregators, these figures could be 72 million trips and 36.2 billion rubles[4].

Platforms implemented by government agencies, especially e-government services, have also shown strong results in recent years. Such e-government services as a Unified Portal of State and Municipal Services (gosuslugi.ru), the system of interdepartmental electronic interaction (IEIS 3.0), the

[4] The pandemic and the transition of companies to remote work. Index of digitalisation of small and medium-sized businesses. A joint study by NAFI, Otkritie Bank and the Moscow School of Management Skolkovo. https://nafi.ru/analytics/pandemiya-i-perekhod-kompaniy-na-udalenku-indeks-tsifrovizatsii-malogo-i-srednego-biznesa/.

unified identification and authentication system, and the interdepartmental electronic document management system have been actively developed. According to a UN study on the quality of digital government services, in 2020 Russia will be ranked 39th with a 'very high level of development of e-government'[5].

At the same time, articles on the 'mortality' of digital platforms and the crises that accompany them are increasingly appearing in foreign publications. In this context, the life cycle of digital platforms in Russia will be further considered.

2. The impact of digital platforms on the development and competitiveness of Russian industrial enterprises

Digital platforms play a very important role in the process of business creation and development, as well as in the creation of unique competitive advantages, including for Russian industrial enterprises.

Faced daily with new sanctions and restrictions, specific challenges from the external environment, constant changes in legislation and relatively underdeveloped institutions, industrial companies are forced to rely on personal contacts and relationships to survive and grow.

Despite the fact that digital platforms can have a huge impact on business development, there is reason to believe that not all the opportunities of digital platforms can be used by Russian industrial enterprises.

2.1. Research methodology

In order to answer the questions, the method of case analysis was used, with eight Russian industrial enterprises as objects, of which three are small enterprises, two are medium enterprises with up to 250 employees, and three are large industrial enterprises with more than 500 employees, all of them having experience with digital platforms for more than five years.

The design of our research assumes that the empirical study will be based on an inductive approach involving the description of reality and the interpretation of the results obtained. The case analysis method will allow us not only to collect the necessary data, but also to 'examine information that is independent of existing theories' [Sutton, 1997]. Moreover, according to [Kwark et al., 2017], it is also very useful for collecting sensitive information and establishing relationships between the level of perception of top managers and the decision-making process.

As mentioned earlier, the empirical analysis was conducted on the basis of eight Russian industrial companies, each of which has been operating on digital platforms for more than five years. All of them are industrial companies and represent different industries: food production, machinery and equipment production, footwear production, clothing production, printing production, toy production, furniture production.

The cases were selected from a wider database of 23 industrial companies that participated in this study. However, 15 of them were not included in the final sample for two reasons: either the company did not belong to the industrial sector, or it had no experience with digital platforms for more than five years.

All selected companies are registered in Moscow, St Petersburg and the Moscow region.

Data collection took place from March to July 2022. Semi-structured interviews, informal communication with employees and top managers of the companies, questionnaires, the analysis of company materials and documents were used as a method of collecting information. The interviews lasted from one to one and a half hours and were conducted both offline and online using the Zoom service.

Data collection took place in two stages. In the first stage, an idea was developed about the formation and implementation of the company's development strategy, as well as the reasons and processes for companies to enter digital platforms. In addition, archival and financial documents were studied in order to understand how working on digital platforms affected the financial performance of the company.

The second stage of information collection involved conducting a series of interviews on the role of digital platforms in developing and creating non-copyable competitive advantages, as well as the disadvantages that companies see in working on digital platforms.

The data analysis was carried out using the traditional grounded theory approach, which allows for a consistent comparison of the available data with the emerging theoretical construction.

We identified three key questions regarding the role of digital platforms in developing and maintaining competitiveness:

1) Why are digital platforms important for the development of industrial firms?
2) How do industrial firms create non-copyable competitive advantages with digital platforms?
3) How do digital platforms affect the performance parameters of companies and what negative network effects do they experience when working on digital platforms?

The data analysis procedure consisted of three stages. In the first stage, the main strategic goals in the development of the companies were highlighted, including the reasons for the decision to work on digital platforms.

In the second phase of data analysis, some common features were identified in terms of how business leaders approach digital platforms and how they use them to develop and create a competitive advantage. The disadvantages of working on digital platforms were also identified. These characteristics

[5] http://www.insme.org/insme-newsletter/2014/file-e-allegati/newsletter_documents/Integrating_SMEs.pdf.

Table 2
Characteristics of the sample companies

	Size	Staff number	Activity	Work on Russian digital platforms	Work on foreign digital platforms	Average monthly sales volume on the digital platform (thousand rubles)
Company 1	Small	38	Production of indoor footwear and felt boots	Wildberries Yandex Market (Take-it) Ozon Lamoda SberMegaMarket Livemaster	Tmall/Aliexpress Joom	1500
Company 2	Small	84	Production of printed products	Wildberries Yandex Market (Take-it) Ozon SberMegaMarket	—	3000
Company 3	Large	996	Production of jewellery	Wildberries Ozon SberMegaMarket Yandex Market (Take-it)	Tmall/Aliexpress	50 000
Company 4	Medium	189	Production of moonshine stills	MegaOpt24 Yandex Market (Take-it) Ozon SberMegaMarket	Tmall/Aliexpress	20 000
Company 5	Small	84	Production of per supplies	Wildberries Yandex Market (Take-it) Ozon Robo.market SberMegaMarket	Tmall/Aliexpress	8000
Company 6	Medium	178	Candy manufacturing	Yandex Market (Take-it) Ozon Robo.market SberMegaMarket Flowwow	Tmall/Aliexpress	1000
Company 7	Large	670	Manufacture of home and office furniture	Leroy Merlin Lot-online Yandex Market (Take-it) Ozon Berito SberMegaMarket	—	45 000
Company 8	Large	530	Manufacture of wearing apparel and household textiles	Wildberries Ozon Lamoda MegaOpt24 Berito SberMegaMarket B2B-Center	Tmall/Aliexpress Joom	35 000

Source: compiled by the authors.

later served as a framework for the case analysis. The third step was to identify key events in the development of companies in relation to the role of digital platforms.

2.2. Case analysis

All eight selected companies had worked with digital platforms for more than five years. The reasons for entering digital marketplaces varied, but the idea of working with digital platforms was driven in all companies by top managers who believed that working with platforms would expand sales markets, strengthen brand image, enter foreign markets, use marketplace logistics and improve the results of their activities. The characteristics of the sample companies are presented in Table. 2.

All the companies studied are active on several digital platforms. They all started from the same platform - Wildberries or Ozon, as they have the largest number of consumers. For most of the companies in question, entering digital platforms is a continuation of their business strategies to develop online sales channels. All companies have started to work on digital platforms in order to expand the sales market and attract new customers.

Access to foreign platforms was mainly used to attract consumers from neighbouring countries who have a good knowledge of Russian and are familiar with the companies' products. Six of the eight companies surveyed operate on foreign digital platforms and have foreign customers. These companies export between 1 and 10% of their turnover.

The data on the companies' work on digital platforms are presented in Table. 3.

The analysis shows that not only universal platforms, but also niche platforms are becoming popular among industrial companies. For example, a furniture manufacturer considers Leroy Merlin to be the most important platform for it, as it does not have to compete 'on all fronts' with the market giants, but can focus on a segment of consumers and offer them the best prices and services compared to universal digital platforms. The same opinion is shared by the clothing and textiles manufacturer which lists Lamoda as its most important platform, and the confectionery manufacturer which prioritises the Flowwow platform for itself.

3. Research findings

3.1. Digital platforms as a source of development for an industrial company

The impact of digital platforms on internationalisation. It seems that internationalisation through digital platforms depends on the nature of the company's product. If a company sells a product associated with a particular culture, it is likely to be in demand by expatriate communities. For example, according to the manufacturer of home shoes and felt boots, felt boots are considered an integral part of Russian costume, Russian lifestyle and Russian winter, therefore this category of goods was not successful on foreign digital platforms and for its promotion the company used not only the marketing tools offered by the platform but also social networks to search for immigrant communities. Similarly, a manufacturer of confectionery products found that promoting its products in foreign markets was only possible among immigrant communities that knew the product well. In order to increase sales through social networks, contacts were made with the owners of Russian shops abroad.

It can be assumed that the more specific the company's products are, the less suitable digital platforms are for internationalisation, and vice versa, the more versatile the product is, the more suitable digital platforms are for internationalisation.

Many companies working for Tmall/Aliexpress also try to establish personal contacts with product sellers through the messaging system, to learn from them the potential market capacity and to find new partners. The company, a manufacturer of clothing and textile products working on the Tmall/Aliexpress platform, found wholesale buyers from more than 5 countries (the Tmall/Aliexpress platform itself covers more than 200 countries and works in 18 languages). To meet the needs of foreign consumers, the garment and textile manufacturer had to expand its existing capacity, which, according to the company owner, it was not prepared to do.

At the same time, companies note that not only working on foreign digital platforms but also on Russian ones helps internationalisation. For example, a jewellery manufacturer working on the Ozon platform found two foreign wholesalers – consumers from neighbouring countries (Belarus and Kazakhstan), and on the Wildberries platform – consumers from Israel, Germany and Slovakia.

An obstacle for small companies to find partners in foreign markets is the difficulty associated with the lack of language skills and the inability to employ a suitable specialist in the company.

Digital platforms as a source of innovation. As mentioned above, digital platforms are considered as a source of open innovation. However, all the company representatives interviewed said that the main disadvantage of working on digital platforms is the lack of communication with the consumer. For example, a confectionery company believes that the consumer is part of the brand and a source of additional innovation, but there is no connection with the consumer on digital platforms. Moreover, the reviews that consumers leave on the site under the product are in most cases related to shortcomings of the platform work itself and not of a specific product (for example 'We ordered chocolate, they brought sweets', which is not the fault of the manufacturer). A similar opinion is shared by the company-manufacturer of clothing and textile products. It also sees the disadvantage of working on digital platforms in the inability

Table 3
Reasons for starting work on a digital platform and choosing a launch site

	Reasons for going digital	Things to consider when planning for digital platforms	What mistakes has your company made when entering digital platforms?	How digital platforms were chosen for launch	Which of the digital platforms is a priority for the company?
Company 1	Minimum investment to start a business	The cost of working with the marketplace	Placement of the entire range without taking into account the needs of consumers in a specific market	The working model offered by the platform (DBS, FBS, FBY, Express) was evaluated and the platforms that best fit the company's business model were selected	Wildberries Ozon
Company 2	Expanding the market, attracting new customers	Evaluate your product, niche and payment system	Did not use marketplace sales analytics	Selected the most popular sites (for the current date)	Wildberries Ozon
Company 3	Development of omnichannel sales	Use of tools to promote products	Did not develop our own online store. Transferred all sales to the marketplace.	Considered brands that operate on the site and sell a similar product. We chose sites with the least number of such brands, as there is less competition.	Ozon Tmall/Aliexpress
Company 4	Enter new markets and use the platform's logistics capabilities. No need to create your own online store	Ways to meet market demands	Tried to occupy the niche where competition is too fierce and there is a surplus of goods.	Calculated the commission the platform would have to pay, determined the price for storage and delivery, additional payments for illiquid goods, and selected sites with the most favourable policies.	Yandex Market (Take-it) Ozon
Company 5	Winning new customers Solving logistics and warehousing problems	The costs associated with the creation, storage and transmission of product content	Formed an LLC, not an individual entrepreneurship, and at the first stages, taxes took all the profits	Made a list of universal and niche platforms. Developed a strategy for working on both universal and niche platforms	Wildberries Ozon
Company 6	Market expansion	Where does the production take place?	Poorly filled product cards, blurred photos	Did not choose a specific platform, but implemented a strategy of working on as many platforms as possible, considering each as an additional source of sales	Flowwow Ozon SberMegaMarket
Company 7	Development of own online store and new sales channels	Transport options and costs	Ignoring the advertising opportunities of the marketplace and incorrectly setting up an advertising campaign	So far all platforms are universal, we have chosen the most popular ones. Today these are Wildberries and Ozon	Lot-online Leroy Merlin Yandex Market (Take-it) Ozon
Company 8	Find new customers and enter foreign markets. Low cost distribution channel	Company production facilities	Lack of customer feedback (not responding to consumer reviews and questions). We didn't follow the charts of promotions and sales on certain marketplaces.	Used analytics services to analyse the marketplaces and chose a platform where there was demand and a minimum level of competition.	B2B-Center Lamoda Tmall/Aliexpress Ozon Wildberries

Source: compiled by the authors.

to build relationships with customers and involve them in product improvement, so it only uses its own online shop as a source of joint improvement and product creation with consumers. However, there are still unresolved issues for the manufacturer: for example, an item that was not sold and liked by the consumers of the online store. It was decided to remove it from the range and replace it with a new product. This was not done, however, as it was also the first or second best seller on the Wildberries platform. As there is no link with the consumer, it is impossible to understand what exactly attracts the consumer to this product.

Moreover, all the manufacturers interviewed confirmed that they did not involve other companies operating in this niche as co-innovators. They considered them only as competitors and considering them for collaboration in the process of creating a new product.

Thus, we did not see any evidence of the use of such digital platforms as a source of innovation for companies.

Digital platforms as an ecosystem for creating better value for consumers. As shown above, many researchers describe digital platforms as ecosystems for creating the best offer for a consumer. Most of the companies surveyed confirm

Table 4
The impact of digital platforms on the development of Russian industrial companies

	Digital platforms as a source of internationalisation	Digital platforms as a source of innovation	Digital platforms as an ecosystem for creating better value for consumers
Company 1	Used, but the volume of foreign operations and consumers is small	Not used	Exploiting the logistical opportunities of digital platforms
Company 2	Not used	Not used	Exploiting the logistical opportunities of platforms
Company 3	Used by foreign consumers from both near and far abroad	Не используется	Используются возможности логистики и оплаты частями
Company 4	Used. Overseas sales by CPU - 10-15% of total sales	Not used	The opportunity to create a set together with partners is used, the service of logistics and payment in parts is used
Company 5	Used, but the volume of sales abroad is small, around 1% of total sales	Not used	Opportunities of logistics and payment in installments are used
Company 6	Used, sales abroad are small, mainly to European countries with large communities of Russian emigrants.	Not used	Logistics opportunities are used
Company 7	Not used	Not used	Opportunities of logistics and payment by installments are used
Company 8	Used, consumers are mostly from neighbouring countries, sales abroad from digital platform are about 4-6% of total sales	Not used	The opportunity to create a set together with partners is used, the service of logistics and payment in parts is used

Source: compiled by the authors.

that they have created the best logistics in collaboration with the platform. For example, a confectionery company uses the logistics of digital platforms and is confident of the shortest delivery time for goods. The furniture manufacturer considers it important to cooperate with the platform for the sale of goods in instalments. According to the company's representatives, when the buyer sees that he can pay for the purchase in equal instalments without overpaying, his confidence increases and he becomes more loyal. In addition, the opportunity to pay for goods in instalments on the website allowed the company to increase the average sales by 1.5-2.5 times. Other companies surveyed also find the instalment payment option beneficial for themselves and their customers. According to the respondents, it increases the average purchase size by 20-30% and increases sales by 30-50%.

However, only two companies have created a value proposition with other partner companies. One, a manufacturer of moonshine stills, used the kit creation feature in conjunction with other companies operating on this digital platform. The company offered a common kit: moonshine, yeast, aromatic additives, coals and wood chips. As in-house production has the advantage of reducing costs by 20%, we were able to agree with our partners to reduce the price of the whole kit by 10%. This increased sales to around 2,000 per month. Subsequently, the company continued to expand production and opened its own online store, and then a wholesale department for other online stores.

Similarly, a clothing and textile company was able to negotiate with partners – manufacturers of accessories (belts, bags) – to complement the image and reduce the price per set by 1-3%. It also influenced consumer loyalty to the brand and increased sales by 5-7%. Two other companies, a printing company and a jewellery manufacturer, took advantage of the opportunity to create kits, but only with products from their own range.

It can therefore be assumed that the larger the company is, the more likely it is to look for partners to create a joint offer for customers. Other companies use the platform's capabilities to create a better offer for customers: in most cases, the companies surveyed used logistics services for fast delivery and instalment services, which allowed them to increase sales.

A generalised analysis of the impact of digital platforms on the development is presented in Table 4.

3.2. Digital platforms as a source of non-copyable competitive advantages

Digital platforms as a source of information. Almost all the companies surveyed use digital platforms to obtain information about competing companies, their products and services, and to formulate their value proposition. Analytical services provided by digital platforms allow you to identify niches and characteristics of the target audience, develop strategies to optimise work on the digital platform. For example, a company producing clothing and textiles uses popular goods analytics tools, which allow you to follow the graph of the dynamics of goods in categories, analyse the brand, sales and comments. This makes it possible to select the most popular niches and products for work on digital platforms. A jewellery company uses a comprehensive tool for analysing work data on all platforms to effectively manage sales and find new niches. For example, thanks to analytics, it became clear that the best-selling product on digital platforms was silver jewellery with sitalls. As a result, the company expanded a range of products in this category and began to produce some types of gold jewellery in the same design in silver. At the same time, the company decided to sell most of its gold products on its own website and silver jewellery of similar design on digital platforms. This business model is based on the fact that, according to company representatives, the categories of consumers on the digital platform and in their own online store are different and do not overlap. Digital platform consumers are customers who are willing to look at many products and browse through a large number of product pages. They tend to buy jewellery and focus on a lower price. They go to an online shop to buy products from a particular manufacturer and are prepared to pay a higher price for quality.

All other respondents also use digital platforms as a source of information that allows them to create a competitive business model, predict prices, analyse brands, niches, SKUs and product positions, and thus create the best value proposition for customers.

With caution, based on the analysis of only eight cases, it can be argued that the larger the company is, the more diverse the business intelligence services it uses. In our case, large companies used not only information on niches, sales, orders and product balances of their own products but also the analysis of competitors' sales, sales geography, price and profitability monitoring. In addition, the use of advanced analytics requires recruiting specialists, which in most cases small companies cannot afford.

Digital platforms as a source for finding and interacting with partners. According to the majority of representatives of large and medium-sized companies, they look for wholesale buyers on the platforms. For example, a company producing clothing and home textiles managed to find ten partner companies on the platforms: eight of them are wholesale buyers in Russia and abroad, two others are manufacturers of complementary goods (belts, bags, shoes) to create a consumer image and increase brand loyalty. To find Russian suppliers, the company used the B2B Centre business platform.

The company, a manufacturer of moonshine stills, also managed to find partners to create sets of goods. The company, a furniture manufacturer, uses the digital platform 'Lot-online' to find partners for the supply of fittings, wood-based panels and other materials necessary for the production of furniture. The company also uses commercial sites to seek tenders for the supply of its products for office spaces.

It can be assumed that large and medium-sized companies use digital platforms to find partners while small companies prefer personal contacts and social networks.

Digital platforms as a source of unique resources. Almost all interviewees admitted that in order to create unique resources, formal relationships need to be reinforced by informal interaction. For example, in a company producing moonshine stills there are usually only formal relationships at the beginning which gradually turn into friendly relationships. It was a friendly relationship established with one of its suppliers that allowed the company to expand its product range sales by adding hot smoking barrels and stew autoclaves. It increased the number of visits to the shop site and sales.

The company, a furniture manufacturer, believes that it was a friendly relationship that helped them find land in the Moscow region at a low price and open their own production. It was also thanks to friendly relations that we found suppliers, who were willing to give large discounts. However, such searches were not conducted within digital platforms.

For a clothing and textile manufacturer, friendly relations helped to find a unique clothing designer and not only to produce universal clothing, but also to create its own clothing collections, which gave the company a unique competitive advantage. This search also took place outside the digital platform.

However, there are exceptions, such as a company that makes indoor footware and felt boots. The Fair of Masters platform was used to find unique craftsmen who make felt boots using ancient technologies.

The company, a manufacturer of confectionery products, is aware of the difficulty of establishing friendly relations among migrants from Russia. According to the owner of the company, former immigrants from the CIS countries or Russia are not interested in establishing friendly, honest and transparent relations, they are only interested in making a quick profit, sometimes even using deceptive interaction schemes. The same thesis is confirmed by the company, a manufacturer of indoor footware and felt boots. Former compatriots in Poland tried to sell fabrics for sewing house shoes at an artificially high price.

Another way to create unique competitive advantages with unique resources is to employ people who live in other countries. For example, one clothing and textile manufacturer managed to hire a sourcing specialist in Italy. This has enabled the company to find unique stock positions of fabrics in small quantities (ensuring the exclusivity of the items produced) and at prices lower than similar fabrics from China to create clothing collections.

The jewellery company has hired two managers from Germany and Slovakia to set up their own online stores in these countries, work on local digital platforms and ensure the necessary level of trust from European partners. However, the digital platforms were ineffective in finding such employees.

Thus, we did not find evidence of the importance of digital platforms as a source of unique resources; for most companies, they do not matter much, as companies rely on personal connections rather than platforms to find unique resources.

A generalised analysis of the impact of digital platforms on the creation of non-copyable competitive advantages is presented in Table 5.

3.3. Impact of digital platforms on efficiency and negative network effects

As shown above, most researchers associate the efficiency of work on digital platforms with the presence of network effects. However, firms can experience both positive and negative network effects.

Direct positive network effects. Firstly, all the companies surveyed attributed high traffic to such effects. For example, according to Medianetology, in 2022 the average number of visitors per month on the Wildberries platform will be 27,600 thousand, OZON – 24,600 thousand, Yandex.Market – 12,000 thousand, Tiu – 11,400 thousand, Lamoda – 7950 thousand rubles.

This makes it possible to sell goods even if the brand of the company is not yet known. At the same time, the organic growth of the digital platform ensures the growth of the company itself. Most of the Russian digital platforms such as Wildberries, Yandex.Market (Beru), Ozon, SberMegaMarket allow you to sell products in all EAEU countries (RF, RB, Kazakhstan). At the same time, none of the companies we interviewed was able to create such a distribution channel on its own.

Direct negative network effects. Due to the high workload, the platform may confuse the delivered goods, supply them late, etc. while consumers perceive all shortcomings as poor performance of the manufacturing company.

Cross negative network effects. As platforms provide a highly dynamic sales system, sellers need to be as flexible as the platform itself. At the same time, participating in a large number of promotions, sales and discounts often leads to a negative margin on the company's products and significantly reduces net profit.

Table 5
The impact of digital platforms on the formation of non-copied competitive advantages by Russian industrial companies

	Digital platforms as a source of information	Digital platforms as a source for finding and interacting with partners	Digital platforms as a source of unique resources
Company 1	Analysing sales in the category and in the context of brands and individual products Analysing sales cards, search result positions, product reviews	Does not use	Search for unique masters - manufacturers of felt boots
Company 2	Finance, supply plan, general sales report	Does not use	Does not use
Company 3	ABC analysis, deliveries, balances, logistics, sales geography, product range, niche analysis and introduction of new products to the platform.	To find suppliers To search for foreign wholesalers To search for Russian wholesalers	Does not use
Company 4	Tracking the visibility of goods on the marketplace, planning supplies, searching for information on brands, creating comparative charts	To create a shared value proposition To search for wholesale consumers To find suppliers	Range extension
Company 5	Analysing fastest growing categories, identification of top categories and products, analysing fastest growing categories, tracking of stock levels	Does not use	Does not use
Company 6	Analysing competitors' sales, automatic planning of purchases according to a given period, analysing product ratings with details by category	Does not use	Does not use
Company 7	Calculating commission, potential income, margin, sales geography for specific categories and positions, dynamics of indicators, supply planning	To search for tenders To find suppliers To search for wholesale buyers	Does not use
Company 8	Comparing brands, analysing sales and redemption rates of goods, visibility of goods on the marketplace, niche analysis and introduction of new products to the platform	To create a shared value proposition To find suppliers To search for wholesale buyers abroad To search for wholesale buyers in Russia	Does not use

Source: compiled by the authors.

Table 6
Network effects of digital platforms

Direct effects		Cross-network effects		Component-driven network effects
Positive	**Negative**	**Positive**	**Negative**	
Large visitor traffic The growth of the platform has a direct impact on the growth of the company's sales	Shortcomings in the work of the platform due to workload are perceived by consumers as shortcomings of the company itself	Dynamic sales system Growth in sales due to a large number of promotions, sales and discounts Creation of a large number of promotion tools	Participation in sales and promotions leads to a negative margin of the company's products and significantly reduces net profit	Not available on Russian digital platforms On foreign platforms, there is the possibility of messaging between sellers and consumers

Source: compiled by the authors.

Component driven network effects. On Russian digital platforms, platforms often limit communication between sellers and consumers. The customer buys the product, but does so under the supervision of the marketplace. The seller can answer questions about the product, but cannot communicate with consumers outside the digital platforms. There are also restrictions on including company business cards in the package. Basically, Russian marketplaces focus on the fact that everything is decided by the service. Foreign platforms take a different approach. For example, Tmall/ Aliexpress help communication between the consumer and the producer, the buyer can ask not only questions to the producers of goods but also exchange messages (both on the platform resource and outside it). In this way, foreign platforms create component-driven network effects to a greater extent.

Conclusions

Thus, digital platforms are used for development components such as entering foreign markets, but their impact is insignificant for large and medium-sized companies – 1-3% of total turnover (with the exception of the production of moonshine distilleries), and has no impact on small industrial companies. Digital platforms are not used by the companies surveyed for innovative development and as a source of open innovation. As ecosystems for creating the best offer for customers, most of the companies surveyed use only logistics and instalment services on the platforms; only two companies have found partners within digital platforms to create a comprehensive offer.

For components of non-copyable competitive advantage, such as building relationships with partners, most of the companies surveyed used digital platforms to find suppliers, wholesalers and partners to create a value proposition for customers. All companies surveyed used digital platforms as a source of information. As a source of unique resources, digital platforms were practically not used by the companies, with the exception of one manufacturer of house shoes and felt boots, which used the Fair of Masters platform to find unique manufacturers of felt boots using old technologies.

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Designing entrepreneurial business model in the Iranian club industry in post-Coronavirus conditions

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Abstract

The purpose of this study was to investigate the COVID-19 and the challenges facing the club industry in developing countries. In this qualitative-analytical study, 17 sports experts, sports club managers, and sports entrepreneurs were interviewed based on purposive and triangular sampling methods. The data analysis was also performed by open and axial coding, of which 6 concepts and 42 categories were classified under 6 general themes. The main concepts include government support, financial issues, club activity, sponsorship, mental consequences, and social media. This study highlights the role of sports entrepreneurship in overcoming problems. Managers must use the ability of entrepreneurship because entrepreneurship is considered essential in the economy and provides the impetus for economic growth. Sports entrepreneurship can overcome the coronavirus crisis and solve the problems that have arisen.

Keywords: sports industry, sport club, corona virus.

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在后冠状病毒（COVID-19）环境下的伊朗健身俱乐部行业发展创业商业模式

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摘要

本研究的目的是探讨发展中国家的健身俱乐部行业面临的与COVID-19有关的挑战。在这项定性与分析研究中，基于目的性和三部分抽样法，采访了17位体育专家、体育俱乐部经理和体育企业家。数据分析也采用了开放式和主轴性编码的方式进行：6种方法和42个类别被划分了为6个共同主题。关键概念包括：政府支持、财务问题、俱乐部活动、赞助、心理健康影响和社会网络。这项研究强调了体育企业家精神在克服问题方面的作用。管理者应该利用创业的能力，因为它对经济很重要，能推动经济增长。体育创业将有助于克服冠状病毒影响等危机，解决经济中出现的问题。

关键词：体育产业、健身俱乐部、冠状病毒（COVID-19）。

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Introduction

In a rapidly changing global business environment, innovation and change are the main axis in the sports industry. Sport is a dynamic and unique industry that is inherently in the context of entrepreneurship [Atilgan, Tukel, 2021]. Sport provides a lucrative and ever-growing market for huge investments, thus providing not only economic impact but also entertainment for millions of people worldwide [Fu, 2021]. Sports entrepreneurship is a tool for the growth of recreational and industrial sports structures. Entrepreneurship is an integral part of sports management and creates a comp etitive advantage for individuals and organisations involved in sports. On the other hand, change in sport has necessitated entrepreneurship [Chen, Lin, 2021].

In recent years, the most significant and influential change in the sports industry has been the COVID-19 pandemic, which has delayed the world's largest sporting event, the Tokyo 2020 Summer Olympic Games [Gallego et al., 2020]. The crisis caused by this pandemic means fundamental changes in mobility, international trade, consumption and lifestyle. Current research findings on entrepreneurship policies during the coronavirus crisis are reviewed and extrapolated to suggest new practical proposals and future research directions. Given the ongoing nature of the coronavirus crisis worldwide, research should continue on entrepreneurship, management, and political implications.

Governments and policymakers are trying to use entrepreneurial thinking as a way to respond to the crisis. This policy is due to the widespread impact of coronavirus on business and society. Despite the obvious need for entrepreneurship due to the change in the disease, there is a lack of research that adequately explains how to use entrepreneurial policy initiatives in a crisis Donthu, Gustafsson, 2020]. Uncertainty about the coronavirus has provided an incentive for entrepreneurship. There is more awareness of how innovation and forward-thinking can turn epidemic hardship into opportunity. Some studies have been done on coronavirus and entrepreneurship. However, they are more focused on certain types of entrepreneurship such as social needs [Bacq et al., 2020].

