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CONTENT

SURVEY ON SURVEY IN THE CZECH INDUSTRY SECTOR

Veronika Ptáčková, Jiří Novák[1]

Abstract

These are uncertain times. Economists and politicians search for information to show how the economy will develop in the future. Business and consumer surveys are examples of the leading indicators. This paper presents the key findings of the survey on survey in the industry sector in the Czech Republic. The collected answers mean we can (i) better understand the behaviour of our respondents, (ii) modify the future methodology, (iii) and find the clusters of the respondents. Through these changes, the respondents will find the definitions of the economic terms or a recommendation of 'significant change' for the evaluation of the questions. These proposed changes improve the quality of the analysis, which is respectively focused on the business cycle and the economic terms.

Key words: business survey; consumer survey; composite indicator; business cycle; survey
JEL Classification: M2, C8, D22

Introduction

Uncertainty affects us in today's world more than we ever thought. A pandemic that has swept the world has changed the meaning of business and consumer surveys and it is no longer only economists, journalists and the professional public that are interested in the results of the survey.

Everyone is expecting a significant drop in the economy, but the question remains: What kind of drop will it be? Everybody wants to know the answer to this question: small entrepreneurs, factory owners and ordinary citizens. The uncertainty about production and employment is increasing with the length of the constraints. As a result of the mentioned conditions, the pressure on the speed and quality of statistical results is growing — especially for the leading indicators. This is why the Business and Consumer Survey, ifo Business Climate Index and the KOF Index (KOF Swiss Economic Index) are beneficial for users, especially the macroeconomic analysts, microeconomic economists and for economics in general. In the Czech Republic, the leading indicators are collected and calculated using business and consumer surveys, which are harmonised by the European Commission.

1 Literature review

Business and consumer surveys should supplement short-term statistics — quantitative information — and collect the subjective opinions of company leaders on their development, which can help with the prognosis (Marek, Hronová, & Hindls, 2019). Sorić, Škrabić and

[1] *Prague University of Economics and Business, Faculty of Informatics and Statistics (veronika.ptackova@vse.cz; xnovj159@vse.cz). The authors are also employees of the Czech Statistical Office.*

Čižmešija (2013) add that they can help with making day-to-day decisions on consumption, investments and savings. Consumers and business indicators are also beneficial for making predictions in developing countries (Vázques et al., 2009).

Analysts use business and consumer survey outputs for a vast range of predictions and describing the tendencies in the economy. The indicator development can be used for quantitative macroeconomics forecasts (Oinonen & Paloviita, 2017) or as an alternative source for near-future forecasts in the business sector and for consumers (Claveria et al., 2019). Claveria, Monte and Torra (2020) detected the underlying existing periodicities in indicators and created a filter for extracting components that can be defined as similar to the periodicities that are in the economic activity dynamics. They state the differences between business and consumer indicators — the length predictions in the questions can be the main problem. They used spectral analysis for their findings. Ahmed and Cossou (2016) state that consumers reflect the news during economic expansions in their answers. Claveria (2020) focuses on the effects on the macro data in the three economic indicators: economic, inflation and employment uncertainty (they use industry and consumers answers). As an example, we chose the impact of the changes in economic activity due to the decrease in manufacturing production.

1.1 Business and consumer survey

From previous analyses from across the world, we know that the business and consumer survey is the beneficial data source for information about the confidence in the business sector and consumers. In the Czech Republic, the Czech Statistical Office (CZSO) is responsible for the collection, data processing and publication of the results. At the end of the process, the individual confidence indicator and Economic Sentiment Indicator (ESI) are the main outputs of the survey. According to the survey, information is collected about the current situation and future development in the business sector by asking about prices, demand, production, boundaries, stocks and consumers. They answer questions about their financial situation, product prices and savings (CZSO, 2020). In this article, we focus solely on the business sector.

The survey is conducted every month. The advantage of this survey is it provides qualitative data, which means that respondents usually choose from three options:

- growth,
- stagnation,
- decrease.

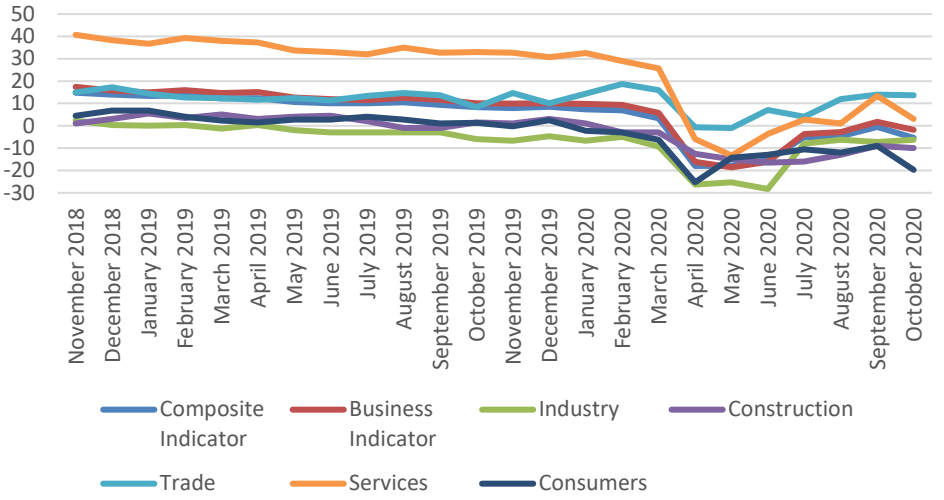
Finally, the individual confidence indicators are calculated for the sectors: industry, construction, trade and selected services. The balance is calculated as the difference between positive and negative responses. It must be mentioned that every sector has a different weight:

- Confidence indicator in industry (40%)
- Confidence indicator in construction (5%)

- Confidence indicator in trade (5%)
- Confidence indicator in selected service (30%)

The business confidence indicator (80%) is calculated from these confidence indicators. When adding the consumer confidence indicator (20%), there is the composite confidence indicator and the economic sentiment indicator (CZSO, 2020). The European Commission (EC) states this weighting scheme because they want to compare the development of the economy across European countries. Figure 1 describes the development of the individual confidence indicators and the composite indicator from November 2018 to October 2020 in the Czech Republic (in the basic indices form). The impact of the uncertainty during the first and the start of the second wave of the pandemic can be observed.

Figure 1 | Business and consumer survey in the Czech Republic (2018–2020, basic indices)



Source: CZSO (2020)

The business and consumer survey has many advantages, for example, speed of publication, a straightforward interpretation and that the answers come from business people. In the Czech Republic, a question is now asked whether the respondents understand the questionnaires. This activity is also a reaction to questions from the primary users (Czech National Bank, Ministry of Industry and Trade, Ministry of Finance of the Czech Republic and commercial banks). Analysts from these institutions use the outputs from business and consumer surveys for their analysis and forecasts. Staff at the CZSO are also asked what the individual outputs mean for them. Unfortunately, the European Commission does not have a definition of economic terms (see chapter Results). Due to the mentioned reasons, we decided to conduct a survey on survey. We started with industry because it is a crucial area of the economy in the Czech Republic. According to the EC (2020, p. 7), 'the industry survey

is largely qualitative. The main questions refer to an assessment of recent trends in production, the current levels of order books and stocks, as well as expectations about production, selling prices and employment. In addition, the survey provides quantitative information on a quarterly basis on two variables that are not reported in conventional statistics, namely capacity utilisation and the number of months of production assured.'

The aim of the paper and the research questions are: How do respondents understand the questions in the questionnaire? How do we define the clusters of the respondents in the business and consumer survey?

2 Methods and results

To determine the quality of the business and consumer surveys (and the methodology), we used a survey on survey method, which meant that we prepared a questionnaire that evaluates the information about the monthly survey (we sent the questionnaire to the same respondents who fill in the form every month). The following parts of the chapter will describe the motivation, preparation of the survey and present the elementary results of the respondents' views on specific economic terms. Visualisations are published at the end of the third chapter, which describe the flow of the respondents' answers to individual questions.

2.1 Motivation for the survey on survey

The survey on survey in the industry sector is the first of further surveys of the CZSO.
We plan to identify:

- The definition of the evaluated terms (similarity, differences)
- The impact of the subjectivity and objectivity in the answers
- The respondents' characteristics
- The management quality

These definitions mean we can obtain better predictions of the national and the European Union economies. In the initial preparation, we discussed the complicated questions in the survey with crucial respondents and users. Their responses reveal that many respondents do not understand the economic terms in the questionnaire — they have a different meaning for each economic term. The respondents included banks, ministries, the Czech National Bank and analysts who comment on the economic situation for newspapers or magazines. We collected the remarks and prepared a questionnaire about business and consumers surveys. CZSO and the Faculty of Informatics and Statistics at the Prague University of Economics and Business organised this survey on survey. The survey took place at the end of 2019.

2.2 Survey on survey results

We prepared the questionnaire, which has 19 questions primarily focusing on the meaning of the evaluation of the economic indicators. This chapter presents the chosen items and

responses to them. These outputs from the survey on survey are compared with the recommendation from the European Commission or the understanding of our users.

CZSO recommends using the order book for the estimation of the level of overall demand for production in the questionnaire. Our respondents answered if they used this source of data or not with 23.8% of respondents answering yes; 33.8% agree with this source; 6.7% do not use this source and 14.3% use another one. A fifth of the respondents (21.4%) do not use any data source. They answered the question about the production demand due to their subjective feeling.

We then asked what data source they use when they are evaluating future production: 47.8% of respondents use the order book while 21.1% use another data source. They mention the forecast for the next quarter, SAP, direct orders from customers, reporting from management accounting, the corporate information system and the production plan. The rest of the respondents use their subjective feeling for answering.

We then discuss what the economic indicators mention for Czech respondents in the industry sector. The evaluation of the overall economic situation in the company was for the first term. The respondent could choose from multiple answers.

The respondents evaluated the financial situation in the company as the most important (81.9%). The results correspond with the Polish survey on survey, which presents the same results (Stefaniak, 2016). The respondents (56.2%) evaluated the production demand as the second most important. These responses are helpful because it enables us to visualise what the balance or basis index should predict (describe) in our analysis.

Table 1 | Overall economic situation (%)

	%
The financial situation in the company	81.9
Production demand	56.2
Market competitiveness	21.4
Overall economic situation in the sector	20.0
The number and qualification of employees	10.9
The development of the global economy	6.2
The general economic situation in countries which are the company's business partners	5.2
The general economic situation in the national economy	3.8
Other	0.9

Source: Authors' own processing
Note: Respondents could mark multiple answers, so the sum does not add up to 100%.

Secondly, we asked respondents what production (in the past or future) meant to them. They choose from three options:

- natural production – 35.9%
- sales/total revenue – 61.2%
- other – 2.9%

In the 'other' choice, they mentioned sales and production together, the quantity of the contracts or the number of working hours.

Capacity utilisation is another confusing term for Czech respondents. We think that the meaning of this term will be re-evaluated in the upcoming years because technology is developing. On account of this, people in business and industry have to react and change their equipment. The results draft the growth of the importance of qualified employees, technology and know-how. A third of respondents (31.6%) evaluated only the capacity utilisation of the facility. There are many factories in the Czech Republic and the automotive industry still dominates the manufacturing sector. Unfortunately, this sector is sensitive to the changes in the business cycle (Aliu, Pavelkova, & Dehning, 2017). The option the capacity utilisation of the facility and human capital (exceptionally qualified employees) was selected by 40.2% of the respondents while 27.2% agreed with the statement: a complex level of all manufacturing factors (the capacity utilisation of the facility, human capital, materials, sub-orders, financial capital, IT technologies, know-how) and just 1% choose another option. Unfortunately, the European Commission does not have a definition of this term.

Everybody agrees that the answer 'stagnation' is a problem in business and consumer surveys. According to Aysoy and Brand (2017), the dominant category 'unchanged' is a mix of the answer 'do not have an opinion' from other categories. They mention that 'stagnating' can be a signal for economic uncertainty — which is connected with 'don't know' behaviour. According to Ptáčková, Štěpánek and Hanzal (2018), future production and future employment are separated. They find — in comparison with the business and consumer survey with short-term statistical outputs on the microdata level — a significant 60% (70% respectively) change for production and 10% (20% respectively) change for employment. Table 2 shows the answers regarding the significant percentage of the change for selecting a different option than 'no change'. It can be observed that the respondents are more sensitive about employment — 43.5% chose a 5–10% change. For future production, the main category is 10–25% (41.8% of respondents).

Table 2 | Stagnation answers (%)

	Less than 1%	1–5%	5–10%	10–25%	25–50%	More than 50%
Future production	3.4	5.3	33.7	41.8	15.4	0.4
Future employment	7.2	15.5	43.5	27.1	6.7	0.0

Source: Authors' own processing

The respondents are satisfied with the three-option scale (87.1%) for the current and future economic situation evaluation. When asked about the current and future production evaluation, the share of the satisfied respondents was 90%. In the question on the evaluation of the overall economic situation in the company, only 30.3% of respondents distinguished the period of three and six months (when it makes sense for the evaluation) while 35.1% of respondents sometimes differentiate between the three- and six-month period (when it makes sense for the assessment). A figure of 34.6% of the respondents evaluated the mentioned periods as the same.

Are there any sources which influence the respondents' response? Do politicians, analysts and economists change their opinion about the development in the Czech Republic? The respondents have read about the pandemic, Brexit, the coming crisis, the trade war, various political crises and the increasing level of unemployment — all this information can influence their choice when completing the questionnaire.

When asked if they answer the questions only using internal data sources, 66% of the respondents said ‘no’ while 22.9% of respondents consider economic forecasts. This is beneficial knowledge because the respondents are not manipulated by politicians or other personalities who can change public opinion.

Table 3 | Important data sources (%)

	%
Czech media	9.0
Foreign media	2.9
Economic forecasts	22.9
Geopolitical events	4.3
Branch development abroad	18.6
Outputs of the short-term statistics and BTS	2.9
Statements and political debates	1.9
Statements, debates by economics and professionals	6.2
Other	2.9
No, I only use data from the company information system, or internal data sources	66.2

Source: Authors’ own processing
Note: Respondents could mark multiple answers, so the sum does not add up to 100%.

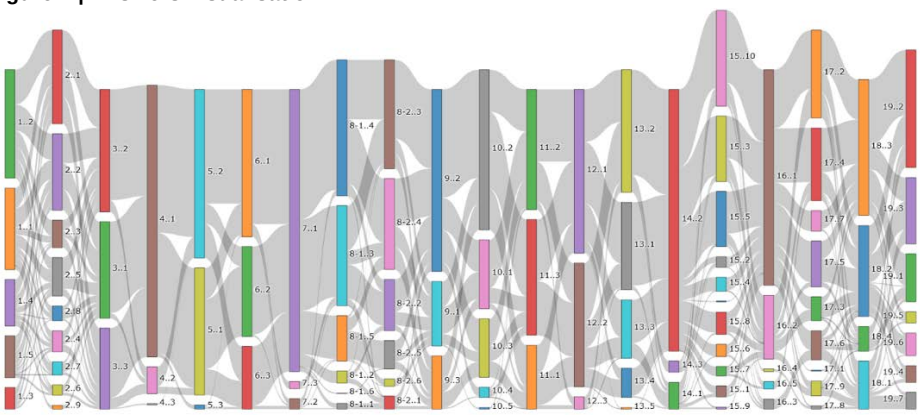
Summary: The results are significant to both the users and the analysts as it enables us to know what we can use for our predictions. Business people, managers and politicians make

daily decisions about the future development of their companies. Using fast published, qualitative data (on a monthly basis) is beneficial for their conclusions about employees and investments. Business and Consumer Surveys are an important data source about the economy — or their NACE (Nomenclature statistique des activités économiques dans la Communauté européenne) level and sectors.

2.3 Visualisation

In the last part of the paper, we visualised the flow of the answers in the survey on survey questionnaire. Our goal was to understand as much as possible how the respondents answered the questions we asked. To clarify the relationship between the questions, we decided on the following visualisation. We used the Sankey chart, which was created for the whole questionnaire. For this visualization, we used program R and their packages (R Core Team, 2014). Figure 2 describes several columns, each representing one question and the answers it contained. Between the columns are aggregated paths that show the trend in the responses. The aim is for better orientation within the structure of the questionnaire and to observe the flow between the answers. The real power of the visualisation is in the interactivity, so this image was created as an html page, which enables the researcher to focus in more detail on the detail between the questions.

Figure 2 | Answers visualisation



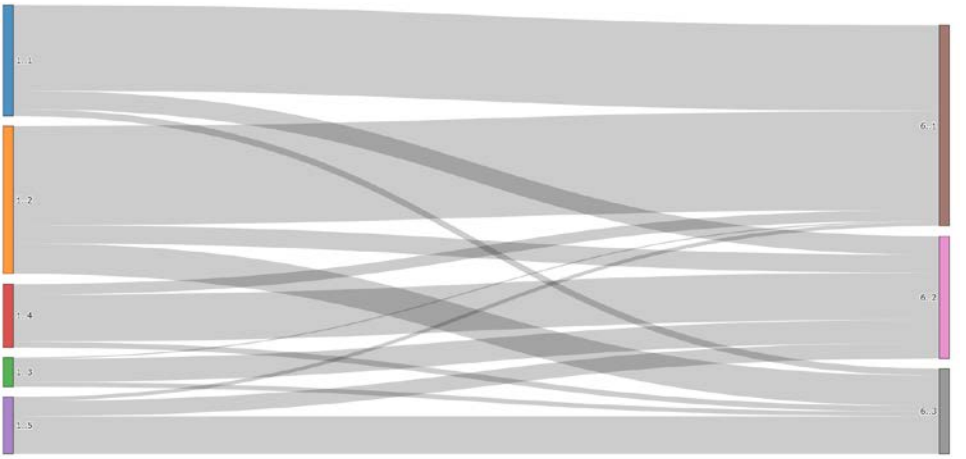
Source: Authors' own processing

However, we are most interested in the relationship between:

- question 1, which asked whether the respondents assess the current level of demand for production using a book of orders. The options were:
    - o definitely yes,
    - o rather yes,
    - o rather no,
    - o no,
    - o I use another accounting source; I follow my own judgment,

- and question 6, which identified the source they use to estimate future production activity. The options were:
    - o from the order book,
    - o from another accounting source,
    - o I follow my own judgment.

Figure 3 | Visualisation questions 1 and 6



Source: Authors' own processing

In Figure 3, we showed the relationship in the structure between these two questions. From the option: 'I definitely use the order book to estimate the level of demand for production', 77% went to the option that they also use the order book for future activities while 16% of respondents use a different accounting source and the remaining respondents use their own judgement. The important finding from this section is that we know that the results from the respondents are relevant, are based on data and not just the opinion of one employee or a business owner.

We can choose other questions and describe or analyse them. The visualisation means we can understand the respondents — the answers, the relationship between the previous answer and the next response.

Conclusions

The survey on survey opens up a discussion about the meaning of specific terms in the business and consumer survey questionnaire. Through the presented outputs, we can better understand the results from the monthly survey and better describe the near future to the public, journalists and politicians. The visualisation enables us to compile groups of respondents that we can describe and so identify significant information about them. Information from business and consumer surveys is beneficial and is the main reason why

we should focus on them — especially in uncertain times. For example, at present, when many companies have stopped production and are worried about the future.