In addition, to date, there is no comprehensive analysis of the role of politics in entrepreneurship-related efforts in this context. Entrepreneurship is essential in times of crisis because it provides a positive outlook for new situations. This is necessary to turn a negative event into a positive one and thus change people's perception of the crisis. Coronavirus is a major crisis that has not been seen before, and it has resulted in unpredictable changes. Some of these changes are evident in policy practices that can lead to innovative solutions that happen quickly [Bond et al., 2022]. These innovations can pave the way for future innovations that are rapidly evolving to meet social needs. However, the response time to innovation depends on the feasibility of the idea and the perseverance of those involved. There is a need for short-term business survival using an entrepreneurial mindset with a commitment to change, which includes innovation [Ratten et al., 2021]. These innovations can be the beginning of the next innovation that is rapidly evolving to meet social needs. However, the response time to innovation depends on the feasibility of the idea and the perseverance of those involved.

Sports clubs need to be flexible to survive in the new market conditions. Managers must use the ability of entrepreneurship, because entrepreneurship is considered essential in the economy and provides the impetus for economic growth. Entrepreneurship has traditionally been considered a purely economic factor, but this has changed with the acceptance of the necessity of the social forms of entrepreneurship [Ma et al., 2021]. Entrepreneurship is common in knowledge-based industries, new activities and technology-based sectors. Most research in the past decade in the field of entrepreneurship has focused on these areas and less on sports. However, some previous research has examined the relationship between sport and entrepreneurship [Ratten, Jones, 2021].

C.M. Hall found that the development of large sports programmes is associated with urban entrepreneurship [Hall, 2006]. S. Ball found that entrepreneurship is very important for the sports sector because it allows to change consumer demand with a greater emphasis on innovation [Ball, 2005]. In a study of rugby, A. Maritz examined sports performance using the entrepreneurial scorecard [Maritz, 2004]. In sports management publications such as Sport Journal, a sports entrepreneur is defined as a person who organises and takes on a sport-related business activity [Santos et al., 2019]. As of mid-January 2020, sporting events in Asia were postponed or canceled. These delays or cancellations related to the epidemic later spread and affected organised sports at all levels and in almost all countries. The 2020 Olympic Games in Tokyo, the world's most important sporting event, were postponed to 2021. Hammerschmidt and co-authors in his study entitled "Professional football clubs and the empirical evidence of the COVID-19 crisis: The time of sports entrepreneurship?" stated that the Coronavirus disease had spread worldwide in a short period of time. Measures taken by governments to minimise person-to-person contact have severely affected professional football clubs [Hammerschmidt et al., 2021]. In this regard, P. Escamilla-Fajardo and co-authors conducted a study entitled "The effect of coronavirus epidemic on sports entrepreneurship." In their view, sports entrepreneurship is considered an important part of sports organisations when overcoming critical situations [Escamilla-Fajardo et al., 2020].

According to many researchers, the coronavirus epidemic has changed people's lifestyles, so using entrepreneurship in the sports industry is essential to meet the epidemic needs of the coronavirus. According to the contents of this study, an attempt is made to identify the status and performance of sports entrepreneurship in Iranian clubs so that it can meet the needs, because the epidemic of coronavirus has changed the human lifestyle and has created new needs. Business models must also be designed and planned for good and sustainable performance in similar situations. Sports entrepreneurship is dynamic and affects a number of management areas such as business strategy, crisis management, new sport development, performance management, product innovation, advertising strategies, social issues, sustainability concerns and technological developments. There are many types of entrepreneurship in

sport, including community-based entrepreneurship, corporate entrepreneurship, ethnic entrepreneurship, immigrant entrepreneurship, institutional entrepreneurship, international entrepreneurship, social entrepreneurship, technology entrepreneurship, and women entrepreneurship. Therefore, the purpose of this study is to identify the entrepreneurial business model in the country's sports industry to meet the needs of post-corona conditions.

1. Research method

A qualitative research was used. The study group was all experts in the field of sports management, sports club management and entrepreneurship with educational, research and executive background in the field of entrepreneurship. The sample of the present study was determined qualitatively with an exploratory approach and at the time of research and interviews based on the saturation approach. Data collection tools were semi-structured interviews and demographic information questionnaire. In this study, after conducting 17 interviews, theoretical saturation was reached. The interview was conducted according to a pre-arranged interview guide. The interview was conducted according to a pre-arranged guide.

All interviews were conducted by one specialist. Some interviews were conducted in person and in accordance with health protocols, and some interviews were conducted by telephone due to the prevailing conditions. The transcripts of the interviews were written on paper and reviewed on the same day and used as the main research data. The interview with each person lasted between 30 and 45 minutes, depending on the tolerance and the level of interest. At the beginning of the interview, participants were asked questions such as: What are the effects of COVID-19 on sport? Has the pandemic affected the performance of sports clubs? Which part of the sports industry has been most affected by the pandemic? Do you think the pandemic has had an effect on sporting goods? Can sports clubs continue to operate? Could this crisis happen again? What should be done? What is the role of government in controlling the pandemic? Is it possible to control the crisis with traditional methods? More questions were asked during the interview to answer the main research questions.

At the end of each interview, the researcher summarises the interviews and re-presents them to the interviewees to ensure that the material is understood correctly. Then all the interviews were read and written, summaries and key points were considered, all interviews were reviewed interpretively, to identify the main sub-topics and compare them with each other. Patterns were determined, and a group was used to review and receive new ideas and suggestions. In fact, it can be said that after each interview, the information and speeches made by the participants were turned into text and some of the sentences and experiences of the people were highlighted. In the next step, the researchers categorised the important phrases and identified the main and secondary concepts. Participants' reviews and field notes were used to verify the data and codes extracted. The extracted interviews, codes and classes were reviewed by three faculty members and 90% agreement was reached among the extracted results.

2. Result

Out of 17 participants in this study, there were five faculty members from the Sport Management Department, four faculty members of the Economic Department, three professionals and managers of the Iran clubs, two members from the media, and three members of Sports entrepreneurs, whose demographic characteristics are presented in Table 1.

As outlined above, the given study follows an exploratory approach. Therefore, the used method should offer an accessible and theoretically flexible approach to analyse qualitative data. To address the research questions, the interviews were conducted in a deep and continuous manner, using the interviewee's experiences. An accurate analysis of the information obtained from the interview began with word-for-word transcription. This process was accompanied by initial note-taking to document the information obtained from the interviews. Then, the important parts of the interviews were coded in a systematic approach. The codes were then categorised and refined to examine the homogeneity of the content. This process was performed in two stages; first, the issues were examined at the level of the obtained data. Topics that were similar in content were summarised to make it possible to identify general themes. Second, after reviewing all the topics, an overview of the topics produced was applied, in which the introductory topics were examined according to the data set, which means that the statements of an interviewee could not lead to a topic. Finally, according to the research methodology, at the end of the open coding process, a total number of 42 categories and 6 concepts were identified, as listed in Table 2.

As mentioned above, the interviews were carefully coded and the main concepts were extracted, then reviewed and revised. Preliminary data showed that Iranian sports clubs have been severely affected by the consequences of coronavirus. The number of clients has decreased, the club's revenues have decreased, and there have been many economic problems for sports clubs. On the other hand, economic support from the government is very low and there is no clear law on the protection of sports clubs. Sponsorship has also declined and investment in sports has declined sharply, while online sports and home sports are on the rise. Exercise has increased on social networks. Traditional club systems do not seem to meet the needs and the new conditions require fundamental changes in club management.

3. Discussion and conclusions

The coronavirus crisis has spread rapidly around the world in the months since the beginning of 2020. Many countries, including Iran, experienced certain restrictions, such as quarantine. In this situation, some businesses used the telecommuting system and tried to keep their business active. Some other businesses were unable to work from home and were forced to reduce their activities. Travel, sporting events and entertainment programmes, going to restaurants or cafes, shopping malls and museums, and public spaces in general were banned or restricted. These restrictions have affected all sectors. There is evidence that the financial capacity of consumers in

Table 1
The frequency of the study participants' demographic characteristics

Demographic characteristics	University degree		Gender		Age		
	PhD degree	Master's degree and lower	Male	Female	30–40	40–50	Above 50
Sport management department	5	0	3	2	1	1	3
Economic department	4	0	3	1	0	1	3
Managers of the Iran clubs	1	2	3	0	0	1	2
Media members	0	2	2	0	0	2	0
Sports entrepreneurs	1	2	3	0	1	2	0

most societies to pay optional costs has declined sharply. The closure of educational institutions around the world due to the corona epidemic has affected the sports education sector, which includes a wide range of stakeholders, national ministries and local authorities, public and private educational institutions, sports organizations and athletes [Sajjadi et al., 2021]. However, service businesses are more affected than others, and more jobs are at risk. Athletes getting sick, closing clubs and leagues, and stopping sporting events were the first visible signs of a corona outbreak in the world. This seriously affected the income of sports clubs and federations, which resulted in the unemployment of many club staff or the limitation of their working hours and the payment of lower salaries [Keshkar et al., 2021]. The impact of the epidemic on the sports industry is intense, profound and widespread, and may persist for some time in the post-epidemic period. In this regard, experts believe that it is not easy to predict what will happen to the sports industry in the post-epidemic period, therefore, in the future, the sports business models will change significantly. Sports organisations will have changes in the content of personnel contracts and premiums due to the possibility of a recurrence of the crisis to support the activities of sports centers, athletes and staff [Guba et al., 2020]. Therefore, it is necessary to plan and implement accurate and specific planning to prevent possible damage.

4. Lack of government support for sports clubs and rising rental prices

One of the challenges that sports clubs faced, which was identified as a concept in interviews, was the lack of government support. The prevalence of coronary heart disease in the world has highlighted the role of governments in supporting the economy, but given the limited resources, support must be provided to have the greatest impact on controlling economic

Table 2
Concepts and final codes

	Concepts	Final codes
1	Lack of government support for sports clubs	Special conditions, neglect of clubs, privatisation, financial support, private sponsor, government, government budget
2	Rising rental prices due to economic inflation	Economic inflation with the advent of coronavirus, rents, declining liquidity, the cost of maintaining sports venues, declining incomes, membership fees
3	Reduced activity of sports clubs	Registration of sports club clients, athletes staying home, virtual sports, home sports, cancellation of membership, non-renewal of contracts
4	Reduced sponsorship	Lack of media coverage, lack of law to support clubs, framework less investment, non-renewal of contract, reduction of broadcasting rights, reduction of club capital
5	Mental consequences of coronavirus	Obligation to follow health protocols, cost of purchasing health items, compliance with standards, obsession with over-compliance and overpayment, fear of getting sick, fear of transmitting the virus, coronavirus phobia
6	Social media	Internet costs, increase of sports activities on the Internet, content production, online trainers, home sports, unlicensed activities, unlicensed training program, network marketing, traditional systems

losses. Therefore, the need for financial support from the government and even the private sector in order to reduce the economic damage caused by coronavirus to coaches and clubs is more felt, and operational steps must be taken in this regard [Piotrowski, Piotrowska, 2021]. The interviewers emphasised that the government and government agencies made only assumptions, and none of them were implemented. According to a government decree to protect tenants during the corona outbreak, no landlord has the right to increase rents by more than 25 percent in Tehran and 20 percent in other cities. The most important decision was that all contracts are extended for up to one year with the same price increase, and the landlord has no right to terminate. For many club managers, the biggest challenge has been renewing their contracts. To prevent possible injuries in the future, it is necessary to pass precise and clear rules in the field of club management. It is also necessary to determine how the government supports sports clubs in critical situations.

5. Reduced activity of sports clubs

Reducing the activity of small and entrepreneurial businesses was a challenging issue for sports club managers. One of the most important challenges for small businesses is access to cash. Running any business comes with risks. However, small businesses are very vulnerable. Only half of small businesses live more than five years. The costs of any business such as rent, salaries and utilities, especially in the early years, require a lot of liquidity. However, the decline in revenue from the coronavirus crisis should also be considered [Pietsch et al., 2022]. Considering the existence of a lot of sports clubs in the country, most of which are private clubs, the business and livelihood of coaches, assistant coaches, gym managers and service staff, etc. due to closure and lack of the realisation of the received fees are endangered. In the professional clubs section, there is a risk of canceling or modifying the contract with the sponsors and the related modification of the players' contracts. Most club managers rented venues or used loans to equip their clubs. Some of them only had a club job. Many clubs were closed due to increased rent. The high cost of following health protocols was also a reason for the decrease in the activity of clubs and the reduction of clients. This decline in activity due to the coronavirus crisis has caused great economic damage to clubs. However, these clubs do not have the necessary financial support or are not covered by insurance in critical situations [Hashimoto et al., 2021]. Therefore, it is necessary to design and implement programmes to prevent possible future damage.

6. Reduced sponsorship

In the sports and club industry, one of the most important issues is the existence of sponsors. In developed countries, the mechanisms of sponsors in the sports industry are well defined, and there are necessary laws and regulations regarding sponsors. This is while financial support in developing countries faces many challenges. The coronavirus crisis has complicated the situation of financial support. Sponsors can easily terminate their contracts. The lack of support from sponsors has caused irreparable damage to the club industry, and the future of this industry is still uncertain [Martino et al., 2021]. In this situation, sports clubs are trying to continue their activities and seek to attract new sponsors. Therefore, it is necessary to review the financial support infrastructure in the sports industry.

7. Mental consequences of coronavirus

Compliance with health protocols, cost of purchasing health items, adherence to standards, obsession and overpayment, fear of getting sick, fear of transmitting the virus, fear of the corona are some of the mental concerns about the corona pandemic crisis [Wright et al., 2021]. These cases have limited the conditions for athletes to attend sports clubs. On the other hand, with the decrease in the activity of athletes, the activity of clubs has also decreased, and this has caused many problems for the management of sports clubs, this is especially true in group sports [Di Cagno et al., 2020]. It is clear that traditional club systems do not respond to the situation and in similar circumstances cannot meet the relevant needs, so it is necessary to review and modify the previous mechanisms.

8. Social media

During the coronavirus pandemic, many restrictions were imposed, one of the most important restrictions being quarantine and homelessness in many countries, including Iran. Under these circumstances, the use of the Internet and social networks increased rapidly [Pacak, 2020]. School and university classes also went online, and the Internet usage in the country increased. In the field of business, many businesses offered their services online. In the sports industry, due to the closure of sports clubs, coaches used social networks to hold online sports classes. However, the necessary infrastructure to cover this volume of cyberspace was not enough, and there were many problems in connecting to the Internet and low Internet speed. On the other hand, the production of sports content on social networks increased and there was no specific reference to confirm the published information. Social media activity seems to be a major challenge to traditional club systems, with online systems rapidly expanding to meet existing needs. Therefore, the existing mechanisms in this field should be carefully considered, because traditional club management systems do not meet the existing needs.

In the current situation, sports clubs need to be flexible to survive in the new market conditions. Managers must use the ability of entrepreneurship, because entrepreneurship is considered essential in the economy and provides the impetus for economic growth. Entrepreneurship has traditionally been considered a purely economic factor, but this has changed with the acceptance of the necessity of the social forms of entrepreneurship [Ma et al., 2021]. Entrepreneurship is common in knowledge-based industries, new activities and technology-based sectors. Most research in the past decade in the field of entrepreneurship has focused on these areas and less on sports. However, some previous research has examined the relationship between sport and entrepreneurship [Ratten, Jones, 2021].

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Imitation strategies in entrepreneurship: Bibliometric analysis

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Abstract

The article presents the research results on the evolution of key patterns of scientific publications devoted to the use of imitation strategies by business entities. End of purpose was ensured by solving two interrelated tasks: first, to form a relevant sample of scientific articles (2,302 publications on selected topic, indexed by the Scopus scientometric database, for the period from 1992 to 2022); secondly, to analyse the co-occurrence of keywords to characterise the current state of the research field and determining the perspective of its development. The terms “imitation strategy, innovation” or “innovation, imitation, strategy” were chosen as keywords. The bibliometric analysis and visualisation of its results were performed using the VOSviewer software product. On the basis of visualisation maps, five clusters of the content matching of keywords in articles and five stages of the evolutionary development of innovative behavior of enterprises were identified. The results of the research can be used in studying various aspects of the implementation the imitation strategies by business entities.

Keywords: imitation, innovation, strategy, entrepreneurship, bibliometric analysis.

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商业中的模仿战略：文献计量分析

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摘要

本文介绍关于企业行为者使用模仿战略的科学出版物主要模式演变的研究结果。两个相互关联的目标有助于实现这一目标：以确定研究领域的现状和当前趋势的特点，制定了相关的科学文章样本（1992–2022 年被 Scopus 引文数据库索引的2302篇出版物） 以及进行了对关键词的相合分析。“模仿战略、创新”或“创新、模仿、战略”的组合被选择作为关键词。文献计量分析和其结果的形象化是使用 VOSviewer 软件产品进行的。 基于形象化根据文章中的意义关键词匹配，确定了五个集群。以及企业创新行为的问题范围的发展五个阶段。结果可用于研究企业实体实施模仿战略的不同方面。

关键词：模仿、创新、战略、企业经营、文献计量分析。

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Introduction

The strategic impact of innovation activity on individual enterprises, industries and the economy as a whole is undeniable, which is confirmed by the constantly growing volume of publications. Today, both scientists and practitioners [Meshkov et al., 2021; Innovative environment for business..., 2022; Kravchenko, 2022a; 2022b] consider innovation to be an important source of competitive advantage, ensuring not only, and sometimes not so much, the sustainable development of business entities but also the quality and possibility of their continued existence. At the same time, in the last decade more and more studies have appeared showing that imitation as an attempt to reproduce a part or a whole also effectively allows business entities to obtain valuable and fairly stable opportunities for competitive advantage [Rivkin, 2000; Linder, 2020; Trachuk, Linder, 2022]. It is obvious that over time the emphasis in scientific publications changes, the content characteristics of innovation and imitation are transformed and intertwined, but their fusion (relationship) in one formula of success, which some researchers call 'imovation' [Shenkar, 2015; Wu et al., 2020; Scuotto et al., 2022], is not focused on.

Considering the importance of ensuring sustainable competitive advantages in the aggressively turbulent conditions of the modern external environment, the problems of analysing the characteristics of the development of innovative behaviour in entrepreneurial activity are relevant and deserve special attention. The purpose of the article is to characterise the development of the main patterns of scientific publications devoted to the use of imitation strategies by business entities.

1. Research methodology

The analysis of scientific articles on innovative behaviour in entrepreneurship was carried out in several stages. In the first stage, periods of high publication activity on the subject under study were identified in the scientometric database Scopus in order to construct a relevant data sample. The title, abstract and keywords were chosen as the basic patterns of scientific publications. The search query included the following combinations: 'imitation strategy, innovation' or 'innovation, imitation, strategy' (with different endings). The study covers publications in the Scopus database from 1992 to 10 December 2022. Based on the results of the first stage, 3397 publications were selected.

In the second stage, the subject area of the initial sample was clarified - scientific articles in the following publication areas of Scopus publications were selected for further analysis: business, management and accounting; social and human sciences; economics, econometrics and finance; the science of decision making. In this way, the sample size was reduced to 2302 publications, while respecting the principle of representativeness of the data analysed.

The third step is a bibliometric analysis of the generated sample of publications, using the software product VOSviewer v.1.6.18, in order to identify existing promising areas for the study of innovation and imitation problems. The use of this tool made it possible to create neural network visualisation maps of keyword matches that identify areas of research on innovative behaviour in entrepreneurial activity. Note that the size of the circle on the visualisation map is responsible for the frequency of occurrence of the element in the considered publications, while its colour is responsible for belonging to a certain cluster. The strength of the connection between elements is characterised by the length of the line between them (a longer line indicates a weaker connection between two elements).

2. Research findings

Over the last thirty years - since 1992 - there has been a steady increase in publications on the use of imitation strategies in the implementation of innovation activities by firms (Figure 1). From January to the first ten days of December 2022, 137 articles were published in the Scopus database on the subject under study, which indicates its relevance and, accordingly, the growing interest of researchers in this area. This trend is due to the importance of sustainable scientific, technological and innovative development for the economy of any country, especially in the face of aggressive competition, disruption of supply chains and partnerships, including in the field of R&D. The latter has to a large extent updated and taken to a new level the issue of the active use of imitation strategies.

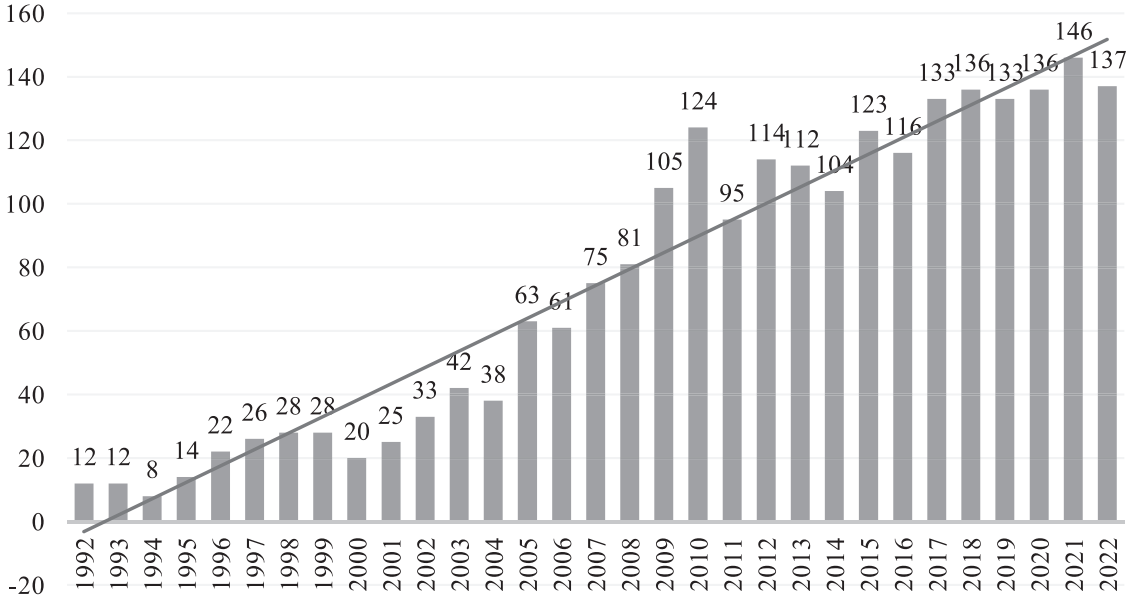
2.1. Most cited publications

Based on the metadata of the scientific papers included in the generated sample, a rating was made using the software product VOSviewer - the top 5 most cited publications in the scientometric database Scopus for the period from 1992 to December 2022 (Table 1).

The most cited paper (more than 17 thousand citations) is 'Dynamic opportunities and strategic management' by D. Teece, G. Pisano and E. Shuen [Teece et al., 1997]. In this paper, attention is drawn to the fact that the creation of private capital in regimes of rapid technological change largely depends on the refinement of the firm's internal technological, organisational and managerial processes, including the ability to reproduce and imitate innovations that enter the market and are in demand. The authors conclude that it is necessary to synthesise research in the fields of strategy, innovation, production, organisational behaviour and business history in order to study the factors underlying firm and national competitive advantage.

The second most cited paper was Local Learning and Industrial Competitiveness [Maskell and Malmberg, 1999], which suggests that changes in the international economy

Fig. 1. Dynamics of publications devoted to the imitation strategies in entrepreneurial activity



Source: compiled by the authors using the Scopus database.

are gradually shifting the basis of industrial competitiveness from static price competition to dynamic improvement, favouring firms that can create knowledge faster than their competitors. In the publication of the same title, the authors argue that proximity between firms plays an important role in interactive learning processes and that knowledge creation is supported by the institutionalisation of tacit knowledge useful for certain activities. Sustained competitiveness requires the constant replacement of obsolete resources, the rebuilding of obsolete structures and the renewal of economically important national or regional institutions, as imitation gradually transforms local capabilities into global ubiquitous capabilities.

The next most cited publication is 'Competing with Opportunities: New Rules for Corporate Strategy' [Stalk et al., 1992], where the authors write that a company's success in the marketplace depends on anticipating trends and responding quickly to changing customer needs. In such an environment, the essence of strategy lies not in the structure of the firm's products and markets, but in the dynamics of its behaviour. Scholars conclude that to be successful, a company must transform its core business processes into hard-to-imitate strategic opportunities that differentiate it from competitors in the eyes of customers.

The paper by K. Zhu and K.L. Kremer [Zhu, Kraemer, 2005] is the most cited, with 1059 citations. The results of this study show that technological competence, firm size, financial commitment, competitive pressure and regulatory support are important preconditions for the functioning of e-business. In addition, the authors argue that internal integration has the strongest impact on the value of e-business. This is consistent with the resource theory of the organisation, since internal integration has value-creating resource characteristics (e.g. firm-specific, difficult to imitate by competitors).

The last publication in the rating in Table. 1 – the article 'Crisis construction and organisational learning: capacity building in the catching-up Hyundai Motor' [Kim, 1998]. The author states that effective organisational learning requires a high absorptive capacity, which consists of two main elements: a prior knowledge base and effort intensity. Describing the experience of the implementation of the strategy of independence in the development of the absorptive capacity of Hyundai Motor Company, the researcher comes to the conclusion that in the process of moving from one stage to another through the preparation and acquisition, development and improvement of foreign technologies, the company received migratory knowledge, which allowed it to expand its prior knowledge base, and actively created crises as a strategic means to intensify its learning efforts. The author concludes that, unlike external crises, proactively designed internal crises shift the learning orientation from imitation to innovation and increase the intensity of organisational learning efforts.

2.2. Keyword analysis of publications

Based on the results of the bibliometric analysis carried out with the software product VOSviewer, a terminological map was created that shows the existing relationships between

Table 1
Top-5 most cited publications in the Scopus scientometric database (within the study sample for 1992–2022)

№	Authors, year	Title	Number of citations	Journal
1	Teece D.J., Pisano G., Shuen A., 1997	Dynamic capabilities and strategic management	17 029	*Strategic Management Journal*
2	Maskell P., Malmberg A., 1999	Localised learning and industrial competitiveness	1457	*Cambridge Journal of Economics*
3	Stalk G., Evans P., Shulman L.E., 1992	Competing on capabilities: The new rules of corporate strategy	1143	*Harvard Business Review*
4	Zhu K., Kraemer K.L., 2005	Post-adoption variations in usage and value of e-business by organizations: Cross-country evidence from the retail industry	1059	*Information Systems Research*
5	Kim L., 1998	Crisis construction and organizational learning: Capability building in catching-up at Hyundai Motor	675	*Organization Science*

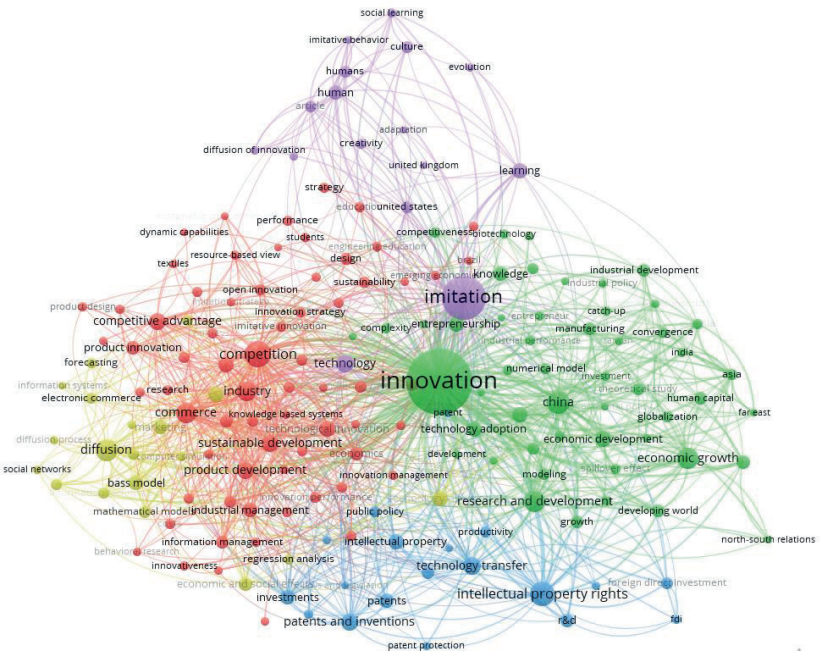
Source: Compiled by the authors on the basis of the Scopus database.

keywords and phrases used in publications. The resulting map makes it possible to identify the main clusters in which publications on the use of imitation strategies by firms can be distributed. In general, based on the analysis of keyword matches, five clusters were identified in the work (Fig. 2).

The first cluster (red colour) contains the largest number of terms - 68 elements, among which the following can be distinguished 'industry', 'trade', 'sustainable development', 'competitive advantage', 'technological innovation', 'product development', 'product innovation', 'strategy', 'dynamic opportunities', 'industrial management', 'industrial economy', 'imitation strategy', 'production', 'efficiency'. Separately, the keyword 'competition' should be mentioned, the frequency of sharing in the sample studied is 104 and the strength of the connection is 444. This cluster therefore mainly covers aspects of technological support for the innovation strategy (the relationship between innovation and imitation) in order to achieve the organisation's competitive advantages. In this sense, the cluster can be called 'Technological innovation and imitation strategy in the context of increasing the company's competitiveness'.

The second cluster (green colour, 51 elements) combines the terms such as 'innovation', 'research and development', 'knowledge', 'economic growth', 'endogenous growth', 'simulation', 'technology borrowing', 'developing countries', 'globalisation', 'entrepreneurship', 'convergence', 'market conditions'. In this cluster, the keyword 'innovation' has the highest frequency of sharing - 634, while the strength of communication is 2000. Thus, the content of the formed cluster can be characterised by the

Fig. 2. A terminological map of categories with the highest frequency of occurrence in publications on imitation strategies in the activity of enterprises



Source: created by the authors from the Scopus database using VOSviewer v.1.6.18.

name ‘Innovations as a way of convergence of the world economies’.

The third cluster (blue colour, 19 items) describes the relationship between imitation strategies and innovation in the firm’s activities in the context of the following concepts: ‘patent’, ‘intellectual property rights’, ‘foreign direct investment’, ‘government policy’, ‘investment’ and others. The main key term in this cluster is ‘intellectual property rights’, the frequency of which in the sample of scientific publications studied is 88, and the strength of communication is 326. The name of the cluster ‘Legal aspects of ensuring the implementation of imitation strategies when introducing innovations’ seems logical.

The fourth cluster (yellow, 19 elements) is associated with the following terms: ‘diffusion of innovation’, ‘Bass diffusion model’, ‘regression analysis’, ‘decision making’, ‘computer simulation’, ‘game theory’, ‘forecasting’, ‘social network’. The highest frequency of sharing - 72 - has the keyword ‘diffusion’, while the strength of the connection is 268. The content of this cluster can be characterised by the name ‘Information and communication aspects of diffusion of innovations’.

The fifth cluster (violet colour, 16 elements) includes the following categories ‘imitation’, ‘technology’, ‘creativity’, ‘human’, ‘adaptation’, ‘learning’, ‘imitative behaviour’, ‘culture’, etc. The frequency of common use of the keyword ‘imitation’ in the cluster is 279 and the strength of the connection is 821. The name reflecting the content of this cluster can be formulated as ‘Personnel aspects of the implementation of the simulation strategy in the company’s activities’.

The obtained results indicate, on the one hand, the relevance and multidimensionality of the issues of formation of effective innovative behaviour of business entities, since their high occurrence in various studies is observed, and, on the other hand, their interdependence due to the presence of numerous links between key terms.

2.3. Evolution of thematic research areas

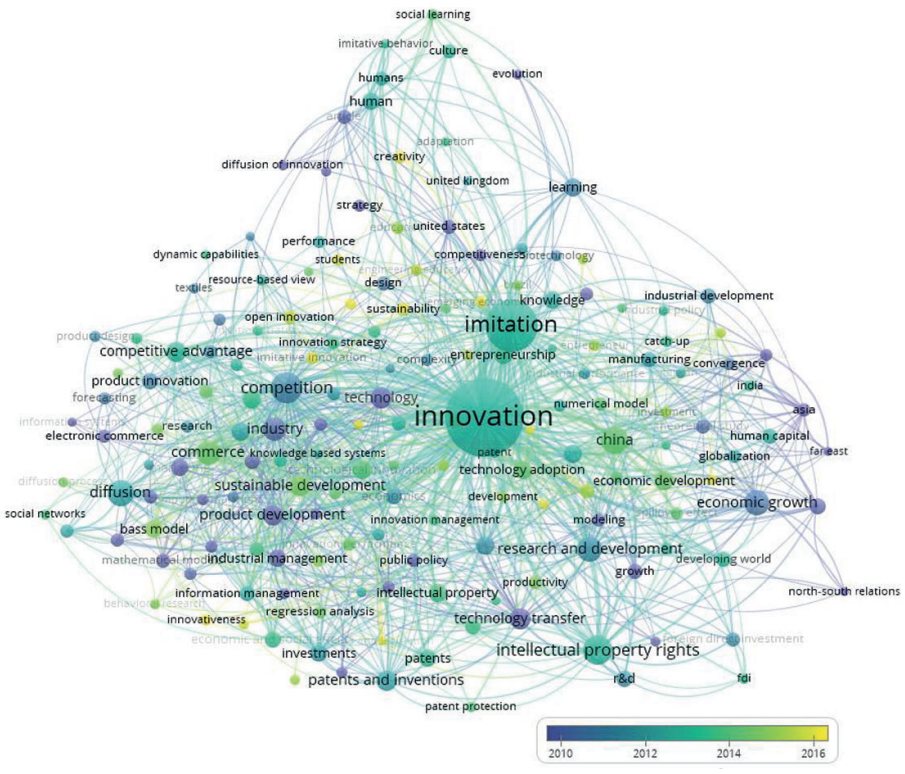
Based on the results of the bibliometric analysis in the evolutionary time dimension, it can be noted that there are five most significant stages in the development of scientific research on the implementation of imitation strategies when introducing innovations in the firm (Fig. 3).

The first stage of development can be observed until 2010, when the dominant keywords in researchers’ publications were ‘technology transfer’, ‘industrial management’, ‘product development’, ‘strategy’, ‘marketing’, ‘growth’. During this period, for example, the work described above [Teece et al., 1997] was published, which emphasises the need for a synthesis of research in the fields of strategy, innovation and imitation, production, organisational behaviour and business history in order to study the factors underlying firm and national competitive advantage.

In the second phase - from 2010 to 2012 - the focus of research shifted to the concepts of ‘innovation’, ‘imitation’, ‘research and development’, ‘diffusion of technology’, ‘competition’, ‘economic growth’, ‘patents and inventions’, ‘globalisation’. For example, the publication [Naranjo-Valencia et al., 2011], which is devoted to the analysis of organisational culture in terms of its favouring or hindering organisational innovation and imitation strategy, has a significant number of citations. The authors conclude that, depending on their orientation (to be the first to enter new markets or to develop new products for the market or to follow the pioneer), companies should promote different values and norms in their organisations.

From 2012 to 2014, i.e. in the third phase of the highlighted ones, the dominant keywords were ‘intellectual

Fig. 3. A visualisation map of the evolving relationship between the main aspects of the implementing imitation strategies



Source: constructed by the authors on the basis of the Scopus database using VOSviewer v.1.6.18.

property', 'intellectual property rights', 'innovation management', 'patent protection', 'knowledge management', 'entrepreneurship', 'technological innovation'. A popular (highly cited) paper from this period is [Andries, Faems, 2013], which shows the impact of patenting on licensing, innovation and financial results for both small and large companies. It is hypothesised that small and medium-sized enterprises (SMEs) benefit less from patenting activity in terms of protection from imitators than large firms. At the same time, the propensity and ability of SMEs to license their patents and generate additional revenue streams may be relatively higher than that of large firms. Contrary to expectations, the authors' study shows that not only large firms but also SMEs benefit from patenting in terms of commercialising innovative products.

The fourth phase - from 2014 to 2016 - is characterised by the predominance of the terms 'sustainable development', 'technology borrowing', 'life cycle', 'empirical analysis', 'social learning', 'catching up', 'behavioural research', 'open innovation'. For example, in their work [Revilla, Knoppen, 2015], E. Revilla and D. Knoppen explore the impact of knowledge integration in terms of joint decision-making and joint thinking on the effectiveness of relationships, including operational efficiency and innovation. The authors emphasise the need to create the ability to dynamically integrate knowledge (valuable, rare and difficult to imitate).

The final, fifth stage started after 2016. The main terms in the research were 'emerging economies', 'business model of innovation', 'imitation innovation', 'creativity', 'management approach', 'small and medium enterprises', 'policy definition'. For example, one of the most cited papers is a publication by a team of authors led by Yu. Zhao [Zhao et al., 2020], which analyses the evolution of platform business models. The authors conclude that success in platform battles is plausibly due to a combination of the complexity of business model design and the simultaneous use of innovation and imitation to create complex action systems. In another publication typical of the period [Chen, Dimitrov, 2017], the authors explore the nature of eco-innovations, aspects of their licensing and imitation. The results obtained allow the authors to conclude that an eco-innovator may lose its competitive advantage when licensing an innovative product; in addition, licensing may lead to an increase in the number of imitations.

Summarising the results of the bibliometric analysis in the evolutionary-temporal dimension it should be noted that there is a pronounced shift in emphasis in scientific publications - the transformation and interweaving of the content characteristics of innovations and imitations.

Conclusion

The bibliometric analysis of the main patterns of scientific publications on the subject of imaginative strategies in entrepreneurial activity over the last thirty years has made it possible to identify and characterise five clusters according to the content match of the keywords in articles studied, as well as to determine the five most significant stages in the development of scientific research on the subject under consideration.

The results from the analysis of the scientific articles indexed by the Scopus scientometric database as well as the terminological maps of the categories constructed and the most significant keywords related to the problems of innovation, allow us, on the one hand, to note the relevance and multidimensionality of the field studied. To this end, here are numerous links between as well as their high occurrence in different studies). On the other hand, they allow us to trace the shift of emphasis in scientific publications from traditional approaches to the use of imitation strategies in the implementation of innovative projects by enterprises (the first – the third stages) to an increase in the importance of environmentally and anthropocentrically oriented development of business entities as well as an increase in the importance of tools, technologies and business models for the introduction of innovations (the fourth – the fifth stages).

The obtained results characterise the current state and direction of research in the sphere of problems of imaginative behaviour of enterprises, which makes it possible to determine the key aspects of ensuring their effective functioning in modern economic conditions, as well as to get a better idea of the formation of new trends.

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The analysis of methodological integrity in the operational risk management of modern banks

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Abstract

The aim of the article is to study the importance of maintaining methodological integrity in the operational risk management framework in Russian credit institutions. To reach the goal, an analysis of practical approaches to operational risk management is carried out, opportunities for optimising equity capital are presented. The major needs the credit institutions will face due to the transition of operational risk calculation to a new standardised approach are analysed. The significance of a systematic approach in operational risk management applied by credit institutions is determined.

The paper systematises modern factors that influence operational risk management, and applies the author's approach to calculating operational risk exposure indicators. The author's approach is based on an item-by-item analysing the ratio of the amount of operational risk losses to the amount of expenses for applying operational risk management methods.

The scientific novelty of the research consists of highlighting the main practical approaches to managing bank risks in the context of digitalisation and development of financial technologies.

The article formulates key trends in operational risk management in commercial banks and presents ways to solve problems caused by the use of operational risk management methods that will improve methodological process of bank risk management.

The practical significance of the article is to reflect the need and importance of adequate methodological process of banking risk management and the presentation of practical recommendations aimed at improving the quality of the risk management system and risk culture in general. It can be applied in the work of risk management department and internal control department.

Keywords: credit institutions, methodological integrity, operational risks, operational risk exposure, banking risk management system.

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管理现代银行运营风险的方法完整性保证之分析

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摘要

这篇文章的目标是调查在俄罗斯信贷机构运营风险管理的方法完整性保证之重要性。为了实现这一目标对营风险管理的实际方法进行了分析，以及提出了自己资本的优化机会。分析了信贷机构在向新的标准化方法下的运营风险计算过渡的过程中会面临的主要需求。信贷机构采取系统的运营风险管理方法的重要性已确定。

本文章使当前影响营运风险管理的因素系统化。作者运用了自己的计算受到营运风险程度指标的方法，基于对营运风险损失与应用营运风险管理技术的成本的比率的逐条分析。

这项研究的科学创新之处于在经济数字化和金融技术发展的背景下确定了银行风险管理的主要实践方法。

本文章阐述了商业银行营运风险管理过程中出现的关键问题，并提出了处理该问题用营运风险管理技术的方法，这将改善银行风险管理方法过程的组织。本文章的实际意义在于它反映了充分提供管理银行风险的方法过程的需要。本文章还为提高风险管理系统和一般风险文化的质量提供了切实可行的建议，这些建议可适用于风险管理和内部控制部门。

关键词：信贷机构、方法完整性、营运风险、受到营运风险程度、银行风险管理制度。

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Introduction

The use of financial technologies in the banking sector is accompanied by a high probability of various risks, in particular, operational risks. On 8 April 2010, the Central Bank of the Russian Federation (hereinafter referred to as the CBR) adopted Regulation No. 716-P 'On Requirements for the Operational Risk Management System in a Credit Institution and a Banking Group'. It expanded the definition of operational risk from the imperfection of internal banking business processes to the actions of personnel, failures and shortcomings of information, technological and other systems functioning in credit institutions.

As a result, the risk of information security and the risk of information systems have become one of the key components of operational risk. The creation of this regulatory document by the Central Bank of the Russian Federation made it possible to form an integrated approach to the management of operational risks. According to the author, it is a significant step in the implementation of a qualitative analysis of banking business processes and the current methodological support for the management of operational risks in terms of formalising or updating the tools used in the operational risk management process.

Methodological documents of banking risk management used by credit institutions are one of the key elements of the business process and strategic business model of the bank, aimed at ensuring high efficiency of decision-making in the hierarchical structure of risk management in banking.

Taking into account the close relationship between market and credit risks and operational risks that includes the cumulative negative impact of operational risks on banking risks in general and the criticality of incurring losses that affect the stability of a credit institution [Kuznetsova, 2012], the author of this paper focuses on the management of operational risks in Russian credit institutions. The relevance of the research topic lies in the intensification of the use of financial technologies in the activities of commercial banks, the modernisation of banking business models and risk management models, the development of innovative methodological support for banking risk management in the context of digitalising the activities of credit institutions.

As the main method of reducing operational risk, Russian researchers highlight qualitative methodological justification presented in the form of approved internal rules and procedures for banking operations to minimise the likelihood of negative consequences of operational risk. It provides for setting limits for banking activities; separation of powers for ongoing operations; risk transfer to third parties; risk insurance; development of a system of measures to ensure the continuity and restoration of the activities of credit institutions [Ilyina, 2022].

The purpose of the study is to determine the importance of maintaining methodological integrity in the process of managing operational risks, to determine the adequacy of resources allocated by credit institutions for measures to improve methodological support in the process of managing operational risks.

The article focuses on credit institutions in the Russian Federation. The study aims to provide methodological support for the management of operational risk in commercial banks.

The author used the works of Russian scientists on the subject of banking risk management, in particular, operational risk. In addition, statistical and analytical data from the published financial statements of commercial banks, presented on the official website of the Central Bank of the Russian Federation, were used in the calculation part. The methodological basis of the study consisted of general scientific methods: analysis, synthesis, induction, deduction and generalisation of the obtained results.

The author carried out an item-by-item analysis of the ratio of operational risk losses to the amount of expenses allocated to their management for a group of credit institutions with a

basic licence and the largest amount of assets. The author's approach to the analysis of indicators made it possible to obtain a more structured picture of the measures taken by commercial banks to manage operational risks.

1. Description of the research methodology

This study is based on the analysis and evaluation of operational risk management in the banks of the Russian Federation in the following two directions.

The first direction is the analysis of the main practical approaches used by banks to calculate the amount of capital reserved for operational risk. The author provides analytical data on the compliance of credit institutions with the requirements and deadlines for implementation of the Regulation of the Central Bank of the Russian Federation dated 7 December 2020 No. 744-P. These are the results of a questionnaire survey conducted by the British auditing and consulting company Ernst & Young in cooperation with the Association of Banks of Russia.

The respondents to the survey were heads of risk management services of 52 commercial banks (of which 15% of banks were part of a foreign banking group).

The article highlights the main needs that credit institutions will face in the process of transition to compliance with the requirements of Regulation No. 744-P, such as ensuring the quality and availability of information data and other vulnerabilities.

The second direction is assessing the level of operational risk by conducting an analysis of operational risk exposure (an indicator of operational risk to equity), as well as taking into account the actual losses incurred by 15 commercial banks with a basic licence, selected by the largest amount of assets. The financial statements of credit institutions published on the official website of the Central Bank of the Russian Federation were used as information data. Among them are a balance sheet - form 0409806, a report on the level of capital adequacy to cover risks - form 0409808, information on mandatory ratios, financial leverage and short-term liquidity ratio for reporting periods - form 0409813 at the end of the following periods: 01.01.2019, 01.01.2020, 01.01.2021.

As part of the second direction, in order to analyse the trends in expenses allocated to the management of operational risks, the author analyses the main items in the balance sheet of the profit and loss account (form 0409102) related to the management of operational risks for three reporting years - 2019, 2020 and 2021. This makes it possible to assess how effective commercial banks are in financing operational risk management methods.

It is clear that credit institutions must give priority to maintaining the methodological integrity and relevance of internal bank risk management documents. In addition, the version of Regulation No. 716-P provides for the responsibility of commercial banks for the quality and mandatory management of information security risks and information systems risks as the main components of operational risks that affect capital adequacy.

This study allows us to identify and systematise the main approaches of modern banks to risk management in the context of the development of financial technologies, as well as the main problems that arise in the process of managing banks' operational risks. The directions for solving the problems identified by the author due to the use of methods of operational risk management will improve the organisation of the methodological process in the practical activities of credit institutions.

2. Modern approaches to operational risk management in credit institutions

One of the first references to the need for operational risk management was made in Letter of the Central Bank of the Russian Federation dated 23 June 2004 No. 70-T 'On Typical Banking Risks' and Letter of the Central Bank of the Russian Federation dated 24 May 2005 No. 76-T 'On Organisation of Operational Risk Management in Credit Institutions'. The term 'operational risk' presented in these documents reveals its essence in full, and if we take into account the Regulation of the Central Bank of the Russian Federation No. 716-P 'On Requirements for the Operational Risk Management System in a Credit Institution', there is ambiguity as to which of the definitions of operational risk is the main one.

In the Regulation of the Central Bank of the Russian Federation No. 716-P, which came into force in 2020, the structure of operational risk was supplemented by the risk of information security and the risk of information systems, while previously operational risk included only legal risk. The study of problems caused by the identification of operational risk and its subsequent quantitative assessment was reflected in scientific works of previous years, for example, in [Filippov, 2015]. The author of this article concludes that the issue of operational risk identification remains relevant against the background of the growing role of financial technologies in the conduct of daily banking activities.

In the Regulation of the Central Bank of the Russian Federation No. 716-P, the supervisory authority determines the mandatory application of uniform requirements for the management of operational risk, in addition to creating favourable conditions for the timely identification of operational risks and the response of credit institutions to offset probable financial losses. The article concludes that important and significant work is being carried out by credit institutions to analyse current business processes and applicable methodological standards, as well as to develop modern management tools and to implement automated solutions as part of operational risk management. Nevertheless, it requires certain financial and time resources.

Having examined the approaches proposed by the Basel Committee on Banking Supervision for calculating the amount of capital reserved for operational risk, we can

identify the main shortcomings in the application of each of the three approaches:

1. When applying the basic indicative approach, researchers focus on a similar amount of operational risk with an equivalent return, including the absence of the need to form reserves for possible losses [Pokrovsky, 2011]. For his part, the author of this work notes that the estimated value of capital is overestimated in comparison with the current practical activities of a commercial bank due to the fact that the losses actually incurred by a credit institution are not taken into account.
2. When applying the standardised approach, the author shares the opinion of academics regarding the underestimation of the amount of capital required to cover operational risks. Some studies also focus on the accuracy of calculations obtained using this approach [Gushan, 2021]. They do not take into account the degree of control over operational risks that occurred in the previous reporting period [Pokrovsky, 2011; Kartukhin, 2015].
3. When applying the improved approach, Russian researchers noted certain difficulties caused by its cost and the need to use expert analysis as part of the continuous updating of the base of operational risk events, taking into account their qualitative characteristics due to the specificity of the bank's financial losses [Pokrovsky, 2011].

In [Manuilenko, 2011], which examines the approaches to calculating the capital allocated to operational risk proposed by the Basel Committee on Banking Supervision, it is emphasised that the values obtained in the calculations for all three approaches do not differ significantly.

In 2021, the Central Bank of the Russian Federation developed Regulation No. 744-P, according to which the amount of operational risk will be calculated according to a new standardised approach using the internal loss ratio. Compliance with this requirement will be mandatory from 1 January 2023 for credit institutions with a universal licence. At the same time commercial banks with a basic banking licence will have an option to perform calculations in accordance with the Decision of the Central Bank of the Russian Federation No. 744-P on the Implementation of the Calculation of Operational Risk in Accordance with Regulation of the Central Bank of the Russian Federation No. 744.

Ernst & Young audit and consulting company, together with the Association of Russian Banks, conducted a survey on the compliance of credit institutions with the requirements and deadlines for implementation of the Regulation of the Central Bank of the Russian Federation No. 744-P in 2021.

Heads of risk management departments of 52 credit institutions participated in the survey: 64% of them were private banks, 19% - banks with the share of state capital over 50%, 17% - with the share of foreign capital over 50%. The shares of the studied commercial banks were distributed as follows: 27% - banks with assets over 750 billion roubles, 17% - banks with assets from 500 to 750 billion roubles, 22% - banks with assets from 50 to 500 billion roubles, 22% - banks with assets from 10 to 50 billion roubles and 12% - banks with assets not exceeding 10 billion roubles.

Based on the results of the questionnaire survey, 13% of credit institutions set the dates for the transition to the calculation of operational risk according to the New Approach as 2023-2025, for 30% of respondents the transition dates vary between 2025 and 2027. At the same time, 25% of respondents indicated that they do not plan to make the transition. 34% of credit institutions assessed the potential impact, of which 24% of credit institutions expect an additional effect on the amount of capital reserved for operational risk of up to 10%; 10% of credit institutions expect an additional optimisation effect of more than 10% [implementation of requirements 716-P.., 2021]. The opportunities for banks to optimise their operational risk capital as a result of the introduction of new regulatory requirements are shown in Figure 1.

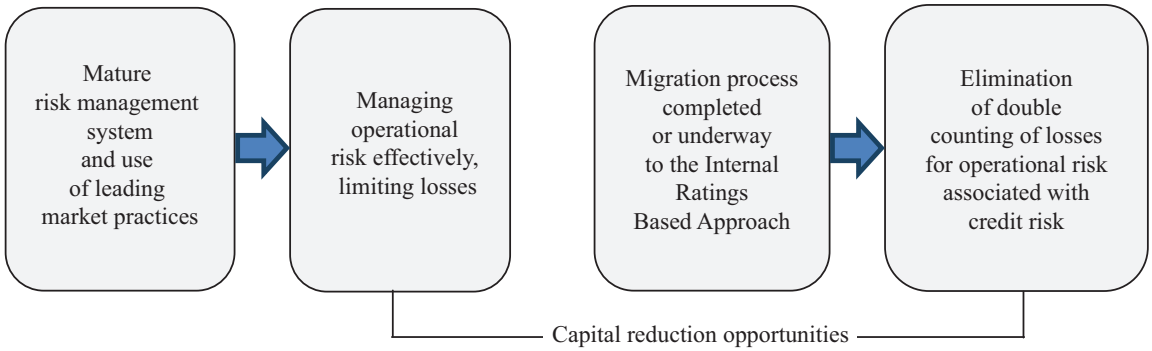
One of the main differences of the developed approach is the calculation of the capital required to cover operational risk based on the level of actual losses due to operational risks that have occurred. It is assumed that savings in the amount of capital required to cover operational risks are due to the calculation of the actual level of financial losses. In addition, the volatility of the calculation multiplier gives commercial banks more opportunities for capital management. It should be emphasised that the implementation of calculations according to this approach will allow medium and small credit institutions to reduce the burden on capital, including the capital buffer.

It is important to note the existence of certain types of problems that credit institutions will face in the process of implementing the requirements of Regulation No. 744-P, such as the completeness, reliability and timeliness of the information in the operational risk database (Fig. 2).

According to the results of a questionnaire survey, ensuring the quality and availability of information data is the most demanded by credit institutions with assets over 500 billion rubles when implementing the transition to a new standardised approach in the process of implementing the requirements of Regulation of the Central Bank of the Russian Federation No. 744-P. At the same time, credit institutions with assets of less than 100 billion roubles are most interested in providing quality accounting.

Summarising the results, we can emphasise the importance of applying a systematic approach by credit institutions in the process of managing operational risks, more precisely, in terms of initiating automation of the process of managing operational risks. This will improve the quality of the analysis of operational risk events, reduce the subsequent financial burden on the bank associated with the collection and systematisation of operational risk

Fig. 1. Opportunities for optimising equity capital for credit institutions according to new valuation standards



Source: compiled by the author on the basis of [Implementation of Requirements 716-P..., 2021].

information, and minimise or eliminate the occurrence of grey areas that contribute to the emergence of explicit and implicit operational risks.

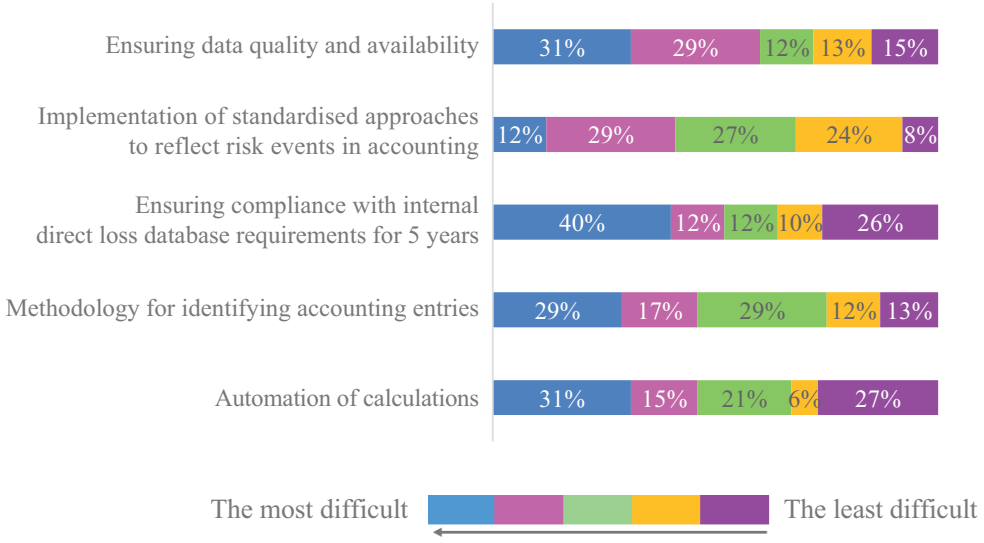
Automated systems for the management of operational risks contribute to their qualitative and quantitative assessment, followed by the prompt extraction of information in order to respond in a timely manner at a given hierarchical management level. It should be noted, however, that unlike systemically important and large credit institutions, medium and small commercial banks, which directly include credit institutions with a basic licence, do not have the opportunity to acquire automated information systems.

This study uses data from 15 credit institutions with a basic licence (by the largest amount of assets as of 1 January 2021), obtained from the official website of the Central Bank of the Russian Federation. Their selection is based on the fact that commercial banks with a basic licence in some cases have an adequate level of capital adequacy compared to the minimum requirements of the Bank of Russia, and in other cases have a significant number of problems caused by external factors of market conditions. The high proportion of unprofitable banks with a basic licence, accompanied by low profitability and problems with capitalisation, indicates a fundamental weakness in the business models of banks [Economics and banks.., 2020].

It can be assumed that a certain degree of inefficiency of the operational risk management system, accompanied by a high level of financial losses due to operational risk events, is due to the inadequate strategic orientation of commercial banks to maintain positions in the financial market.

A similar study was conducted by I.A. Yankina and E.E. Debt for systemically important and large banks [Yankina, Dolgova, 2016]. It is necessary to emphasise the structure and practical significance of the methods used by these authors, while I would like to complement existing studies in the following aspects.

Fig. 2. The credit institutions' demands in implementing the Regulation of the Central Bank of the Russian Federation No 744-P



Source: compiled by the author on the basis of [Implementation of requirements 716-P.., 2021].

Let us first analyse the exposure of commercial banks with a basic licence to the operational risk of credit institutions (Table 1). The amount of operational risk is calculated using the basic indicative method. It is necessary to note certain limitations in the scope of the study due to the non-disclosure of financial statements of Russian commercial banks since March 2022.

A peculiarity of the analysis is that it uses the financial indicators of commercial banks as of 01.01.2021, which developed under the influence of the pandemic, international sanctions, the development of the digital economy and the introduction of financial technologies.

The exposure of the analysed credit institutions to operational risk is considered significant. In seven out of fifteen credit institutions, the ratio of operational risk to equity significantly exceeded the value of the economic standard CAR.

Statistical calculations confirm the idea about the imperfection of the applied basic indicative method of assessing operational risk, accompanied by inefficient management of operational risk [Sokolinskaya, Nikandrov, 2019], and the fact that in the context of improving financial indicators characterising the reliability of a bank's activities, operational risk increases when applying the basic assessment method.

Second, operational risk is measured in terms of financial losses actually incurred. In the column 'Operational risk (the ratio of operational risk costs to capital)', Table. 1, the amount of operational risk is calculated according to the data obtained from the statement of financial results (form 0409102) as on 1 January 2021.