The results of the survey on survey mean we can open up a discussion about creating a methodology on the European/national level for respondents (national handbook), which can assist them in completing the questionnaire. Understanding the responses improves the prediction ability of the survey. Through visualisation, we can define clusters of the respondents and make individual predictions for the sectors or individual terms (as for employment).

In the next research, we will extend this survey on survey to the following sectors — trade, construction and selected services.

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INVENTORY MANAGEMENT: OPTIMAL QUANTITY ORDERING FOR PERISHABLE GOODS WITH A FIXED EXPIRATION DATE AND APPLICATION IN THE FOOD INDUSTRY

Martin Hrabík[2]

Abstract

The aim of this article is to find a solution to the decision-making problem of the purchase of perishable goods with a fixed expiration date with different prices for different order quantities while taking stochastic demand, capital costs and costs for the disposal of expired goods into consideration. The resulting model was used in a company operating in the food industry. The Monte Carlo method was chosen for its integration into company systems. The model fulfilled its goal and its application led to a significant reduction in the total costs of the company. Better results were achieved for high-volume items, while a slight increase in costs was achieved for some of the low-volume items due to expiration. Although this increase is negligible in comparison with the total costs, this finding is significant and unlocks opportunities for future research and model improvements.

Key words: inventory management, perishable goods, fixed lifetime, non-gradual degradation

JEL Classification: C25, C44

Introduction

The field of inventory management has been constantly growing over the last two centuries. In recent decades, an increased interest in developing the theory of perishable goods can be observed. Inventory models for perishable (or sometimes called degradable) goods have also increased in importance due to the global trend for reducing waste. Despite a considerable number of articles on this topic, this area still offers some opportunities for development, which confirms the constant supply of research articles.

One of the oldest formulas in inventory management is economic order quantity (EOQ). It was first developed by Harris and published for the first time in 1913 (Erlenkotter, 1990). This widely used model often failed in sectors working with perishable goods. That was the reason for developing models and formulas for perishable goods and although this model was concerned only with non-degradable goods, many later studies, which already considered degradable goods, were based on EOQ.

The first people who attempted to tackle the problem of degradable goods was Ghare and Schrader (1963) who created an inventory model with exponential decay. They

[2] *Prague University of Economics and Business, Faculty of Management (xhram33@vse.cz).*

noticed that some types of commodities degrade gradually with a rate that can be estimated using the negative exponential function of time.

Many others followed up on their work. For example, Covert and Philip (1973) with their two-parameter model, Nahmias (1982) and Raafat (1991). Goyal and Giri (2001) conducted a literature review, in which they presented a number of models, either with a fixed gradual degradation and fixed expiration date or with a gradual degradation and random expiration date. In general, the most common issue in inventory management for perishable goods is to determine the optimal package size for either stochastic or deterministic demand while taking into account other conditions. These will be discussed later.

Unlike managing items, which do not lose their value over time, managing degradable goods is a much greater and more complicated challenge for companies around the world. According to Duong et al. (2018), up to 15% of degradable goods will not find their way to the customer due to spoilage or damage. In addition to companies, the topic of degradable goods is also the subject of discussion of non-governmental and intergovernmental organisations. For example, in their '2030 Agenda for Sustainable Development' (UN, 2015), the United Nations set the goal of reducing food waste per capita by up to 50%. While non-governmental and intergovernmental multinationals usually aim to reduce waste, companies often specifically monitor overall costs to try to minimise them.

Although the issue of degradable goods may appear to be solely a topic for the food industry, other sectors also face the challenge of managing degradable goods. An example is the technology industry, where although there is no physical degradation, the goods lose their value relatively quickly as newer technologies enter the market. Other industries that work with degradable items are fashion (Ali et al., 2013) and aviation.

This work aims to construct a formula that will serve as a support for deciding on the optimal order size. At the same time, it will be necessary to consider several conditions, which are mentioned in the next part of this paper. The resulting model will then be compared with 183 decisions that were made in a company operating in the food industry.

1 Literature review

This topic is usually solved by mathematical models and purely numerical operations. However, some mathematicians have taken a different approach and tried to apply various programming methods, such as Worall and Hall (1982), who solved the problem of multiple groups of degradable stocks. Ben-Daya and Raouf (1993) developed an approach for solving SPIP, i.e. the problem of inventory management considering only one cycle. This approach considers more items for which they have set budgetary and spatial constraints. At the same time, they assumed that demand for products had the same probability distribution. Although they examined only non-degradable goods, I consider their model to be beneficial, especially when taking into account the above-mentioned spatial limitation into account.

Lenard and Roy (1995) define another approach to inventory management of degrading products by classifying individual products into groups and managing them in an

aggregated way. Sulem (1986) was among the first authors to create a deterministic model that considers two products. He also considers savings from ordering products at once. To simplify the model, Sulem considered linear demand. A similar, albeit more sophisticated, model was later created by Bhattacharya (2005). His model is also two-product and considers degradable goods. Again, the model considers gradual degradation and linear demand. Hsu et al. (2007) presented an optimal decision-making model that considers gradually degradable goods when with the expiration date approaching, the demand for these goods decreases as well as the price of the goods.

Another important factor that often appears in the literature is stock deficiency. There are two approaches to stock deficiency costs in the literature. Although the cost of deficiency is not one of the variables in my formula, for the sake of completeness of the review, I would like to mention these two approaches The first approach is to consider that all customers switch to another supplier in the event of a product shortage. Such an approach is called 'complete'. However, in the real world, some customers are willing to wait, and the cost of deficiency is lower than in the first case. Such an approach is called 'partial'. These approaches are described in more detail by, for example, Tayal et al. (2014).

The forerunner of the models that allow temporary shortage of degradable goods was the model of Goswami and Chaudhuri (1992). They created a model that again considers linear demand. Although the model does not allow a shortage of goods, the author nevertheless mentions this possibility. This was later used, for example, by Bhunia and Maiti (1998), who modified Goswami and Chaudhuri's model to allow temporary shortage and to consider the gradual degradation of supplies.

Since the article by Goswami and Chaudri (1992), many models have emerged that consider different rates of customer losses in the event of a shortage. The first model based on real customer behaviour was compiled by Abad (1996). His work was followed by Chang and Dye (1999), who based their model with a finite recovery horizon on the rate of customer loss based on their actual behaviour. Wu (2001) developed an inventory management model that considered the growing number of customers leaving depending on the time the customer must wait for the next replenishment.

The further development of degradable goods models enabling a shortage was then continued by Tayal et al. (2014). They also developed two models for supply chains, where they consider gradual degradation and the partial departure of customers, which in this case, is derived from the time the customer must wait. They also included investments in preservation technology in the models.

A publication by Atan and Rouseau (2015) is also interesting as they examine the optimal level of stocks across the supply chain. Their publication was the first to attempt to quantify the benefits of an 'inventory mitigation strategy', a strategy to achieve the lowest possible stocks throughout the supply chain. The results of their work prove that losses in the form of degraded goods increase with the shortening life cycle of the product.

As previously outlined, one of the most typical groups of degradable materials is food. For example, Lin Duong, from Vietnam University Duy Tan, has long been involved

in supply chains specialising directly in food. As an example of his work, I cite one of his later articles (2018), in which he addresses the effects of demand, product lifecycle and product substitutability on supply chain management.

Another article dealing with food degradation and optimising inventory management is by Kaipia et al. (2013). They show that by reducing waste, companies can reduce their operational costs. The main key to reducing costs were not mathematical models but the synchronisation of activities and the faster dissemination of information throughout the supply chain.

Thus, most of the current authors and inventory management experts consider the value of inventory in their models as gradually changing over time. They consider stocks of goods that exist in a market environment. Their reasoning is based on the following premise: If we have a surplus of a commodity, then by reducing its price or investing in promotion we can increase the demand for that commodity.

This paper focuses on stocks that are not in a typical market environment and behave differently. Reducing their price or promoting them does not affect demand, and so the development of their value is different. These are, for example, stocks that are a negligible complement or component of the product and for which the price elasticity is zero. Alternatively, they are a direct product whose behaviour is not market-based or a complement to a product whose demand also does not show typical market characteristics and their price elasticity is zero.

Therefore, the decrease in the value of this type of goods does not occur gradually, but only at the time it expires – non-gradual degradation. This article only considers these types of goods and aims to present a formula that can help decide an optimal order quantity of goods when the purchasing price varies with the size of the batch. This is because different prices for different batch sizes occur in the real world much more often than they do in the models from the articles above.

2 Methodology

The model was tested on real data of a company operating in the food industry and 183 purchasing decisions for material with non-gradual degradation were analysed. The information available to the buyer at the time of purchase was entered as variables into the created model. The algorithm then suggested the optimal order. The impact of both human and algorithm-based decisions was analysed and then compared with each other. The results are presented in Table 5.

2.1 Notion and assumptions

The model was created based on information and fully reflects the reality of a company operating in the food industry. Considering the assumptions and limitations, it is not possible to apply the model to every company in this sector although the assumptions and limitations are general enough to be met by at least some companies. The model considers stochastic demand, where the uncertainty is given by the relative standard deviation σ, which can be

obtained either from historical data, as in this paper or by an expert estimate. The mean value is determined by the forecasting department and is based on historical data and market analysis. The model considers demand without seasonality.

The size of the warehouse, in this case, is not a limiting condition so infinite storage spaces are considered. Another reason to not consider storage capacity is that a one-item model is proposed. No storage costs are also considered, even though this is not common in the literature, as storage costs are fixed so it is not appropriate to include them in the model. However, the cost of capital has a similar function as storage costs in the model. These costs represent opportunity costs that could not be achieved due to the investment in the material. However, the main limiting condition is the expiration date of the material. It is no longer possible to use the material after this date. At the same time, it is necessary to dispose of this expired material, which entails the cost for disposing – c_l (see Table 3). All the symbols and abbreviations used are listed in Table 1.

2.2 Model

Considering all the above conditions, the following model was compiled. After substituting the variables, the optimal size of the purchase order can be found. As the optimal size of the batch is evaluated as the one with the lowest average price per used unit. △ Pu is calculated as the average of n simulations, which are simulated by the Monte Carlo method at the standard deviation σ, upper (r_{max}) and lower (r_{min}) constraints. For the comparison of the model with real data, the total sample was set at n = 106, which is considered sufficient to minimise the imperfections of this method.

Figure 1 | Proposed model

$$\Delta P_{ul}(\mu = d_p, \sigma) = \frac{\sum_{d \in [s+q_1, \infty)} p_1 + \sum_{d \in [s+1, s+q_1]} \frac{(s+q_1-d)\cdot c_l + q_1 \cdot p_1}{d-s} + \sum_{d \in (0, s+1)} q_1 \cdot (p_1 + c_l) + \sum_{d \in (0, \infty)} (1+c_k)^{\left(\frac{s, s+q_1}{\frac{d+d}{2}}\right)^{\frac{E}{365}}} - 1) \cdot p_1}{n}$$

Source: Author's own elaboration

Table 1 | Symbols

c_1	Unit disposal costs
E	Time at which the material expires = shelf life + delivery time
d_p	Predicted demand for material in E
D	Actual demand for material in E
Σ	Relative deviation
r_{max}	Maximum error of underestimating predicted demand
r_{min}	Maximum error of overestimating predicted demand

c_k	Cost of capital: 5% for all materials p.a.
q_1	Number of units in batch 1
p_1	Price for 1 unit when buying batch 1
ΔP_{u1}	Average price for used unit of material when buying batch 1
S	Stock of material including material on the way
n	Number of samples
ΔP_u	Average price for used unit of material

Source: Author's own elaboration

2.3 Examined materials

The materials that were the subject of this study are additives to various types and brands of beverages. A total of eight materials were examined, each used in a different final product. These otherwise different materials have several characteristics in common.

- The demand for them is stochastic and is given only by the demand for final products.
- The price of the materials has a negligible impact on the price of the final product so there is no possibility to increase the demand for the product due to the impending expiration of the material.
- The material expiration date is fixed and known in advance.
- When ordering different quantities of material, they have different unit prices. The prices for individual order sizes are in Table 4.

Table 2 shows the relative standard deviations for each material. These standard deviations are calculated as the difference between the production plan for period E, which was current at the time when the material was ordered, and the actual production.

Table 2 | Volatility

	σ	r_{min}	r_{max}	Number of orders
Material A	0.2	0.5	2.2	27
Material B	0.192195	0.6	1.5	38
Material C	0.185	0.625	1.75	23
Material D	0.16	0.5	2.2	31
Material E	0.25	0.4	2.5	13
Material F	0.25	0.4	2.5	18
Material G	0.22	0.45	2.3	10
Material H	0.115	0.4	2.5	23

Source: Author's own elaboration

At the same time, the maximum possible theoretical deviations are given. The deviation r_{max}, is the maximum error for underestimating predicted demand and shows the maximum possible increase in production in period E. This value is given mainly by production capacity and the capacity of the material suppliers and is determined individually for each type of product. The opposite is the maximum error for overestimating predicted demand – r_{min}. This is the maximum possible decrease in demand for the material. This lower limit is set by long-term contracts with customers. The last data in **Chyba! Nenalezen zdroj odkazů.** is the number of orders in the monitored period and thus the number of examined orders.

Table 3 | Disposal costs

	Disposal costs per unit
Material A	0.003406
Material B	0.010331
Material C	0.009025
Material D	0.010225
Material E	0.005995
Material F	0.005376
Material G	0.008224
Material H	0.013889

Source: Author's own elaboration

Table 4 | Order quantities

Material	Q	Purchasing price per unit	Number of orders by buyer	Number of orders by algorithm
Material A	250	1	1	13
	525	0.958225	24	0
	1050	0.781984	2	14
Material B	500	1	6	2
	1500	0.932563	16	3
	2500	0.909441	16	33
Material C	500	1	2	6
	1000	0.954874	3	1
	1500	0.931408	14	7
	2500	0.906137	4	9
Material D	500	1	5	10
	1000	0.952965	9	2
	1500	0.928425	8	3
	2500	0.90184	9	16

Material E	190	1	11	6
	300	0.910072	0	3
	500	0.868106	2	4
	1500	0.811751	0	0
Material F	100	1	5	6
	300	0.835484	11	1
	500	0.786022	1	10
	1000	0.762366	1	1
Material G	500	1	1	4
	1000	0.957237	4	2
	1500	0.947368	5	4
Material H	500	1	9	2
	1500	0.938889	7	7
	2500	0.925	7	14

Source: Author's own elaboration

Table 3 shows the results. Compared to the standard ordering method, the algorithm achieved a better average price per used unit — $\triangle P_u$ for seven out of eight materials. Lower total costs were achieved by ordering different, more often higher batch sizes, which resulted in lower purchase prices. Although holding a higher amount increased capital costs and, in several cases, liquidation costs, the resulting savings in total costs were significant.

Table 3 | Results

Average price for used unit of material			
Material	**Buyer**	**Algorithm**	**Relative difference**
Material A	0.959816	0.831759	-13.342%
Material B	0.923937	0.920946	-0.324%
Material C	0.93063	0.924875	-0.618%
Material D	0.936857	0.927331	-1.017%
Material E	1.032836	0.957623	-7.282%
Material F	0.896759	0.807467	-9.957%
Material G	0.976578	0.986526	1.019%
Material H	0.944723	0.934438	-1.089%

Source: Author's own elaboration

The highest positive difference was achieved for materials A, E, F. This result could be expected because the purchasing prices per unit decreased significantly with ordering bigger

batch size. Worse results were achieved with materials B, C, D. The quantity discount when ordering the highest possible batch was below 10% and thus the space for optimalisation was limited. The worst result was achieved for material G, where the total cost per used unit even increased, namely by 1.019%. Possible reasons for the unsuccessful attempt to optimise the purchasing process of this material will be discussed below.

3 Discussion and conclusions

This article aimed to find a suitable formula as a support for making decisions about the size of purchase orders for non-gradual degradable goods. The main criterion was the minimisation of total costs. The proposed formula was tested and compared with 183 human-made purchasing decisions of 8 examined materials. Different costs were achieved in the range of -13.342% to +1.019%, while 7 out of 8 materials achieved a cost reduction.

The highest savings were observed for the materials for which the volume discounts were the highest. Therefore, the urgency to pay attention to decision-making processes increases with the size of volume discounts, because it is in cases where price degression is high that the potential for savings is highest.

An important input is the prices and sizes of possible orders for individual batches of material. If the algorithm significantly more often prefers one of the extreme values, i.e. either the highest or the lowest batch, the task of the purchasing department could be to negotiate a new package size. An example of this is material B for which the algorithm preferred the highest batch in almost 87% of cases. Therefore, if the purchasing department negotiated a larger package size at a lower price, it is highly likely that this would result in a further reduction in total costs.

The worst result, i.e. an increase in total costs, was achieved with material G. Unlike other materials, the average order size decreased, thus increasing the purchase price and the average costs per unit used. The increase in the average purchase price was not sufficiently offset by the reduction in the cost of capital and, at the same time, there was no reduction in the cost of liquidation. Possible explanations for this failed optimisation attempt are:

- The potential for optimisation for this material was the lowest of all examined materials, as it has the lowest quantity discounts.
- The relative standard deviation used was too high; using a lower relative standard deviation would result in higher order quantities. However, since the deviation has been calculated from historical data, it is not appropriate to change it.
- Only ten decisions were examined for this material, which is the least of all tested materials, so it is possible that better results could have been achieved with a larger number of decisions.
- Omission of some important variables. The final product of which the material is a part was produced in large production batches with a large time interval. Therefore, compared to other materials, it had a higher average stock. This high average stock of the product could have a large extent effect on the volatility of the demand for material G.

3.1 Shortcomings of the methodology

The research is based on the presumption that I had all the information that was available to the buyer who decided the order quantity at the time when he made the decision and vice versa. This presumption is not fulfilled because at the time of the decision, the buyer was also likely to have had some information that was communicated orally. However, this should not call into question the conclusions of the research, as it gives a slight advantage to the retrospectively tested subject.

3.2 Possible improvements and further research

Based on the achieved results of the model, it can be judged that the stock level of finished products can affect the volatility of production – demand for material. This so-called bullwhip effect was first described in a paper by Lee et al. (1997). Therefore, I consider it is appropriate to modify the formula, so it would consider the stock level of finished products.

Another possible improvement to the formula is to incorporate the dependence of the standard deviation on the originally predicted quantity. This hypothesis is also supported by data when, for example, in the case of material A or H, the relative standard deviation decreases with the increasing amount. However, this correlation has not been proven for all materials.

It is also possible to apply different standard deviations to individual seasons or individual weeks. In some sectors, it will also be the case that more distant plans tend to have a higher error rate, considering this may also lead to a further significant refinement of the model.

The biggest challenge is extending the model by calculating the optimal time for placing an order. Unlike most of the models mentioned, this formula is only designed to decide on the optimal order size. If this model were extended by an algorithm that would determine the optimal time for ordering, it would enable wider use of the model. Among other things, the use of a model for non-gradually degradable materials with seasonal stochastic demand would be possible with minor modifications to the formula.

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RISK IN ORGANISATIONAL DECISION-MAKING: SUCCESSFUL IMPLEMENTATION OF CRYPTOGRAPHIC TOOLS

Radek Švadlenka[3]

Abstract

The dynamic development in the field of ICT technologies in recent years has brought a relatively significant phenomenon in the form of the growing dependence of society and organisations on information and communication systems. Thus, information security is gradually attracting more and more attention from management, as its underestimation can lead to significant economic losses and in extreme cases, even to the termination of the organisation. Cryptographic methods are increasingly used to implement security measures, and their implementation can be key to the effective functioning of an organisation. Thus, security managers are faced with deciding which tool to choose to meet legislative requirements, to ensure the required level of security, and at the same time, so that implementation does not undermine the effective operation of the organisation. The main goal of the paper is to identify and evaluate the factors influencing the selection and implementation of cryptographic tools in the field of remote authentication. The output of this analysis provides a comprehensive overview of how and the basis of what sub-objectives or constraints managers decide on the selection of a suitable security tool.

Key words: security; cryptographic tool; authentication; confidentiality; integrity; availability; algorithm

JEL Classification: O31, O33

Introduction

It is not necessary to go back in time to observe the IT departments of large companies as they focus almost exclusively on the effectiveness of the services provided for the organisation's primary purposes. Why not? Information security was the prerogative of a few fields, and most organisations need a firewall and antivirus program. Threats were discussed mainly in connection with physical security and natural disasters, and real security incidents in the Czech Republic could be counted annually on the fingers of one hand. However, these times are gone forever. The massive development of digitisation and automation in all branches of human activity has made information systems indispensable for the operation of organisations. However, this dependence, combined with the ever-increasing complexity and systemic interconnectedness, conceals a major pitfall in the form of the risk of endangering security and thus the operation of the entire organisation. The protection of information assets has naturally become an integral part of any organisation that is serious about security.

[3] *Prague University of Economics and Business, Faculty of Management (xsvar05@vse.cz).*

Thus, information security is gradually attracting more and more attention from management, as to underestimate it can lead to significant economic losses and in extreme cases, even to the termination of the organisation. Cryptographic methods are increasingly used to implement security measures, and this can be key to the effective functioning of an organisation. Thus, security managers are faced with deciding which tool to choose to meet legislative requirements, to ensure the required level of security, and at the same time so that its implementation does not undermine the effective operation of the organisation.

1 Research objectives

The main goal of the paper is to identify and evaluate the factors influencing the selection and implementation of cryptographic tools in the area of remote authentication. The output of this analysis will provide a comprehensive overview of how and based on which partial objectives or constraints the responsible managers decide on the selection of a suitable security measure. Therefore, the research questions can be formulated as: 'Which factors influence manager's decision to choose an authentication tool based on cryptographic functions? Which tools are used and based on which influences are they selected for the ICT environment of the organisation?' The results of this research will be used as an input for the main goal of my forthcoming dissertation — to build an effective model to support managerial decision-making in the implementation of cryptographic tools.

1.1 Assumptions

To move forward with the research, it was necessary to understand the basic current principles of initialising the need to implement authentication security tools and the factors that influence the choice of such a tool. Based on practical experience, it could be assumed that the initiation of the need for a secure authentication tool could be triggered in several ways. This is especially in less complex IT environments, where a person can orient themselves without auxiliary system resources. The intuition and experience of a responsible manager will make it necessary to purchase authentication solutions. However, for corporate organisations, it is no longer possible to rely solely on intuition due to the complexity and interconnectedness of systems and the related processes. Thus, supporting norms and standards come into play, which helps, and in some cases even dictate how organisations should approach the security of information and other assets. However, there have been cases where a security incident, whether internal or resolved by another organisation, leads to company's decision to implement a security tool. In particular, the media coverage of such incidents has a strong effect on the need to secure organisation's assets and especially on the willingness to invest resources in security measures.

From the above assumptions, it can be concluded that legislative measures, industry norms and standards have a significant influence on decisions to implement security measures in organisations. In particular, public sector bodies have to deal with many mandatory measures. A special category is the entities falling under the wording of the Cyber Security Act No. 181/2014 Coll. (CR, 2014). The value, i.e. the price, certainly has an

inseparable effect on any investment. However, its calculation can be based on different metrics in each organisation. In particular, the role of time has a significant effect on the resulting value although this has a much more important role in the selection process. A level of security that meets current requirements may not be sufficient in a few years. Likewise, the chosen method may prove to be unpromising or even unsupported by the manufacturer in the future. At the same time, the responsible manager must take sufficient account of the future needs of the organisation. The user of the security tool should not be omitted either. User-friendliness, time load and the degree of intuitiveness of the tool can be key to the effective operation of the organisation. The reliability of the given tool should not be left aside, both in the form of errors in the authentication process and in the form of failure of the tool itself. Some security tools work completely independently of other technical means although most authentication tools use networks and other common devices, so it is necessary to consider compatibility as another factor that influences decisions.

However, the ICT environment is a living organism and cannot be considered a static element, so the manager must take into account the time and adapt the compatibility of the tool to any future situation. The security tool performs the primary required function, but it may not be the only function available for the product sold. Combining multiple purposes in one tool appears to be resource-efficient. A further assumed factor that influences a manager's decision to implement an authentication tool is the willingness of top management to invest in security.

1.2 Theoretical background

The above assumptions include multidisciplinary knowledge such as legal norms, various areas of economic theory, knowledge of cryptography, ICT standards and best practice. To date, I am not aware that a comprehensive study has been published analysing a similarly complex problem. It is perhaps worth mentioning the *magic quadrant* (Gartner, 2020) by the Gartner Company, which provides a basic orientation in the form of a graphic representation of the position of a particular technological product on the market.

However, an overly complicated security situation can be found in the area of norms and standards. In an attempt to ensure information security at the required level, especially for providing key services for society, the legislative framework defined by Act No. 181/2014 Coll. (CR, 2014) on cybersecurity was adopted in the Czech Republic in 2014 along with its implementation documentation (NÚKIB, 2018). According to this standard, mandatory objects have incurred a number of obligations to implement technical and organisational measures, including the necessary security documentation. The development of cybersecurity legislation at the international level has not been lagging. In 2016, Directive 2016/1148 (EU, 2016a) on measures to ensure a high level of the security of networks and information systems in the Union entered into force, providing member states with the ultimate alignment of national legislation with this standard. As part of the harmonisation of European law, Directive 2016/1148 was transposed into the Cyber Security Act in 2017, which brought new requirements and changes for the organisations concerned.

In parallel, another important European document was created, which cannot be ignored. In 2016, with effect from 25 May 2018, Regulation 2016/679 (EU, 2016b) on the protection of individuals concerning the processing of personal data and on the free movement of such data entered into force. This requires the application of many other measures for entities subject to this standard. The truth is that the general panic caused by this norm was partially calmed with the effectiveness of Act No. 110/2019 Coll. (CR, 2019) on the processing of personal data. However, the wording of the above legislative measures is controlled by the relevant state authorities and non-compliance with the standard may result in sanctions. However, in addition to the above-mentioned standards, some organisations are subject to their industry security standards and the standards required to ensure a high level of security of information systems and processed data. Although non-compliance with such a standard is usually not related to a direct financial sanction, it can have a devastating effect on an organisation in the form of a ban or restriction on its activities, which in turn, can cause significant economic loss.

In the field of economic theory, research can be based on the theory of organisational behaviour (Cejthamr et al., 2010) and the theory of managerial decision-making (Fotr & Švecová, 2016). Furthermore, knowledge from the field of IT risk management is needed, especially in the form of the international standard ISO/IEC 27000:2018 (ISO, 2018), or ITIL (AXELOS, 2020) and PoGP methodologies (Community Development, 2020). However, neither the international organisations National Institute of Standards and Technology (NIST), European Union Agency for Cybersecurity (ENISA) or the National Office for Cyber and Information Security of the Czech Republic (NÚKIB) can be omitted.

A key area of the research for this paper is the security of the implemented authentication tool in an organisation. This is defined by the method of remote authentication, which is directly related to the applied cryptographic methods. In connection with the need to understand the basic principles in the field of applied cryptography, I first used the basic available resources in this area by Piper and Murphy (2006) and Burda (2015). Then I continued by studying more advanced resources in the field of cryptography, especially from the authors Ferguson and Schneier (2003), Oulehla and Jašek (2017) and Burda (2013).

1.3 Ethical issues

As it was decided to research within the segment of corporate companies, it was necessary to address several issues related to the ethical behaviour of the researcher. The main problem was the sensitivity of the obtained data. Therefore, it was necessary to treat the research methodology in advance so that the addressed representatives of individual companies were not concerned about the misuse of the information provided. For this reason, I decided not to record the interviews and only take notes during the interviews. This significantly affected the structure and form of the questions asked during the interview. At the same time, it was confirmed to all participants in the research that all research outputs will be anonymised and

aggregated and not contain the name of the organisation or the name of the respondent. These conditions were set in advance to obtain the maximum number of informed consents for research from the respondents with relevant data.

2 Research methodology

When creating the research methodology, I was inspired by Hendl (2005). The purpose of the research was to explore a new topic to observe all the unexpected phenomena. Such research can be classified into the category of exploratory research. According to Hendl (2005), to determine if it is exploratory research, the following questions need to be answered:this study attempts to avoid influencing gaze behaviour through bottom-up processes.

1. 'Did the researcher investigate a phenomenon that was little known?'
2. 'Did the researcher avoid using an existing theory to be able to approach the problem without the burden of known views on the problem?'
3. 'Has the researcher sought to identify important factors and suggest new concepts and relationships for further research?'

This type of research also assumes a more extensive and systematic approach to the researched topic in the future. A more comprehensive research approach will form part of my dissertation. Because I am looking for solutions to practical problems, I can classify my project according to the characteristics of the focus into the category of applied research. Applied research is often conducted in its natural environment.

2.1 Qualitative research

Due to the limited number of respondents and the purpose and depth of the research, I decided to use the method of qualitative research, despite certain limitations that accompany this type of research. There is no single generally accepted way to define or conduct qualitative research. Negative definitions have been given by methodologists Glaser and Corbin (1989, as cited in Hendl, 2005), who consider it as any research where the results are not achieved using statistical methods or other methods of quantification (Hendl, 2005). However, not all methodologists agree with this definition, because the uniqueness of qualitative research does not lie only in the absence of numbers. Notable methodologist John W. Creswell (1998, p. 15) defined qualitative research as 'an inquiry process of understanding based on distinct methodological traditions of inquiry that explore a social or human problem. The researcher builds a complex, holistic picture, analyses words, reports detailed views of informants and conducts the study in a natural setting.'

Typically, a qualitative researcher selects a topic at the beginning of the research and identifies the basic research questions. They can modify or supplement the questions during the research and data collection and analysis. The work of a qualitative researcher is compared to the work of a detective. The researcher identifies and analyses any information that contributes to the elucidation of research questions and makes deductive and inductive

conclusions. Qualitative research has many advantages, but also weaknesses. Qualitative research is criticised because its results represent a collection of subjective impressions. Due to its flexible and unstructured nature, it is difficult to replicate. Because it works with a limited number of individuals and usually in one place, there are also difficulties in generalising the results. Qualitative research is also sometimes criticised for its opacity and lack of transparency. For example, sometimes it is not clear from a research report how individuals were selected for an interview or observation. Also, it is often not possible to recognise how the analysis was conducted. The detailed description of the individual steps usually exceeds the possibilities of the limited scope of the scientific article.

Objections to qualitative research are balanced by its other characteristics. The research process is always a compromise and balances shortcomings and benefits. The advantage of a qualitative approach is to obtain an in-depth description of cases. It does not remain on the surface, a detailed comparison of cases is conducted, and the development and relevant processes are monitored. The effect of the context, the local situation and the conditions must be taken into account. Qualitative research provides detailed information on why the phenomenon occurred (Hendl, 2005).

2.2 Research plan

The design of a research plan is an important part of the whole project. The definition of the purpose, theoretical background, research questions and the methodology of the research are described in previous chapters. It remains to complete a suitable method of data collection. Due to the purpose of the research and the limited number of respondents, I chose the method of conducting managerial interviews of those responsible for the selection of security tools in individual organisations for the research. The research sample selection strategy is also related to this method. For the research to be data-diverse and to include a wider range of respondents as close to reality as possible, I addressed organisations operating in both the commercial and public spheres. The criterion for including an organisation in the research was the number of employees, which had to be more than 1000 people in the case of separate units. I lowered the limit to a minimum of 250 employees for organisations that are part of a larger unit, such as a subsidiary of an international company. The aim was to address 20 organisations from different spheres of business activities and obtain data from the maximum number of respondents concerning the rules on ethics.

For the addressed companies, I focused on the position of security director, who usually has an overview of the security tools implemented in the organisation. This is also the person who usually decides on the parameters of these tools. In organisations where the position of Security Director was not been created, I approached the IT Director, who takes responsibility for information security in similar cases. The quality of research is supported in several ways by the method of triangulation. Before starting the research, I asked a representative of the manufacturer of cryptographic tools for an interview, where I discussed the practical evaluation and applicability of specific products on the market. At the same time, I contacted one of the security specialists to verify the technical level of the questions

prepared for the research. For most organisations, I further studied information from publicly available sources such as annual reports, websites, etc. For the organisations with whom I am in direct business contact, I was able to verify the validity of some data with other employees in the organisation. Due to the limited time of the respondents, I set the time for the interview at 60 minutes. Also, for this reason, I decided to apply the method of a structured interview with open questions. This reduced the likelihood that the data obtained in the individual interviews would differ significantly. I was also able to record answers more effectively and minimise my subjective influence on the quality of the interview.

3 Results

In my research, I addressed twenty organisations from various fields, including the public sector. These were the largest organisations in banking, energy, finance, automotive, aviation, media, logistics, and hypermarkets and hobby markets. A total of nineteen out of the twenty companies took part in the interviews. One organisation refused to consent to the interview due to their internal security regulations.

The founder of four of the nineteen participating entities is the state. One organisation is partly state-controlled and fourteen entities fall into the category of commercial companies. The average number of employees in the organisations participating in the research is 4168, which only included employees of Czech branches, not global groups. Nearly 70% of the interviewees were in the role of director of security and the remaining 30% were in the role of IT director or other related responsible roles. The interviews with the respondents took place from May to August 2020.

3.1 Decision-making autonomy

Before starting the research, I assumed that some of the addressed organisations, especially subsidiaries of international companies, would accept a global solution chosen by the mother company. Such companies provide data on currently used authentication tools, but this will not help me to determine the criteria based on which these tools were selected. It was a surprise to find that all the subjects in the research have a certain freedom in decision-making in the field of security tools. In some cases, the parent organisation defines the basic rules or recommendations, but the choice of the actual tool is fully within the competence of the organisation. This also applies to public entities.

3.2 Legislation

Binding legal norms, industry norms and standards are a fundamental factor influencing the choice of authentication tools for an organisation's infrastructure. The norm, which is binding for all organisations, is the law on the processing of personal data although according to the respondents, it does not have a significant influence on the decision-making process. The Act on Cyber Security has a much more significant effect, which requires the obliged entities to comply with the minimum functional and security parameters when choosing an authentication tool. Multi-factor authentication with the support of

cryptographic algorithms, the robustness of which meets the strict requirements of the controller, becomes an obligation. A list of such algorithms can be found on the NÚKIB website. From the research sample, seven organisations fall into the category of mandatory entities according to that law and another four entities are preparing to be included in that category. However, all other entities have a more or less sophisticated security strategy with an information security management system in place, which sets out the basic rules for ensuring availability, integrity and confidentiality with the implementation of risk-based security management and continuous improvement process. This system approach helps responsible managers initiate the need for new or improved security measures.

In addition to these standards, it should be mentioned that all entities owned by the state must comply with the Public Procurement Act, which has a significant impact on the purchase of any technical equipment. Some industries also have their own industry standards, which organisations must adhere to. In the area of the financial sector, these are mainly regulations of the Czech National Bank and international standards such as PCI DSS and PSD2. In the automotive industry, this is the TISAX standard. Companies in the telecommunications sector are required to comply with the Electronic Communications Act and the measures of the Czech Telecommunications Office. In any case, the legislative framework and industry standards should be seen as a mandatory requirement that precedes any further consideration of the choice of authentication tool.

3.3 Time perspective

An interesting conclusion follows from the answer to the question regarding the time horizon of the operation of the remote authentication tool. Most managers preferred more than five years, and about a third of the respondents opted for ten or more years. The main reason for this decision is the complexity of deploying the tool. Implementation into a complex environment alone takes more than a year and it does not make sense to often change such a tool. Proponents of planning a shorter period of operation of the tool then argued, in particular, about the tool life, which they estimated at a maximum of five years.

3.4 Price

Price is a key factor when choosing an IT tool, so it was fascinating to hear the answers to the questions regarding the price of security tools from the point of view of security/IT managers. For most respondents, the price of the tool plays a relatively low role. On the other hand, the cost in the form of internal human resources for the implementation and operation of the tool was often mentioned. However, the truth is that technology is usually purchased by the purchasing department, and the security roles are given only by the technical requirements for the selection of an instrument with a rough financial framework. For this reason, it is possible to calculate the product price factor for further work only in the final stage of tool selection. All respondents agreed on a similar model for calculating the price in the form of the total cost of ownership (TCO) with different lengths of time. This period usually corresponds to 3–5 years. Most organisations work with individual price

limits that are the responsibility of a particular department. The approval of the higher budget then passes to the superior level of the organisation. Public administration entities have price limits set by law according to the type of public contract.

3.5 User-friendliness

Remote authentication tools are used primarily by company employees to access corporate resources via VPN, as well as external employees and suppliers of the organisation when setting up configurations of infrastructure elements, system resources and incident resolution. Therefore, user-friendliness has a significant impact on the operation of the organisation after the implementation of the authentication tool. Most respondents agreed that users are invited to test the authentication tool under proof of concept (PoC). In particular, the time delay associated with the authentication method, the number of steps that the user must perform, the number of unsuccessful attempts and the overall complexity of the user's procedure are monitored.

The main concern is the rejection of the tool by the user, which leads to the failure of the project, or the inefficiency of employees in their work. It is interesting to observe how employees are selected to participate in the test. Representatives of different roles within the corporate hierarchy are most often invited to verify the applicability of the tool across the entire organisation. Some companies intentionally include natural department leaders in user-friendliness tests, who then do some of the work involved in deploying the product for the IT/security department. This is related to an issue described by one of the respondents as a measure of resistance to change. More conservative-minded managers then leave the assessment of user-friendliness under the responsibility of the security department, and a test is conducted, for example, on the family members of the department members.

3.6 Security

The security of an authentication method is the main prerequisite for purchasing security tools. On a scale of 0–100%, none of the respondents would give less than 60% of the safety factor. Extreme responses then approached 90% just for safety. At this point, it is necessary to work with the concept of the risk appetite of the organisation or the responsible manager, which defines the tolerance to a certain level of threat risk. Representatives of obligated subjects according to the Cyber Act automatically reached out after the choice of NÚKIB algorithms. Approximately one-third of the respondents transfer the security risk to the manufacturer and thus to the solution provider through a contractual obligation, without verifying the authentication methods from a security point of view. Other participants in the research validate the level of security of the method within the professional forums of which they are members. Some companies have their own specialists in cryptographic security solutions.