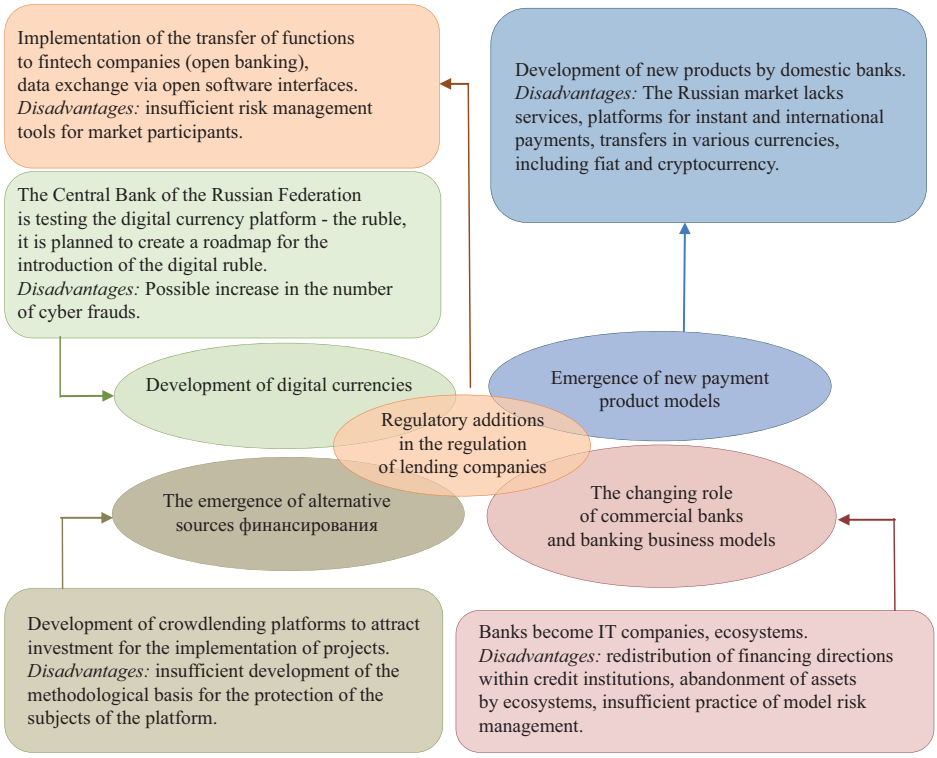
Contrary to the values obtained as a result of the calculation using the basic method, the value of operational risk for credit institutions varied from 0.01% to 2.7%. The operational risk for the period analysed can be considered acceptable. However, the amount of operating expenses incurred by Kamkombank, LLC in the analysed period was different. Taking into account the indicator of Kamkombank's exposure to operational risk, the assumption of an inefficient system of operational risk management, expressed in significant one-time losses due to inadequate activity of the organisation in the financial market, was confirmed.

Table 1
Operational risk exposure of banks with a basic license as of 01.01.2021

Bank	Value of OR (thousand rubles)	Equity capital (thousand rubles)	Exposure to OR (%)	CAR, (min. 8%) (%)	Total expenses for OR (thousand rubles)	OR (ratio of expenditures on OR to equity capital) (%)
LLC PTB	110 332	986 430	11.18	14.2	2584	0.3
JSC 'Black Sea Bank for Development and Reconstruction'	83 753	398 680	21.01	17.25	4383	1.1
'Kuznetsky Bank' Public JSC	80 136	622 964	12.86	13.8	1225	0.2
Public JSC 'Stavropolpromstroybank'	127 288	931 178	13.67	14.48	13 922	1.5
LLC 'Oranzhevyy'	92 873	709 371	13.09	10.55	429	0.1
JS Investment Commercial Bank 'Eniseisk United Bank'	78 554	552 382	14.22	11.13	3222	0.6
JSC 'Avtogradbank'	83 747	840 468	9.96	11.98	22 338	2.7
JSC 'Royal Credit Bank'	59 172	561 277	10.54	14.28	1218	0.2
Public JSC 'Bank Siab'	12 675	881 148	1.44	17.51	1979	0.2
Commercial Bank 'Dolinsk'	76 991	383 953	20.05	13.19	2	0.0
JSC 'Municipal Kamchatprofitbank'	86 641	811 869	10.67	17.79	4193	0.5
JSC 'Bratsky Narodny Bank'	45 663	562 850	8.11	16.9	122	0.0
LLC 'Kama Commercial Bank'	177 484	712 292	24.92	19.4	294 366	41.3
LLC Commercial Bank 'Altaikapitalbank'	150 097	676 394	22.19	16.69	12 820	1.9
JSC 'Ikano Bank'	206 881	564 638	36.64	12.41	6197	1.1

Source: Author's compilation based on data from the Central Bank of the Russian Federation. https://cbr.ru/banking_sector/credit/.

Fig. 3. Modern factors influencing operational risk management in banks



Source: compiled by the author.

It can be concluded that the value of operational risk, calculated on the basis of actually incurred expenses of a credit institution, more objectively illustrates the amount of funds allocated by the bank to cover losses.

3. Methods of operational risk management

In this paper, unlike the previous ones, two risk factors that may have a significant impact on the choice of operational risk management methods are highlighted separately: the introduction of international sanctions and a technological factor.

In the analytical materials of the national rating agencies, the introduction of international sanctions against a credit institution is considered as an operational risk, acting as one of the categories of force majeure situations [Methodology for assigning credit ratings..., 2020, p. 15]. Taking into account the influence of technological risk factors, it can be noted that the difficulties of qualitative mathematical structuring of the assessment of the potential impact of technological risk factors negatively correlate with the adequacy of the determination of the magnitude of operational risk. In addition, the works devoted to the modelling of operational risk lack universal components of economic capital and uniform approaches to the aggregation of operational risk models.

In Regulation No. 716-P, the Central Bank of the Russian Federation proposes to pay special attention to the practice of managing model risk in order to optimise the reserved capital to cover operational risk. It should be noted that this direction of the development of the risk management system of banks is one of the innovative and key directions for improving the reliability of Russian credit institutions and the banking sector as a whole.

Thus, the current methodological base of credit institutions is formed in the context of the development of the digital economy, the introduction of innovative technologies and international sanctions. This study allowed us to highlight the factors caused by international sanctions and the development of financial technologies that affect the management of operational risks in banks (Fig. 3).

In this respect, the importance of improving the research and practical activities of banks is emphasised, taking into account modern factors in the development of the digital economy.

It is necessary to consider the structure of the total expenses allocated by credit institutions for the management of operational risks (Table 2). In the author's opinion, the sum of the items of balance groups 48100 'Personnel expenses' and 48400 'Organisational and administrative expenses' reflects as much as possible the amount of the bank's expenses directed to the management of operational risks.

The largest share of costs allocated to risk management is the cost of using such operational risk management methods as the use of telecommunications and information systems - 22.8%. It can be explained by the complication of business process management systems against the backdrop of the development of digital technologies and the constant growth of risks related to cybersecurity in financial transactions [Morozko, 2022]. It is necessary to focus on information security risks, which should be prioritised in the process of organising a banking risk management system as a component of the operational risk management process, and determine the growing needs of credit institutions in the formation of effective and personalised resources that ensure proper control.

In the structure of total expenses for operational risk management, the share of insurance is 22.1%, while the share of other organisational and management expenses is 22.8%.

Table. 3 shows that the smallest share in the structure of the expenses for the management of operational risks is occupied by the expenses for the training and retraining of personnel: over the three periods under review they varied within 0.2%.

Looking at the expenses in the context of credit institutions, we note that only Ikano Bank, LLC allocated financial resources to research and development, which may indicate the measures taken by the bank to improve the efficiency of its activities, while the other banks under consideration have no expenses in this balance sheet item.

Conclusion

Based on the results of the analysis, the main approaches to risk management in connection with the development of financial technologies in modern credit institutions were identified:

- Legal (regulatory) approach, which creates a legal framework for commercial banks that stimulates the formation of competitive advantages, differentiation of the range of services provided and facilitates the integration of various experiences in managing the risks of the functioning of credit institutions;
- A financial approach that includes the following ways to create optimal conditions for the functioning of credit institutions in the context of the digital transformation of the financial market, where a positive financial result is a key indicator of their success:
  - Improvement of the banking sector, including reducing the number of unprofitable credit institutions and increasing the overall profit of the banking sector;
  - Strengthening of competitive advantages through synergy of business practices, expansion of service portfolio and increase in financial performance (including transformation of microfinance companies into a bank or merger of microfinance companies with commercial banks, etc.);
  - Maximisation of the profitability indicators of credit institutions, taking into account the increasing volume of transactions carried out through financial platforms;
- A methodical approach that places great emphasis on the degree of interaction between regulatory authorities and commercial banks in the process of developing and applying certain regulatory requirements, as well as on the direct involvement of credit institutions themselves in the implementation of internal legal norms. It includes external project programmes for the development of an innovative environment implemented at the government level. The method involves the development and assistance in application of norms of banking legislation, provisions and requirements of regulatory legal acts, methodologies and other regulatory documents.

The focus of the supervisory authorities has shifted to the implementation of comprehensive and high-quality control and regulation of digital and technological risks by credit institutions. At present, with the development of the market for new digital technologies, changes in the business models of financial market participants, their adaptation to new operating conditions, a new methodological base

Table 2
Ratio of operational risk losses to the amount of its management costs in commercial banks with a basic license

Balance cost	1 January 2022		1 January 2021		1 January 2020	
	Cost of OR management for 15 banks (thousand rubles)	Share in total expenses for OR management (%)	Cost of OR management for 15 banks (thousand rubles)	Share in total expenses for OR management (%)	Cost of OR management for 15 banks (thousand rubles)	Share in total expenses for OR management (%)
48112	2330	0.2	1882	0.2	2414	0.2
48113	5542	0.5	6534	0.6	7130	0.6
48402	4080	0.3	24 633	2.2	27 219	2.1
48403	250 674	20.9	213 456	18.7	213 162	16.5
48405	13 519	1.1	10 898	1.0	19 689	1.5
48406	95 879	8.0	107 990	9.5	122 314	9.5
48409	272 554	22.8	228 799	20.0	197 211	15.3
48410	15 938	1.3	9413	0.8	9796	0.8
48411	—	0.0	—	0.0	—	0.0
48412	264 157	22.1	297 240	26.0	474 464	36.8
48414	272 829	22.8	240 733	21.1	215 096	16.7
Total operational risk management expenses	**1 197 502**	**100.0**	**1 141 578**	**100.0**	**1 288 495**	**100.0**

Source: compiled by the author according to the Central Bank of the Russian Federation. http://www.cbr.ru.

is being developed, which will improve the quality of procedures and methods of risk assessment in accordance with the characteristics of the innovative technologies and business processes introduced. Priority will be given to the process of building competence in digital tools and the implementation of a specific course of action in certain high-risk situations.

The study identified the main problems that arise in the process of operational risk management in Russian banks with a basic licence:

- Insufficiency of resources allocated by credit institutions to research and development, which indicates the vulnerability of credit institutions to the risks of the global economy: technological, information and other risks caused by digitalisation. A systematic approach to the allocation of resources in this area will help to minimise the problems associated with forecasting and timely identification of potential threats. However, the limited own resources of individual commercial banks hamper the implementation of reforms aimed at improving the methodological support of bank risk management;
- Inadequate resources for training and retraining of personnel due to increasing requirements for the level of professional qualifications of employees of credit institutions as a result of ongoing transformation processes;
- High demand for quality management of business processes and initiation of the process of making operational decisions in conditions of insufficient adaptation and scarcity of resources;
- An intensively growing number of cyber risks.

The directions for solving the problems caused by the application of the methods of operational risk management involve the following:

- Including the expenses in the budget of commercial banks for improving the qualifications of the responsible employees in the process of operational risk management, taking into account the specifics of the personnel, industry and other nature of the credit institution;
- Considering the introduction of modern software products that facilitate the collection and systematisation of information data on operational risks;
- Implementing a set of relevant measures, adapted to the digital reality, to reduce the time gap that occurs in the process of updating internal bank documents on risk management in the context of the introduction of certain technological innovations, to bring the methodological framework for risk management in line with the minimum prudential requirements of the supervisory authorities;
- Providing for software development activities related to the application of internal bank risk assessment models, including operational risk.

At the same time, attention needs to be paid to the quality of the risk management system and risk culture of banks with a basic licence which to a large extent do not meet the requirements for assessing operational risk. In this regard, it is recommended that banks with a basic licence consider the transition to the use of a standardised method for assessing operational risk, although one of the main constraints is the accumulation of a historical base of operational events due to the cost of financial, human and time resources.

In addition, one of the methods to solve problems related to the cost of the process of creating and implementing technological solutions for medium and small banks can be interaction with fintech companies as part of the proposed modernised approach to risk management. Interaction can take the form of concluding cooperation agreements, where the technology company acts as a start-up supplier for the period of the agreement. In the author's opinion, in the future, adequate provision of the methodological process against the background of integrated interaction between banks and fintech companies will make it possible to make progress in matters of effective risk management.

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The concept of transformation of the retail electricity market in the context of digital transformation of the industry

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Abstract

The market model of the Russian power industry that currently exists is facing trends and challenges, such as rising electricity prices for end-consumers, rising tariffs for power transmission services and sales mark-ups, the complexity and high cost of technological connection to power grids and capacity expansion, as well as increase in cross-subsidisation.

At the same time, the energy industry is influenced by external factors caused by a number of technological changes that have matured in Russia and in the world, such as the transition from electric energy production at large power plants to the use of distributed generators (including those using renewable energy sources (RES), an increase in the final price on electricity due to growth in demand, as well as the transformation of the spread and reduction in the cost of generator techniques with the use of renewable energy sources, technologies for energy storage systems, as well as the development of smart metering systems.

In turn, cutting-edge technologies of the electric power industry not only lead to positive economic effects when implemented separately, they reveal the fullest range of effects and lead to the emergence of new models of interaction in the retail market if their interaction is coordinated by Industry 4.0 digital technologies. Thus, the combined influence of digital transition technologies in the electric power industry forms the prerequisites for the emergence of a new type of consumer of electric power – an active consumer.

The purpose of this study is to analyse the factors influencing the adoption of these technologies by retail market entities and the effectiveness of their implementation, as well as the formation of a target retail market concept that takes into account the introduction of active consumers and has the potential to create direct and indirect economic effects for energy industry entities.

Keywords: digital maturity, energy complex, digitalisation, retail market, active consumer.

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电力零售市场在行业数字化转型中转变的概念

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摘要

俄罗斯电力部门目前的市场模式面临着一些趋势和挑战，例如：终端用户的电价增加、电力传输服务费率与销售加价的增加、电网的技术连接和增容的复杂性和高成本、以及交叉补贴的增加。

能源部门还受到俄罗斯和全球出现的一些技术变革带来的外部因素的影响，如：从大型发电厂的发电过渡到使用分布式发电机组（包括那些使用可再生能源的企业）、由于需求增加而导致电价上升、以及可再生能源发电技术与储电系统技术的普及和减价化、智能电表系统的发展。

反过来，有前途的电力部门技术在分别实施时，如果通过工业4.0数字技术协调它们的互动，会带来积极的经济效应以及揭示最全面的效果，并导致零售市场的新互动模式。因此，电力部门的数字转型技术的综合影响构成了一种新型电力消费者—活跃消费者—出现的先决条件。

本研究的目的是分析影响零售市场参与者采用这些技术的因素以及这些技术的实施效果，以及形成一个零售市场目标概念，考虑到引入活跃消费者，并有可能为能源部门的参与者创造直接和间接的经济效应。

关键词：数字化成熟度、能源部门、数字化、零售市场、活跃消费者。

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Introduction

The current market model of the Russian electric power industry is facing trends and challenges, such as an increase in electricity prices for end-consumers, caused by an increase in prices for both electricity and capacity in the wholesale electricity and capacity market (WEM), rising tariffs for power transmission services and sales mark-ups, the complexity and high costs of technological connection to power grids and capacity expansion, as well as increase in crossssubsidisation. [Khovalova, Zholnerchik, 2018].

At the same time, the energy industry is influenced by external factors caused by a number of technological changes that have matured in Russia and in the world, such as the transition from electric energy production at large power plants to the use of distributed generators (including those using renewable energy sources (RES), an increase in the final price on electricity due to growth in demand, as well as transformation of the behavioural model of consumers [Trachuk, Linder, 2018]. These factors determine the trend of transition from a centralised architecture of power supply to the decentralised one, which uses both small distributed generation and demand-side management [Frankel, Wagner, 2017].

These trends are enhanced by the spread and cheapening of generation technologies with the use of renewable energy sources [Digital transition.., 2017], technologies of energy storage systems [Application of energy.., 2019], as well as the development of smart metering [Kuzmin, 2021c]. The trend that allows the integration of innovative energy technologies, new energy sources and smart metering systems is the spread of Industry 4.0 digital technologies [Ivanov et al., 2018].

As it was shown earlier in the author's work [Kuzmin, 2021b], cutting-edge technologies of the electric power industry not only lead to positive economic effects when implemented separately, reveal the most complete range of effects and lead to the emergence of new interaction models in the retail market in case of their interaction coordinated by Industry 4.0 digital technologies. Thus, the cooperative effect of digital transition technologies in the electric power industry forms the prerequisites for the emergence of a new type of consumer of electric power - an active consumer.

The author identifies 5 models of an active consumer in his study [Kuzmin, 2021b]:

1. The basic model of an active consumer. In the basic model a source of electric power or an energy storage system can be located on the consumer side before the electricity meter. A customer can consume electricity produced by a generator belonging to him and buy it from the grid if its own energy output is not enough to cover consumption. If there is no generation or accumulator system, the consumer has the opportunity to change the load profile taking into account hourly or zone electricity prices.

2. Active energy complex/microgrid. This model is based on end-users and retail generators (including generating capacities owned by active consumers and/or energy storage systems) connected to a low-voltage power grid on the territory of the microgrid owned by the microgrid operator. Electricity is recorded at the border of the active energy complex as the balance of generated and consumed electricity.

3. Energy cell. The concept of an energy cell (or a local energy company) is not dissimilar to the concept of a microgrid, however, unlike a microgrid, the energy cell also includes local distributed generation connected to other consumers and microgrids through networks of territorial electricity transmitters.

4. P2P model / Internet of Energy. Peer-to-peer business models are based on eliminating the electricity supplier as an intermediary between active consumers. This model uses a third-party platform on which consumers trade electricity among themselves. If the generating capacities of active consumers are not enough for the balance of platform participants or, on the contrary, there is an excess, electricity can be purchased from the centralised electric power system or sold into it.

5. Load aggregator. This model implies the use of a subject, a Load aggregator, selling flexibility on the WEM and forming this flexibility (the ability of the electric power system to maintain a power balance in conditions of high volatility of consumption power and generation power) by means of demand management of many small consumers in the retail market.

The study [Kuzmin, 2021b] has shown that these models have the potential to create direct and indirect economic effects for energy industry members and consumers.

The purpose of the present study is a deeper analysis of the factors influencing the adoption of these technologies by the retail market participants and the effectiveness of their implementation, as well as the formation of a target retail market conception that takes into account the introduction of active consumers.

1. Research design

For a deeper analysis of the relationship between the investments of the retail electricity market participants in projects for the implementation of innovative models of interaction - active consumers using Industry 4.0 technologies in the energy sector, as well as the achievement of positive economic effects, it was decided to take as a basis the widely used structural model (CDM) proposed by B. Crépon, E. Duguet and J. Mairesse [Crépon et al., 1998].

This model has been successfully used for works analysing the relationship of investments in cutting-edge technologies with the increase of the effectiveness and productivity of companies and among other things, was tested in the study [Trachuk, Linder, 2020] and also in the research [Trachuk, Linder, 2017].

The initial CDM model describes three areas of relationships, linking the investments in development and research and the effectiveness and efficiency of these investments, expressed as the ratio of revenue to the full-equivalent employee number in enterprises. In the first part of the CDM model there are two equations characterising the propensity of companies to make investments and their "value". The second set of equations describes the relationship between different types of innovations and the amount of investments made in them. The third and the final part of the CDM model evaluates the relationship between the effectiveness of investment activity and the size of the created effects [Trachuk, Linder, 2017].

In order to analyse the efficiency of implementing active consumer models the CDM model was redesigned as follows.

1.1. Investments in projects for the implementation of active consumer models

The first group of model equations is designed to assess the probability of a company making a decision to invest in projects implementing active consumer models and in the case of an investment decision, to assess the relative value of investment (intensity) defined as the amount of expenses related to the number of employees of the company.

To specify the first part of the model it was decided to use the Heckman's censored regression equations. A feature of this model is the ability not only to estimate the probability of making a decision on investments in development projects, but also to calculate the relative value of these investments. The model consists of two ratios. The first equation is a binary choice model that evaluates the binary decision "to invest / not to invest" depending on a number of factors that will be determined later in the study. The second ratio is a linear model that determines the relative value of investments in projects for the implementation of active consumer models. It should be noted that the advantage of the Heckman's (censored regression) model is the ability to take into account not only companies that are already investing in projects for the implementation of active consumer models, but also those that only plan to make investments.

Thus, the specification of the first part of this mathematical model has the form expressed by equations (1)–(2):

The first equation has a hidden (unobservable) variable that describes the decision of the company (the electricity consumer) to invest in the implementation of the active consumer model:

$$D_i = \begin{cases} 1, if D_i^* = d_i x + \varepsilon_i > \vartheta \\ 0, if D_i^* = d_i x + \varepsilon_i \le \vartheta \end{cases}, \quad (1)$$

where D_i is a manifest variable that takes the value 1 if the company has decided to invest in the implementation of the active consumer model and it takes 0 if the company has not made such decision; D_i^* is a hidden variable that describes the probability of a company to invest in the implementation of an active consumer model and is a conventional regression model that depends on a number of factors – independent variables; d_i are independent variables that are factors that influence the company's decision to invest in the implementation of the active consumer model; x is a column vector of model parameters; ε_i is a column vector of remainder terms (random errors).

The list of d_i – independent variables that are factors influencing the company's decision to invest in the implementation of the active consumer model is defined in the study [Kuzmin, 2021c]. It is presented in table 1.

The Heckman's censored regression uses the assumption that random errors are described by a normal distribution.

Companies that consume electricity tend to invest in projects for the implementation of active consumer models if the manifest variable D_i is greater than a certain threshold value ϑ, which can be characterised as a decision criterion, for example, the projected amount of positive economic effects from the investment in active consumer models.

The second ratio in the Heckman's censored regression describes the relative value of investments when making a decision on investments in the first equation of the model, which is expressed as a value of investment in the project of the active consumer model implementation, calculated for one employee of the company:

$$Inv_i = \begin{cases} Inv_i^* = i_i y + e_i, \text{если } D_i = 1 \\ 0, \text{если } D_i = 0 \end{cases}, \quad (2)$$

where Inv_i is a manifest variable, which takes the value of the volume of investments in the project of implementing the active consumer model if the company has decided to invest and 0 – if the company has not made such decision; Inv_i^* is a hidden variable describing the amount of investment in the project for the implementation of the active consumer model; i_i are independent variables that are factors describing the relative amount of investment in the project for the implementation

Table 1
Factors influencing the adoption of active consumer models by companies

Perceptual factor	Explanation
d_1	Technical feasibility
d_2	Perceived advantages
d_3	Perceived risks
d_4	Expected costs
d_5	Complexity of assimilation
d_6	Influence of regulatory authorities
d_7	Influence of electric power companies
d_8	Pressure of market environment
d_9	Technological changes in the industry
d_{10}	Reliability

Source: compiled by the author.

of the active consumer model; y is a column vector of model parameters; e_i is a column vector of remainder terms (random errors).

1.2. The results of investments in the elements of the project for the implementation of active consumer models

The second part of the model describes the dependence of investments in various elements of the project for the implementation of the active consumer model on the total intensity of investments in the project.

As it was shown in the work [Kuzmin, 2021b], the key equipment necessary for the implementation of active consumer models are: distributed generation, electrical energy storage systems, electricity smart metering systems, as well as Industry 4.0 digital technologies.

Thus, the specification of the second part is mathematically expressed by the ratio:

$$RGInv_i = \overline{Inv_i} z + k_i \alpha + \epsilon_i, \quad (3)$$

where $RGInv_i$ is the company's investment in the implementation of distributed generation;

$$SNEInv_i = \overline{Inv_i} z + k_i \alpha + \epsilon_i, \quad (4)$$

where $SNEInv_i$ is the company's investment in the implementation of electrical energy storage systems;

$$ISUInv_i = \overline{Inv_i} z + k_i \alpha + \epsilon_i, \quad (5)$$

where $ISUInv_i$ is the company's investment in the implementation of electricity smart metering systems;

$$CTIInv_i = \overline{Inv_i} z + k_i \alpha + \epsilon_i, \quad (6)$$

where $CTIInv_i$ is the company's investment in the implementation of Industry 4.0 digital technologies; $\overline{Inv_i}$ is the average amount of investment in the implementation of the active consumer model, calculated for one employee of the company; k_i are independent variables that are factors describing investments in the implementation of the active consumer model; α is a column vector of model parameters; ϵ_i is a column vector of remainder terms (random errors).

1.3. The achievement of positive economic effects for the active consumer model implementation

According to the research [Parag, Sovacool, 2016; Engel et al., 2018; Morley et al., 2018; Nalbandian, Zholnerchik, 2018; Brown et al., 2019; Brown et al., 2020; Architecture.., 2021; Harnessing artificial intelligence.., 2021], the following number of effects can be distinguished when distributing active consumer models. The economic effect for companies that have implemented active consumer models will be formed from a number of direct and indirect effects.

Direct effects:

- direct reduction of the final cost of electricity for the company with the use of distributed generation (Cost);
- creation of additional revenue for the company through the provision of system and ancillary services (participation in demand response programmes) (DR);
- creation of additional revenue for companies through the commercialisation of big data on energy consumption (Data);
- reduction of operating costs and reliability improvement of power supply due to predictive analytics of equipment (Expense).

Indirect effects:

- reduction of the equilibrium price of RSV by shifting and smoothing consumption peaks, as well as replacing expensive and inefficient capacities in the wholesale market with a flexible load (RSV);
- reduction of investment needs in new generating and power network capacities to cover peak consumption in the long term (Inv);
- reduction of technological and commercial losses in the power network complex (Loss);
- improvement of the effectiveness of participation in demand response programmes due to a deeper analysis of end-user behavioural patterns (BigData).

Thus, the total economic effect can be described by the ratio (7):

$$Eff_i = Cost + DR + Data + Expense + RSV + Inv + Loss + BigData. \quad (7)$$

In turn, the relationship between the relative value of investments in the elements of active consumer models and the achievement of positive economic effects is described by the equation (8):

$$Eff_i = \overline{Inv_i} + RGInv\beta + SNEInv\beta + ISUInv\beta + CTIInv\beta + \sigma_i, \quad (8)$$

where Eff_i is the economic effect of the implementation of active consumer models; α and β are the corresponding column vectors of the model parameters; σ_i is a column vector of remainder terms (random errors).

For a deeper analysis of the relationship between investments in projects for the implementation of active consumer models and the achievement of positive economic effects four main types of active consumer models will be considered in the analysis:

- active energy complex/microgrid;
- energy cell;
- P2P model / Internet of energy;
- load aggregator.

It was decided to abandon the consideration of the Basic model of an active consumer in the CDM model, as this model exists in theoretical studies and cannot be implemented in practice due to incommensurably high transaction costs relative to the potentially created positive economic effects.

2. Results of the CDM model study

To conduct the study the questionnaires were sent to 356 experts selected according to the criteria similar to the criteria of paragraph 2.1 among electricity consumer companies in the retail market. The response was sent by 203 experts, the response was 57%. The sample characteristic is presented in table 2.

Table 2

Sample characteristic (%)

Company characteristic	Number of companies
Electricity consumers	
Construction and investment company	4.1
Retail trade	27.0
Owner of commercial real estate	25.1
Housing and public utilities managing company	8.3
Production sector	16.2
Other SME	19.3

Source: compiled by the author.

The results of the analysis with the use of a two-stage Heckman's censored regression (the first group of equations) are presented in table 3. The decision of companies to invest in active consumer models is evaluated using a probit model, where the independent variables are the factors described in table 1.

In addition, the adoption of new technologies is influenced by factors characterising the company and the industry in which it operates, therefore the size of the company, calculated as the logarithm of the full-equivalent employee number, investments in current activities (the logarithm of investments in current assets) are used as control variables.

The relative value of investments is defined as the amount of investment in the implementation of active consumer models, calculated for one employee of the company.

The results obtained demonstrate that in the case of the implementation of an Active energy complex / microgrid the factors of technical feasibility, the influence of regulatory authorities and the influence of companies in the electric power industry have the strongest influence.

The strength of the impact of technical feasibility can be explained by the high level of requirements for the current infrastructure of companies, since in this model it is required to link heterogeneous hardware, from generators and storage devices to digital sensors and actuators.

Since many relations in the electric power industry are regulated by the authorities, especially in terms of consumers in the retail market, the corresponding factor was also scored high. The power of influence of electric power companies is explained by the fact that in the current structure of the laws and regulations of the industry they will be more entrusted with the role of operators of the active power complex and they can be the main suppliers of equipment for the deployment of the active consumer model and its further operation.

The factors of complexity of assimilation and expected costs scored slightly higher. This can be explained by the fact that for the successful deployment of the active consumer model the company should have a high level of competence not only in the field of energy and price setting in retail markets, but also possess significant digital competencies. The expected costs are significant since digital power equipment is quite expensive, and the benefits achieved during its implementation lead to a payback period of the implementation in the medium or long term.

The reliability and risk factors earned moderate scores. Companies are concerned about the reliability of energy supply, however, with a sufficient level of equipment quality, availability of its reserves and timely post order management, as well as the possibility of interaction with the UES retail consumers assess these risks as controllable.

The factors of technological changes in the company's operating industry and pressure from competitors have a weak influence on the decision to implement models of an active energy complex. Thus, it can be concluded that in terms of the introduction of energy technologies of Industry 4.0 retail consumers have a relatively small share of innovators.

The energy cell model has similar parameters, however, in this model the factor of electric power companies influence is more powerful, since this model assumes local retail generation owned by energy companies, and the success of the implementation of this model will mostly depend on the effectiveness of interaction with these local energy companies.

For the P2P model / Internet of Energy the factors of technical feasibility and expected costs are significantly highlighted as their power of influence is globally similar. The implementation of this model requires the most complex and expensive digital equipment both on the side of end consumers and energy companies, while the company's fixed assets must be compatible with this equipment. For the same reason the factor of complexity of assimilation has the strongest influence on the decision to implement this particular model relative to neighbouring models.

The power of influence of factors for the Load aggregator model differ the most from the previous models. This model does not require significant investments in expensive equipment and smart metering devices and a digital energy consumption monitoring platform are sufficient for its implementation. Thus, in this model the strongest influence is exerted by electric power companies and authorities, which are the main methodologists and operators demand response and load aggregation programmes. Technical feasibility, expected costs, the complexity of assimilation and perceived benefits have a moderate impact. The influence of other factors is relatively small.

Thus, the following conclusions can be drawn from the analysis of factors:

1) companies need to have plausible guesses concerning the level of their infrastructure readiness and digital maturity before deciding on the implementation of a particular model;

2) for the successful distribution of active consumer model's effective interaction of consumers with energy companies is necessary, it creates value for both end-consumers and electric power companies;

3) the low impact of technological progress and the pressure of competitors in the market indicates low innovation activity among end-consumers in terms of the introduction of electric power technologies.

After analysing the factors influencing the company's decision to invest in the active consumer model, an analysis of investments in the implementation of such models was carried

Table 3
Forces of influence of factors on companies' decisions to invest in active consumer models

Exogenous variables	Active energy complex/ microgrid		Energy cell		P2P model / Internet of Energy		Load aggregator	
	The decision to invest in active consumer models	Relative value of investments	The decision to invest in active consumer models	Relative value of investments	The decision to invest in active consumer models	Relative value of investments	The decision to invest in active consumer models	Relative value of investments
Analysis method	The first component of the model – the Heckman's censored regression							
	The first equation	The second equation	The first equation	The second equation	The first equation	The second equation	The first equation	The second equation
Technical feasibility (d_1)	0.506 (0.101)	0.621 (0.132)	0.493 (0.109)	0.564 (0.127)	0.635 (0.114)	0.664 (0.157)	0.356 (0.068)	0.370 (0.059)
Perceived advantages (d_2)	0.350 (0.092)	0.327 (0.062)	0.368 (0.099)	0.342 (0.072)	0.341 (0.091)	0.335 (0.075)	0.324 (0.074)	0.365 (0.082)
Perceived risks (d_3)	0.331 (0.071)	0.261 (0.052)	0.301 (0.079)	0.256 (0.063)	0.368 (0.088)	0.296 (0.083)	0.158 (0.032)	0.174 (0.044)
Expected costs (d_4)	0.498 (0.056)	0.321 (0.048)	0.502 (0.106)	0.425 (0.098)	0.601 (0.131)	0.561 (0.108)	0.249 (0.046)	0.266 (0.050)
Complexity of assimilation (d_5)	0.444 (0.051)	0.321 (0.069)	0.424 (0.074)	0.331 (0.065)	0.554 (0.097)	0.487 (0.069)	0.274 (0.052)	0.261 (0.044)
Influence of regulatory authorities (d_6)	0.506 (0.101)	0.621 (0.132)	0.511 (0.112)	0.638 (0.127)	0.498 (0.085)	0.467 (0.83)	0.598 (0.136)	0.600 (0.149)
Influence of electric power companies (d_7)	0.550 (0.092)	0.427 (0.062)	0.682 (0.108)	0.598 (0.098)	0.596 (0.091)	0.598 (0.093)	0.571 (0.105)	0.537 (0.097)
Pressure of market environment (d_8)	0.131 (0.071)	0.161 (0.052)	0.117 (0.048)	0.136 (0.050)	0.124 (0.066)	0.154 (0.061)	0.152 (0.064)	0.141 (0.055)
Technological changes in the industry (d_9)	0.098 (0.056)	0.121 (0.048)	0.103 (0.037)	0.112 (0.025)	0.128 (0.032)	0.135 (0.029)	0.100 (0.029)	0.118 (0.046)
Reliability (d_{10})	0.244 (0.051)	0.221 (0.069)	0.278 (0.066)	0.235 (0.053)	0.305 (0.074)	0.311 (0.059)	0.109 (0.019)	0.114 (0.033)
Size of the company (log average number)	0.224 (0.055)	0.321 (0.069)	0.254 (0.045)	0.329 (0.051)	0.217 (0.023)	0.264 (0.027)	0.199 (0.021)	0.184 (0.024)
Logarithm of the number of employees engaged in innovation activity	0.321 (0.069)	—	0.345 (0.083)	—	0.405 (0.106)	—	0.344 (0.071)	—
Investments in current activities (log of investments in current assets)	0.125 (0.048)	0.129 (0.043)	0.159 (0.043)	0.162 (0.056)	0.201 (0.069)	0.218 (0.058)	0.138 (0.058)	0.142 (0.054)
Number of observations	203		203		203		203	
Evaluation of the quality of the model – the Heckman's Lambda	0.225 (0.110)		0.193 (0.102)		0.207 (0.089)		0.211 (0.093)	
Wald test for Ho, rho = 0	5.64		21.18		11.42		17.39	
The likelihood function	1453.24		3201.37		2535.08		2022.10	

Notes: 1. The numbers presented have marginal effect values. 2. Statistical significance of coefficients: $p \leq 0.01$. 3. Robust standard errors are indicated in-between parenthesis.
Source: compiled by the author.

Table 4
Results of the analysis of investments in the implementation of active consumer models, disaggregated by investment directions

Exogenous variables	Active energy complex/microgrid				Energy cell				P2P model / Internet of Energy				Load aggregator			
	IDG	IESS	IESMS	IIDT	IDG	IESS	IESMS	IIDT	IDG	IESS	IESMS	IIDT	IDG	IESS	IESMS	IIDT
The estimated value of the relative amount of the investment	0.392 (0.073)	0.289 (0.045)	0.089 (0.015)	0.147 (0.026)	0.385 (0.078)	0.277 (0.055)	0.102 (0.017)	0.163 (0.021)	0.373 (0.099)	0.312 (0.084)	0.125 (0.024)	0.206 (0.039)	–	–	0.156 (0.035)	0.178 (0.047)
Participation in government programmes (1 – yes, 0 – no)	0.286 (0.052)	0.247 (0.042)	0.235 (0.037)	0.201 (0.34)	0.308 (0.074)	0.254 (0.059)	0.265 (0.041)	0.223 (0.062)	0.274 (0.034)	0.229 (0.048)	0.243 (0.050)	0.221 (0.029)	–	–	0.395 (0.081)	0.402 (0.093)
Interaction with representatives of consulting companies (1 – yes, 0 – no)	0.128 (0.017)	0.175 (0.021)	0.123 (0.206)	0.246 (0.063)	0.124 (0.024)	0.156 (0.028)	0.145 (0.019)	0.239 (0.075)	0.178 (0.030)	0.189 (0.025)	0.226 (0.035)	0.265 (0.046)	–	–	0.283 (0.072)	0.296 (0.065)
Interaction with energy companies (1 – yes, 0 – no)	0.386 (0.074)	0.428 (0.083)	0.351 (0.059)	0.258 (0.042)	0.425 (0.089)	0.446 (0.094)	0.378 (0.072)	0.267 (0.048)	0.356 (0.088)	0.411 (0.101)	0.334 (0.062)	0.249 (0.038)	–	–	0.494 (0.091)	0.567 (0.103)
Interaction with scientific organisations (1 – yes, 0 – no)	0.087 (0.011)	0.103 (0.016)	0.078 (0.013)	0.124 (0.025)	0.077 (0.015)	0.095 (0.025)	0.093 (0.016)	0.111 (0.019)	0.125 (0.015)	0.132 (0.022)	0.119 (0.026)	0.127 (0.017)	–	–	0.154 (0.022)	0.136 (0.036)
Size of the company (log average number)	0.224 (0.055)	0.236 (0.063)	0.089 (0.029)	0.125 (0.048)	0.234 (0.076)	0.249 (0.057)	0.097 (0.019)	0.120 (0.031)	0.226 (0.054)	0.244 (0.068)	0.104 (0.026)	0.178 (0.053)	–	–	0.084 (0.011)	0.078 (0.017)
Logarithm of the number of employees engaged in innovation activity	0.105 (0.038)	0.112 (0.040)	0.143 (0.052)	0.137 (0.027)	0.110 (0.018)	0.101 (0.028)	0.128 (0.043)	0.145 (0.034)	0.165 (0.045)	0.157 (0.043)	0.203 (0.059)	0.222 (0.038)	–	–	0.093 (0.023)	0.105 (0.018)
Investments in current activities (log of investments in current assets)	0.246 (0.059)	0.213 (0.061)	0.157 (0.046)	0.198 (0.054)	0.253 (0.051)	0.231 (0.046)	0.187 (0.038)	0.172 (0.045)	0.264 (0.074)	0.231 (0.066)	0.175 (0.038)	0.189 (0.036)	–	–	0.157 (0.024)	0.198 (0.015)
Numberof observations	203				203				203				203			
McFadden Rsquared	48.31%				54.12%				53.03%				49.34%			
LR-statistic	71.23				66.14				78.89				63.56			
Prob (LR-statistic)	0				0				0				0			

Notes: 1. IDG – investments in the implementation of distributed generation. 2. IESS – investments in the implementation of energy storage system. 3. IESMS – investments in the implementation of electricity smart metering systems. 4. IIDT – investments in the implementation of Industry 4.0 digital technologies. 5. The numbers presented have marginal effect values. 6. Statistical significance of coefficients: $p \leq 0.01$. 7. Robust standard errors are indicated in-between parenthesis.
Source: compiled by the author.

out, disaggregated by investment directions (the second part of the model). The calculation results are presented in table 4.

The calculated value of the relative amount of investments in projects for the implementation of active consumer models has a moderately strong impact for the first three models, while the greatest values are achieved in the case of investments in the development of distributed generation and energy storage systems. This variable has a significantly lower impact on the Load aggregator model, which can be explained by the significantly lower cost of the elements of this solution.

Participation in government programmes has a moderately strong impact on all directions of investment. In addition, at present it is the authorities that legislatively support the implementation of pilot programmes (including a pilot project on Load aggregators and Active energy complexes). Thus, participation in pilot projects and sending timely and objective feedback can increase the effectiveness of the implementation of these pilot projects. The authorities also responsible for the determination of costs of energy companies that can be included in tariff sources of financing.

Interaction with representatives of consulting companies most strongly influence the investments in smart metering systems and Industry 4.0 digital technologies for all types of active consumer models. At the same time, the greatest influence is exerted in the introduction of models of the Internet of Energy and the Load aggregator. This may be due to the fact that consulting companies have a great understanding of the functioning of Industry 4.0 digital technologies, including

Table 5
The influence of the relative amount of investments in the equipment of active consumer models on the achievement of positive economic effects

Exogenous variables	Equation of economic effects (dependent variable – the economic effect of the implementation of active consumer models)			
The method of least squares	Active energy complex/ microgrid	Energy cell	P2P model / Internet of Energy	Load aggregator
Estimated value of the relative amount of investments in projects for the implementation of active consumer models	0.145 (0.037)	0.164 (0.041)	0.179 (0.035)	0.093 (0.017)
Intensity of the investments in the implementation of distributed generation	0.482 (0.095)	0.507 (0.093)	0.456 (0.072)	—
Intensity of the investments in the implementation of energy storage systems	0.534 (0.107)	0.514 (0.110)	0.505 (0.097)	—
Intensity of the investments in the implementation of electricity smart metering systems	0.335 (0.084)	0.327 (0.092)	0.339 (0.077)	0.539 (0.108)
Intensity of the investments in the implementation of the Industry 4.0 digital technologies	0.298 (0.076)	0.309 (0.080)	0.471 (0.083)	0.523 (0.096)
Size of the company (log average number)	0.154 (0.027)	0.143 (0.032)	0.212 (0.038)	0.099 (0.017)
Logarithm of the number of employees engaged in innovation activity	0.145 (0.035)	0.153 (0.031)	0.174 (0.068)	0.112 (0.028)
Investments in current activities (log of investments in current assets)	0.166 (0.053)	0.189 (0.043)	0.203 (0.061)	0.142 (0.039)
Number of observations	203	203	203	203
McFadden R-squared	47.41%	51.12%	49.55%	60.17%
LR-statistic	72.25	66.14	78.87	63.42
Prob (LR-statistic)	0	0	0	0

Notes: 1. The numbers presented have marginal effect values. 2. Statistical significance of coefficients: $p \leq 0.01$. 3. Robust standard errors are indicated in-between parenthesis.
Source: compiled by the author.

platform solutions, and also have extensive expertise in the implementation of digital solutions in enterprises, which allows them to provide effective assistance in the design of solutions and lead to more efficient deployment of digital components of models. The high effect for the Internet of Energy model is due to the highest requirements of this model for its IT component. In the case of a Load aggregator, an increased degree of influence may be due to the fact that the main component of this model also lies in the field of digital technologies.

Interaction with energy companies demonstrates the greatest power of influence, both in terms of the types of active consumer models and the components of the models themselves. First of all, this is due to the direct participation of energy companies in pilot projects for the implementation of active consumer models. Also, some energy companies participate in the development of equipment necessary for the implementation of such models and offers comprehensive solutions for the end-consumer.

Interaction with scientific organisations shows the least power of influence, which may be due to insufficient opportunities for commercialisation of developments by scientific organisations themselves. In addition, most of scientific organisations developing Industry 4.0 technologies in the energy sector are in the control loop of large energy companies, and it is energy companies that take responsibility for integrating developments into unified customer value propositions and subsequent commercialisation.

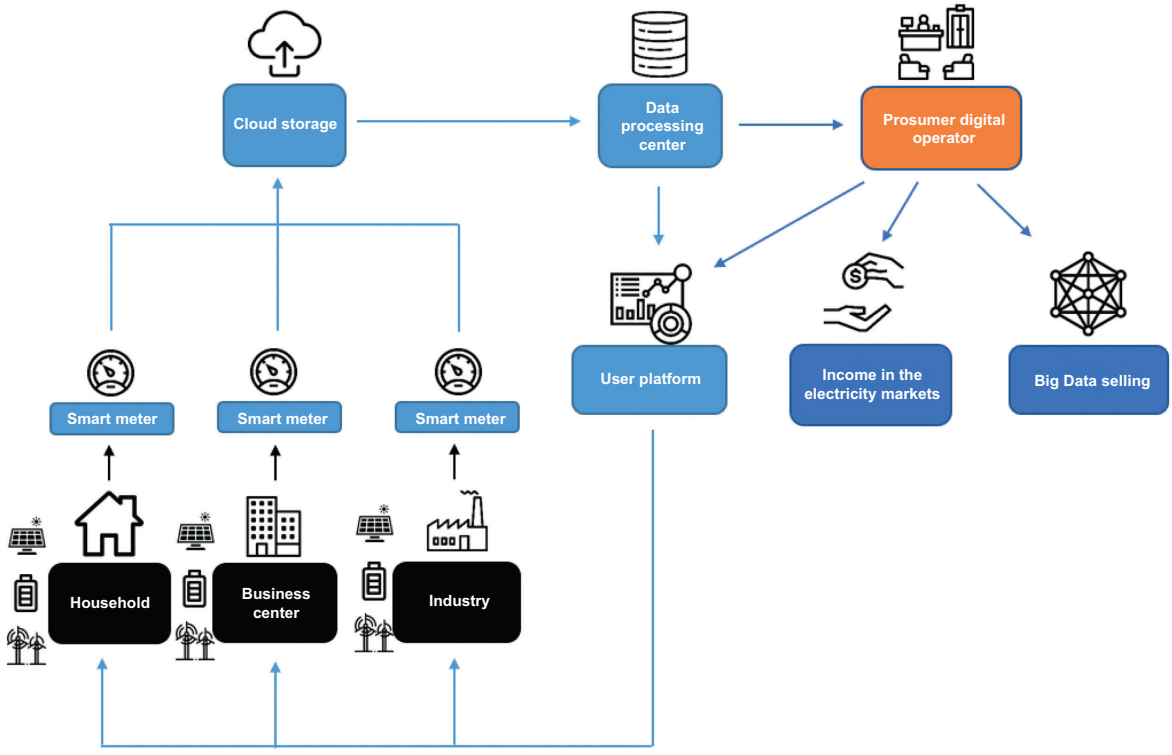
Thus, the results of the present calculation serve as an additional justification for the need for close interaction of consumers with energy companies when implementing projects for the introduction of active consumer models. Consulting companies with the necessary digital competencies and relevant experience, as well as participation in government programmes are also able to increase the efficiency of investments.

Concluding the present paragraph, the results of the calculation of the third part of the model, the impact of the relative amount of investment in the equipment of active consumer models on achieving positive economic effects are presented in table 5.

According to the results obtained, for each of the active consumer models the volume of investments in implementation projects is positively connected to the achieved positive economic effects, which is consistent with the theory.

At the same time, for the models of an Active energy complex and an Energy cell the strongest positive dependence is observed for investments in distributed generation and energy storage systems, since these two elements provide a direct reduction in costs per 1 kW*hr of energy. Also, the development of distributed generation and NEA leads to an increase in direct effects from the provision of system and ancillary services, as well as indirect effects from a decrease in the equilibrium price of RSV and a decrease in the need to investment in network and generating capacities in parts of the UES.

Fig. 1. Schematic diagram of interaction



Source: compiled by the author.

For these models the investments in smart metering systems and Industry 4.0 digital technologies demonstrate a moderate connection, since it is these elements that allow to link and optimise the operation of other equipment, thereby enhancing the effects of distributed generation and NEA and creating the own ones, such as optimising the operation of the enterprise equipment, predictive analytics of failures and breakdowns and also the possibility of commercialisation of the data collected at the enterprise.

The P2P model / Internet of Energy has similar calculation results, however the role of investments in Industry 4.0 digital technologies is significantly increasing. Unlike the previous model, this one assumes the presence of a transactional platform for accounting of produced and consumed energy, system services provided, etc. in real time, as well as an industrial Internet of Things system for optimising the energy mode within the entire model as a whole, which significantly increases the effect of investments in the implementation of digital technologies within this model.

The Load aggregator model creates the greatest positive effects when investing in smart metering systems and digital technologies. This model creates direct economic effects due to the provision of one of the system services – demand response and commercialisation of big data collected from the consumer and also leads to an indirect effect of reducing the equilibrium price in the RSV in the short term and in the capacity market in the long term. On the side of retail consumers there is a significant potential for demand response and big data collection, which can be successfully implemented with the development of smart metering systems and digital technologies, which is confirmed by high elasticity coefficients.

3. The concept of transformation of retail electricity market

Having analysed the theoretical aspects of digital and Industry 4.0 electric power technologies, having formed a list of active consumer models and effects generated by them for retail market participants, having identified and evaluated qualitatively and quantitatively the factors influencing their adoption, it is necessary to form a concept of transformation of the retail electricity market, considering the implementation of active consumer models.

In this paragraph it was decided to demonstrate the value created by the implemented models of an active consumer for retail market participants, to describe the key principles of building an information exchange system and organisational interaction when implementing such models.

The construction of an active consumer model begins with the installation of digital and electric power equipment necessary for a particular type of model on the consumer side.

For each model it is necessary above all to establish information exchange with the energy company with the use of a smart metering system either based on traditional electricity meters supplemented with a GSM or WiFi module or with the use of NILM systems (fig. 1).

At the beginning, we will consider the simplest model of an active consumer – a load aggregator. In the case of households or small buildings, it is enough to install one ISU sensor at the entrance to the room and establish a stable Wi-Fi or GSM connection for further information exchange. When installing an SM system in factories or large commercial real estate objects, the number of electricity meters may increase depending on the purpose of their installation. For example, when distributing energy consumption by floors or rented rooms, the number of sensors will be equal to the number of floors or rooms, respectively.

After the connection is set up, the information collected by the SM in real time is sent to the cloud data storage, and then transmitted to the data processing center for subsequent analysis.

The processed data can arrive to the client in various ways. For individual users a custom application installed on a mobile phone will be enough. This method will allow the consumer to get the full range of advantages of the Load aggregator model, which only requires setting up smart metering and information exchange, avoiding the need to understand complex interfaces or interpret a large set of statistical data. For a commercial organisation using several sensors of the SM it is advisable to receive information through a personal account on a user platform, to which all sensors installed in the building will be linked. The possibility of implementing the software of the SM system using API-interfaces into digital solutions used by customers is not excluded.

At the same time, the end-consumer can supplement the system with additional sensors and actuators to automate the operation of their production or office equipment in order to obtain greater effects from the load aggregator model.

Having received the information, consumers increase their operational efficiency, reduce energy costs by adapting the energy consumption schedule to the existing tariff scale, analyse the load of power receivers, generate data and realise other advantages inherent in the load aggregator model.

In turn, data on the energy consumption of all users with SM are aggregated on the system server and the energy company acting as a load aggregator can use them to its advantage. The collected data can be used both inside the electric power company and in interaction with external concerned parties.

The internal use is expressed in improving the quality of consolidation of electricity balances, increasing the effectiveness of countering non-contractual and non-metered energy consumption and improving the quality of work with accounts receivable. Big data on load characteristics will make it possible to predict energy consumption more accurately, which will contribute to the growth of the performance of energy companies in the wholesale and retail markets.

Analytical data collected during piloting of load aggregators can become a powerful tool for the participation of energy companies in pilot programmes of new interaction models implemented in the Russian Federation. For example, the pilot project on demand response, regulated by the Resolution of the Government of the Russian Federation No.287 dated March 20, 2019, also includes the concept of a load aggregator.

And finally, big data can be commercialised beyond the electricity markets as well. In this case, the companies of the electric power industry act as sellers in the big data market and arrays of information about energy consumption act as a product. Potential buyers here are marketing companies, business consulting companies, manufacturers of household and industrial appliances, organizations in the field of remote healthcare and social monitoring.

Next, we will consider the models of the active energy complex / microgrid and the model of the Internet of Energy / P2P model. To implement these models the SM sensors, as well as digital sensors, communicators and actuators need to be supplemented with electricity generating equipment. First of all, these are distributed power sources, such as small generators using diesel fuel or gas, generators based on renewable energy sources, as well as energy storage systems.

In order to successfully integrate these devices into the enterprise network and in the unified energy system network, in addition to the SM meters, voltage source inverters, additional controllers and other grid equipment may be required.

The advantages described earlier for the load aggregator model, in case of the implementation of the active energy complex model or the Internet of energy model, will be expanded by additional effects of the implementation of innovative electricity generating equipment.

Distributed generators and NEA can be used as uninterruptible power supplies, thereby increasing the company's resistance to accidents in external networks (which is especially important for industries with equipment sensitive to voltage and frequency jumps or enterprises of a continuous production cycle).

The use of distributed generation will directly reduce the cost of buying electricity. The price of electricity from the guaranteeing supplier consists of a uniform (common pot) tariff for the transmission of electricity through networks, as well as fees for the services of infrastructure organisations and the sales premium of the guaranteeing supplier, plus the price for the purchase of electricity and capacity at the WEM.

The price of electricity generated by a distributed generator consists of a uniform (common pot) tariff for the transmission of electricity through networks, as well as unit costs that ensure the return of capital and unit operating costs for the production of electricity on this generator.

Since a common pot tariff for electricity transmission will be the same in both cases, the effect of using electricity generated by distributed generation facilities will depend on the unit costs that ensure the return of invested capital in the construction of a distributed generation facility and the value of unit operating costs for electricity production.

Another direct effect of the installation of distributed generation is the reduction of costs for technological connection to networks.

In addition to direct effects, a number of indirect ones are possible for retail consumers, such as the reduction of the cost of building additional generating and power grid capacities at the level of the WEM in the long term, optimising the mode of operation of the UES. The models of the active energy complex and the Internet of Energy due to the fact, that distributed generators have an even greater margin of flexibility of energy consumption from a unified power system are relative to the load aggregator model.

The greatest efficiency of models of the active energy complex and the Internet of Energy is achieved when distributed generation is used together with energy storage systems.

Due to the ability of the NEA to quickly accumulate and issue electricity, the quality of participation of retail consumers in the market of system services, including primary and secondary frequency regulation services is significantly improved. Thus, on the side of the retail consumer electricity becomes cheaper, the reliability of power supply increases, it is possible to ensure the operation of critical equipment in case of power failure and create a reserve in case of accidents.

The NEA, as well as distributed generation, reduce the peak load on electric substations and the costs for upgrading the network infrastructure, improve the quality and reliability of energy supply to consumers and reduce the need for the construction of new capacities on the generation side.

Thus, in the current point of the study the value created by the implemented active consumer models for the participants of the retail market was shown. At the same time, in order to build such a concept and achieve the described effects, it is necessary to create a new functionality (digital operator of an active consumer) focused on organising the relationship of an active consumer with infrastructure and other electric power companies.

Active consumer models are solutions located at the intersection of digital and electric power technologies and thus include many components that organise a single system – generators, storages, SM sensors, network infrastructure, cloud or local servers, analytical platforms. As the analysis has shown, the successful achievement of economic effects from the implementation of these models requires retail electricity consumers to have a certain level of competence, as well as a certain level of maturity of the technologies and the infrastructure used, compliance with which forms the prerequisites for the successful implementation of active consumer models.

At the same time, the expediency and success of the implementation of the active consumer model directly depends

Fig. 2. Elements of the model for the maturity assessment of the retail market entities for the active consumer model implementation

	Directions				
Aspects	**Organisational readiness**	**Internal competencies**	**Infrastructure readiness**	**The specifics of the production process**	**Financial capability**
	Availability of a developed business case for the application of the active consumer model	Experience and level of expertise of the organisation's employees in the field of digital technologies	Infrastructure maturity level of the organisation	Ability to flexibly manage the production process	Availability of attracting financial resources
	Availability of the organisation's resources and management support	Experience of employees in the field of electric power industry and price setting in retail markets	The level of development of electric power and digital technologies	Availability of devices with high power consumption manoeuvrability	Competences in the field of implementation cost planning
	Maturity of process interaction with regulatory authorities	Experience in data management and data processing	The level of development of data protection and security technologies	Availability of inertial parameters of the production process	
	Maturity of process interaction with energy companies	Experience in data integration and data analysis			

Source: compiled by the author.

on the technological process of the enterprise and/or the characteristics of the building where the implementation is carried out: continuous production, how sensitive it is to starts and stoppages? The effectiveness of implementation can be enhanced by a large share of climate equipment or lighting technology in the energy consumption of an enterprise or building.

Thus, at the end of the study the author proposes to develop a method that allows to assess the readiness of end-consumers of electricity in the retail market to implement active consumer models based on an assessment of their compliance with previously identified factors of the success of the implementation of these models.

4. Methodology for the digital readiness assessment of consumers to implement the active consumer model

To develop a methodology for the digital maturity assessment of consumers for the implementation of the active consumer model, it was decided to use the methodology developed in the study "Industrial digitalisation: an empirical assessment of the digital maturity of enterprises" [Kuzmin, 2021a].

The previously identified factors influencing the implementation of active consumer models were further analysed and structured into four main categories, which are proposed to be used in the concept as directions for the maturity assessment of the end-consumers in the retail market for the implementation of these models:

1) organisational readiness.
2) internal competencies of the organisation.
3) infrastructure and technological readiness.
4) the specifics of the production process.
5) financial capability.

The general structure of the model can be represented in the form of five directions with detailed breakdown of each direction on a number of aspects of the success related to implementing the active consumer model (fig. 2):

In order to assess the maturity of the retail market entities in each of the proposed directions the author has developed a standardised questionnaire. The questionnaire proposed by the author contains a list of closed questions, for each of which the respondent chooses one of the proposed options, which in the opinion of the respondent, most accurately and fully reflects the features and stages of development of individual directions of the company's activity. A five-point scale was used in the survey, where number 1 stands for "strongly disagree" and number 5 stands for "completely agree".

The questionnaire can be given to the organisation both in hard copy and with the use of various electronic means (sending by e-mail, using web resources for conducting the survey). The survey data are used as a basis for calculating the level of maturity of a retail market entity to implement an active consumer model in each of the directions under consideration.

At the same time, not all directions of maturity of the retail electricity market entity have the same influence on the success and effectiveness of the implementation of the active consumer model. In order to determine the degree of significance of each of the proposed directions for the successful implementation of projects a series of interviews with experts was conducted. Based on the interviews conducted, the average expert ratings were calculated for each of the aspects of the success of the implementation, as well as directions that were assembled into a single scale for the readiness to assess the organisation in various directions and are considered as a weight coefficient.

Thus, based on the assessments obtained as a result of filling out the questionnaire, the readiness assessment (RL_D) of the organisation is calculated as the sum of the weighted average values of the answers to questions within a certain factor, adjusted for the significance of this factor in terms of the impact on the success of the project implementation of the active consumer model and calculated using the following formula:

$$RL_D = \sum \frac{\sum_{i=1}^{n} S_{DFi}}{n} * W_{DF}, \quad (9)$$

where D is the direction of the organisation's readiness assessment; F is the aspect of success under investigation; n is the number of questions within the factor under investigation; S is the value of the answer to the question on a five–point scale; W is the significance of the aspect of the success of the active consumer model implementation.

After the organisation fills out the questionnaire, the responses received are processed in accordance with the formula mentioned above. Based on the results obtained, a petal diagram is constructed, on the basis of which the organisation is assigned a certain level of maturity for each of the analysed directions.

The obtained estimates for each of the analysed directions can be further used to make a decision on the implementation

Table 6
Results of expert surveys determining the degree of influence of digital transformation aspects

Success aspects of the active consumer model implementation	Average score	Significance
Organisational readiness		
Availability of a developed business case for the application of the active consumer model	2.06	0.75
Availability of the organisation's resources and management support	4.06	1.48
Maturity of process interaction with regulatory authorities	3.67	1.34
Maturity of process interaction with energy companies	3.94	1.44
Internal competencies of the organisation		
Experience and level of expertise of the organization's employees in the field of digital technologies	3.78	1.26
Experience of employees in the field of electric power industry and price setting in the retail markets	4.44	1.49
Experience in data management and data processing	3.28	1.10
Experience in data integration and data analysis	3.44	1.15
Infrastructure readiness of the organisation		
Infrastructure maturity level of the organisation	4.56	2.06
The level of electric power and digital technology development	4.22	1.91
The level of data protection and security technology development	2.28	1.03
The specifics of the production process		
Ability to flexibly manage the production process	4.44	1.69
Availability of devices with high power consumption manoeuvrability	4.56	1.74
Availability of inertial parameters of the production process	4.11	1.57
Financial capability		
Availability of attracting financial resources	4.22	2.90
Competences in the field of implementation cost planning	3.06	2.10

Source: compiled by the author.