3.7 Compatibility

Some authentication solutions require support and thus compatibility with existing ICT architecture and equipment. All respondents agreed that they would choose the authentication tool in accordance with the current state of technology, so as not to make unnecessary investments in new elements. However, the answers to the question related to future changes in the infrastructure and planned compatibility were much more interesting. Approximately 20% of the respondents choose an independent autonomous solution so that they do not have to solve this problem in the future. A further third of the respondents confirmed that they expect future changes in infrastructure in the development of security measures. On the other hand, another third of companies are not able to think about future changes and do not take this factor into account in the selection criteria. The remainder of the respondents decide concerning the future state, but only within the horizon of already planned changes.

3.8 Method perspective and solution support

Most respondents stated that the authentication tool should be selected for more than five years although some have considered more than ten years. But how will they ensure that the chosen method will be effective in the distant future and be supported by the manufacturer? I received a relatively wide range of answers to this question, but the common feature was in most cases trust in the manufacturer and good experience with the technology supplier. The credibility of a producer mainly lies in its market power. Therefore, the perspective and support of the solution are based on the assumption of product development and adaptation to dynamic development by the manufacturer. Some respondents pointed to an auxiliary element in the form of Gartner's magic quadrant. However, the manufacturer often transfers responsibility for support to local partners. These partners are evaluated by customers, especially concerning good historical experience. Some organisations do not rely on just one method for this factor but choose the tool so that they can easily modify the authentication process in the future.

3.9 Reliability

The reliability of an authentication tool is directly related to authentication methods. Most organisations test the reliability and failure of the method in user tests. Some respondents verify the reliability of the method using the mean time between failures (MTBF).

3.10 Support from top management

A less important factor, but an interesting phenomenon is the issue of support for security solutions by top management. While top managers are not involved in the authentication tool selection process, they often act as solution approvers, so their approach to security also influences the final product selection. Most respondents agreed that their top managers support security investments. However, it was interesting to compare this support over time.

The growing number of mediated cyber incidents has a positive effect on the willingness to invest in security solutions. The interviews also showed that the higher the manager's awareness of information security, the more inclined they are to invest in security. On the contrary, the economic problems of the organisation have a negative impact on the resources released into security measures.

3.11 Other factors

The respondents also mentioned individually more or less strong factors, such as the option to use the tool for other purposes, as an electronic signature, support for logging and monitoring activities and also mentioned preferences between cloud and on-premise solutions, support for open-source products and other specialities, which, unfortunately, there is no more room for in this article.

3.12 Current state in organisations

Most of the addressed organisations currently use multifactor authentication for remote access or are in the implementation phase of this solution at least for specific roles and critical systems. However, the composition of specific tools is diverse. Some organisations are equipped with HW tokens, others work with certificate authentication, and others rely on mobile phone applications. However, at the same time, 80% of respondents are dissatisfied with the current state of authentication tools in their organisation and see room for improvement.

Conclusions

The main goal of my research was to find and analyse the factors influencing the choice of cryptographic tools for remote authentication in large organisations. The introductory part of the paper is devoted to determining the area of research, the research problem, the research purpose and research questions. Furthermore, the reader is slowly introduced to the research assumptions, the related theoretical areas and research methodology. The following chapter deals with the research plan, which describes in detail the selection of the research subjects and the method of data collection. The most important part of the paper is the analysis and interpretation of the obtained data. The interviews show that the requirements of legislation and industry standards can be considered mandatory obligations that prevent further influences on decision-making.

Other important factors included the respondents' user-friendliness, which is often verified in cooperation with users, as well as the solution security as the most important factor from the perspective of the security/IT manager, and compatibility with other infrastructure elements and system tools. Time plays an important role in two ways. In terms of the expected lifetime of the authentication tool, organisations plan for more than five years. The perspective of the authentication method over time then reflects the level of trust in the product manufacturer and the solution provider. The last variable is the price, which is in the competence of the security manager. Most organisations already use multifactor

authentication using various methods and tools although 80% of the respondents are dissatisfied with the current situation in their organisation. The above and other specific factors will be analysed in more detail in my dissertation, which will directly follow this research.

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NÚKIB (National Office for Cyber and Information Security of the Czech Republic): https://www.nukib.cz/

CONSUMER PREFERENCES AND GAZE BEHAVIOUR: A PILOT STUDY

Simona Bažantová[4]

Abstract

This pilot study focuses on gaze behaviour and visual attention in the context of consumer preferences and decision making. Various studies indicate that there is a relationship between visual attention and consumer choice and preferences. However, other studies support the assumption that any relationship between visual attention and consumer preferences could be weak. The objective of this study is to examine the relationship between eye fixation and consumer preferences at product-level and factor-level. Consumer preferences were expressed by product choice between pairs of alternative products in 2-AFC tasks (product-level). In doing so, the study examined the importance of price, package aesthetic and brand awareness, i.e. product attributes (factor-level). Visual attention was measured by eye-tracking equipment during decision making in the 2-AFC tasks. Data analysis included the dependence of preferences and visual attention through Cohen's Kappa and Cramer's V association and agreement statistical indicators. Close to perfect agreement and high association has been shown between fixation duration and preferences at product-level although none of the eye-tracking metrics (within agreement and association) showed the relationship between eye fixation and preferences at factor-level. The results of this study indicate some doubts about particular arguments and basic attention — selectivity, which suggests that attention is based on filtering irrelevant stimuli and focusing on a task-relevant or decision-relevant information in the field of a consumer's gaze behaviour.

Key words: eye-tracking; visual attention; consumer behaviour; consumer choice
JEL Classification: M31

Introduction

In the field of marketing management, there is a growing interest in understanding the issues related to 'how brain responses reflect the decision-making process of consumers' although modern neuromarketing techniques are used for this purpose' (Cherubino et al., 2019, p. 2). For example, eye-tracking equipment investigates eye movements and is useful for detecting a consumer's visual attention (Wedel & Pieters, 2006). It is widely accepted that the human brain has a limited capacity for perceptual stimuli, and consumers' visual attention is limited. Therefore, attention is considered a scarce resource (Falkinger, 2008). Selectivity, which is one of the fundamental characteristics of attention (Desimone & Duncan, 1995) suggests that attention is based on filtering irrelevant stimuli and focusing on task-relevant or decision-relevant information (McMains & Kastner, 2009; Yang, 2017; Fu et al., 2020). At the same time, consumers are exposed to many visual stimuli in their everyday purchasing

[4] *Prague University of Economics and Business, Faculty of Management (simona.bazantova@vse.cz).*

decisions. According to Clement et al. (2013), consumers pay initial attention to less than half the products on the shelves in a store (on average, 36 of 95 jam products in their experiment). The concept of visual attention integrates eye fixation and attention into the eye-mind hypotheses (Just & Carpenter, 1980), which assumes that only fixated stimuli are processed, i.e. the unviewed product is not included in the selection. This is why marketers seek to attract a consumer's attention through visual stimuli (e.g. aesthetic packages). In this vein, efforts to find the extent to which the various aspects are related to gaze behaviour have emerged in the field of marketing.

Previous studies show that gaze behaviour is affected by a wide variety of factors that contribute to gaining and raising a consumer's visual attention toward a particular product (Gidlöf et al., 2017; Ladeira et al., 2019) and in stimuli rich visual environments, visual attention is driven by two basic processes: top-down (goal or utility-driven) and bottom-up (stimulus or saliency driven) (Orquin et al., 2013; Kattner & Clausen, 2020). Gidlöf et al. (2017) divided these factors into two groups: external and internal factors, which work together in influencing consumer gaze behaviour. Critical factors that affect consumer attention are the aforementioned internal factors (Gidlöf et al., 2017), such as shipping goals and consumers' preferences. On the other hand, external factors primarily encompass visual saliency of the stimulus (determined by colour, shape and size) (Orquin et al., 2018) in the sense of product differentiation from others (products or stimulus) or the 'pop-out' from others (Milosavljevic et al., 2012). According to Tatler (2007), the natural propensity of an individual is to focus their initial eye fixation in the centre of the field of vision. This claim is also supported in consumer gaze behaviour by Atalay et al. (2012). Their findings indicated that consumers look longer at products in the centre of the display, which implies that not only visual saliency but also the location of the product plays a key role in consumer gaze behaviour. Therefore, before examining the impact of internal factors on gaze behaviour, the external factors that are considered to have a significant effect should be established or considered.

Recent studies suggest a connection between gaze behaviour and preferences. The tendency toward longer eye fixation at a subsequently chosen alternative is referred to as gaze bias (Saito et al., 2017). Glaholt and Reingold (2009) argue that gaze bias is due to selective encoding, i.e. that greater visual attention is allocated toward relevant stimulus for observers. Furthermore, this is followed by Schotter et al. (2010), who claim that gaze bias is driven by selective encoding and the liking effect (where the liking effect is only an additional effect). This means that the liking effect intensifies the gaze bias when participants choose 'like item' and, conversely, weakens the gaze bias effect when they choose 'dislike item'. The relationship between preferences (based on the choice) and the gaze behaviour mentioned above considers preferences from a different perspective than from the perspective of consumer decision or product preference. However, selective encoding may indicate that a higher degree of visual attention is focused on a relevant attribute of the product (the most crucial attribute in consumer decisions) than on an irrelevant or negligible one in decision-making.

The following studies examine the issues surrounding consumer preferences (based on a choice between alternative products) and gaze behaviour. A higher level of visual attention (e.g. longer eye fixation duration, based on the *Total Fixation Duration* eye-tracking metric) is more typical for the chosen than the non-chosen product alternative (Atalay et al., 2012; Bialkova et al., 2014) and, accordingly, products with a higher eye fixation count (based on the *Total Fixation Count* eye-tracking metric) and duration had a higher probability of being chosen (Jantathai et al., 2013). Goyal et al. (2015) suggested that a consumer's choice (which can reflect a consumer's preferences) can be predicted by the mean value of eye fixation duration and fixation count. However, their results show that first fixated item (based on the *Time to First Fixation* eye-tracking metric) is not indicative of consumer preferences expressed by product choice from four alternatives. Van der Laan et al. (2015) indicate that Time to First Fixation (indicating which item is first fixated) does not increase the probability of being chosen. On the other hand, Reutskaja et al. (2011) claim that the first fixated items have a higher probability of being chosen. If the assumption is that a particular choice between some alternatives follows preferences then, in this case, these findings can lead to claims that there is a link between visual attention (in particular in Total Fixation Duration, Total Fixation Count eye-tracking metrics) and preferences in consumer decision making. However, it is unclear that there is a link between Time to First Fixation eye-tracking metric and consumer preferences (at product-level).

Simultaneously, product attributes with higher value and relevance in consumer decision are, in many cases, reflected by a higher rate of visual attention (Meißner & Decker, 2010; Meyerding & Merz, 2018). This finding is confirmed by Van Loo et al. (2015) who states that price-sensitive consumers pay more visual attention to the price attribute of the product. This is in line with the assumption that selective attention directs a person's limited attention toward decision-relevant information (McMains & Kastner, 2009; Yang, 2017; Fu et al., 2020), and selective encoding, which predicts the allocation of greater visual attention toward relevant stimulus (Glaholt & Reingold, 2009). These findings can also lead to the assumption that there is a relation between visual attention and preferences at factor-level. However, Balcombe et al. (2017) and Wei et al. (2019) provide an assumption that the relationship between visual attention and consumer preferences could be weak. Based on these inconsistencies about the relationship between visual attention and consumer's preferences, this study aims to re-examine the relationship between consumer preferences (at product-level and factor-level) and visual attention. Concerning directing visual attention based on top-down and bottom-up factors (Orquin et al., 2013; Kattner & Clausen, 2020), this study attempts to avoid influencing gaze behaviour through bottom-up processes.

1 Methods

Based on the presented theoretical background, this study tests the relationship between eye fixation and consumer preferences. It sets out questions regarding preferences at product-level (based on product choice) and factor-level (based on the importance of product attributes for observers in their decision making).

- **RQ1:** Is there any relationship between eye fixation and preferred product? *(product-level)*
- **RQ2:** Is there any relationship between eye fixation and the most important factor of the product for consumers? *(factor-level)*

In this study, the most frequently used eye-tracking metrics concerning eye fixation were used. Specifically, Time to First Fixation (TTFF), Total Fixation Counts (TFC), Total Fixation Duration (TFD) and Revisits within pre-defined AOI's (in this experiment, AOI's relate to products and product's attributes). Consumer preferences were expressed by product choice between pairs of alternative products. In doing so, the study examined the importance of price, package aesthetic and brand awareness (product attributes).

1.1 Product samples and pre-research

Bottles of cola drinks (as a representative of FMCG products) were used in this study. The sample of products (product attributes) was selected based on the pre-research derived from the replicated experiment conducted by Reimann et al. (2010) and modified due to insufficient argumentation in the authors' procedure. They investigated the effect of price, brand and package on consumer decision during the purchase of FMCG, especially the importance of these product factors (see Reimann et al., 2010, section: experiment 2). The goal of this pre-research was to define a *well-known/unknown brand*, a *low/high price* and *aesthetic/standardised packaging* of cola drinks from the point of view of students of the Faculty of Management (Prague University of Economics and Business) which were presented to participants in two-alternative forced-choice (2-AFC) tasks. A questionnaire was used in this study.

The price level in the original experiment (Reimann et al., 2010) was based on the average price of the product. The low price was set 30% lower than the average price, and the high price was set 30% higher than the average price; however, this course was not sufficiently argued. The present study used a Price Sensitive Meter comprising of four indirect questions to indicate the price levels (Lipovetsky, 2006). This method was chosen because it offers more realistic options (price levels), i.e. not only excessively high and low prices leading to the unaccepted price level. Aesthetic and standard packages in Reimann et al.'s (2010) experiment built on a pre-test of 16 students, which divided the presented packages into two categories based on definitions of aesthetics versus standardised product packaging. This study used questions with a Likert scale about consent to agree (1) ranging to disagree (5) with claims reflecting the possibility to divide 20 randomly selected bottles into aesthetic and standard categories. At the same time, definitions about aesthetic and standardised packaging were inspired by Reimann et al. (2010). Finally, a well-known brand and unknown brand was detected by a question about known or 20 randomly selected brands (yes or no) in this study. In the pre-research phase, data from 44 questionnaires was analysed with the results shown in Table 1.

Table 1 | Resulting combination of factors (based on the pre-research)

	Aesthetic packaging design	**Standardised packaging design**	**Aesthetic packaging design**	**Standardised packaging design**
Low price	Coca-Cola 19 CZK Package no. 19	Coca-Cola 19 CZK Package no. 1	Zam Zam cola 19 CZK Package no. 19	Zam Zam cola 19 CZK Package no. 1
High price	Coca-Cola 30 CZK Package no. 19	Coca-Cola 30 CZK Package no. 1	Zam Zam cola 30 CZK Package no. 19	Zam Zam cola 30 CZK Package no. 1
	Well-known brand		**Unknown brand**	

Source: Author's own processing

These variables were further used for primary research within 2-AFC tasks in an eye-tracking experiment. To define the importance of the product's attributes, pairs of products were composed based on Table 2. This table shows that six pairs of products were shown to the respondents in this study. For instance, the first category was used to compare the importance between price and the participants' brand awareness. A combination in this category consisted of the product with a low price and an unknown brand (product A) and a product with a high price and a known brand (product B) while the packages are the same. If price were a more important attribute in a buying decision, the participants would likely have chosen product A with a low price even though it was an unknown brand and vice versa. Figure 1 shows the illustration of the product combinations in the first category (with the standardised bottle).

Table 2 | Model of combinations for detecting consumer preferences (significance in consumer decision making) of the product attribute based on choice

1. category: analysis for comparing importance between price and brand awareness		2. category: analysis for comparing importance between price and package design		3. category: analysis for comparing importance between brand awareness and package design	
Product A	Product B	Product A	Product B	Product A	Product B
product with low price and unknown brand (standardised bottle)	product with high price and well-known brand (standardised bottle)	product with high price and aesthetic bottle (well-known brand)	product with low price and standardised bottle (well-known brand)	product with standardised bottle and well-known brand (low price)	product with aesthetic bottle and unknown brand (low price)
Product A	Product B	Product A	Product B	Product A	Product B
product with low price and unknown brand (aesthetic bottle)	product with high price and well-known brand (aesthetic bottle)	product with high price and aesthetic bottle (unknown brand)	product with low price and standardised bottle (unknown brand)	product with standardised bottle and well-known brand (high price)	product with aesthetic bottle and unknown brand (high price)

Source: Author's own research

Picture 1 | Illustration of product combinations in the first category (analysis for comparing the importance between price and brand awareness)

Source: Author's own research

In addition, pairs of products divided into group A (for three respondents) and B (for three respondents) with the opposite location of the product were presented to the respondents in the eye-tracking study. This approach was chosen because the respondents could fixate their gaze more, or first, at stimulus on the left side of the screen (Fisher & Rangel, 2014). These authors put this tendency within the context of European culture where the text is read from left to right.

1.3 Participants, procedure and analysis

Based on Nielsen's (2000) claim, the saturation should be achieved in eye-tracking studies even with a smaller number of respondents. This study used a sample of six participants. They were all students of the Faculty of Management (Prague University of Economics and Business) and had normal vision. First, the participants consented to their participation in the research. Consequently, they were seated in front of the monitor with eye-tracking equipment (the distance was set at 50–60 cm) and the equipment was calibrated through five-point calibration in Gazepoint Control software. This was followed by a display of six pairs of products. The data regarding gaze behaviour was collected via a GP3 desktop eye tracker while the participants chose between pairs of cola drinks. The sampling frequency of the GP3 eye tracker is stated at 60 Hz (the sampling interval is 16.67 milliseconds) with a stated accuracy of 0.5–1 degree.

The Gazepoint analysis (UX Edition) software was used for eye-tracking data analysis. First, the areas of interest (AOIs) in each picture with products were defined (specifically product A, product B, brand of product A, brand of product B, price of product A, price of product B, package of product A, package of product B). To analyse gaze

behaviour towards the pre-defined AOI's, four eye-tracking metrics were used in this study. Namely, Time to First Fixation (TTFF), Total Fixation Counts (TFC), Total Fixation Duration (TFD) and Revisits within AOIs. To analyse the relationship between consumer preferences and gaze behaviour, the association methods in statistic software R (specifically, association indicators such as Cohen's Kappa and Cramer's V) were used.

2 Results

Figure 2 illustrates data processing based on the Total Fixation Duration eye-tracking metric. Raw data from eye-tracking shows that the first respondent looked longer at product A (3.657 s) than B (1.768 s). In the following step, the table for analysis was created. Finally, contingency tables for all metrics that were used to calculate the association and agreement indicator were generated.

Figure 2 | Illustration of data-processing

AOI Statistics (for each user)

Media ID	...	AOI Name	...	User Name	...	Time to 1st View (sec)	Time Viewed (sec)	Fixations (#)	Revisits (#)
M1	...	Product A	...	R1	...	0.980	3.657	6	3
M1	...	Product B	...	R1	...	0.324	1.768	2	1

ID	TFD	Choice
R1_O1	A	A
R1_O2	B	A
R1_O3	A	A
R1_O4	B	B
R1_O5	B	B
R1_O6	A	A
R2_O1	A	A
R2_O2	B	B
R2_O3	B	B
R2_O4	A	A
...	...	...