Table 7
Required levels of maturity in the directions for the implementation of active consumer models

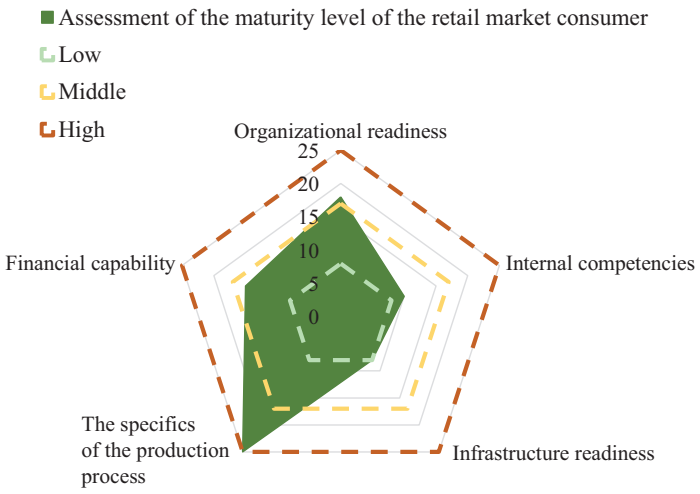
Direction of maturity assessment	Load aggregator	Active energy complex / microgrid / energy cell	P2P model / Internet of Energy
Organisational readiness	Middle	High	High
Internal competencies of the organisation	Low	Middle	High
Infrastructure readiness of the organisation	Middle	Middle	High
The specifics of the production process	High	Middle	Low
Financial capability	Low	High	High

Source: compiled by the author.

of the active consumer model and, if necessary, the formation of measures aimed at the development of individual directions of the organization's activities in order to increase the level of readiness of the organization for the implementation. Also, additional questions were added to the survey list in order to determine the required level of maturity in each of the directions for different types of active consumer models and to select the recommended model depending on the level of maturity.

Figure 3 shows a sample of a petal diagram of the maturity level of the retail market entities in each of the analysed directions, which allows us to visualize the result of the analysis of readiness for the implementation of the active consumer model.

Fig. 3. Petal diagram of the level of maturity of the retail market entity for each of the analysed directions



Source: compiled by the author.

In order to determine the degree of significance of each of the proposed aspects within the directions of success of the active consumer models implementation, as well as to correlate the maturity levels in each of the directions with the recommended implementation of the active consumer model an additional expert survey was conducted.

As part of the survey, each of the experts assessed the significance of aspects on a scale from 1 (minimal influence on the success of the model implementation) to 5 (high degree of influence on the success of the model implementation). According to the results of the survey, the frequencies of assessing the degree of influence of the success aspects related to the active consumer model implementation were obtained.

With the purpose of further application of the results of the expert survey, the significance of aspects for each of the direction of assessing the maturity of the retail market entities for the active consumer model implementation was calculated using the ratio:

$$W_{DF} = \overline{A_{DF}} \cdot \frac{b}{\sum_{i=1}^{m} \overline{A_{DFi}}}, \quad (10)$$

where W is the significance of the success aspect of the active consumer model implementation; A is the average value of the significance of the success aspect of the active consumer model implementation; m is the number of aspects of the success of the active consumer model implementation in the direction of maturity assessment; b is the maximum score for the item of the questionnaire for assessing the maturity of the retail market entities.

The average scores calculated based on the results of expert surveys and the significance of the success aspects of the active consumer model implementation are presented in table 6.

Thus, based on the interviews conducted weight coefficients of the significance of success aspects of the active consumer model implementation were obtained for further use in the methodology for assessing the readiness of the retail market entities to implement the active consumer model.

Further, the experts were suggested to correlate the assessments of the level of readiness in the directions with the types of active consumer models and to determine what level of maturity in each of the assessment directions is required for a particular active consumer model. Based on the results of the survey, a table of the required maturity levels for the implementation of active consumer models was formed (table 7).

Thus, the methodology proposed by the author makes it possible to assess the level of maturity of the retail market entities for the implementation of the active consumer model based on the assessment of its maturity levels in five directions, as well as to correlate the estimates obtained with the recommended requirements for the successful implementation of various types of active consumer models: load aggregator,

active energy complex / microgrid and P2P model / Internet of Energy.

Conclusion

The study presents the results of the analysis of the key factors influencing the perception and willingness to implement active consumer models among end-consumers – participants of the retail market, as well as factors determining the effectiveness of the subsequent application of these models. It is proved that the decision to implement the active consumer model is most strongly influenced by the factors of readiness of the organisation's infrastructure and the level of its digital competencies. For the successful distribution of active consumer models, the effective interaction of consumers with energy companies as well as regulatory authorities is necessary.

Further, the author proposed the concept of transformation of the retail electricity market, concerning the implementation of active consumer models that meet the conditions of digital transformation of the electric power industry. A new schematic diagram of interaction with the energy company in the implementation of the active consumer model has been formed, implying the emergence of a new functionality (digital operator of the active consumer) focused on the organisation of relationships between the active consumer and infrastructure and other electric power companies, aimed at creating new value for both consumers and the companies of the electric power industry.

In the conclusion of the study, a transformation methodology was formed aimed at the successful implementation of active consumer models among the retail market entities. Taking into account the previously identified factors, the methodology allows us to assess the level of maturity of the retail market entities for the implementation of an active consumer model based on the assessment of the maturity level in five directions and correlate the estimates obtained with the recommended requirements for the successful implementation of various types of active consumer models.

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Overcoming the barriers to the digital transformation of industrial enterprises through the business model selection mechanism

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Abstract

The article describes the main barriers to digital transformation faced by industrial enterprises in various industries, such as: lack of appropriate funding, information security risks, insufficient digital skills of employees, insufficient maturity of current processes, internal resistance to change, insufficient awareness of managers, lack of certainty over the future of digital standards. To analyse the barriers, the author used a three-step approach, including a literature review, a primary research with representatives of the companies, and a qualitative comparative analysis that are based on the Kruskal – Wallis test and used to identify differences between groups of enterprises. To overcome the barriers identified by the author it was offered to use a mechanism of a business model selection, which takes into account the assessment of obtained competitive advantages (improvement of operational, financial and technical efficiency), digital maturity (digital culture level, staff qualifications, the quality of business process organisation and access to digital infrastructure) and risks (non-receipt of expected income from business model implementation, information security, reputational and personnel). The novelty of the proposed business model selection mechanism for an industrial enterprise is to improve the classification and develop a multi-criteria mechanism for choosing a business model, which would be implemented using a knowledge-based system incorporating a fuzzy inference mechanism.

Keywords: digital transformation, business model, industrial enterprises, barriers to digital transformation, business model selection mechanism.

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通过商业模式选择机制克服工业企业数字化转型的障碍

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摘要

本文章介绍了不同行业的工业企业面临的数字化转型的主要障碍：缺乏足够的资助、 信息安全危险、员工的数字技能不足、目前的流程不够成熟性、变革的内部阻力、管理熟悉情况不足、对未来的数字标准缺乏确定性。为了进行障碍的分析，作者采用了一个三步法，包括：文学评论、公司代表者调查以及使用克鲁斯卡尔-沃利斯检验（Kruskal - Wallis test）进行定性比较分析，以确定各组企业之间的差异。作为克服所发现的障碍的工具，作者提出了一个考虑到对所获得的竞争优势（业务、财务和技术效率提高）的评估的选择商业模式的机制。该机制还考虑到了数字成熟度（数字文化、员工能力、业务流程组织的质量和数字基础设施的使用）和潜在风险（未能从商业模式的实施中获得预期收入、信息安全、声誉和人力资源风险）。提出的工业企业商业模式选择机制的新颖性在于改进了商业模式分类并开发了一个通过具有模糊推理机制的知识系统实现的多标准商业模式选择机制。

关键词：数字化转型，商业模式，工业企业，数字化转型的障碍，商业模式选择机制。

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Introduction

Digital transformation (DX) of industrial enterprises is a process of digitisation which allows to optimise production processes, improve product quality, reduce costs and increase the competitiveness of an enterprise. However, despite these prospects, implementation of digital transformation may face certain difficulties. New challenges constantly lead industrial enterprises to new barriers that they have to overcome. Trends in consumer and company behaviour that have a profound impact on manufacturing operations are reviewed below.

Customisation. Many consumers are not satisfied with the production design and mass production. For example, in response to rapidly changing social media tendencies, consumers wish that products would fulfill their personal choices. In addition to that, they want these customised items to be shipped quickly.

Regionalisation. Globalisation is being reversed, since such factors as trade tension, geopolitical conflicts and the COVID-19 pandemic have increased the risks associated with complex supply chains. Wherever possible, companies want to get resources and make products close to their customers.

Digital differentiation. Traditionally, manufacturers'IT departments possess digital skills. Various trends, including remote work, rising labour costs, and wider use of automation in workshops, have transformed digital skills from support capacities to a source of competitive advantage.

Sustainability. For many consumers, climate change has become a reality. Motivated by extreme weather conditions, organised by movements of activists, as well as government regulations and stimulations, an increasing number of consumers are choosing to purchase sustainable products and brands with a low or decreasing carbon footprint. Sustainability also increases value from the point of operations. For example, the recent rise in energy prices all around the world encourages organisations to invest in renewable energy sources.

Business models of digital transformation help in adapting to the above-mentioned trends. In a previous studies two types of such business models were identified: platform business models and "factory-future" business models [Karikova, 2022]. The flexibility and modularity inherent in the "factory-future" business models simplify the customisation of products, while the resiliency of the supply chain encourages regionalisation. Digital culture empowers workers, and sustainable activities assist in achieving climate goals and other important goals related to the well-being of sustainable communities [McGrath, 2010; Heikkilä et al., 2016; Terrenghi et al., 2017; Tesch, Brillinger, 2017].

Digital transformation in industrial enterprises is directly related to the resources, since large amounts of data, energy, materials and other aspects are used in the process of implementation of digital technologies and solutions. Considering the barriers to digital transformation, we rely on the resource-based view, according to which it is necessary to determine and develop the unique resources or capabilities of the company to achieve a competitive advantage. The role of resource theory if developing and maintaining competitive advantage through resource management in the process of digital transformation is gaining popularity in the academic field and stimulates industrial companies [Newbert, 2007; Parmenter, 2020; Rupeika-Apoga et al., 2022].

1. Literature review

The company's resources can be both tangible and intangible. Tangible resources include physical assets such as financial and human resources, while intangible resources include an organisation's reputation, culture, knowledge or know-how, accumulated experience, and relationships with customers, suppliers, or other key stakeholders. Implementation of digital transformation is a complex process with many challenges in resource and other barriers that need to be overcome. In the research, barriers to sustainable digital transformation are identified through the resource theory approach. Table 1 represents a summary of the available literature on the topic of identification of the barriers or obstacles in the process of digital transformation.

The literature review identifies a number of barriers, including lack of sufficient funding, information security risks, insufficient digital skills of employees, lack of maturity of current processes, internal resistance to change, lack of managerial awareness, uncertainty regarding the future of digital standards, etc. All identified barriers are related to resources, since, as for example, lack of suitable financing options relates to financial resources. The resources of the companies can be conditionally divided into five categories: financial, human, educational, emotional and physical resources. As mentioned earlier, according to the resource theory, effective resource management provides the company with a competitive advantage.

Competitive advantage allows a company to produce goods or services better or at lower costs than competitors. According to Michael Porter's theory of competitive advantage, governments and enterprises should pursue policies aimed at producing high-quality goods that can be sold at high market prices. In terms of competitive advantages, various characteristics of companies are considered, such as company size, location, corporate governance, etc.

Competitive advantages that are based on economies of scale are often used to highlight advantages from the side of suppliers such as the purchasing power of a retail chain. Nevertheless, there are also advantages from the demand-side – usually called network effects, they occur when the service becomes more valuable to all users and the number of users of that service accordingly increases. The advantage of large companies is that they can pay higher wages and provide their employees with more job placements than small companies. Large corporations often provide their employees with health and life insurance, stock options, retirement benefits, and various assistance programmes. It is usually more complicated for small businesses to access high-quality digital infrastructure, solve data security and privacy issues, and adapt

Table 1
Literature review on the topic of digital transformation barriers

Authors	Barriers
[Cichosz et al., 2020]	The complexity of the logistics network and its underlying processes Lack of resources, including qualified resources Technology implementation Resilience to change Data protection and security breach
[Vogelsang et al., 2019]	Absence of necessary skills Technical barriers Individual barriers Organisational and cultural barriers Environmental barriers
[Fanelli, 2021]	Limited support from local politicians Lack of financial resources Lack of experience/skills among employees Inability to hire new employees with relevant skills/experience Absence of consumer demand or limited interest from stakeholders Lack of technological skills High integration costs Difficulties in establishing effective cooperation with suppliers and network partners Competition in the industry
[Abel-Koch et al., 2019]	Lack of appropriate financial opportunities IT security concerns Insufficient digital skills of employees Lack of IT specialists on the external market Internal resistance to change Uncertainty about future digital standards
[Verhoef et al., 2021]	Lack of talented specialists Difficulties with changing corporate culture Lack of understanding and certainty in the accuracy of the chosen courses for all levels of the organisation Limited transparency and data availability Lack of investments in IT systems and technologies
[Bouncken et al., 2019]	Difficulties with company's change management Limited budgets for digital projects Lack of competencies and experience among employees Absence of a digital strategy and action plan

Source: compiled by the author.
to new regulatory environment.

2. Research methodology

To analyse the barriers to digital transformation, three-step approach is used. The first stage is devoted to the literature review. The second stage is based on a survey of company representatives and is aimed at collecting evidence on barriers to DX. At the third stage, in order to identify differences between groups of enterprises, a qualitative comparative analysis is carried out using the Kruskal – Wallis test. First, enterprises were classified according to their size: those with less than 250 employees (small companies), more than 250 employees (medium-sized companies) and more than 500 employees (large companies). In addition to that, enterprises were classified according to their high or low income. Then the enterprises were categorised based on their ability to independently implement digital transformation. Then, the significance of barriers was examined depending on the status of the respondents: employees among the management who are responsible for digital transformation, and rank- and-file workers.

At the first stage, a literature review was carried out to identify potential barriers in the interest of highlighting patterns and facilitating more accurate analysis of the qualitative and quantitative sections. Based on the barriers identified in the literature review, a questionnaire was created. During the second phase, a survey was conducted; the survey included 17 statements and five questions about the status/ position of the respondent in the company, company size, income, business model, and industry sector. The Likert seven-point scale was used to collect answers, as it allows to assess and measure the level of agreement or disagreement with the importance of barriers "which are not at all important" to "the stages extremely important". The survey was conducted among 196 industrial enterprises, the respondents received the questionnaire created on the basis of the literature review presented above. Representatives of the companies were asked to describe the barriers they faced when introducing digital transformation in enterprises. Due to the fact that the chosen sample is multisectoral, a universal combination of barriers in various industries was offered.

In addition, it was examined whether the barriers depend on the ability of enterprises to independently implement digital transformation. The capabilities to introduce digital transformation ranged from 1 (the company cannot carry out digital transformation independently) till 7 (the company can execute digital transformation independently). Then the enterprises were divided into two groups: the companies of the first group, which can independently implement digital transformation (score from 5 to 7), and another group, which cannot execute it independently (score from 1 to 4). Using the Kruskal – Wallis test it was assessed whether there are statistically significant differences between the enterprises of different sizes and two groups based on their ability to implement digital transformation. Finally, the respondents' perceptions of barriers were tested and accordingly divided into two groups: employees among the management who are responsible for digital transformation and rank-and-file workers.

In the process of conducting the survey, responders were notified that the collected information would remain confidential. Additionally, digital transformation experts from several universities were asked to preview the proposed questionnaire. Before submitting the questionnaire, some entrepreneurs were asked if the conditions were clear and understandable. The correlation was studied to shift the general method, and according to it, not a single dimension had a correlation above 0.68.

The Kaiser-Meyer-Olkin (KMO) test for sampling adequacy was used to test the adequacy of the sample. According to the result, which amounted to 0.816 (more than 0.5) the adequacy of the factor analysis was confirmed. To determine how closely related groups of elements are connected, Cronbach's Alpha method was used. The Cronbach's alpha for the considered barriers is 0.802, which indicates the reliability of the data.

3. Barriers to digital transformation: Research results

Table 2 systematises the answers of the responders to the question about the serious barriers they faced in digital transformation of their companies. Figure 1 shows the visualisation of the obtained data.

The analysis of the survey shows that the most problematic challenge faced by small businesses is the lack of adequate funding. The most important barrier for medium-sized enterprises is the lack of maturity of current processes and insufficient digital skills of employees. Large enterprises highlighted lack of certainty regarding future digital standards, internal resistance to change, lack of maturity in current processes, and information security risks.

The Kruskal – Wallis test was used to determine if there are statistically significant differences between companies based on their properties (Table 3). Following designations for the barriers under consideration are introduced: lack of adequate funding – FIN, information security risks – IT, insufficient digital skills of employees – DS, insufficient maturity of current processes – MAT, internal resistance to change – IR, lack of awareness among leaders – KN, lack of certainty regarding future digital standards – DS.

According to the results, only two out of the seven barriers are perceived differently depending on their importance. The lack of adequate funding and the lack of awareness among leaders about the implementation of digital transformation have a statistically significant difference between the represented companies. As a result, a lack of finance is more important for small businesses than for medium-sized ones, and the same implies to the awareness of the industry leaders. However, the difference in the importance of all other barriers is not statistically significant depending on the number of the employees. This allows us to conclude that the significance and value of the barriers is uniform for most barriers, and that they can be generalised.

Table 2
Barriers to digital transformation faced by the companies (%)

Barriers	Size	1	2	3	4	5	6	7	Total	Score*
Absence of proper funding	Small	2	6	2	6	26	25	34	100	7
	Medium	3	4	7	16	29	24	17	100	5
	Large	4	11	5	18	34	11	18	100	5
Informational security risks	Small	5	10	8	20	21	24	13	100	6
	Medium	2	11	2	21	31	29	3	100	5
	Large	4	10	6	21	24	27	8	100	6
Insufficient digital skills of employees	Small	3	5	6	16	28	23	18	100	5
	Medium	3	5	12	9	29	32	9	100	6
	Large	2	2	13	9	32	23	20	100	5
Insufficient maturity of current processes	Small	3	4	5	22	26	22	19	100	5
	Medium	2	4	8	15	24	39	8	100	6
	Large	4	5	4	14	14	50	9	100	6
Internal resistance to change	Small	10	10	12	19	24	17	10	100	5
	Medium	6	9	14	24	25	18	3	100	5
	Large	4	11	21	16	13	23	13	100	6
Lack of awareness among leaders	Small	10	10	6	19	30	14	11	100	5
	Medium	4	16	16	21	23	14	6	100	5
	Large	9	23	23	16	14	11	4	100	3
Lack of managerial awareness, uncertainty regarding the future of digital standards	Small	5	6	6	26	23	24	10	100	4
	Medium	3	5	7	29	29	22	4	100	4
	Large	7	7	5	23	20	32	5	100	6

* Likert scale scores correspond to the following responses of company representatives: 3 – slightly important, 4 – neutral, 5 – moderately important, 6 – very important, 7 – extremely important.

Source: compiled by the author.

Table 4 presents the results of a qualitative comparative analysis for two groups classified according to their income.

Qualitative analysis shows that the importance of barriers both for the high-income group (from 1 billion rubles) and for the low-income group (less than 1 billion rubles) is statistically significant due to lack of finances and insufficient experience of leaders, as well as information security problems. The lack of finance and managerial experience is more important for the low-income group than for the high-income group, while information security is more important for the high-income group.

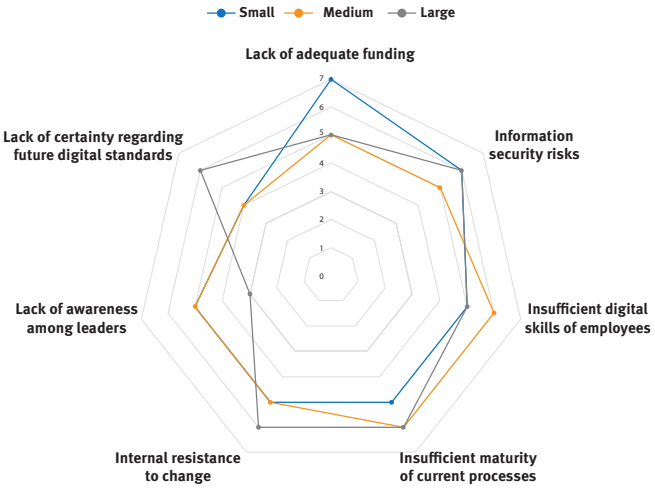
Table 5 presents the results from the analysis of companies that can and cannot independently introduce digital transformation.

A qualitative analysis of the importance of barriers depending on the company's ability to independently manage digital transformation shows that five out of the seven barriers are perceived differently, while all of them are more important for the enterprises, who cannot implement digital transformation independently than for the second group of respondents. The importance of information security and the lack of awareness among managers regarding the future of digital standards were taken into account.

Table 6 represents the results of testing the importance of barriers depending on the status of the respondent.

The analysis shows that, with the exception of a lack of finance, the leaders and managers of companies equally perceive the importance of barriers.

Fig. 1. Significance of barriers depending on the size of the enterprise



Source: compiled by the author.

According to the data received, the main obstacle to digital transformation for small companies is the lack of adequate funding. Most of the interviewed companies reported a lack of financial resources that are needed to implement technological innovations, as well as significant difficulties in obtaining public and private funding. The most serious problem for small businesses is that, despite the fact that innovative technologies often require significant upfront investment, financial institutions are not ready to lend money for risky projects

Table 3
Differences in barriers depending on the size of the company

	Test statistic						
	FIN	IT	DS	MAT	IR	KN	DS
Chi-square	23.900	0.173	1.552	1.040	0.741	12.032	0.578
Degree of freedom	2	2	2	2	2	2	2
Deviation from the normal distribution	**0.0000**	0.917	0.0460	0.595	0.690	**0.002**	0.749
Number of employees	Mean reciprocal rank						
Small	243.60	211.84	216.63	209.79	215.01	230.31	217.27
Medium	194.03	212.29	205.25	211.72	207.86	209.02	207.93
Large	170.70	219.19	225.63	227.97	222.74	167.38	214.88

Source: compiled by the author.

Table 4
The difference in barriers depending on the company's income

	Test statistic						
	FIN	IT	DS	MAT	IR	KN	DS
Chi-square	41.781	10.367	0.347	1.044	0.641	5.371	0.000
Degree of freedom	1	1	1	1	1	1	1
Deviation from the normal distribution	**0.000**	**0.001**	0.556	0.307	0.423	**0.020**	0.991
Income	Mean reciprocal rank						
Low	241.27	198.87	215.58	217.46	209.46	223.25	212.95
High	163.24	237.86	208.46	205.16	219.23	194.96	213.09

Source: compiled by the author.

connected to technological solutions of small businesses that are operating in a low-margin industry. Similar conclusions were reached by M. Cichosz and co-authors, who stated that the impact of a shortage of human and financial resources is primarily determined by the size of the company [Cichosz et al., 2020]. Financial barriers are especially important for small players with limited financial resources.

The importance of barriers varies depending on the size of the company. Despite the fact that the lack of competencies tends to be less of an issue in larger organisations that can invest in training programmes, this barrier becomes especially noticeable in smaller companies. The Kruskal – Wallis test confirmed some statistically significant differences depending on the company size. In the absence of adequate funding and lack of knowledge of the leader about implementation of digital transformation, statistically significant differences between small, medium and large enterprises were found.

When differences based on the income levels were compared, it was investigated that, as in the case of size comparisons, businesses perceive the same barriers differently. This means that in terms of employees and incomes, small businesses face more pressure in attracting fundings and hiring better managers than medium and large size businesses. Small and medium size businesses face the same problems. In terms of information security issues, an intriguing result was explored: this barrier is more important for high-margin companies than for low-margin ones. This fact can be explained from the point of view of the level of digital implementation, since high-margin companies have already met the basic requirements and are currently dealing with more complex issues.

The results of the study showed that the barriers to digital transformation depend on the ability of enterprises to independently manage this process. The analysis revealed statistically significant differences in almost all barriers, except for information security and future digital standards. As already known, there is no evidence from other studies on how the ability to manage digital transformation affects barriers, but according to this research, there is a difference in expected public support for digital transformation between the two groups. The Kruskal - Wallis test confirmed that the lack of adequate funding, insufficient digital skills of employees, lack of maturity of current processes, internal resistance to change, and the lack of knowledge of leaders about the implementation of digital transformation have a different degree of importance for enterprises and depend on their ability to manage digital transformation. All these barriers are more important for companies that cannot implement digital transformation independently. These companies are hoping for public support to continue their digital transformation. Both groups consider information security issues very significant, while neither of them considers the factor of uncertainty regarding the future of digital standards to be particularly relevant.

Table 5
Differences in barriers depending on the ability of an enterprise to independently manage its own digital transformation

	Test statistic						
	FIN	**IT**	**DS**	**MAT**	**IR**	**KN**	**DS**
Chi-square	28.748	0.023	7.871	8.826	15.025	36.102	1.181
Degree of freedom	1	1	1	1	1	1	1
Deviation from the normal distribution	**0.000**	0.880	**0.005**	**0.003**	**0.000**	**0.000**	0.277
Ability to implement DX	Mean reciprocal rank						
Not able	239.25	214.23	226.99	227.74	232.32	242.68	218.72
Able	175.84	212.44	193.78	192.68	185.98	170.82	205.86

Source: compiled by the author.

Table 6
Differences in barriers between leaders и managers

	Test statistic						
	FIN	**IT**	**DS**	**MAT**	**IR**	**KN**	**DS**
Chi-square	8.185	0.527	1.154	0.263	0.215	0.598	1.268
Degree of freedom	1	1	1	1	1	1	1
Deviation from the normal distribution	**0.004**	0.468	0.283	0.608	0.643	0.439	0.260
Status of the responder	Mean reciprocal rank						
Leader	232.67	217.63	220.07	216.11	209.20	218.01	220.44
Manager	198.87	209.03	207.38	210.06	214.73	208.77	207.13

Source: compiled by the author.

It was assumed that the barriers to digital transformation differ depending on the status of the respondent. However, research analysis has shown that only for one out of the seven barriers responder's status is statistically significant – the lack of adequate funding. This barrier seems to be more critical for leaders than for managers.

4. The mechanism of a business model selection

Selecting the right business model of the digital transformation for the enterprise can be a tool for overcoming the barriers of the digital transformation. The choice of the optimal business model for the digital transformation of an industrial enterprise should be based on the need (justification of the set of competitive advantages that the enterprise will receive as a result of the implementation of the business model) and the possibility of its implementation (the analysis of the availability of the necessary resources for the implementation). For the business model of an industrial enterprise, the following competitive advantages can be distinguished: improving operational efficiency (digital technologies can help to automate and optimise business processes, speed up production processes and improve product quality); improving financial efficiency (digital technologies can help to generate profits and achieve financial goals by using their resources in the best possible way); improving digital efficiency (level of success of an enterprise that is using digital technologies to improve its production and business processes).

The possibility of implementation of a business model is determined by assessing digital maturity and the risks that may arise during the implementing process of a digital transformation business model. The indicators of digital maturity include the level of digital culture and staff competencies, the quality of business processes and access to digital infrastructure [Linder, 2020]. In terms of risks, the risks of non-receipt of expected income from the business model implementation, information security risks, reputational and personnel risks are the most important ones. To select a business model for an industrial enterprise, it is proposed to use a mechanism that will allow to achieve the goals of the digital transformation in the best possible way and obtain necessary competitive advantages, when assessing company's readiness to implement the selected model, while taking into account its economic potential and minimising risks. Cronbach's alpha method was used to determine the level of interconnection of elements selected for the mechanism. Cronbach's alpha for the considered elements is 0.802, which indicates the reliability of the collected data. The basis for the business model selection mechanism is shown in Fig. 2.