Total Fixation Duration and Choice

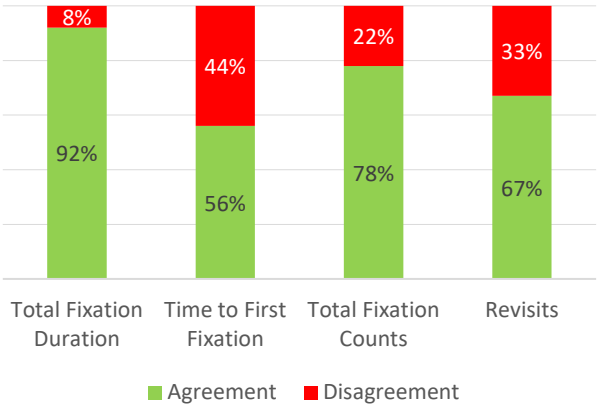
	A	B
A	16	1
B	2	17

Source: Author's own research

Note: Characters A in the TFD column (which is the sum of all eye-fixations on the product) mean that respondent looked longer at product A. In contrast, characters B mean that the respondent looked longer at product B. The second column, choice, contains the respondent's chosen product (A or B).

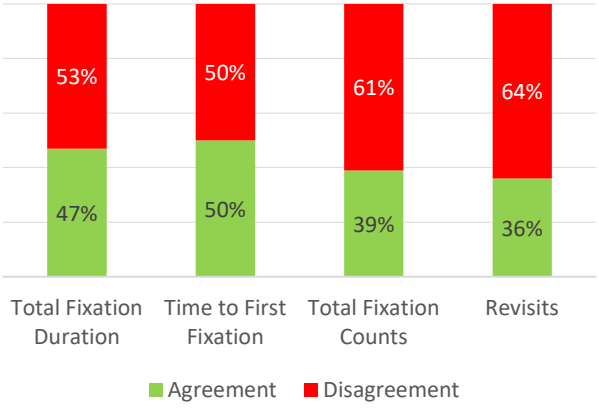
The following graphs were compiled to indicate connections between the given eye-tracking metrics and product choice (Figure 1) and the most important product factor for the respondents (Figure 2).

Figure 1 | Eye-tracking metrics and percentage of agreement within product AOIs (A and B)



Source: Author's own research
Note: Agreement means that products with the highest value of eye-tracking metrics TFD, TFC and Revisits or the lowest value of TTFF were simultaneously chosen (preferred) and is vice versa for Disagreement.

Figure 2 | Eye-tracking metrics and their percentage of agreement within product attribute AOIs (price, brand and package)



Source: Author's own research
Note: Agreement means that product attribute with the highest value of TFD, TFC and Revisits eye-tracking metrics or the lowest value of TTFF was simultaneously the most important for respondents and vice versa in the case of Disagreement.

At product-level, Figure 1 shows that the respondents fixed their gaze for the longest time (determined based on the eye-tracking metric Total Fixation Duration) on the later selected alternative in 92% of cases. This means that that almost every measurement indicates agreement between the longest fixed product and subsequent product choice. Similarly, the

highest number of fixations on a later selected alternative was shown in 78% of measurements (determined based on the Total Fixation Count eye-tracking metric). A lower percentage agreement can be seen for Revisits and Time to First Fixation. On the other hand, Figure 2 indicates that only a low association among all measured eye-tracking variables occurred at factor-level. These results were subsequently confirmed by statistical tests of association and agreement.

Tables 3 and 4 show the results of statistical testing measuring the degree of association and agreement (*at product-level* and *factor-level* analysis). Cohen's Kappa statistic (measure of agreement) was based on the outputs in the statistical software R (*Kappa.test (library (fmsb)*) and Cramer's V (measure of association) was defined based on the outputs in the statistical software R (*assocstats (library (vcd)*).

Table 4 | Degree of association and agreement in product-level analysis

	Cohen's Kappa				**Cramer's V**
	Z	**p-value**	**Interval**	**Sample estimates**	
	H_0: "the extent of agreement is the same as random"				
Total fixation duration and Choice	5.037	2.363e-07	0.655 – 1.014	0.834	0.846
	Z > 1.64 H_0 is rejected	p-value < 0.05 H_0 is rejected	Interval does not include 0 H_0 is rejected	**0.81-0.99 = Almost perfect agreement** *(Landis & Koch, 1977)*	**0.70-0.89 = High association** *(David & Sutton, 2004)*
Total fixation counts and Choice	3.333	0.000	0.284 – 0.827	0.556	0.559
	Z > 1.64 H_0 is rejected	p-value < 0.05 H_0 is rejected	Interval does not include 0 H_0 is rejected	**0.41-0.60 = Moderate agreement** *(Landis & Koch, 1977)*	**0.4-0.69 = Modest association** *(David & Sutton, 2004)*
Revisits and Choice	1.852	0.032	0.001 — 0.632	0.316	0.319
	Z > 1.64 H_0 is rejected	p-value < 0.05 H_0 is rejected	Interval does not include 0 H_0 is rejected	**0.21-0.40 = Fair agreement** *(Landis & Koch, 1977)*	**0.2-0.39 = Low association** *(David & Sutton, 2004)*
Time to first fixation and Choice	0.815	0.208	-0.184 – 0.450	0.133	0.140
	Z < 1.64 H_0 is not rejected	p-value > 0.05 H_0 is not rejected	Interval includes 0 H_0 is not rejected	**0.00-0.20 = Slight agreement** *(Landis & Koch, 1977)*	**0.19 or less = Very low association** *(David & Sutton, 2004)*

Source: Author's own research

Table 5 | **Degree of association and agreement in factor-level analysis**

	Cohen's Kappa				
	Z	**p-value**	**Interval**	**Sample estimates**	**Cramer's V**
	H_0: "the extent of agreement is same as random"				
Total fixation duration and Most important factor	0.967	0.167	-0.139 – 0.399	0.130	0.141
	Z < 1.64 H_0 is not rejected	p-value > 0.05 H_0 is not rejected	Interval includes 0 H_0 is not rejected	**0.00-0.20 = Slight agreement** *(Landis & Koch, 1977)*	**0.19 or less = Very low association** *(David & Sutton, 2004)*
Total fixation counts and Most important factor	-0.057	0.523	-0.270 – 0.255	-0.008	0.250
	Z < 1.64 H_0 is not rejected	p-value > 0.05 H_0 is not rejected	Interval includes 0 H_0 is not rejected	**< 0.00 = Poor agreement** *(Landis & Koch, 1977)*	**0.2-0.39 = Low association** *(David & Sutton, 2004)*
Revisits and Most important factor	-0.342	0.634	-0.302 – 0.211	-0.045	0.250
	Z < 1.64 H_0 is not rejected	p-value > 0.05 H_0 is not rejected	Interval includes 0 H_0 is not rejected	**< 0.00 = Poor agreement** *(Landis & Koch, 1977)*	**0.2-0.39 = Low association** *(David & Sutton, 2004)*
Time to first fixation and Most important factor	1.549	0. 061	-0.061 – 0.461	0.200	0.290
	Z < 1.64 H_0 is not rejected	p-value > 0.05 H_0 is not rejected	Interval includes 0 H_0 is not rejected	**0.00-0.20 = Slight agreement** *(Landis & Koch, 1977)*	**0.2-0.39 = Low association** *(David & Sutton, 2004)*

Source: Author's own research

At product-level (RQ1), the results show moderate agreement (Cohen's Kappa: sample estimate = 0.56) and modest association (Cramer's V: sample estimate = 0.56) between the chosen (preferred) product and the fixation count (eye-tracking metric Total Fixation Count). The almost perfect agreement (Cohen's Kappa: sample estimate = 0.84) and high association (Cramer's V: sample estimate = 0.85) was captured in the longest fixation duration (eye-tracking metric Total Fixation Duration). However, low association and slight or fair agreement were shown within the metrics Time to First Fixation (Cohen's Kappa = 0.13; Cramer's V = 0.14) and Revisits (Cohen's Kappa = 0.32; Cramer's V = 0.32). On the other hand, at a factor-level (RQ2) Cohen's Kappa indicated only slight or poor agreement and low or very low association between the importance of product factor (the most important product's attribute for respondents in decision making) and all examined metrics

such as Time to First Fixation, Total Fixation Duration, Total Fixation Count and Revisits (the maximum value of Cohen's Kappa = 0.2; the maximum value of Cramer's V = 0.29).

3 Discussion and conclusions

This pilot study aimed to examine the relationship between eye fixation and consumer preferences. The research questions were defined as follows: 1. Is there any relationship between eye fixation and preferred product? and 2. Is there any relationship between eye fixation and the most important product factor for consumers? Association tests between the chosen (preferred) product and gaze behaviour metrics resulted in the indication that Total Fixation Count and Total Fixation Duration could predict consumers' choice (preferences) and that there is significant agreement and association between eye fixation and preferences. The results were in accordance, for example, with Jantathai et al. (2013) and Goyal et al. (2015) even though there was another method of data analysis applied. For instance, Goyal et al. (2015) used the mean value of eye-tracking metrics in their data analysis. On the other hand, and in line with Van der Laan et al. (2015), the results show that there is a slight agreement and a very low association between Time to First Fixation and preferences, meaning that this eye-tracking metric cannot predict consumer choice. However, it is contrary to the claim that the first fixated items have a higher probability of being chosen (Reutskaja et al., 2011). As in the case of Revisits, this analysis indicated low association and fair agreement.

Interestingly, the results indicate that eye fixation cannot detect the most important product attribute for consumers, because only slight or poor agreement and low or very low association between the product factor importance and all examined metrics such as TTFF, TFD, TFC and Revisits were found. This finding is contrary to the assumption that product attributes with higher relevance to a consumer are characterised by a higher rate of eye fixation (Van Loo et al., 2015; Meyerding & Merz, 2018). However, the results of this pilot study are indicative and limited due to the sample size, which prevents broader generalisation of the findings. At the same time, future research should be supplemented by interviews for a more in-depth analysis of respondents' preferences and other internal factors. It would be appropriate to fix the bottom-up factors more precisely or include more in-depth consideration of external factors in the analysis.

Even so, this exploration indicates some doubts about particular arguments in selective attention theories. These theories imply that visual attention is based on the filtering of irrelevant stimuli and focusing on task-relevant or decision-relevant information (McMains & Kastner, 2009; Yang, 2017; Fu et al., 2020). This particularly applies when the bottom-up attention process is eliminated (because it is widely known that ‘the amount of selective attention that is directed to a stimulus depends on both bottom-up and top-down processing’ (Kattner & Clausen, 2020, p. 1–2)). On this basis, it can be assumed, that the non-significant and most irrelevant product factors for a particular consumer in their decision making (such as price or brand) should be eliminated from visual attention based on the mentioned selection. However, this conflicts with the results of this experiment,

because it appears that the respondents did not fixate their gaze for the longest time or most often on the relevant and most important factors when choosing products. Alternatively, the results could indicate that the respondents made their choices in conflict with their preferences. Furthermore, the results of this study challenge the explanation of gaze bias through the process of selective encoding (Glaholt & Reingold, 2009) in the context of consumer gaze behaviour and decision making. Based on the theoretical background set out above and these empirical findings in the context of consumer gaze behaviour in decision-making situations, it is evident that future research needs to broaden its perspective and consider other variables that can affect the relationship between visual attention and consumer choice so as to appreciate consumer gaze behaviour comprehensively.

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INSOLVENCY: WHAT IT TAKES TO ESCAPE

Vojtěch Prchal[5]

Abstract

The Czech insolvency register obtains personal data about debtors that although not often used appears to be underestimated. A data sample is collected for research that shows the dependency between selected variables and the length of the insolvency process. Two types of data are considered — structured and unstructured, e.g. those that can be optically recognised by a machine and those that cannot. This study aims to preselect the variables for a representative sample of individuals based on publicly available data in the insolvency register then define the variables that affect the length of the whole insolvency process, determine those with the most significant impact and interpret the data in a wider context. The paper provides an insight into the insolvency process as a part of the research leading to a better understanding of the debt relief process based on real-life situations while collecting preselected data available from the public insolvency register and presenting a statistical point of view of individuals' insolvency process. The data is obtained and tested on the correlation between the variables and the length of the whole insolvency process. The results, including the variables with the most significant impacts, are generalised and interpreted in a wider context.

Key words: insolvency register; bankruptcy administrator; debtor; debt relief
JEL Classification: G21, G33

Introduction

The main area of the research is focused on analysing the Czech insolvency register and the data it makes available regarding individuals. Although one of many registers in the world, the Czech insolvency register is one of a kind due to unique national legislation. This means that although it has much in common with other countries' insolvency registers it remains specific to the Czech Republic.

The article aims to collect a data sample concerning individual debtors, who are not entrepreneurs, and their successful recovery process. The insolvency register is a publicly available domain controlled and managed by the Czech Ministry of Justice that contains extensive personal data and an out-of-date user interface. Data about debtors can be displayed for five years after the insolvency process is finished so offers an interesting opportunity for more profound research. The Czech insolvency register has been analysed in recent years by only a few authors, e.g. Smrčka (2012, 2013, 2016a, 2016b) and Kislingerová et al. (2013), both based at the Prague University of Economics and Business.

This work focuses on in-depth analysis of the insolvency register, its processes, key shareholders (such as the bankruptcy administrator, debtor(s) and trustee(s)) and the types

[5] *Prague University of Economics and Business, Faculty of Management (vojtech.prchal@vse.cz).*

of available data. The insolvency register contains information about individuals and companies that fail to fulfil their obligations over a certain amount of time (as defined by Czech law) and their recovery process leading to zero debt.

The purpose of the research is to select structured and unstructured data and to determine the dataset for further intensive data collection. Preselected and gathered variables are tested for correlation with the length of the whole insolvency process, and the whole dataset is thoroughly analysed for any relations between the variables to create a model of the average debtor.

1 Literature review

Insolvency is a generally used term, and many countries have their own insolvency law or its equivalent. The insolvency process helps people and companies to eliminate cumulating debts or a debt trap. Various approaches to insolvency can be found throughout the world with many changes applied (Keay, 2003). For instance, a paper entitled 'Insolvency from an International Perspective' (Švoma, 2014) at the 2014 International Scientific Conference on Insolvency explains bankruptcy legislation development and introduces the generalised debt relief process into four phases: Debtor punishment, Debt forgiveness, Debtor reorganisation, and Debtor rehabilitation and explains the importance of the aim to rehabilitate debtors back into the economic system. Švoma (2014) also points out an interesting comparison between the differentiated aims of insolvency processes in selected countries and shows the different approaches to addressing insolvency issues around the world that confirm the uncertain and difficult comparison of insolvency processes between countries. An interesting point of view has been offered by Arltová et al. (2016) on the efficiency of insolvency proceedings in various countries including various characteristics but not taking in account Distribution of consumer credit market according to the value of issued loans. This characteristic has been studied by Jurevičienė (2014), who presents the Consumer credit market participation as an important part of the whole study.

The aims of insolvency, presented in Table 1, seem to be significant. However, as McGowan and Andrews (2016) suggested, the efficiency of insolvency regimes is crucial.

Table 1 | Aims of insolvency in selected countries

Country	Aim of insolvency
USA	Give the company/person the chance to resolve their problems.
United Kingdom	Pay the debt to specific creditors.
France	Safe business, employment and partial debt forgiveness.
Germany	More productive use of assets instead of liquidation
Japan	Timely reorganisation

Source: Švoma (2014)

Czech insolvency in general and insolvency processes are defined by Czech insolvency law (CR, 2006) while important decisions during the process are made by the Insolvency Court, often using the information provided by the bankruptcy administrator. The usual process consists of the Insolvency Court, the debtor(s), bankruptcy administrator and the creditor(s). The whole process is followed by bureaucracy and administration littered with many obstacles, including the technology of the insolvency register itself. Insolvency law and its measures and possible mutual comparisons are mentioned by Finch (1997). Her article presents the area of insolvency in 1997 and leaves personal bankruptcy issues for future consideration.

The entire register was built (programmed) many years ago, and despite Czech government declarations and willingness, the selection procedure for a new system supplier has been cancelled due to low quality and confusing documentation. The actual system is only partly automatised, and most of the information is unstructured. It cannot be read by machines, which makes all processes complicated, is time-consuming, and it publicly provides all information about debtors including their personal data.

In paper by Smrčka (2013, p. 1), there are a few sentences that fully reflect the current situation:

> *'It was intended to bring about a state where a third party would easily acquaint itself with details concerning individual cases so as to compile sufficiently substantiating statistics on insolvency proceedings. While the first goal has been accomplished and it is now possible to access a range of information online and follow a concrete case practically simultaneously to the development of the insolvency proceedings, the second goal has remained unfulfilled. The fault lies in inadequate technological and jurisdictional solutions which have not paid sufficient attention to the possibilities of using information technology in insolvency practice in the Czech Republic.'*

As mentioned, obtaining data from the insolvency register is complicated. There is a part of the register that can automatically provide data. However, the other hard part to access contains information that has remained almost untouched since the existence of the register despite researchers being well informed about it. For example, Mrázová and Zvirinský (2017) published a paper called 'Extraction and Interpretation of Textual Data from Czech Insolvency Proceedings', where they aim to efficiently pre-process attachments. They state that the insolvency register contains around 200,000 insolvency proceedings and 1,200,000 pdf files. This might reveal more than one can think. The potential of the data is enormous. The whole system needs revision, and historical data should be included in a new version of the insolvency register. The only thing needed is the amount of human work beyond compute. This paper collects only a tiny sample of the whole piece but still might be a piece of the puzzle that would point out the limits of the Czech insolvency register and suggest few steps for its future revision (Mrázová & Zvirinský, 2018).

2 Data, analysis and methods

The Czech insolvency register allows visitors to look up information while applying various conditions and filters. Selected for this paper were individuals, non-entrepreneurs who were able to comply with all the legal conditions (predicted to pay at least 30% of their cumulative debts in the upcoming 5 years). The detailed webpage (profile) contains indicative information about the debtor and five structured sections in which all the legal steps of the process are recorded. Each step usually contains information about the date and time of the record, a description of the step and at least one attached document. The whole folder of materials on a person's insolvency process can contain up to 200 documents, each between 2–150 pages.

Attached documents are the most important source of interesting data and contain personal information and other useful data for the research as a by-product. The biggest problem in obtaining data from the documents is the absent description of their structure and form. Although the documents are sometimes completed and uploaded electronically, they are usually printed out and completed by hand and scanned afterwards. This makes them unreadable by any existing method, including OCR (optical character recognition).

The only way to obtain data is to analyse all the documents, create a preselected dataset of all possibly collected variables, and narrow it down by excluding irrelevant variables to approximately 50. In this paper, only 16 sample variables have been selected with another 4 side variables computed based on the main sample (see Table 2). Each variable from the main sample can be found in one or more documents on the debtor's profile. At least one document is assigned, downloaded, human-read, and the result (if found) noted down for each variable. As mentioned above, the whole dataset consists of 20 variables for each of the 40 individual debtors.