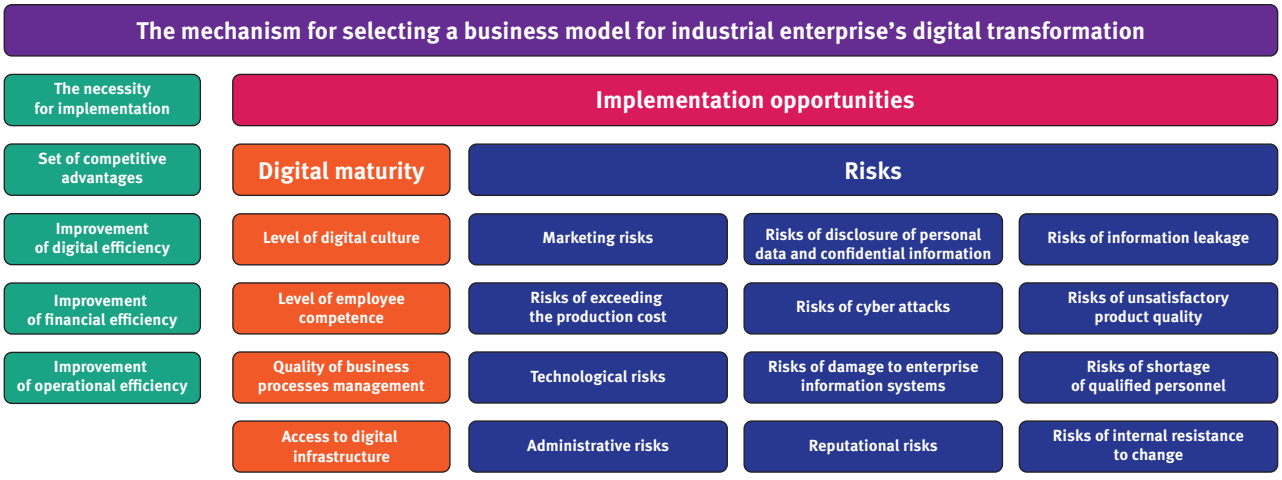
The mechanism for selecting a business model for an industrial enterprise is based on a preliminary clustering of the business model types, on self-assessment of the company and subsequent multi-criteria assessment of the applicability of the selected business model. At the same time the assessment of improving product quality, increasing productivity, increasing the efficiency of the use of resource, reducing production costs and increasing market competitiveness are taken into account

Preliminary clustering was described in detail in previous studies [Karikova, 2022], a brief description of each selected type of a business model is given below.

Digital ecosystems are network structures that unite various market participants (companies, customers, suppliers, partners, etc.) into a single digital space for creating and exchanging their values. To choose this business model of digital transformation, an enterprise must be able to interact with other market participants, have an access to digitalisation technologies and sufficient resources to create and maintain a digital ecosystem.

Value co-creation platforms are digital tools or technology solutions that enable participants to create, exchange and share their value. They provide a framework for collaboration between different participants such as companies, customers, suppliers and other stakeholders who want to solve problems

Fig. 2. Basis for the mechanism for selecting a business model for the digital transformation



Source: compiled by the author.

and achieve common goals. In order to choose this business model for the digital transformation, an enterprise must have the potential to create a platform that will bring together various market participants and create value for all parties.

The implementation of a customised product is a business model that is based on the creation of unique and customised products or services for each client. Choosing this business model, an enterprise must have an opportunity to establish massive production of customised products and services to meet customer needs.

The Smart Factory business model involves the use of advanced technologies such as the Internet of Things (IoT), artificial intelligence (AI), factory automation, and other digital solutions for optimising operations on the manufacturing site. Smart factories allow companies to significantly improve production efficiency, reduce costs, time and improve product quality.

Factory upgrade and digital engineering are business models that are based on the introduction of modern digital technologies, automation and optimisation of production processes. To select these business models for digital transformation, an enterprise must have the potential to introduce and successfully implement advanced technologies in its production processes.

As a preparatory stage for using the declared mechanism of a business model selection for the digital transformation, the following steps for a preliminary self-assessment of the companies can be highlighted:

1. Customer demand analysis: conducting market research and determining the needs of the company's customers. Identifying the main requirements and expectations of customers about the products and services offered by the company.
2. Analysis of technological capabilities: assessing the technological potential of the enterprise and its abilities to implement digital solutions. Determining the availability of the necessary technologies, infrastructure and competencies within the company.
3. Analysis of expected resultsanalysing the expected results from the implementation of various digital transformation business models. Identifying potential benefits such as process optimisation, market expansion, increase in the number of implemented innovations, and others.
4. Evaluation of resource capabilities: assessing the resource capabilities of the company, such as budget, personnel, infrastructure and other resources needed to implement the chosen business model. Identifying possible limitations and risks associated with these resources.
5. Assessing the culture of the organisation: conducting an analysis of the culture of the organszation and its willingness for changes associated with digital transformation. Identifying the strengths and weaknesses of the organisational culture and determining the appropriate business model that best fits the current culture of the company and contributes to its development.

After a preliminary self-assessment, a proceed of a business model selection starts and bases on the mechanism that is proposed further. After selecting a business model, it is necessary to develop a plan for adapting the chosen business model to the specific conditions of the company. It is important to determine the necessary actions, resources, timelines and expected results for the successful implementation of the chosen business model. The implementation process of the business model for the digital transformation requires constant monitoring and evaluation of its results [Gilsing et al., 2021]. It is necessary to develop a monitoring and evaluation system that will allow to evaluate the effectiveness of the implemented business model and make necessary adjustments in the process of its implementation. The implementation of a business model is a dynamic process and requires constant optimisation and development [Gokhberg et al., 2010; Trachuk, Linder, 2015; Chennell et al., 2020; Khachaturyan, 2022]. The company must analyse the effectiveness of implemented solutions, compare them with business goals, and make adjustments when necessary. Additional optimisation of production processes, technology upgrades, improvement of data analytics systems and AI algorithms, as well as the development of employee competencies and innovative culture may be required. In addition to that, the company should continue monitoring the market changes, analyse upcoming trends in technology development, customer requirements and the competitive environment. This will allow the company to stay ahead of its competitors, adapt to market changes and develop its business model in accordance with new updated requirements and opportunities. Particular attention should be paid to the training and development of the personnel, since the successful implementation of a business model requires training and improvement of the employees' qualifications. The company must provide trainings and assist in developing the competencies of its employees in the field of digital technologies, data analytics, AI and factory automation. This will allow them to efficiently use new solutions and tools, optimise production processes and implement innovations to the company's business model. The implementation of the business model may require significant changes in organisational culture, work processes and interactions between employees. The company must actively manage these changes, provide support and communication to employees to ensure that new decisions and work processes are clearly understood and successfully adopted. Particular attention should be paid to the continuous development and innovation. The company must constantly investigate new opportunities in order to implement technologies, optimise production processes, improve data analytics systems and increase efficiency of the production. This may include the introduction of new technologies, such as Internet of Things (IoT), augmented reality (AR), virtual reality (VR), blockchain and other innovative solutions. With the raising number of connected devices and systems, a company must pay special attention to cybersecurity issues. Protecting

data privacy, preventing unauthorised access, and other aspects of cybersecurity should be prioritised while selecting a business model. The introduction of new technologies and changes in the business processes are always associated with certain risks. The company must actively assess and manage the risks associated with the implementation of the business model, including technical risks, organisational risks, data security risks and others.

Creating a business model selection mechanism requires taking into account the variety of qualitative and uncertain value drivers. For this reason, a system can be used which includes a knowledge base of production rules and unclear withdrawal mechanism that allows to conduct the evaluation and convolution of expert opinions. Unlike score-based models, the usage of the mathematical apparatus of fuzzy logic makes it possible to qualitatively evaluate factors using linguistic variables. Thus, it is possible to fuzzify the quantitative values of the estimated indicators into fuzzy values according to formalised interval scales.

This allows to display the expert's experience in assessing factors in the knowledge base of fuzzy production rules. In addition, the system of fuzzy rules displays multilevel evaluation models, in which the evaluation of intermediate factors is carried out using the corresponding subset of rules.

The mechanism for choosing a business model is represented in the form of an "AND – OR" graph and is presented in Fig. 3.

Using this mechanism, each of the five previously determined business models is evaluated one by one, which receives a positive or negative value for use with a certain reliability coefficient (in the case of obtaining a positive evaluation by several business models, it is recommended to choose the one with the highest reliability coefficient).

In the business model selection mechanism, the following designations of determinants are used – fuzzy variables with the values "satisfactory" or "not satisfactory", for which the reliability coefficient is set on a scale [0; 1]:

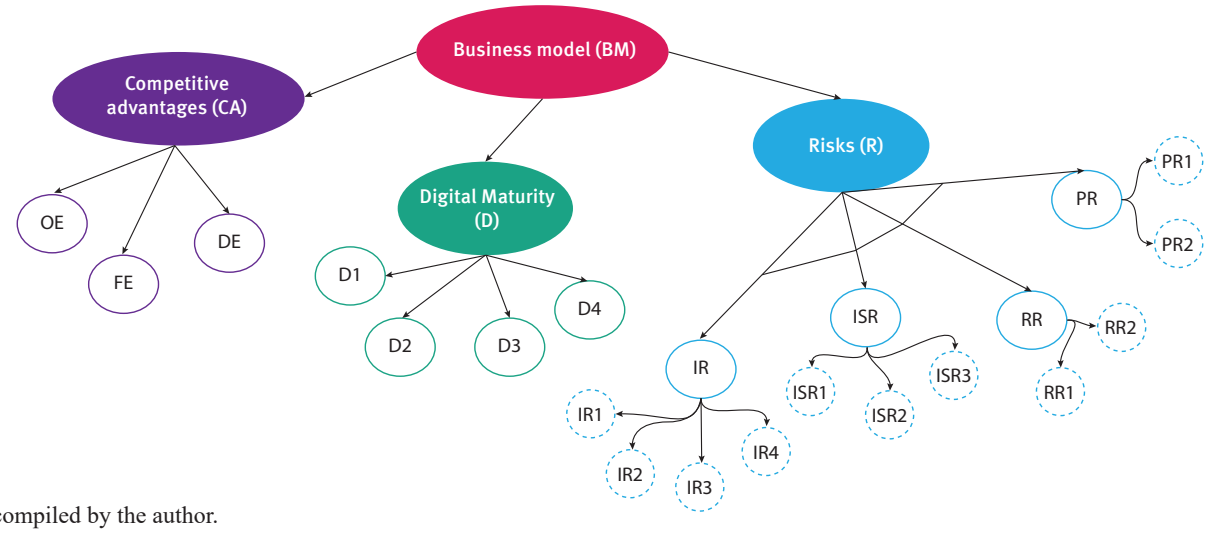
BM – choice of business model;
D – digital maturity;
D1 – level of digital culture;
D2 – level of employee competence;
D3 – quality of business processes management;
D4 – access to digital infrastructure;
CA – competitive advantages;
OE – improvement of operational efficiency;
FE – improvement of financial efficiency;
DE – improvement of Digital Efficiency;
R – risks;
IR – the risk of non-receipt of expected income
IR1 – marketing risks;
IR2 – risks of exceeding the production cost;
IR3 – technological risks;
IR4 – administrative risks;
ISR – information security risks;
ISR1 – risks of disclosure of personal data and confidential information;
ISR2 – risks of cyber attacks;
ISR3 – risks of damage to enterprise information systems;
RR – reputational risks;
RR1 – risks of information leakage;
RR2 – risks of unsatisfactory product quality;
PR – personnel risks;
PR1 – risks of shortage of qualified personnel;
PR2 – risks of internal resistance to change.

Conforming to the production rule of conjunction assessment of digital maturity factors (D), competitive advantages (CA) and risks (R) at the top level of the model a positive or negative assessment of the "business model selection" variables are determined according to formula (1).

$$D \text{ and } CA \text{ and } R \rightarrow BM, \quad (1)$$

where → – implication sigh, – negotion sign.

Fig. 3. Mechanism of selecting a business model for the digital transformation (a simplified version)



Source: compiled by the author.

This production rule in expanded form has the following form:

IF D = *"satisfactory" and CA* = *"satisfactory" and R* = = *"satisfactory" THEN BM*= *"satisfactory"*. (2)

Each factor is a term of "satisfactory" or "unsatisfactory". If at least one of the factors gets the value "unsatisfactorily", then the type of business model being tested receives an unsatisfactory rating. To operate the product rule, all factors must be satisfied, otherwise the target variable will receive an unsatisfactory value. Factors associated with the assessment of digital maturity and risks reflect the possibilities of implementing a business model, and factors related to improving operational, financial and technical efficiency reflect its competitive advantages.

Similarly, product market rules for estimating digital maturity (D), competitive advantages (CA), risks (R), the risk of non-receipt of expected income from the implementation of the business model (IR), information security risks (ISR), reputation risks (RR) and personnel risks (PR).

Risk assessment (R) depends on the conjunction of factors associated with the risks of non-receipt of expected income (IR), information security risks (ISR), reputational risks (RR) and personnel risks (PR) (formula (3)).

$$IR \text{ and } ISR \text{ and } RR \text{ and } PR \rightarrow R. \quad (3)$$

The risks of non-receipt of expected income from the implementation of the business model (IR) are determined by the conjunction of assessments of marketing risks (IR1), risks of exceeding the production cost (IR2), technological risks (IR3) and administrative risks (IR4) (formula (4)).

$$IR1 \text{ and } IR2 \text{ and } IR3 \text{ and } IR4 \rightarrow IR. \quad (4)$$

Similar to that, information security risks (ISR), reputational risks (RR) and personnel risks (PR) are defined.

Each of the risks listed above must be associated with a certain component of the platform business model or the "factory-future" business models, aimed at its leveling. Due to this, in order to assess the risk by one or another factor ($Fact_i$) while selecting the type of business model, it is necessary to obtain an expertise assessment about the quality (reliability) of the component used (*Comp*) to eliminate the risk factor, which at one time puts a fuzzy assessment of the reliability coefficient on a scale [0; 1] and correlates with the risk factor assessment:

$$Comp_i \rightarrow FactR_i, \quad (5)$$

where $FactRi \in \{IR1, IR2, IR3, IR4, ISR1, ISR2, ISR3, ISR4, RR1, RR2, PR1, PR2\}$.

An expanded presentation of the production rule is represented in the following formula:

IF $Comp_i$ ="satisfactory" *THEN* $\oplus < FactR_i$,"satisfactory", $F_i(FactR_i) >$, (6)

where $\oplus$ – represents the fuzzy addition operator; F_i – membership functions, that calculates the reliability coefficient for a variable on a scale of [0; 1].

The nature of the membership function is determined by the type of the variable $FactR_i$, in the simplest case, by some number in the interval of [0; 1].

Digital maturity assessment factors, unlike risk factors, have an additive reinforcing character. Therefore, their influence on the overall assessment of digital maturity D is considered using production rules one by one:

$$FactMj \rightarrow D, \quad (7)$$

where $FactM_j \in \{D1, D2, D3, D4\}$.

An expanded presentation of the production rule is represented in through the following formula:

IF $FactM_j$ = "satisfactory" THEN $\oplus <$ D, "satisfactory", F_i(D) >, (8)

where $\oplus$ – represents the fuzzy addition operator; F_j – membership functions, that calculates the reliability coefficient for a variable on a scale of [0; 1].

The nature of the membership function is determined by the type of the variable $FactM_j$, in the simplest case, by some number in the interval of [0; 1].

In this case each production rule $FactM_j \rightarrow D$ forms some fuzzy estimation of reliability coefficient of digital maturity factor separately on the scale of [0; 1].

Competitive advantage (CA) is assessed in a similar way.

To evaluate the maturity and competitive advantages of a business model through the algorithm, it is necessary to set an acceptable threshold value of the reliability coefficient at which the variables receive a satisfactory value, as for example 0.8.

To accept a positive assessment of the final choice of the business model type, a threshold level of the reliability coefficient can also be set, for example it can be assumed as 0.8.

The implementation of a multi-criteria model for evaluating the selection of a business model type under conditions of fuzzy interpretation of qualitative factors using the tools of a knowledge-based production system, together with the preliminary classification of model types according to certain characteristics, will allow to formalise the decision-making process and justify the effectiveness of selected business model for the digital transformation of industrial enterprises.

5. Conclusions and future research areas

Based on a literature review and a primary research, seven key barriers that enterprises face during digital transformation and that are common to all industries, were identified: lack of appropriate funding, information security risks, insufficient digital skills of employees, insufficient maturity of current processes, internal resistance to changes, insufficient awareness of managers, lack of certainty over the future of digital standards. The resource theory was used as a managerial basis for determining the critical resources of a company used to achieve a sustainable competitive advantage, since each identified barrier is associated with one or more resources, for example: the lack of appropriate funding is a financial resource, the lack of digital skills among employees is a human resource, etc. According to the conducted research, it can be concluded that the importance of barriers varies depending on the size of the company, its level of income and its ability to independently introduce digital transformation. In this case, most often the barriers associated with inadequate funding and a lack of awareness among the leaders on the

topic of introducing and adapting digital transformation are perceived differently depending on these characteristics. The research also proposes a business model selection mechanism, which takes into account the assessment of the competitive advantages obtained (improvement of operational, financial and technical efficiency), digital maturity (the level of digital culture, staff competence, the quality of business processes and access to digital infrastructure) and risks (risk of non-receipt of expected income from the implementation of the business model, information security, reputational and personnel).

At the heart of the mechanism, it is proposed to use a knowledge-based system with a set of product rules that implement uncertain conclusions on the quality factors (variables). The novelty of the proposed mechanism of a business model selection is to improve the classification and develop a multicriteria mechanism for choosing a business model for an industrial enterprise, which is executed using a knowledge-based system incorporating fuzzy inference mechanism. In the future studies, it is recommended to study the barriers to digital transformation that cause the risks described in the mechanism in more details, and propose a system of key indicators for assessing the operational, financial and digital efficiency of the chosen business model.

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Opportunities and problems of applying imitation strategies for technological development in Russia

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Abstract

Economic sanctions against the Russian Federation highlighted the problem of technological sovereignty. It is proposed to consider the problem of using simulation strategies to organise the process of equipment import substitution in a timely manner, successful implementation of which was shown by some Asian countries (Japan, China). Studies in other countries prove the effectiveness of using imitation strategies as a reference point for the technological breakthrough for individual companies and the economy as a whole. The purpose of this article is to analyse the experience of developing countries in using imitation strategies for technological development, and to assess the opportunities for the wide application of such strategies in Russia to form technological sovereignty in the current conditions. In this study the author identifies some key factors of the effectiveness of applying the imitation strategies in developing countries, primarily in China. Among these factors are the role of small and medium-sized businesses in technological development and dissemination of knowledge, the development of a system for protecting intellectual property rights, as well as the existence of a technological gap between domestic and foreign firms in the home market. These factors have had a significant impact on the spread of imitation strategies and the subsequent development of China's own innovation environment. The study demonstrates that small business, the system for protecting intellectual property rights and the competition of foreign high-tech companies will not be able to become the driving force behind the implementation of imitation strategies in the conditions of Russian reality. With this in mind, the article proposes industrial policy measures that will create favourable economic conditions for the successful use of imitation strategies based on the experience of China. The results of this study contribute to the problem of Russia's technological sovereignty formation in the current sanctions. They also contain proposals for the introduction of economic measures that may influence the effectiveness of import substitution.

Keywords: imitation strategies, China, reverse engineering, technological development, import substitution, formation of technological sovereignty.

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在俄罗斯应用促进技术发展模仿战略的机会和挑战

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摘要

对俄罗斯联邦实施的经济制裁凸显了技术主权的问题。为了迅速组织设备的进口替代，建议考虑广泛使用模仿战略。一些亚洲国家（如中国、日本）在此类战略方面有成功经验。国际研究证明了模仿战略作为单个企业和整个经济的技术突破的一个基点的有效性。本文章的目标是分析发展中国家在使用模仿战略促进技术发展方面的经验，以及评估这些战略是否可以在俄罗斯广泛使用，以便在当前环境下建立技术主权。作者确定了发展中国家，特别是中国，模仿战略有效性的一些关键因素。这些因素中：中小企业在技术发展和知识传播中的作用、知识产权保护制度发展、以及国内市场上的外国和国内公司之间存在的技术差距。上述因素对模仿战略的扩散和中国自身创新环境的后续发展产生了重大影响。本研究表明，在俄罗斯的现实中，小企业、知识产权制度和外国高科技公司的竞争将无法成为模仿战略发展的推动力。考虑到这一点根据中国的经验，作者提出了一些为成功使用模仿战略创造一个有利的经济环境的产业政策措施。本研究结果有助于解决在当前制裁环境下塑造俄罗斯技术主权的问题，并提供了可对该过程的效率产生影响的经济措施的建议。

关键词：模仿战略、中国、逆向工程、技术发展、进口替代、技术主权的形成。

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Introduction

Since 2014, when the Russian economy faced the first Western sanctions, the country's leadership has been pursuing a course of import substitution. At the same time, the focus of economic policy was placed on export-oriented production in order to increase the global competitiveness of domestic products and increase non-resource, non-energy exports [Kalygina, 2022]. In recent years, economic measures have been implemented precisely in this paradigm. However, the new sanctions of 2022 led to the realisation that the economy of our country does not have sufficient technological sovereignty, which led to the disruption of many logistics and production chains. In this regard, it became necessary to search for new solutions aimed at implementing the process of import substitution [Rubanova, 2022].

If we look at the experience of other countries, we can see examples of significant technological growth in a relatively short period of time: Japan in the second half of the 20th century or China in the late 20th and early 21st centuries, which can be a guideline for building a strategy for the development of the domestic economy. Undoubtedly, it is not possible to repeat the path taken by these countries due to the different political, economic and socio-cultural characteristics of our countries. However, studying their experience is very important for building our own Russian path of technological development with the possibility of applying individual measures of these states' industrial policy.

One of the factors that led Japan and China to make the technological leap was the use of imitation strategies based on technological imitation. At the same time, if technology was actually transferred from Western countries to Japan in the post-war period [Chung, Tan, 2017], in China, as in most other developing countries, reverse engineering methods

were used to a greater extent to gain knowledge about foreign technologies [Zhang, Zhou , 2016], which has become a benchmark for the development of Chinese industry.

In the current economic conditions, the widespread use of simulation strategies through reverse engineering is a possible strategy for technological development in the Russian Federation, including to achieve the effect of import substitution.

In the domestic literature there are studies on the implementation of import substitution models [Boiko, 2016; Nikitin, 2016; Folomiev, 2017; Kalygina, 2022], an analysis of the so-called Chinese economic miracle [Blinov, 2015; Avdokushin, 2019; Chichilimov, 2021], simulation models [Aleksandrovsky, Shushkin, 2015; Shushkin et al., 2017; Golichenko, Obolenskaya, 2018], however, there are practically no studies on the applicability of simulation strategies in the conditions of the Russian reality for the formation of technological sovereignty. It seems that the present study will fill the gap in this issue.

In view of the above, the purpose of this study is to analyse the experience of developing countries in using simulation strategies for technological development, as well as to assess the possibilities of widespread use of the simulation strategy in Russia to form technological sovereignty in the current conditions.

1. Materials and methods

The theoretical basis of the analysis are publications in scientific journals based on the results of research on the markets of developed (Japan) and developing (Brazil, China, Colombia) countries on the application of imitation strategies and their impact on the economy. For the selection of journals, the bibliographic database Scopus was used, which is available from the territory of the Russian Federation until 31 December 2022. In this database, research articles were searched by title, keywords and abstracts for the terms 'imitation' and 'innovation' (articles with the simultaneous use of the given terms were selected), as well as with the restriction of the subject 'economics, econometrics and finance' and 'business, management and accounting'. The study period was not restricted. Only empirical studies that identified factors influencing the use of imitation strategies were selected for analysis.

As a result, 22 articles published between 1966 and 2022 were taken for analysis. Of these, 3 were published before 2000, 2 in the 2000s, 8 in the 2010s and 9 after 2020. This distribution indicates a growing interest in the study of imitation strategies, which is due to the high estimation of the success of the Chinese economy based on them.

The analysis of the selected articles was carried out by studying the main sections of the publications and highlighting the key factors that influence the use of imitation strategies by individual companies. On the basis of the obtained results the influence of the identified factors on the processes of implementation of imitation strategies in the conditions of the Russian reality was assessed. General scientific methods of system analysis, synthesis and deduction were used in the article.

2. Results of the analysis

Imitation strategy is based on technological imitation. As a rule, imitation activity is perceived from a negative point of view and is seen as an opportunity to run one's own business in the absence of innovative capabilities. Thus, the study [Luo, Child, 2015] states that companies that do not have an advantage in the form of resources, patented technologies or market power can compete successfully and achieve competitive advantages by creatively gathering and integrating available external and internal resources.

Indeed, firms that do not have competitive advantages and the ability to develop their own developments choose an imitation strategy because copying innovations developed by others is usually cheaper than implementing the firm's own innovative activities [Cappelli et al., 2014; Shushkin et al., 2017].

However, in addition to the aforementioned market and competitive effects, the choice of imitation strategies creates long-term conditions for the further technological development of imitating firms. For example, studies conducted in emerging markets have found that imitation is an integral part of the innovation process.

For example, a study on the imitation behaviour of Colombian firms [Corredor et al., 2015] showed that imitation may be the first step for many firms in emerging markets to achieve new innovation goals. Moreover, a small amount of imitation almost always accelerates growth and leads to increased competition, which encourages firms to invest in research and development based on the accumulated knowledge gained in the process of imitation [Aghion et al., 2001; Mukoyama, 2003; Zhou et al., 2021].

In other words, a new firm can start competing with imitation without necessary resources for its own research and development, having accumulated enough knowledge and skills in the process of using such a strategy to develop its own innovative technologies and products over time.

Many successful organisations have used imitation as an important strategy to outperform competitors and have combined it with innovation to offer better product or service

features [Wu et al., 2020]. For example, companies from developing countries that are now key players in their fields (Tata and Ranbaxy in India, Odebrecht and Promon in Brazil, Huawei and Lenovo in China) have used imitation strategies to challenge dominant innovators in the international market.

However, imitation is not only important for companies at the beginning of their development and striving for growth, but also for those that are already a major player in the market and want to maintain a high level of competitiveness.

For example, the study [Levitt, 1966] notes that organisations are motivated by competition to treat imitation as a survival and growth strategy, so that even the largest innovation-active organisations should be involved in the process of imitation.

Moreover, the use of imitation strategies affects not only the technological development of individual firms, but also the market as a whole: imitation increases competition, which makes innovative products and technologies more accessible to a wide range of consumers and contributes to the diffusion of knowledge and innovation to other geographical markets [Aleksandrovsky, Shushkin, 2015].

In the context of the identified effects of imitation strategies under certain conditions, the scientific community is increasingly considering such strategies as acceptable for bridging the technological gap in developing countries. In addition, more and more researchers consider imitation and innovation not as mutually exclusive and opposite concepts, but as complementary ones, the combination of which makes it possible to achieve the maximum return on innovation [Yu at al., 2015; Wang, 2021].

The strategy of imitation at the national level has worked very well in Japan, for example, which has long since moved from a developing economy to a developed one. China is now in the process of such a transition, and its example is also very instructive in terms of the use of imitation. China's rapid economic growth and the achievements of Chinese companies in technological development over the past few decades are largely due to the imitation strategy.

The success of Japan and China is stimulating the interest of other developing countries in imitation strategies for the technological development of their economies. For Russia in particular, the issue of rapidly building technological sovereignty is particularly relevant in the current sanctions environment, and many researchers are considering the possibility of using China's experience.

However, the transition to the use of imitation strategies at the national level is impossible without taking into account the specifics of the Russian economy. Furthermore, the key success factors of imitation strategies for the technological development of emerging markets are analysed and the possibilities of their impact on the Russian economy are assessed. This article focuses only on economic factors without taking into account social and socio-economic factors (population density, average income, etc.).

The first factor is the impact of small and medium-sized enterprises on technological development. At present, small and medium-sized manufacturing enterprises have become the main driving force of China's economic development, providing a huge innovation driving force in the evolution of China's market economy and manufacturing ecosystem, and making important contributions to economic construction [Chung, Tan, 2017]. In addition, research conducted in the Chinese market points out that Chinese SMEs can respond to market trends and conduct research and development of new products more efficiently than large enterprises [Wang, 2021].

Thus, the role of SMEs in China's technological development is enormous, which is reflected in their financial performance. For example, data from 2017-2018 show that Chinese SMEs account for more than 70% of patents and almost 70% of exports, with growth rates higher than all exports [Zhang, Merchant, 2020]. According to 2020

Table 1
Indicators of the SMEs' contribution to the economic development of selected countries (%), 2019

	The USA	Japan	China	Russia
Contribution of SMEs to economic growth	52	47,6	55	20,8
Share of persons employed in SMEs	68	67	76	27

Sources: [Wang, 2021]; Report of the Commissioner to the President of the Russian Federation on the Protection of Entrepreneurs' Rights for 2021: http://doklad.ombudsmanbiz.ru/doklad_2021.html.

data, the contribution of Chinese SMEs to the country's GDP exceeds that of developed countries - the United States and Japan - and amounts to about 55% (Table 1).

In Russia, the situation is quite different: the contribution of small and medium-sized enterprises to GDP is 20-21%, employment is about 25-27% of the economically active population (Table 1), and these figures have remained unchanged for many years.

It becomes clear that the structures of the socio-economic systems of Russia and China are fundamentally different: large enterprises play a significant role in the Russian business structure, which are less dynamic compared to small businesses, react more slowly and less effectively to changes in the domestic market [Maidanevich, Bedrik, 2017].

Japan's experience in moving from imitation to innovation strategies shows that being a quick adopter is a more reliable strategy with the advantage of minimising costs and risks than being a pioneer or market-leading creative innovator [Bolton, 1993]. Conversely, mature stage firms grow slowly and face poor market response to their product improvements and marketing expenditures, and thus are the most disadvantaged compared to early innovators and early adopters [Yu at al., 2015].

Thus, under the imitation strategy paradigm, more dynamic SMEs are more likely to become early adopters through rapid growth opportunities, allowing them to further develop their own R&D base and carry out their own innovation activities. More SMEs following such a strategy create economies of scale, which lead to an increase in the innovativeness of the economy as a whole.

On the contrary, large firms, being more static and slower, may not be willing to follow innovators as quickly, which may ultimately lead to the inertia of the innovation system of such firms.

These conclusions are in line with the position expressed in studies [Chen, Hambrick, 1995; Giachetti, Pira, 2022], according to which small firms may be able to react more quickly than large firms due to their flexibility, while the latter may be limited by structural complexity and slower information processing, which impairs their performance, responsiveness to attack opponents.