Table 3 | **Dataset of variables and origin**

Title	Variable origin
Name	Dataset sample
Surname	Dataset sample
Date of birth	Dataset sample
Marital status	Dataset sample
Gender	Dataset sample
Titles prefixing a person’s name	Dataset sample
Titles after a person’s name	Dataset sample
Debtors monthly income (CZK)	Dataset sample
Date of record – Application for the insolvency process	Dataset sample
Date of record – Insolvency process permission	Dataset sample

Date of record – The end of the insolvency process	Dataset sample
Total sum of debtor's active debts (CZK)	Dataset sample
Total number of the debtor's active debts (pcs)	Dataset sample
Total sum of debtors repaid debts (CZK)	Dataset sample
Bankruptcy administrator salary (CZK)	Dataset sample
Bankruptcy administrator expenditures (CZK)	Dataset sample
The length of the insolvency process (years)	Computed
The length of the insolvency process (months)	Computed
Repaid debts to total debts rate (%)	Computed
Debtors age at the end of the insolvency process (%)	Computed

Source: Author's own research

The data sample consists of debtors who had successfully passed through the insolvency process. Variables are prepared for collecting and testing in two steps. In the first step, all the variables are preselected by monitoring the register and noted down to make a complete overview of the data available. After preselection, the data set is narrowed down to just 20 variables by removing irrelevant data for current research. Particular attention was focused on personal data such as date of birth, marital status, gender, education, monthly income, number of debts and the total amount. The whole process of selecting, collecting and analysing data is influenced and limited by the variable data source (unstructured documents, absence of determined form, low quality, etc.), and the whole process can vary according to the bankruptcy administrators' approach and decisions made by Insolvency court. All data was acquired from the insolvency register. Individuals were randomly selected with only one condition applied — their insolvency process must be successfully finished. The insolvency register, according to Czech law, contains records only of debtors whose insolvency process finished not more than five years ago. Records older than five years are deleted and cannot be found publicly anymore. The variable monthly income can be interpreted differently throughout the years (inflation, etc.) but this research only uses data in a five-year term and approximates zero inflation during this period.

Each individual has a profile on the insolvency register website consisting of various sections. For this research, the first two are relevant A and B (up to and after permitting to undergo the whole process). Each profile contains up to 200 documents (each between 2–150 pages) that are monitored, downloaded, analysed and used as a source for data preselection. Most of the final data sample (20 variables) are from the section in A to obtain the relevant entry data about debtors. Selected variables are most likely to be found about every debtor.

The data in the insolvency register is monitored, preselected based on relevance to the research, analysed, and then narrowed down to 20 variables for further analysis and

testing. The final data sample consists of 40 individual non-entrepreneur debtors and the collected variables are described and used for basic analysis leading to a model of the average debtor. The two most likely dependent variables are tested on dependency with the length of the insolvency process using linear regression modelling to answer two research questions.

Table 3 | Collected data with basic statistics

	Average	MIN	MAX
Debtor's monthly income	16 168 CZK	9 445 CZK	27 000 CZK
Total sum of debtor's active debts (CZK)	647 701 CZK	134 406 CZK	1 716 734 CZK
Total number of the debtor's active debts (pcs)	9	2	28
Total sum of debtor's repaid debts	307 198 CZK	41 999 CZK	1 180 309 CZK
Bankruptcy administrator (BA) salary	50 149 CZK	25 410 CZK	68 880 CZK
Bankruptcy administrator (BA) expenditures	8 208 CZK	1 065 CZK	28 023 CZK
Length of the insolvency process (years)	6.0	2.9	7.6
Length of the insolvency process (months)	71.4	35.2	91.2
Repaid debts to total debts rate	55.1%	31%	100%
Total BA costs to repaid debts rate	32%	4.7%	150.2%
Debtors age at the end of the insolvency process	47.7	29.5	75.4
	Men	**Women**	**Total**
Number of men and women	19	21	40
Men to women rate	47.5%	52.5%	100%
Number of individuals with higher education	0	2	2

Source: Author's own research

3 Results

Using the data collected and shown in Table 3, the model of an average debtor is created. The average debtor is 43–48 years old, slightly more likely to be female (52.5%) without higher education and with a monthly income of 16,168 CZK. She bears a debt of approximately 650,000 CZK consisting of nine individual debts (sometimes nine different creditors as well). The average debtor can pay over 300,000 CZK during the whole

insolvency process and bears the bankruptcy administrator's costs of around 58,000 CZK in addition to the amount paid. The insolvency process for each individual lasts an average of six years, during which time the debtor can pay more than half of the total amount due.

The data collected shows existing debtors across the entire age spectrum, which, at first sight, does not indicate the debtor's age dependency. Gender structure is balanced, which proves that both genders have a similar chance to owe money. Once a person gets into trouble with paying debts and is allowed to undergo an insolvency process, the question raised by the state, the bankruptcy administrator and the creditors is are they an ideal debtor?

The answer to this question differs according to the questioner: To the state, the ideal debtor can repay all debts without prolonging the process and quickly return to the economic system. To the bankruptcy administrator, the longer the process continues and the easier the administration, the better. Bankruptcy administration charges a fixed fee per month for the process according to the insolvency law of the Czech Republic. To the creditor, the situation becomes more complicated and depends on many variables. To simplify the situation, the creditor always wants the whole amount due to be paid. This is debtor-dependent and without their willingness is almost impossible. The debtor (in this case, the individual non-entrepreneur) must pay off at least 30% of the total debt to all unsecured creditors, and then the state will cover the remaining amount. Once the debtor wants to pay their debts, is not so much about money but time. The sooner the conditions are met, the earlier the creditors get their money. This process can be, in reality, tainted by companies that buy and sell active debts for various, often speculative, purposes. Actual insolvency law allows companies to use other insolvencies as a business, which raises even more questions regarding this topic.

The approaches to answer questions about the ideal debtor differ but still have time in common. The length of the insolvency process depends on many variables, including the debtor’s willingness. Apart from this, a data offer hints at predicting the length of the process. For this study, the amount of monthly income and the total amount of debts are tested on possible dependency with the length of the process. The research questions are:

- **RQ1:** Does the insolvency process shorten with the debtor's higher income?
- **RQ2:** Does the insolvency process shorten with the debtor's higher amounts of total debts?

A regression model was used to determine the dependency between the variables. The results of the first research question (see Figure 1) can be interpreted as the dependence of two variables. The p-value of the independent variable (monthly income) is slightly higher than 5%, which shows that the variables are not significantly dependent. The adjusted R-squared value of 5% also represents an extremely low proportion of the variability of response explained by an independent variable.

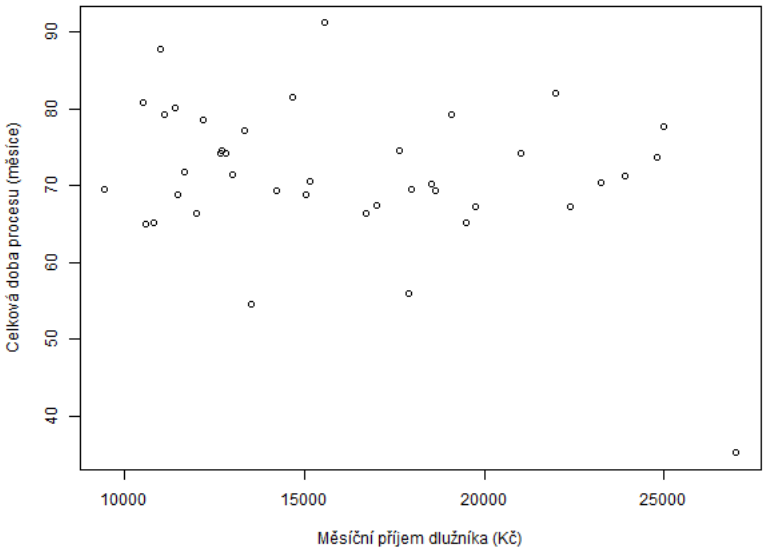
The result was, in this case, partially influenced by one outlier shown in the right bottom corner that may partially influence the whole modelled dependence. Nevertheless, this outlier has an interesting subtext as it represents an individual with the highest income

in the dataset and the shortest length of the insolvency process. As expected, this individual appears to be an outlier in the second model as well. In Figure 2, it is presumably located at the very bottom (the shortest length of the insolvency process) but also belongs to the first third of individuals with a low total amount of debts.

This individual is the only one of a kind in the dataset, which partially influences the results of both models but still represents the real-life situation of an individual with a high income and low amounts of total debts (unlike the rest of the dataset) who was able to fulfil the conditions of the insolvency process sooner than others. It also gives hope to people who have a regular income but find themselves in a debt trap, that if they declare bankruptcy early (before the debts increase and income drops), it may shorten the whole insolvency process plus time and money.

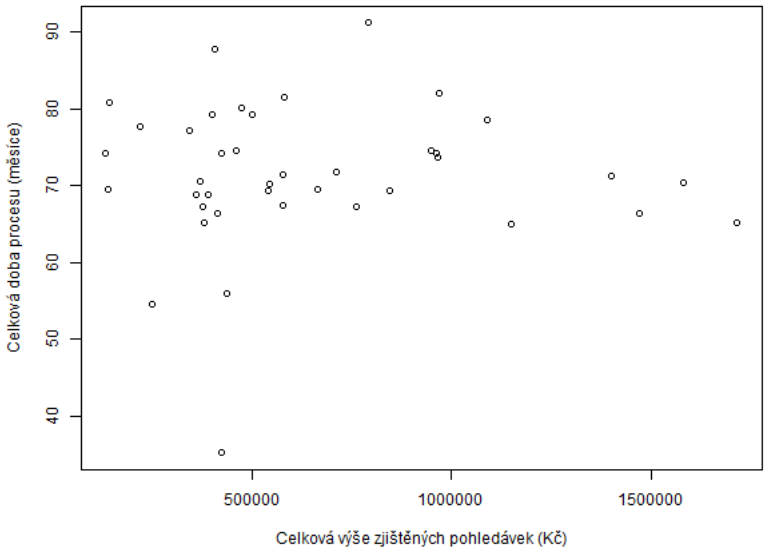
The results of the second regression model testing the dependency between the number of total debts and the length of the insolvency process are graphically demonstrated in Figure 2. The regression model shows almost no dependency between the variables, and the adjusted R-squared is negative -2.6%. This result demonstrates an even lower dependency than in the first regression model. The figure does not show many extremes with most cases located around a length of 70 months (the average is 71.4 months as shown in Table 3) with no particular decrease with higher or lower amounts of debts. The diagram may show a subtle trend of no noticeable increase in the length of the insolvency process with the higher income of the debtor.

Figure 1 | Regression model for RQ 1



Source: Author's own research

Figure 2 | Regression model for RQ 2



Source: Author's own research

Conclusions

The results show that the answer to the first research question is that the regression model shows no or insignificantly low dependency between the height of the income and the length of the insolvency process, e.g., the debtor's higher income does not shorten the insolvency process. The second regression model demonstrates even lower (again, insignificant) dependency between the total amount of debts and the length of the insolvency process. The results of both research questions do not confirm the expectations and prove no (or insignificant) dependency between the analysed variables. The structure of the graphical results in both pictures is consistent and cannot be fractionated into clusters (except for extremes) to be analysed separately. The results raise the question: What, if anything, influences the length of the insolvency process? Furthermore, it leaves an unanswered question that needs to be studied further.

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PRODUCT PLACEMENT IN ONLINE GAMES: LITERATURE REVIEW

Alice Paštiková[6]

Abstract

Widely used product placement appears almost everywhere, even in online games. However, knowledge of its impact in online games is scarce compared to traditional media. As a result, this paper summarises what we know and, more importantly, what we do not know about this phenomenon. The literature review adopted the PRISMA framework for a systematic literature review to summarise the previous research on product placement in online games from 2009 to 2019 in the Scopus and Web of Science databases. A pool of 235 topic related articles was identified under the predefined criteria. The number of articles was reduced to the 36 most relevant for in-depth analysis. The purpose was to identify the key research objectives and factors. The most frequently appearing objectives were related to attitude towards product, recall and recognition. The experiments usually examined the effect of these factors: prominence, congruence and interactivity. The most frequently used method was questionnaires with rating scales. As a result, the paper summarises the findings of the experiments and lists their shortcomings. The common shortcomings of the experiments were the short time frame and using students as participants. The literature review summary forms the basis for the subsequent experimental study.

Key words: advergaming; digital marketing; in-game marketing; PRISMA; state of the art
JEL Classification: M31

Introduction

Companies continually search for new ways to promote their products to win a share of what is a saturated market. The more interesting, unique and original is the product advertisement then the more attention it can gain. Online games have many benefits: game variability, which enables to produce a game for any target group, game nature which ranges from shooting games to educational and relaxation and can be played alone or in groups. The games can be played online, offline or accessed as a video record. Products can be extensively advertised within online games as these provide a suitable platform to target a primarily demographically younger generation (Yoon, 2019). Therefore, game developers often receive attractive offers for collaboration or sponsorship in exchange for brand promotion (Zhu & Chang, 2015; Nielsen, 2017).

Online games provide an excellent opportunity to promote brands/products, especially as the user base is growing. In its 2019 report, the Entertainment Software Association (ESA) claimed that in 2019, 75% of Americans have at least one gamer in their household. Additionally, the player base has a wide age reach with 21% under 18 years old,

[6] *Prague University of Economics and Business, Faculty of Management (pasa00@vse.cz).*

40% 18–35 years old, 18% 36–49 years old and 21% over 50 years old (ESA, 2019). Moreover, the player base has followers, regardless of gender, with a slightly higher male representation (54%) (ESA, 2019). Throughout the rest of the world, the gender difference is greater between male (62%) and female (38%) (STATISTA, 2020). The player base is growing each year while the coronavirus situation has significantly contributed to a new player influx (Gough, 2020). Online games attracted the attention of advertisers with the increase in smartphones and the internet (Guo et al., 2019). However, the smaller mobile screen can limit the effectiveness of product placement (Chaney et al., 2018). The economic position of the online game industry is extremely high in the USA and Asia, although European states have not yet reached the same magnitude (STATISTA, 2020). The popularity of online games will most likely follow this trend and grow in other parts of the world.

Product placement is a frequently used tool to catch a user's attention. Advertising within an online game has similar benefits as in films because the user is interested in what is happening (Jusufovic-Karisik, 2014). Although less intrusive than commercial advertisements, it should be integrated with content; otherwise, the response can be negative (Vashisht, 2019). In addition, admitted product placement is more likely to evoke a negative attitude (Terlutter & Capella, 2013). EU Directive 2007/65/EC (EP, 2007) coordinates the laws of member states to restrict the use of product placement and makes it obligatory to inform users of the promoted content; otherwise, it can be labelled as hidden advertising, which is illegal. However, in many cases, it is questionable if the product is truly intentional product placement or just a casual appearance without marketing intentions.

Many other disciplines probed product placement from different angles. It could be approached from the perspective of psychology, more precisely sociology, anthropology and culture. All these disciplines have many other sub-disciplines (consumer culture theory, cultural studies, promotional culture paradigm, etc.) related to the topic. The neurosciences are also concerned with the product placement mechanism. Ludology (the science of games) could also contribute with its view of this topic of product placement in online games. The marketing technique of product placement could be approached and understood variously. This study decided to focus on the perspective of marketing efficiency by analysing a product placement experiment in video games.

1 Data and methods

This paper conducts a literature review to identify the key research objectives and methods used in product placement online game experiments. The study focuses on the design of the experiments because the future objective is to design an experiment according to the knowledge acquired. The literature review maps the development and findings of product placement in online games and provides an overview of the topic. The paper subsequently summarises the findings of the conducted experiments and lists their shortcomings before

suggesting future research methods. The systematic review method was found to be an appropriate approach to fulfil the purpose of this paper.

The following research intends to use eye-tracking in its experiment. This is one of the methods used to access implicit memory. Product placement has an impact on both implicit and explicit memory and should be accessed from both views. It is expected that at least some articles will be using eye-tracking in their research. Also, the statement of Lee and Faber (2007), who proposed the use of eye-tracking in online games, is strengthening this expectation.

1.1 PRISMA

This review adopted PRISMA as a suitable approach for a literature review. The PRISMA abbreviation stands for Preferred Reporting Items for Systematic reviews and Meta-Analyses. PRISMA is regarded as an appropriate method to access and evaluate the accuracy of relevant literature in the predefined area of search (PRISMA, 2015). The systematic approach significantly increases the probability of appropriate literature reviews because it lessens the selection bias (Moher et al., 2015). Moreover, the literature review is done systematically, which increases validity because each step is recorded. The predefined question and criteria help the researcher stay focused on the chosen area. PRISMA is a useful tool for identifying relevant articles and acquiring information related to the set question (Tranfield et al., 2003). Producing research under the PRISMA rules produces a comprehensive literature review. The limitation could be only a narrow focus on the predefined area because, at first sight, the less relevant areas could also bring an enriching perspective into the examined field.

Other approaches exist that are suitable to conduct a literature review as a semi-structured integrative review or a bibliometric method. The semi-structured review is suitable when the search is conducted within diverse disciplines. The integrative review is even less structured and is used to combine perspectives and develop theoretical models (Snyder, 2019). A systematic review is an approach that aims to collate the relevant evidence that contributes to answering the pre-formulated question within predefined criteria (Tricco et al., 2018). The bibliometric method adopts an inductive approach and tracks the most influential ideas (Yoon, 2019). This method could also be suitable to attain the aims of this paper. The area of this search is focused on a specific topic; hence the systematic approach appears to be the most convenient.

1.2 Data aquisition

The area of search was predefined in advance. The research used only journal articles in the English language that were published in the Scopus and Web of Science online databases. The area of search was restricted only to journals, where there is the best opportunity to find experimental studies. The articles had to be published within the decade (2009–2019). Online marketing is a dynamic industry, which evolves concurrently with online technologies. Hence, the older evidence was excluded as well as articles from 2020

because the databases would be changing throughout the year. The keywords for finding relevant articles were ‘product placement in games’, ‘product placement in online games’ and ‘advergaming’ with no brackets. These keywords were chosen according to the defined area of product placement in online games.

The term product placement was included in two keywords, which identify the relevant articles for the survey. The term ‘product placement’ is defined as the advertising of a product or brand incorporated into another work, such as films, TV programmes, online games and YouTube videos (Jusufovic-Karisik, 2014). Product placement in games is sorted into a superior category labelled as in-game advertisement (IGA). IGA represents any promotion of a brand or product that occurs in the game. This can be a banner, product placement, a loading picture or a dialogue link. IGA provides a new way to engage customers and make the product appear irresistible (Yoon, 2019).

First, only the keywords ‘product placement in games’ and ‘product placement in online games’ were chosen. However, some games have such a strong brand message that they can be confused for advergames, notwithstanding that they are not categorised as one. Advergaming differs from product placement but has the same intentions of improving attitude towards the product and increasing purchases. Advergames are specifically designed and created to promote a brand, product, service, or idea (Terlutter & Capella, 2013). They consist of a powerful advertising message and are usually free. Advergames often use the logos and characters typical for a brand (Roettl et al., 2016). In some online games, the promoted content is evident although the game is not labelled as an advergame, e.g. Monster Energy Supercross. Based on listed arguments, the third keyword ‘advergaming’ was added to the research conditions.

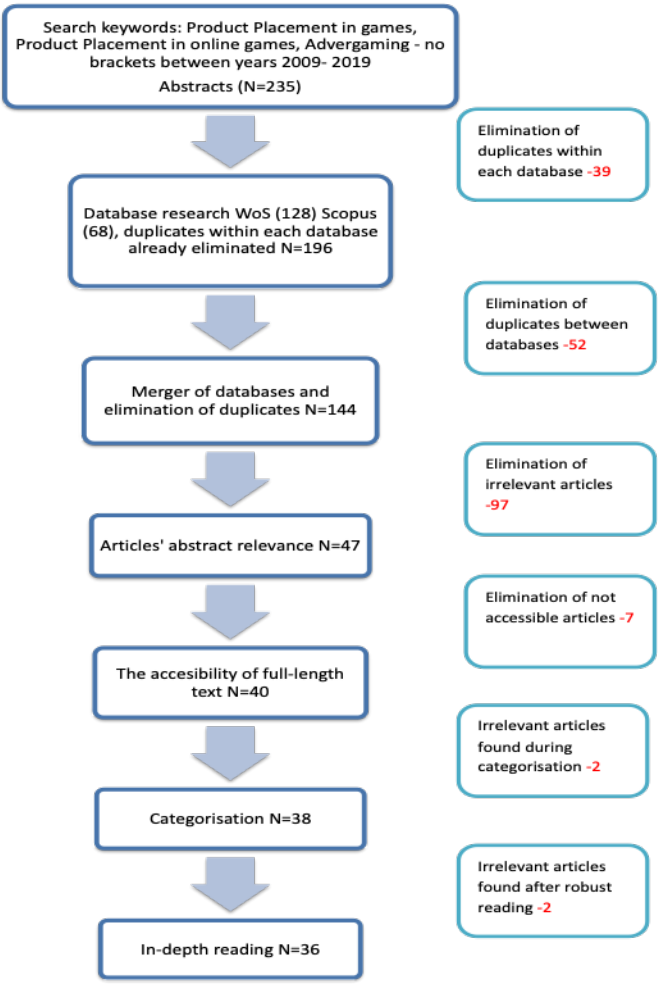
Many studies have examined the issue of product placement in online games. Hence, the literature review had a strong basis for information input for reporting. Scientists have examined the area from different angles, so the summary of their experiments provides a comprehensive picture of the current level of knowledge and any gaps in it.

2 Results

The research was conducted according to the recommended PRISMA steps: identification, screening, eligibility and final inclusion (Picture 1). First, the pool of 235 articles was identified in the databases — Scopus N=80, Web of Science N=155. The duplicates in the database and between the databases were then eliminated, which resulted in the 144 articles. In the second step, all abstracts from the adapted base were read to justify their relevancy. The irrelevant papers were manually excluded. However, some of the excluded articles were relevant to product placement in games but not to the age category of adolescents and adults, which is in the expected age range for future research. The 47 articles were found relevant to the research topic. These articles were searched for their full-length version, although seven papers were not freely available. The remaining 40 articles were categorised according to the date of publication (Table 2).

These articles were double-checked by more robust reading to confirm their eligibility. Two more articles were excluded during this process due to language and irrelevancy to the topic (only observing). The remaining 38 articles underwent in-depth reading. A further two articles were excluded due to irrelevancy — sports games and general banners. The final number of articles resulted in 36. The in-depth reading consisted of identifying the paper's objective, the type of article, the methods and the findings of the experiments. The articles were categorised into three categories according to type: 31 empirical studies, 3 literature reviews and 2 conceptual papers.

Picture 1 | PRISMA steps



Source: Author's own processing

2.1 Literature reviews and conceptual papers

The final batch of the most relevant articles included three literature review papers. One of these was published in 2013 and the other two in 2019. The earlier review produced a detailed summary of advertising in online games. Terlutter and Capella (2013) developed a comprehensive framework to understand the complex relationship of IGA. They examined the characteristics of the game in relationship to an IGA and described the psychological responses and actual behaviour toward the game and the brand. Moreover, they examined the individual and social factors that significantly contribute to player response. Their research succeeded in designing a framework that is still relevant today. They also reviewed highlighted issues that are still relevant today as an IGA regulation and the need for long-time frame research.

The recent literature reviews by Guo et al. (2019) and Yoon (2019) mapped the development of concepts and outlined the directions for future research. Yoon (2019) examined how advergaming and IGA have evolved and developed. The study used the bibliometrics methods of bibliographic coupling and co-citation. The paper identifies the main journals that contributed to IGA and the knowledge of advergames. Yoon identified the publications with the largest number of nodes (the most cited) and followed this by coupling the publications to five thematic clusters which he visualised as a citation-based knowledge map. The paper by Guo et al. (2019) addressed product placement in general, where they used the co-citation and dynamic co-citation methods to fulfil the research purpose. The study identified three clusters: movies and television programmes, in-game placements and advertising disclosures. The research provides a robust understanding of the current knowledge of product placement. They also suggested the use of eye-tracking as a tool to measure product placement effectiveness. The findings of this paper agree with their research.

The first conceptual paper developed a theoretical model to examine the effects of interactions and product information on the initial purchase intention of social gamers in the context of product placement in social games (Zhu & Chang, 2015). It also examined the effect of product familiarity, which was confirmed as an important moderator. They confirmed that an emotional transfer exists between a virtual and a real product and recommend cooperation between marketers and social game developers.

The second conceptual paper examined the relationship between brand personality and advergames. Lee and Cho (2017) identified five dimensions: vibrancy, competence, intelligence, activeness, and excitement. The study confirmed that the advergame personality strongly influences the intentions to play an advergame and purchase a product. Their finding exhorts marketers to choose a suitable advergame for the product according to the identified dimensions to increase purchase intentions.

2.2 Empirical papers

The largest group of 31 articles was empirically based. The experiments focused on different aspects of product placement in online games, although some research objectives

appeared more frequently than others. The following analysis lists the researched factors, objectives, methods and findings of the empirical papers. The options to incorporate product placement in games are immense. It could be incorporated in the form of a logo, product, brand-related character or just a theme with the brand colours. A game also has many dimensions that can be altered to create an environment that would be the most suitable for product placement and the targeted group.

A wide range of factors that contribute to product effectiveness was examined (Table 3). The researchers focused on identifying the factors that influence product placement effectiveness the most. The prominence of product placement appeared most frequently in experiments (Table 1). The experiments reach consensus on its significance for recognition and recall. The interactivity contributes to noticing a placement and improving attitude towards a brand if it is concurrent and does not disturb the flow. Product placement congruity is crucial to conserve the game flow and enjoyment; otherwise, the placement could easily evoke negative emotions, which are undesirable (Chen & Deterding, 2013; Vermeir et al., 2014). However, a non-concurrent product attracts more attention and, in some cases, could be used profitably. The age and gender factors were rarely examined. The age factor confirmed that the younger generation can better distinguish and remember the in-game advertisement, although the results did not show the difference between genders (Toh & Leng, 2014).

Table 1 | Frequency of the appearance of factors and objectives

Factors	(n)	Objectives	(n)
prominence	9	attitude	13
congruity	7	recall	13
interactivity	6	recognition	7
character	3	brand trust	4
speed	3	persuasive mechanism	4
flow	2	initial purchase	3
persuasion knowledge	2	memory - implicit	3
		enjoyment	2
		flow	2
		memory – explicit	2

Source: Author's own processing

The effectiveness of product placement is impossible to directly measure so the researchers used related objectives in their experiments. Attitude towards brand/product was included in most of the experiments. The scientists assumed that the ameliorating relationship towards a brand contributes greatly to overall product placement effectiveness. The other monitored objectives of recall and recognition were recorded often although both objectives

should not be interpreted as placement effectiveness. Recall and recognition have only limited informative value because they are more connected to attention. Most of the objectives were focused on explicit memory, which is more easily measured but has less impact on our values and choices than implicit memory. Flow and enjoyment could be suitable objectives to observe the impact of an in-game experience emotion to forming attitude towards a brand. The researchers should work with objectives that are relevant for both implicit and explicit memory in the future.

Methods used in experiments were not as heterogeneous as objectives and factors. Many of the experiments used data collected through questionnaires that usually included the Likert scale (in 15 cases). Other experiments used a similar method, such as the Zaichkowsky scale (Vashisht, 2018) or a semantic differential (Roettl & Terlutter, 2018). Others applied more unusual methods such as in-depth interviews and assignments (Chen & Deterding, 2013). The research sample often consisted of students (14 cases), which could limit the applicability of findings to the whole population. Some experiments focused more on games by analysing 195 advergames and their persuasive mechanism (Roettl et al., 2016).

Summing up the findings of the analysed empirical articles is complicated because each experiment had its own set of dimensions and different factors as variables. There is no general recommendation on how to make in-game product placement effective. The experiment set objectives and identified significant contribution factors although the optimal mix to product placement effectiveness depends on the aim and nature of the game and product. Findings suggest using concurrent incorporation of the product into a game that results in a more positive attitude towards the product (Gross, 2010; Peters & Leshner, 2013; Vashisht, 2019). This is probably due to not disturbing the game flow, which has a significant impact on brand attitude (Vermeir et al., 2014; Wang et al., 2015). However, consecutive product placement evokes higher recall and recognition but with a negative attitude (Chen & Deterding, 2013; Vermeir et al., 2014). Size, interactivity and repetitiveness increase recognition and recall, but if the product placement is wrongly incorporated then it results in a negative attitude. Additionally, the admitted product placement is perceived worse than hidden advertising (Terlutter & Capella, 2013), which is illegal. Another highly discussed feature was game speed. The easily controlled and slower games leave more space for the brain to access the advertising (Herrewijn & Poels, 2014; Dardis et al., 2015; Vashisht & Sreejesh, 2017). On the other hand, players favoured faster games (Vashisht & Mohan, 2018). Placement and size play a crucial role in attracting the players' attention (Vashisht & Pillai, 2016; Chaney et al., 2018). Finally, satisfying game results lead to stronger purchase intentions (Siemens et al., 2015; Zhu and Chang, 2015).

The experiments had various shortcomings in common. The biggest shortcoming was the participants' base, which mostly consisted of students (Gross, 2010; Chen & Deterding, 2013; Peters and Leshner, 2013; Dardis et al., 2015; Wang et al., 2015; Vashisht & Pillai, 2016; Martí-Parreño et al., 2017; Vashisht & Pillai, 2017; Vashisht & Chauhan,

2017; Vashisht & Sreejesh, 2017; Vashisht, 2017; Vashisht, 2018; Vashisht & Mohan, 2018; Vashisht, 2019). Although student respondents are an easily available group for an academic experiment, the results cannot be generalised for the whole population. A further limitation is that some games were only specifically designed for experimental purposes (Peters & Leshner, 2013; Vashisht et al., 2017). An additional shortcoming is that the experiments were conducted over a short period. Most of the online game players are frequently exposed to product placement and for a longer period. Future research should consider this long-term factor (Terlutter & Capella, 2013).

3 Discussion

The analysis of the chosen article base fulfilled the purpose of the research. The study identified the key research objective, which is the attitude towards product placement and its recall and recognition. The factors examined varied greatly, but those frequently reappearing were prominence, congruity and interactivity of product placement. The abundantly used data collection method was questionnaires with Likert scales or a similar scale rating suitable for deriving attitudes. The paper provides a summary of previous research findings, which emphasise the complexity of in-game product placement incorporation. The experiments highlighted the influence of concurrence and game flow, which have a positive impact on attitude. Prominence and interactivity were also considered to be significant factors. To conclude, the results identified the most frequent shortcomings in most of the empirical research. These were experiments with a short time frame, college students as participants and games specifically designed for experimental purposes. All the articles included were relevant to the topic of in-game advertising and contributed to outlining the direction of future research. The analysis fulfilled the research purpose by answering which objectives, factors, methods and limitations frequently appeared in the conducted experiments.

According to the findings of the literature review, there are knowledge gaps that should be fulfilled by future experiments. The first opportunity to complement such knowledge is to probe the effect of the long-term product placement impact. The researchers could consider using a qualitative approach, such as netnography or autoethnography to uncover deeper relations and longer-term influence. Advanced technologies such as eye-tracking could also provide useful data about implicit memory to gain a deeper understanding of this phenomenon. Surprisingly, none of the analysed articles used eye-tracking even though this method was proposed by Lee and Faber (2007) 14 years ago. The experiments mainly focused on the positive impact of product placement while the negative influencing factors tended to be side product information. Hence, a future experiment should focus on the factors that most deteriorate the effectiveness of product placement. The field of marketing in online games provides many opportunities to observe what are still unexplored areas.

Conclusions

This study provides a systematic literature review of product placement in online games and examines the trends in research and the design of the experiments. The collected information will contribute to further research in this area. The study accesses the literature for product placement in online games in the last ten years. Current technologies provide extensive access to a large pool of data; however, the problem is to unbiasedly identify the relevant literature. Hence, the paper adopted the PRISMA framework to systematically identify the relevant articles and to access articles. In the first stage, 235 articles were identified under the predefined criteria, and in the process, the number was reduced to the 36 most relevant articles to undergo in-depth reading (Table 3).

As a result of the analysis, the paper pinpoints the most frequently appearing objectives and factors that are investigated concerning IGA (Table 1). The paper then states the abundantly used methods, summarises the existing findings and lists the gaps in the experiments. The researchers were not able to measure the effectiveness of product placement directly; the closest way was to use the conceptual models where it was possible to estimate the impact on initial purchase (Zhu & Chang, 2015; Lee & Cho, 2017). The experimental articles usually examined objectives such as attitude towards product placement, recall and recognition. The factors moderating the impact varied but the most abundant were prominence, congruity and interactivity. Questionnaires appeared in the most experimental articles as a method to collect data. The finding cannot be generalised because some factors work contrary to each other. The correct approach is to set a goal of specific product placement and then adjust the mix of factors accordingly. The literature review can be useful to designers and marketers interested in expanding advertising in online games.

The online game industry is steadily growing (ESA, 2019), which creates a new and promising space for advertising. Therefore, the interface of online games will probably become a platform to advertise a wide range of products, as is currently common for product placement in films. IGA is a suitable tool for targeting the younger population. However, it can target any population due to the variability of a game. Nevertheless, only the short-term impact on attitude and recall is explored. The industry lacks robust proof of the effectiveness of product placement in games and how to fully use its potential. The long-term impact is vague as is the impact on implicit memory. Future exploration should adopt a qualitative or mixed approach to narrow this knowledge gap. Advertising in online games will probably receive more attention in the future as IGA becomes more widespread.

The limitations to this research are the conscious restriction of only using articles from the Web of Science and Scopus, which were in English, and under the time constraint. However, this period was justified due to time topicality and major developments in the field. One of the biggest biases may be the subjective view of the individual because another viewer's opinion is missing; however, this subjective bias is lowered by adapting the PRISMA framework. The research analysed the most frequently appearing objectives, factors and methods that are used in in-game advertising. The purpose of this literature

review was not to produce an exhaustive literature review on product placement in online games but to identify objectives, methods and to summarise the findings relevant to product placement in online games.

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Online sources

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Appendix

Table 2 | Overview of journals

Name of journal	Number of articles in the journal	Number of articles in the year										
		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
AFRICAN JOURNAL OF BUSINESS MANAGEMENT	1			1								
ARTS AND THE MARKET	3										2	1
Australasian Marketing Journal	1								1			
Computers in Human Behavior	4		1					1		1	1	
FRONTIERS IN PSYCHOLOGY	1						1					
International Journal of Advertising	3	1					1				1	
INTERNATIONAL JOURNAL OF SPORTS MARKETING & SPONSO	1	1										
INTERNET RESEARCH	2									1		1
Journal of Advertising	5					4						1
JOURNAL OF BUSINESS RESEARCH	1								1			
JOURNAL OF CONSUMER BEHAVIOUR	1							1				
Journal of Direct, Data and Digital Marketing Practice	1											
Journal of Electronic Commerce Research	1							1				
Journal of Interactive Advertising	1						1					
Journal of Interactive Marketing	2							1		1		
JOURNAL OF PRODUCT AND BRAND MANAGEMENT	1									1		
Journal of Promotion Management	2		1					1				
JOURNAL OF RESEARCH IN INTERACTIVE MARKETING	1								1			
Management Research Review	1									1		
MARKETING INTELLIGENCE & PLANNING	1									1		
PLOS ONE	1										1	
PSYCHOLOGY & MARKETING	1								1			
RBGN-REVISTA BRASILEIRA DE GESTAO DE NEGOCIOS	1										1	
REVISTA ICONO 14-REVISTA CIENTIFICA DE COMUNICACION Y	1								1			
SOCIAL BEHAVIOR AND PERSONALITY	1							1				
Young Consumers	1					1						
Total	40	2	2	1	0	5	3	6	5	6	6	3

Source: Author's own processing

Table 3 | Empirical articles summary

Year	Author	Factor	Attribute
2009	Clavio et al.	identifying brands and their incorporation into video games	suitability for advertising
2009	Mackay et al.	pre-existing positive attitude	attitude, recall
2010	Gross	congruity	attitude, memory- explicit, implicit
2010	Kim & Mcclung	ethically charged or normal products, gender	acceptability
2011	Ho et al.	product presentation	explicit and implicit memory
2013	Chen & Deterding	perception and interpretation of PP in social games	initial purchase
2013	Peters & Leshner	congruity and prominence	intention to play
2013	Poels et al.	product information, social role, hedonism, price reducing potential, materialism, believability, realism, congruity flow, attitude	attitude towards PP
2013	Yeu et al.	prominence, achievement score	recall, implicit memory
2014	Herrewijn & Poel	type of controller, PP prominence	processing of PP, brand recall and recognition

2014	Toh & Leng	gender, age	recall and recognition
2014	Vermeir et al.	congruity, flow and prominence	brand recognition and attitude
2015	Dardis et al.	game difficulty	recall, attitude, purchase intention
2015	Choi et al.	character presence, culture, non/publically consumed products	attitude, brand trust, game performance
2015	Jin & Phua	tactile and haptics-based stimuli	brand trust, brand excitement
2015	Siemens et al.	usage of character to display progress, publically seen records, game feedback	enjoyment, effort, flow,
2015	Wang et al.	moderating effect of playing advergame, flow, self-construal independency	attitude towards brand, perception of brand personality
2016	Roettl et al.	looking for factors by coding	persuasive mechanisms in advergames
2016	Sparks & Chung	positive or negative images,	recall, recognition
2016	Vashisht & Sreejesh	speed, prominence, congruity	advertisement persuasion
2017	Parreño et al.	familiarity, repetition	recall, recognition
2017	Vashisht et al.	prominence, involvement, persuasion knowledge	recall, brand attitude
2017	Vashisht & Chauhan	interactivity, congruity	attitude, flow (game presents)
2017	Vashisht & Sreejesh	speed, congruity and need for cognition	ad-persuasion
2017	Vashisht	prominence, involvement	recall, brand attitude
2018	Chaney et al.	prominence (size), order of PPs, level of absorption (experience)	recall, recognition
2018	Choi	character presence/absence, involvement, trust propensity	brand trust, purchase intention, persuasion
2018	Roettl & Terlutter	3d or 2d video game	presence, arousal, attitude, recall, recognition
2018	Vashisht	product involvement, prominence	recall, brand attitude
2018	Vashisht & Mohan	speed, favourability towards game	attitude (favourability), brand attitude
2019	Vashisht	interactivity, congruity	brand advocacy and acceptance

Source: Author's own processing

INTERGENERATIONAL SOLIDARITY IN PENSION SYSTEMS

Jan Pokorný , Pavlína Hejduková[7]

Abstract

Population ageing is a crucial trend in society and the form of financing is becoming an important issue, especially for public schemes. The sustainability of pension schemes is important for their continuation. Pension schemes have two forms of pension plans — defined benefit (DB) and defined contribution pension plan (DC). The latter is defined by Musgrave (DM) and is based on the Musgrave rule (the ratio between average pension and average wage). The objective of this contribution is to analyse a link between expected demographic changes and changes in the pension parameters of public PAYG schemes concerning intergenerational solidarity. This analysis is then applied to cases in Czechia and Slovakia. First, a literature review is used to introduce the concept of financing pension schemes and the design of pension plans. Qualitative research is used for the calculation of DB and DC pension plans and the Musgrave rule in the DM pension plan. The data for the projection of pension plans is from the Czech Statistical Office and the Statistical Office of the Slovak Republic. Population ageing is a current trend in Czechia and Slovakia, which means that both states will have to take advantage of rate changes in their pension plans in the future. In the case of Slovakia, the change is more needed than for Czechia, where the current situation is relatively favourable. Evaluating the development of parameters is important for a timely response to ageing development. DB and DC pension plans provide basic information for policy-makers because they provide boundary analysis for setting the contribution rate and benefit ratio. On the other hand, the Musgrave rule respects ageing concerning the Musgrave ratio.