The following conclusion can be drawn. Since economic growth in Russia is driven by large firms, the technological push effect of imitation strategies may not be achieved due to the insufficient role of SMEs in the Russian economy. In this respect, the state's industrial policy plays a very important role, particularly in terms of smoothing out this factor.

The next factor that requires attention when assessing the possibility of using imitation strategies is the system for protecting intellectual property rights. A number of studies [Sun et al., 2020; Yi et al., 2020] note that a characteristic of emerging markets is the weak protection of intellectual property rights. This feature is typical of both China, where it was one of the factors behind the success of imitation strategies, and Russia, where such a legal feature could contribute to the success of the use of imitation strategies.

Thus, according to the international rating of the degree of protection of property rights in the countries of the World International Property Rights Index 2022[1] China currently ranks 47th, and Russia 85th.

It is worth noting the following. Based on this index for 2009[2], China is ranked 69th and Russia is ranked 88th, which means that 13 years ago the state of China's intellectual property laws was much worse, and in recent years significant restrictions and other changes have been introduced. However, little seems to have changed in Russia's IPR legislation, given the insignificant change in position in the ranking, and this is the next problem.

When a country's IPR system is immature and poorly enforced, companies are not highly motivated to undertake groundbreaking research and development. Instead, they are content to imitate new product development to reduce their exposure to technology and market risks, shorten product development cycle times, and meet changing market demand [Fang et al., 2017; Yi et al., 2020].

It turns out that the effectiveness of imitation strategies is facilitated not so much by a static, weak IPR protection system, but by its dynamism and improvement, accompanied by a gradual increase in R&D in the country and an increase in the innovativeness of firms. At the same time, the process of improving legislation is accompanied by a change in the approach of entrepreneurs to the issue of intellectual property rights protection. Thus, according to a study [Yu et al., 2015], the owners of Chinese enterprises that have moved from low-quality imitations to original innovations and have achieved success are no longer willing to take the legal risks associated with copying other people's products, especially after the tightening of regulation in the area of legal protection of intellectual property.

Thus, for the imitation strategy to be successful in Russia, it is necessary to simultaneously change the legislation in the field of intellectual property protection so that Russian companies do not get stuck in imitation, but receive an additional incentive to use accumulated knowledge in innovative strategies.

[1] https://internationalpropertyrightsindex.org/.
[2] https://rate1.com.ua/ru/society/standard-of-living/3037469d/рейтинг-стран-по-уровню-защиты-права-собственности.

Finally, the third factor to consider is the following. A study [Guo et al., 2016] in the Chinese market found that the technology gap between domestic and foreign firms has a positive impact on the domestic market. The technology acquisition strategy at the industry level is more targeted, as local firms move from imitation to innovation in a catch-up process. That is, the presence of high-tech competitors from other countries sets a certain bar for local firms and stimulates them to technological growth.

However, in 2022, due to the introduction of a large number of economic sanctions against the Russian Federation, a number of Western high-tech companies ceased or suspended their activities in the Russian market (for example, the world's largest manufacturers of special equipment Caterpillar, Deere, Tadano Ltd.). This situation carries the risk of a lack of competition in the domestic market, which may lead to technological backwardness.

This point of view was expressed, for example, by the head of Sberbank German Gref at the Finopolis forum in November 20-22, when he negatively assessed the departure of foreign companies from Russia. In his opinion, the opportunities that will open up for domestic business will be offset by a sharp decline in the level of competition, 'In the long term, the economy will lose because the density of competition will decrease. What we are talking about - innovation, the main means of developing innovation - is very fierce competition. Where there is no competition, there is no innovation. And in this sense, I think that one of the most long-term negative consequences for the Russian economy is the exit of powerful foreign companies from the Russian market and the decrease in "competition"[3].

On the one hand, the incentive to solve this problem is the legalisation of parallel imports since June 2022, which creates a supply of high-tech goods on the Russian market (although not enough). However, parallel imports can lead to a number of problems, including a significant increase in the cost of imported goods [Maglinova, 2022], a potential increase in the flow of counterfeit products under well-known logos, as well as the shifting of responsibility for maintenance, service, labelling and safety to sellers [Kovtun, Kalinina, 2022]. But even these shortcomings can serve as an additional incentive for import substitution.

On the other hand, a significant increase in costs and the existing shortage of high-tech goods imported through parallel imports do not help create conditions for price competition on the domestic market. It may contribute to a situation in which it is advantageous for Russian companies to raise the prices of manufactured import substitutes without ensuring an adequate level of quality of these products, which will not contribute to increasing the innovativeness of the economy of our country.

It is worth mentioning another factor that should be taken into account in connection with the termination of partnerships with some Western companies due to sanctions. In the case of imitation strategies, domestic demand for manufactured products may initially be small and not be the driving force behind the development of the economy. Initially, external demand turns out to be crucial for development, stimulating the supply of innovative goods and services from national industries [Golichenko, Obolenskaya, 2018].

Taking into account the current situation in Russia, domestic producers who start production using imitation strategies may face insufficient demand for their products. In this regard, it is very important to establish partnerships with companies from friendly countries that can become consumers of import-substitution products, which will become an additional incentive to increase production and, in the future, to introduce their own developments and improvements in the production process.

It is difficult today to assess the practical impact of the withdrawal of foreign companies from the market. However, in any case these risks should be taken into account when developing industrial policy measures, which should include measures to create competition in the domestic market, especially in high-tech industries, as well as measures to create demand (including in friendly foreign markets) for import-substituting products.

3. Discussion

The analysis of the economic factors of the effectiveness of imitation strategies in developing countries allows us to identify a number of features without which the use of imitation strategies in Russia on a national scale will not be effective.

It is possible to eliminate the negative impact of the identified features by means of a competent industrial policy. It should be noted that industrial policy, as a set of measures taken by the government to increase the competitiveness of local enterprises and promote the structural transformation of the economy, is a necessary condition for supporting any developing economy in the international arena [Zhang, 2020]. In this regard, the smoothing of national characteristics of technological development of the Russian economy can be carried out precisely through industrial policy measures.

[3] https://www.rbc.ru/finances/10/11/2022/636cb18f9a79478393ddffda.

Taking into account the identified peculiarities of the economic situation in Russia, these measures should, in particular, take into account the following.

1. Developing an institution to support high-tech small and medium-sized enterprises. An important role in gaining experience in carrying out simulations and using this knowledge to carry out their own developments belongs to SMEs as more flexible business entities in contrast to large enterprises. In this regard, it is necessary to expand the strategic areas of support for small and medium-sized enterprises including financial (concessionary loans, state guarantees, grants, extension of loan terms, review of the tax burden); informational (creation of a positive image of an entrepreneur in the media, entrepreneurship education); legal (reducing the burden of inspections, bureaucracy, organising legal consultations); production (organising public procurement of SME goods, providing free places in municipal co-working centres, ensuring interaction between large enterprises and SMEs on the principle of 'customer – contractor') [Plotnikova et al; Rubanova, 2022; Shkuratov, 2022].

2. Taking into account the existing structure of participants in the economic system and the huge role of large enterprises. It is necessary to encourage them to form the flexibility of management systems. It will allow them to respond more quickly to changing market conditions, to follow trends, including in the field of marketing and technology, in order to increase the pace of technological development.

3. Encouraging large enterprises to adopt imitation strategies, including through the implementation of government orders. At the same time, it is advisable to create sales markets for new industries not only within the country, but also to stimulate the conclusion of contracts with foreign buyers.

4. Systematic development of the Institute for the Protection of Intellectual Property, carried out together with the gradual technological development. The introduction of changes in the legal field is particularly important in terms of creating an incentive for domestics.

These measures have general directions and require more detailed study for the purpose of actual implementation, possibly taking into account industrial and regional characteristics. At the same time, they provide a general vector for the development of industrial policy measures in order to successfully adopt the experience of technological development based on simulation strategies, taking into account the national characteristics of our country.

Conclusion

The article discusses the main features of the use of imitation strategies in developing countries and reveals the advantages of imitation strategies for the technological development of the economies of such countries.

The author identifies factors that have had a significant impact on the success of imitation strategies in developing countries: the role of SMEs in economic development, the state of the system for protecting intellectual property rights, and the presence of competition on the domestic market from foreign high-tech companies.

The analysis of these factors in the context of their influence on the possibility of using imitation strategies in Russia showed that the differences in the economic conditions of China and Russia do not allow drawing a clear conclusion about the possibility and potential success of imitation strategies in Russia. The author concludes that the success of such strategies in the Russian Federation at the national level will depend on the industrial policy, which can mitigate the effects of most of the negative factors.

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On the management of an industrial enterprise based on potential indicators

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Abstract

The article is devoted to the consideration of potential indicators as tools of operational and strategic management. Within the framework of operational management, it is necessary to maintain the achieved level of development, and strategic management should be aimed at developing the capabilities of the enterprise, its potential. The operational and strategic parameters of ensuring the competitiveness of the enterprise are identified. To build the indicators of potential, strategic structures of the enterprise have been formed, showing a quantitative representation of the economic, technological and organisational structures of the enterprise (in the form of grouped costs in a certain way). Based on the use of strategic structures, the actual and target values of the enterprise's potential as criteria for assessing the level of development in economic, technological and organisational terms are formed. The use of strategic structures makes it possible to carry out operational balancing of the company's expenses when the actual costs exceed the planned level, as well as to change the company's structure during the transition to the manufacture of new products or for the purposes of crisis management.

Keywords: competitiveness, strategic structures, enterprise potential, cost balancing, operational management, strategic management, restructuring.

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基于潜力指标管理工业企业

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摘要

这篇文章讨论了潜力指标作为业务和战略管理工具的。实行业务管理需要保持已实现的发展水平，而且战略管理的目的是发展企业的能力和潜力。作者确定了企业竞争力的操作和战略参数。为了建立潜力指标，成立了战略企业结构：企业的经济、技术和组织结构的定量表示 （以某种方式分组的费用）。基于战略结构的应用，生成了企业潜力的实际值和目标值，作为评估经济、技术和组织发展水平的标准。当实际成本超过目标水平时，使用战略结构可以对企业成本进行业务平衡。而且在引进新产品或进行危机管理时，也有助于公司的重组。

关键词：竞争力、战略结构、企业潜力、成本平衡、业务管理、战略管理、结构调整。

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Introduction

Managing an industrial company involves the processes of operation and development.

Functioning is the cyclical repetition of the same actions, the quality of which is determined by the stability of the rhythm. In this process it is necessary to maintain the level of development achieved earlier during the implementation of the previous cycle of strategic management.

The development of an enterprise, which is an object of strategic management, involves reaching a new level, which provides opportunities for more successful functioning [Katkalo, 2011; Novikov, 2023]. The need for development is due to changes in the external environment of the organisation, which can lead to a decrease in the efficiency of functioning processes, profits and, potentially, bankruptcy [Novikov, Ivankovich, 2016]. A special place in management is occupied by anti-crisis management, which includes a way out of an already existing crisis, overcoming unprofitability. A necessary condition for the survival of an enterprise is the presence of profit, therefore, faced with the impossibility of increasing the volume of production or rapid diversification; the enterprise pursues a policy of cost reduction, which in turn contributes to a decrease in the level of development achieved by the enterprise, but ensures its survival.

In order to manage the development process and regulate the functioning of the enterprise, quantitative assessments of the level of development are necessary. It seems that the indicators of the industrial potential of the enterprise, estimated on the basis of the cost shares of an operating enterprise, can be considered as such.

Based on product parameters, target values of potential indicators (cost shares of current or planned products) can be formed. It is a management task to ensure that the actual values meet the target values.

In the context of anti-crisis management, potential indicators can also serve as benchmarks for a company and allow it to choose a more appropriate option from a long-term perspective. The present article considers these questions. The study aims to develop indicators of the company's potential and to examine the possibilities of using these indicators in operational and strategic management.

The following tasks were set in the work:

- Study of parameters of competitiveness of enterprises in the short and long term;
- Development of potential indicators of enterprises;
- Consideration of the issue of using potential indicators for cost balancing in the framework of operational management, as well as for managing the structure of the enterprise in the framework of planning the release of new products.

The methodology of this study consists in the application of methods of aggregation of enterprise resources, mathematical modelling, as well as general scientific methods of analysis and synthesis.

1. Parameters of enterprise competitiveness

When assessing the parameters of enterprise competitiveness, the author of the study made the following methodological assumptions:

- - External setting of the enterprise management channels, since it is the effectiveness of the interaction of the enterprise with the external environment that determines the profitability or unprofitability of economic activity, the economic feasibility of the existence of the enterprise as such;
- Differences in operational and strategic parameters of management (the former are related to current activities, functioning of the enterprise, the latter - to development of the enterprise, selection and practical implementation of one of the alternative strategic options). The functioning of the enterprise is characterised by a certain repetition of actions, the stability of the rhythm. Development processes lead to the actual destruction of the established order, but should contribute to the increase of the efficiency of the enterprise's exchange processes with the external environment, operational efficiency, entry into new markets, release of new and updated products, etc;
- The possibility of assessing the level of development based on the ratio of cost components. In the course of development, the company goes a long way, and progressive development is characterised by an increase in the quality and knowledge intensity of products, a gradual transition to mechanised and automated means of production, with a corresponding complication of management, equipment used and an increase in the importance of production preparation structures;
- Dependence of production on the industrial environment, requirements for manufactured products, applied industrial technologies, market capacity and the cost level determined by the price of the product formed on the market. In some cases, enterprises have structural inadequacies or redundancies, which contribute to an increase in production costs and the duration of the production cycle, while possibly reducing the level of product quality. In other words, the real problem is the choice of ‘structural standards’ of enterprises that provide the necessary and sufficient level of development of the production infrastructure for the production of certain types of products. It seems that this problem can be solved on the basis of the development of potential indicators, determined both on the basis of the actual ratio of the costs of the enterprise, and on the basis of the requirements for the ratio of the costs of manufactured and planned products. The requirement that the actual values of the enterprise's potential indicators correspond to the similar parameters determined by the product is a possible condition for ensuring the minimalism and

sufficiency of the enterprise's structure. Structural redundancy leads to the gradual degradation of a part of production capacities and other resources of enterprises [Lorenz, 1994; Eisenhardt, Martin, 2000]. Structural insufficiency results the impossibility of producing certain types of products and degradation of technologies [Novikov, 2017b].

The competitiveness management of the enterprise can be considered from the operational and strategic perspectives [Novikov, 2017a]. From the short-term perspective (functioning of the enterprise on the basis of available resources and production technologies), it is necessary to ensure that the enterprise's products meet the requirements of the market environment - the price of the product, its sales volume and the required level of quality (Table 1).

Table 1

Market and incompany parameters

Market variables	Enterprise management options	
	Operating	Strategic
Price	Unit cost	The structure of enterprise resources
Sales volume	Production output	Production organisation
Quality	Technological accuracy (validity) of the product	Production technology

Source: [Novikov, 2010; 2012].

Compliance with the market price is ensured by achieving a cost level at which the enterprise can make a profit (the market price is higher than the cost of the product). To ensure the sale of products, it is necessary to ensure that the potential sales volume is equal to the production volume (the actual productivity of the production processes must be equal to the planned one). As for product quality, shown in [Novikov, 2017b], in the short term (on the basis of existing technologies) it is possible to ensure only the technological accuracy or suitability of products, since the current technology determines the maximum level of product quality corresponding to a good product. It is impossible to improve the quality of products without significant changes in technological processes.

In the case of a transition to the production of new goods, operational parameters lose their relevance due to spatial and temporal limitations and focus on the current products manufactured by the company. This is where strategic parameters come into play: the structure of the enterprise's resources (their orientation towards the past, present or future), the organisation of production (it determines the maximum volume of production that can potentially be supplied) and the production technology, which should ensure the formation of all consumer characteristics of the future type of products.

Thus, from the point of view of strategic management we can speak about three management channels - resource, organisational and technological, on the basis of which the strategic structures of an enterprise can be formed as a tool of strategic management.

2. Development of enterprise potential indicators

2.1. Creation of strategic structures

Every industrial company is characterised by qualitative and quantitative security. At the same time, qualitative security is marked by the main function of the enterprise, its profile, composition and interconnections of individual components. Quantitative security is formed on the basis of the proportions of individual parts of the enterprise.

The main purpose of quantitative structures is to determine the limits (or, in other words, boundary conditions) of the existence of qualitative ones, i.e. the restructuring of the quantitative structures of production systems is both a prerequisite and a condition for production restructuring at a qualitative level. It is also possible to speak of the different role of structures in the existence of the company, that is, its hierarchical organisation.

Thus, from the point of view of development and introduction into production of new types of goods, the key role belongs to production technology, the improvement of which makes it possible to simulate the formation of all consumer properties of future products, after which they obtain quantitative certainty and organisation of production with the level of product costs. On the contrary, in a crisis situation, the priority is given to the resource structure, the adjustment of which allows the enterprise to reach the break-even level of economic activity and prevent bankruptcy.

The management of a company takes place by influencing a given structure through its qualitative or quantitative change. In other words, management is restructuring, purposeful restructuring, which can be operational, strategic or related to the level of individual technological operations (current management).

Enterprise resource management, technology management and production organisation management are inseparable parts of management, where a change in one of the parameters inevitably affects the others. Thus, all these channels of strategic management have a common cost (resource) base in the form of the company's total costs. In other words, to form quantitative strategic structures, the costs of a company are grouped according to resource, technological and organisational characteristics (Table 2)[1].

[1] In general, the grouping (aggregation) of costs as a management tool is widely used. It is widely known that costs are divided into conditionally fixed and conditionally variable, direct and indirect, a certain form of grouping of costs and income of an enterprise is a balance sheet, etc.

Table 2

Composition of strategic structures of an industrial enterprise

Strategic framework	Elements of a strategic framework	Element characteristics
Resource (economic), R = R1 + R2 + R3	Resources of the past, R1	Depreciation of fixed assets, illiquid assets with their maintenance costs, etc.
	Resources of the present, R2	Cost of raw materials, materials, semi-finished products and other direct costs.
	Future-oriented resources, R3	Pre-production costs, R&D, marketing, etc.
Technological (functional), F = F1 + F2 + F3	Pre-production resources, F1	Organisational structure of production engineering
	Main production resources, F2	
	Resources of the auxiliary and service industries, F3	
Organisational (organisational and managerial), O = O1 + O2 + O3	Enterprise management resources, O1	Enterprise management structure
	Production management resources, O2	
	Pre-production management resources, O3	
R = F = O	Balance ratio characterising the integrity of the company and the interdependence of strategic structures*	

* The formation of elements of strategic structures on the basis of cost components depends on the specifics of enterprises, their industry affiliation and is not considered separately in this paper.

Strategic structures are formed from the costs of the enterprise according to a special methodology. This can be based on the cost aggregation approach presented in Table 3, developed for one of the largest shipbuilding enterprises in the Russian Federation.

In order to make the strategic structures of a company dynamic, it is necessary to use a specific management accounting system. The consideration of this issue is beyond the scope of this study.

2.2. Indicators of enterprise potential

In order to manage the development of an enterprise on the basis of quantitative strategic structures, the following systems of indicators are considered in this paper:

- Current potential indicators, which are an assessment of the achieved level of development of the enterprise in economic, technological, organisational and managerial terms;
- Target indicators of the potential, formed on the basis of the parameters of the new products to be launched, representing an assessment of the required level of development of the enterprise, which should be achieved as a result of adapting the structure of the enterprise to new products.

Current potential indicators

The potential of the enterprise is a characteristic that reflects the current production capabilities of the enterprise and its ability to grow in the future. In accordance with the elementary composition of the quantitative strategic structures presented above, potential indicators can be formed. They characterise the level of development of the enterprise in three main aspects - economic, functional and organisational and managerial (Table 4).

As mentioned above (Paragraph 1), the author of this study, when developing potential indicators, assumed the main progressive direction of production development, which corresponds to a gradual increase in the knowledge intensity of products, the complication and automation of production equipment, the increasing role of production preparation structures, R&D, marketing, management, and so on. From an economic point of view, these changes are reflected in the change of the cost ratios, which correspond to those capacity indicators shown in Table 4.

Unfortunately, in some cases, the need to solve the problems of survival has forced companies to sacrifice their future, and instead of an increase, a decrease in scientific and industrial potential can be observed[2].

[2] Thus, in the 1990s, many domestic enterprises, especially those linked to the military-industrial complex, accepted any random orders in order to fill production capacities and personnel, not always paying attention to industrial degradation, as they were faced with the problem of unprofitability. According to the author of this study, when planning alternative development options, it is necessary to take into account the currently achieved scientific, production and human potential of enterprises, trying to make the best use of it in the present and in the future.

Table 3
An example of forming the elements of strategic structures

Potential component	Names of strategic structure elements	Aggregate composition
Resource (economic), R = R1 + R2 + R3	Expenses relating to prior years, R1 = R11 + R12 + R13 + + R14 + R15	R11 – Depreciation of the fixed production assets
		R12 – expenses for the maintenance and operation of the fixed production assets involved in the production process
		R13 – depreciation of fixed production assets that are not involved in the production process
		R14 – inventories with maintenance costs (capitalised portion of technology costs)
		R15 – work in progress with maintenance costs (capitalised part of work in progress)
	Current expenses, R2 = R21 + R22 + R23 + + R24 + R25	R21 – wages of main production workers with accruals
		R22 – the cost of raw materials, materials, semi-finished products, components with less inventory
		R23 – energy costs for technological purposes
		R24 – the cost of low-value, fast-wearing items and tools
		R25 – cost of work in progress (less the capitalised portion, i.e. illiquid assets)
	Forward-looking spendings, R3 = R31 + + R32 + R33 + R34 + R35	R31 – long-term production preparation costs
		R32 – Costs of management and operational preparation of production (R32 = R32пп + R32оп + R32во)
		R33 – Cost of supplies and services (R33 = R33вп + R33обп)
		R34 – the cost of paying for the work of contractors and installation supervision organisations
		R35 – other structural costs
Functional, F = F1 + F2 + F3	Pre-production resources, F1	F1 = R31 + R32пп
	Main production resources, F2	F2 = R1 + R2 + R32оп + R34 + R35
	Resources of the auxiliary and service industries, F3	F3 = R32во + R33
Organisational and managerial, O = O1 + O2 + O3	Enterprise Management Resources, O1	O1 = R34 + R35
	Production management resources, O2	O2 = R1 + R2 + R32оп + R32во + R33
	Pre-production management resources, O3	O3 = R31 + R32пп

Table 4
The indicators of enterprisepotential

Strategic framework	Potential indicator	Purpose of the indicator
Economic	PE = R / R2	Characterises the level of economic development of the enterprise, i.e. the formation of the required (in terms of market price and profit) level of production costs
Functional	PF = F / F2	Characterises the level of technological development of the enterprise
Organisational and managerial	PO = O / O2	Characterises the level of organisational development of the enterprise

Table 5
Correlation of production proportions with market requirements for new products

Strategic framework	New product parameter name	Formula for calculating the parameters of new products	Purpose of the parameter
Economic	The required value of the resource potential of the enterprise (or a separate type of production)	FE = (r1 + r2 + r3) / r2	Determining the prospects for the economic structure of the enterprise
Functional	The required value of the functional potential of the enterprise (or production)	FF = (f1 + f2 + f3) / f2	Determining the prospects for the ratio or proportions of the functional structure of the enterprise
Organisational and managerial	The required value of the organizational and managerial potential of the enterprise (or production)	FO = (o1+o2+o3) / o2	Determining the prospects for the organisational structure of the enterprise

In the process of progressive development of production, the level of knowledge intensity of products increases, which contributes to the increase in the accuracy class of equipment and its significant increase in price. The share of production preparation and management costs increases. The structures of auxiliary and service industries are becoming more complex. The design of future products and their input, research and marketing deserves more attention. The role of intangible production factors is growing. At the same time, the share of primary production in the cost structure is decreasing, and the share of raw materials and consumables in the cost structure is decreasing. All these changes are reflected in the formulas for calculating the potential, in which the share of the parameters R2, F2 and O2 in the cost structure should decrease over time, leading to an increase in the values of the PE, PF and PO indicators.

These indicators are dimensionless values, they can be used for analysis, comparison of alternative options for production development. Potential indicators can be used as an additional criterion for selecting alternative investment projects, where the best options should correspond to the growth of parameters PE, PF and PO. However, the main purpose of these indicators is different: they must link the current state of the company with the parameters of future products. In other words, for the development of the enterprise it is necessary to have a certain standard in the form of parameters of the future product, which should become the basis for the structural restructuring of the enterprise.

Target values of business potential indicators

In order to calculate the planned (reference) values of indicators of economic, functional and organisational and managerial potential, we will use the following relations.

If the expected price of a production unit is equal to P, and the profit share in this price is planned at the level Pr_{proc}, then the maximum possible cost of a production unit C_{max} is equal to the value

$$C_{max} = P (1 – Pr_{proc}). \quad (1)$$

If we then divide the cost of a unit of production, C_{max} according to the purpose of the structural components of the strategic structures, we obtain the following specific ratios of the strategic structures:

$$C_{max} = r1 + r2 + r3 = r, \quad (2)$$

$$C_{max} = f1 + f2 + f3 = f, \quad (3)$$

$$C_{max} = o1 + o2 + o3 = o. \quad (4)$$

Here r1, r2 and r3 are the specific parameters corresponding to the elements of the economic structure (Table 2); f1, f2 and f3are the specific elements of the elements of the functional structure; o1, o2 and o3, by analogy, correspond to the organisational and managerial structure.

Dividing expressions (2), (3) and (4) by r2, f2 and o2 respectively, we obtain the so-called planned or required values of potential indicators for all strategic structures (Table 5). The reference values of the potential indicators (FE, FF and FO), corresponding to the parameters of future production, are calculated per unit of output, but their relative nature allows us to correlate on this basis the parameters of the target product and the structural proportions of the projected (or reformed) production[3].

The condition for full compliance of production parameters with the requirements of new or long-lived products is equality of actual and required (forecast) values of potential indicators, i.e PE = FE, PF = FF, PO = FO[4].

[3] The calculation of specific cost values for the elements of the strategic structures (r1, r2, r3, f1, f2, f3, o1, o2, o3) and the corresponding reference values of the potential indicators FE, FE and FO can be associated with certain difficulties, which, however, in the opinion of the author, are quite solvable: First of all, any calculations for new products will always be approximate, i.e. high initial accuracy is not required, the company has the opportunity to adjust its structure more precisely in the future; at the same time, a part of the cost parameters of future products can be calculated on the basis of the previous experience of the company's operation and related trends of changes in unit costs of products; in a number of industries, a part of the information (the cost of raw materials, materials, energy, labour costs, etc.) in monetary terms is not available. In a number of industries, some of the information (the cost of raw materials, materials, energy, labour, etc. per unit of output) can be obtained in monetary terms from the design and technical specifications of a new product.

[4] These figures are not the only ones to be considered when designing a new production line, as there are various production technology options to be considered.

After determining the current and future state of the enterprise in terms of the ratio of structural proportions of production and products, the calculation of the necessary structural changes is carried out, which consists in varying the share of certain elements in the composition of strategic structures.

Within the framework of operational management, the balance of costs according to the target and actual values of potential indicators can be carried out by operational means (in particular, based on the implementation of projects for the development of the production system, methods of the theory of constraints, Six Sigma, business process reengineering, etc.) if the discrepancy between planned and actual costs does not exceed 3-5%.

Strategic management, carried out as part of anti-crisis management or in preparation for the launch of new products, involves more serious measures. They lead to a balance of potential indicators, since here we are talking about the functional insufficiency or redundancy of existing production structures to solve future strategic tasks: we can talk about the replacement of technological equipment, changes in production technology and the structure of departments, the composition and qualifications of specialists, etc. Another possible area of application of potential indicators is anti-crisis management, where solving the problem of minimalism and sufficiency of the enterprise structure for current production tasks is one of the most important conditions for the survival of the enterprise.

The calculation of the actual potential indicators (Table 4) can be carried out on the basis of the creation in the enterprise of an appropriate system of strategic management accounting, which allows us to group the costs according to the criteria presented in this study. As for the target level of the values of the potential indicators (Table 5), during the development of new products most of the cost components become fixed, but at the same time they can undergo certain changes. In other words, the structure of the company must be dynamic, and adaptation to new and planned types of products can take place continuously, including on the basis of operational cost adjustments using the methods and tools of Lean Manufacturing, Six Sigma, Business Process Reengineering and other available tools for application of approaches.

Conclusion

Thus, in this study indicators of the enterprise's potential (actual and target) were developed. On the one hand, they make it possible to assess the level of development of an enterprise from the economic, technological and organisational point of view. On the other hand, they determine the prospects of development of an enterprise in terms of mastering opportunities for launching new products or implementing anti-crisis management.

Potential indicators are based on the use of quantitative strategic structures, which are a quantitative form of presentation of the company's economy, technology and production organisation.

Potential indicators are a tool for operational cost accounting, which allows you to set targets for the economic impact of measures to improve work and business processes, and also to introduce targets for adjusting enterprise costs after qualitative determination of the updated structure of production technology. It is also possible to use potential indicators for the comparative assessment of alternative options for the development of the company and for anti-crisis management.

Based on the use of strategic structures and potential indicators, it is possible, in principle, to develop tools for adapting the enterprise to the manufactured products, creating an updated structure to meet the requirements of current or planned types of products, ensuring structural minimalism and sufficiency of the enterprise structure for solving current and future management problems. These changes should contribute to the gradual restructuring of management theory based on the resource approach and the development of the dynamic capabilities of the enterprise.

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