Key words: demographic changes; intergenerational solidarity; pension system; pension policy; population ageing

JEL Classification: D64, H55, H75, J11

Introduction

The ageing population is a current trend in society and has two causes — a decreasing fertility rate and an increasing life expectancy. This leads to a different structure of the population (growth of the elderly population). This global trend has different forms in different regions (UN DESA, 2020).

Modern pension systems have their origin in Germany during the reign of Chancellor Bismarck. The pension system aims to protect against biometric risks where the main risk is longevity. Given the ageing population, the issue of pension sustainability must be addressed.

[7] *University of West Bohemia, Faculty of Economics (pokorny@kfu.zcu.cz; pahejdu@kfu.zcu.cz).*

Pension sustainability has several aspects. First, fiscal sustainability, which takes into account the overall position of public finances and second, the financial aspect. This means the sustainability of pension schemes — the long-term balance of pension revenue and pension expenditures. A pension scheme can have funded or unfunded financing. The last aspect of pension sustainability is the view of social sustainability. This aspect has two forms – intergenerational and intragenerational solidarity (Pokorný, 2019).

The theme of this paper is to analyse intergenerational solidarity in pension systems and then apply the results to a case study on the example of Czechia and Slovakia. Intergenerational solidarity is affected by expected demographic changes and changes in pension parameters in public PAYG schemes. The case uses benefit and contribution as crucial aspects of pension systems. Defined-contribution (DC) and defined-benefit (DB) plan are used for measurements. In addition, Musgrave (1981) defines the rule used for the measurement of defined Musgrave (DM).

1 Literature review

The design of pension systems is substantial for defining demographic, macroeconomic or political risks and for the robustness of pension systems against these. A basic question is whether the scheme, as part of the pension system, should be public or private. The German pension system was public as was the Danish pension system, which was created two years later than the German system. Both pension systems were public, but the systems were financed differently. The German pension system was created based on insurance and the Danish pension system was financed through taxes (Baldwin, 1990; Nørgaard, 2000).

Public schemes have become the basis for pension systems and are recommended by international organisations such as the International Monetary Fund. James et al. (1994) suggest a pension system with three pillars with the first pillar designed as public and mandatory with unfunded financing. The aim of the first pillar is basic protection. Holzmann, Hinz and Dorfman (2008) reformulated the pension system from three to five pillars. The zero and the first pillars are designed as public. The difference is the form of financing. The proposal for financing the zero pillar is without contributions, which means tax financing. The first pillar is financing through contributions (insurance).

Cesaratto (2005) defines two forms of public schemes concerning the type of financing. The first option is fund financing, which means to use financial market tools such as bonds and stocks. Another option is unfunded financing. This choice of financing means that the revenue of the pension scheme is taxation or insurance. For the first type, Cesaratto (2005) uses the term fully funded trust funds, and for public schemes with unfunded financing the term Pay-As-You-Go (PAYG).

Both forms of financing have pros and cons concerning risks. Barr (2003) and Vostatek (2016) define several types of risk and risk levels. Fund financing has a high level of threat from the risk of inflation. Medium risk for fund financing is political risk, managerial, investment and market risks. On the other hand, unemployment and demography mean low risk for fund financing.

In the case of unfunded financing, high risk is the development of demography and political change. Inflation and unemployment as macroeconomic quantities mean a high level of risk for unfunded financing. Managerial, investment and market risks are negligible for this type of financing.

1.1 Intergenerational contract and public pension plans

Next, an important aspect of unfunded financing is intergenerational solidarity and intergenerational contract. The aim of the contract is a guarantee of a dignified life in retirement without any strain for a productive generation. This aim should be long-term. It follows that there are two groups – pensioners and workers. But it is necessary to think about the next generation – young people (workers in the future and then pensioners).

In general, three demographic developments can be defined. First, worker population growth more than pension growth as it means the possibility of saving for the next generation in a demographically unfavourable period, increased benefit ratio, reduced contribution rate or a combination of these variants.

The second development is the status quo, which means that if the population has the same structure then changes are not required. The last version, where the number of pensioners grows more than the worker population means drawing on savings (in their existence or the pension debt), increased contribution rate or decreased benefit ratio. The last possibility for this situation is a combination of these methods.

The previous description takes into account the existence of a pension account. The central idea of this is the balance of revenue and expenditure by Devolder and de Valeriola (2019). In general, the balance equation in the PAYG scheme is:

$$D_0 P = \pi_0 S, \quad (1)$$

where dependency ratio $D0$ and a homogenous pension benefit P are pension expenses and revenue of the pension account is a multiple of a contribution rate $\pi 0$ and a homogenous salary S. The formula (1) can be modified:

$$P = \delta_0 S, \quad (2)$$

where replacement ratio $\delta 0$ and a homogenous salary are a homogenous pension benefit. And $\pi 0$ is determined by $D0$ and $\delta 0$:

$$\pi_0 = D_0 \delta_0. \quad (3)$$

These three equations show equality of revenue and expenditure. In these equations, $\pi 0$ and $\delta 0$ can take values from 0 to 1. We expect demographic change (shock) in the next time (t = 1). This change means an increased ratio between the number of pensioners and workers

(D1 > D0) — it is ageing of the population. A change is needed for the stabilisation of the pension balance account in the next time (t = 1).

The change is affected by a pension plan. First, a defined benefit pension plan in the PAYG scheme is called social insurance (Hinrichs & Lynch, 2010). This means that the replacement rate is constant ($\delta 1 = \delta 0$) and the π responds to population change (ageing in this case). The equation (3) can be adjusted based on this. The π in the next time is:

$$\pi_1 = \pi_0 \frac{D_1}{D_0}. (4)$$

The equation (4) responds to demographic change although the first idea for this equation is the balance of the pension account. In the case that π in time t = 0 does not match the equation (1), then the equation (4) represents a change concerning demographic change but without balance revenue and expenditure in equation (1). For the balance of the pension account is equation (3). Both approaches are used in this paper. Second, a defined contribution pension plan in the PAYG scheme is called a notional defined pension scheme (Hinrichs & Lynch 2010). π is a constant in this case and the benefit is a dependent variable on demographic change:

$$\delta_1 = \delta_0 \frac{D_0}{D_1}. (5)$$

Equation (5) applies the same rules as equation (4). The negatives of both approaches are not respecting the ratio between benefit and net wage. In the case of increase *D1*, it means a higher π in a DB pension plan and a lower net wage. In a DC pension plan, a higher dependency ratio means a constant π but a decreased pension benefit for the balance of pension account. Musgrave defines equation (6), now known as the Musgrave ratio:

$$M_0 = \frac{P}{S\,(1-\pi_0\,)} = \frac{\delta_0}{1-\pi_0}. (6)$$

In a DB plan, *M1* is higher than *M0* for a higher *D1* and in the DC plan is *M1* lower than *M0* for the same case of the population development. The aim of the Musgrave ratio is a constant of Musgrave ratio. This pension plan is called Defined Musgrave (DM):

$$M_0 = M_1 = M = \frac{\delta_t}{1-\pi_t}. (7)$$

Based on this, δ_t and π_t can be defined for the next time:

$$\delta_1 = \delta_0 \frac{1}{1+\,\delta_0\,(D_1-D_0)}. (8)$$

And

$$\pi_1 = \pi_0 \frac{D_1}{D_0 + \pi_0 (D_1 - D_0)}. (9)$$

Musgrave and Musgrave (1994) define this type of pension plan with regard to a lower level of fertility rate and an increase in the old-age dependency ratio. This step is important for the stabilisation of the pension account. Another opinion is to decrease pension benefit (DC plan) or increase the contribution rate (DB plan). The aim of DM is intergenerational solidarity. This approach can limit the effect of demographic changes and changes in labour productivity. The question for this is the level of the Musgrave ratio.

1.2 Czech and Slovak pension systems

In 1993, Czechoslovakia pension politics ceased and two pension politics began to exist. Both countries have a common base and negatives in their pension systems. Standing (1996) describes the negatives of the pension systems of post-communist countries: low retirement age (up to 60 years and lower retirement age for women than men), relatively low pension benefits compared to Western Europe (for example, the benefit ratio in Russia was 37% in 1985 and 34% in 1990) and unfunded financing. At present, the World Bank advocates a change of pension system inspired by the Chilean pension reform in the 1980s. This reform was affected by liberal ideas.

In the 1990s, the Czech pension system was affected by liberalisation tendency, which means that a flat-rate pension benefit was the aim. This change has not met with success. Pension benefit in the public scheme has a two-part flat rate (10% of the average wage) and the second part is dependent by wage in employment in the labour market.

'Small' pension reform was made in 2011. One of the changes in this reform was retirement age. The aim of this change is the same retirement age for everyone (65 years). Currently, the retirement age depends on two factors. First, men have a higher retirement age than women. Second, the retirement age for women depends on the number of children.
The 'big' pension reform brought the second pillar in 2013. This pillar was abolished in 2016. The principle of the second pillar was funding financing. The revenue of the pillar was contributions — 3% from social insurance and 2% of wages. This is one of the reasons why this pillar was not popular.

The Czech pension system now has the first pillar and a third pillar. The first pillar is financing by social insurance, respectively the part of social insurance called pension insurance. Three types of pension (old-age pension, inherited, and invalidity pension) are paid from this contribution. The social insurance in Czechia is 31.3% and pension insurance is 28% — the employer pays 21.5% and the employee 6.5% (Vostatek, 2016; MFCR, 2020). The pension system in Slovakia had a similar design in the 1990s as the Czech pension system. The change in the Slovak pension system started in 2005 when the second pillar was established.

The Social Insurance Agency manages the first pillar. This is the difference compared to the Czech system where the pension account is part of the state budget. The revenue of the first pillar is contributions. The contribution is 18% of wages and this revenue of the first pillar is allocated to an old-age pension. The invalidity pension with a 6% wage contribution is a subsystem of pension insurance. Both subsystems provide inherited pension concerning the previous pension type. It is the next difference between the Czech and Slovakia pension systems because the Czech system does not have differentiated rates for old-age and invalidity insurance.

Table 1 | Evolution of the Slovakia pension system

Category	2005	2020
I. pillar:	mandatory, public with unfunded financing (PAYG)	
contributory rate (% of gross wage)	9	14
II. pillar:	funded financing, private	
contributory rate (% of gross wage)	9	4
participation	mandatory for young people and others voluntarily	voluntary
minimal time of savings	10 years	cancelled

Source: Authors' own processing based on (Klepárník et al., 2017).

The second pillar was established in 2005. The changes in the second pillar are in Table 1, which shows the change in the contribution rates and the cancelled minimum time of savings. The second pillar is voluntary compared to the situation in 2005 when the scheme was mandatory for young people entering the labour market. The changes in the second pillar are connected with political and economic changes (MoLSAF SR, 2020). The retirement age in Slovakia is gradually increasing as in Czechia. Slovak retirement age depends on sex and the number of children for women. This principle is still valid for this pension system. For persons born in 1966 and later, the retirement age is 64 years for men and women without children and for women with a child is 63 years and 6 months and so on.

2 Data and methods

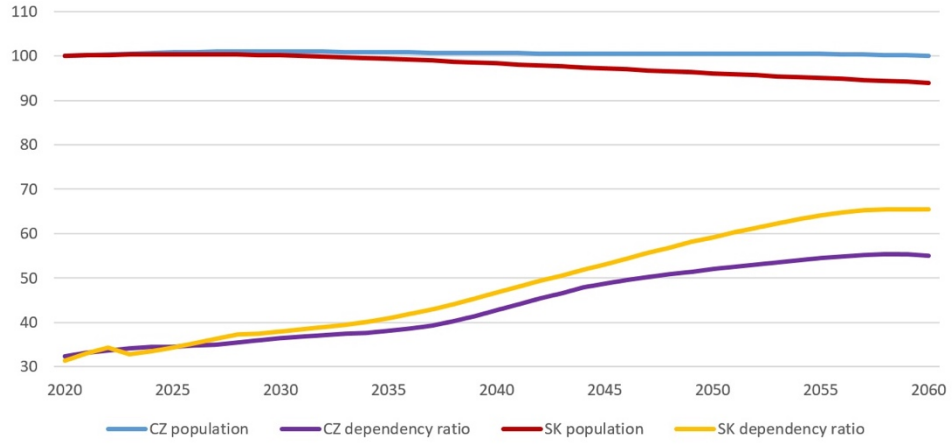
This paper aims to evaluate the differences in the parameters, especially using the method of comparison. Czechia and Slovakia have common history but after their Velvet Divorce, these countries chose different routes for their pension systems. On the other hand, both countries have a significant first pillar as basic protection against social exclusion.

With the results of this paper, we expect an increase in the dependency ratio and economic old-age dependency ratio for 2020–2060. Next, we expect that this process will have a negative impact on the parameters. Through previous research (Pokorný & Hejduková, 2019), the actual position of the Czech pension account is positive, but we

expect a negative change around 2040. We expect a similar scenario in Slovakia. The DM plan can represent the possible maintenance of fiscal, financial, and social sustainability.

First, demographic changes are the objective of this paper. Graph 1 shows the expected demographic trend for 2020–2060. Czechia (CZ) and Slovakia (SK) show the expected trend for the ratio between the population in t and the population in 2020 in per cent. The population in Czechia will be at about the same level. The population in Czechia will not fall below 100% (base in 2020). Slovakia can expect a slight increase against the base by 2030, followed by a decline below the base. The expected population in Slovakia in 2060 is 94.1% (Czechia has 100.3%). It is the first demographic differences between these countries.

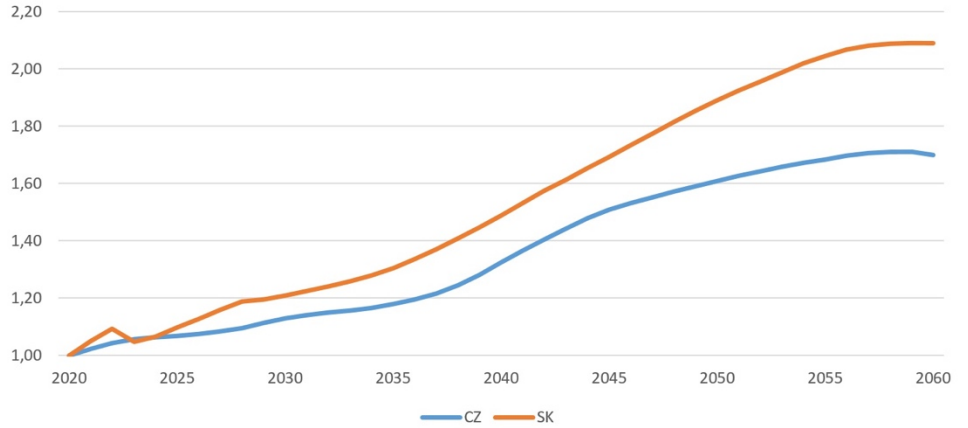
Graph 1 | Demographic trend for 2020–2060 (in % of population and dependency ratio)



Source: Authors' own processing

The second trend is the ageing of the population in Czechia and Slovakia. Graph 1 shows a similar starting situation (the difference is less than one per cent) for the old-age dependency ratio (the ratio between pensioners and the number of people from 15 years to retirement age). To calculate these groups into three with regard to age (up to 15 years, 15-RA and retirement age and older), the calculation by Gil et al. (2007) was used, which the authors also used in their previous study (Pokorný & Hejduková, 2019).

Graph 2 | Economic old-age dependency ratio for 2020–2060 (base in 2020)



Source: Authors' own calculations based on CZSO (2020b), DRC (2020) and SOSR (2020).

Both countries have ageing trends, which means an increase in the old-age dependency ratio. The difference between the countries is higher than one percentage point since 2027. In 2060, the difference is 10.6 percentage points between Czechia and Slovakia. Based on Graph 1, Slovakia is more endangered by the rate of ageing than Czechia.

The old-age dependency ratio can be adjusted to the economic old-age dependency ratio. This means that the number of people from 15 years old to retirement age is modified by the employment rate (the basic statistical indicators are in Table 2). The employment rate is between 0 and 1. Based on this, the economic old-age dependency ratio is higher than the old-age dependency ratio. This ratio is used for calculations in this paper as Dt.

Table 2 | Statistical indicators 2009–2019

Variable	Country	Average	Minimum	Maximum	Standard deviation
P_{it}	CZ	41,87	38,74	43,82	1,57
	SK	45,59	42,16	47,39	1,36
Employment (15–64)	CZ	69,55	65,00	75,10	3,50
	SK	62,60	58,80	68,40	3,25
Musgrave ratio	CZ	44,78	41,44	46,86	1,75
	SK	47,49	43,92	49,37	1,48

Source: Authors' own calculations based on CZSO (2020b), DRC (2020) and SOSR (2020).

Dt is in Graph 2. The base of this period is D0 in 2020. The period shows the ratio between Dt and D0. The economic old-age dependency ratio is rising for both countries. At the end of the reference period, the Czech ratio is 1.7, an increase from 46.5% to 79%. Slovakia has a higher rate than Czechia. The premise by calculation is a double share in 2060 against the economic old-age dependency ratio in 2020.

Table 2 shows the basic variables with statistical characteristics. Of importance is the average value because it is used for calculation. In this case, historical data from 2009

to 2019 is used. These variables are described in Table 3. The pension benefit is higher in Slovakia and both countries show similar differences between the maximum and the minimum. The employment rate is higher in Czechia although the difference between the extreme values (max and min) is also similar and the standard deviation is not too different.

Table 3 | Variables and their characteristics

Variable	Statistical indicator	Note	Available Time Period	Source
$\boldsymbol{D_{it}}$	Dependency ratio	NR_{it}/NW_{it} * 100	2020–2060	
NR_{it}	Number of pensioners	Population (RA+)	2020–2060	CZSO, Demographic Research Centre
NW_{it}	Number of employees	Population (15-RA) * employment	2020–2060	
	Employment (15-64 years)		2009–2019	CZSO, SO SR
$\boldsymbol{P_{it}}$	Pension benefit	$\delta_0 S$	2009–2019	
S_{it}	Salary	Average wage	2009–2019	CZSO, SO SR
δ_{it}	Benefit ratio	Ratio between average pension benefit and average wage	2009–2019	CZSO, CSSA, SO SR
$\boldsymbol{\pi_{it}}$	Contribution rate	Rate of social insurance intended for old-age pension	2020	CZSO, SO SR
$\boldsymbol{M}$	Musgrave ratio	Ratio between benefit ratio and net wage	2009–2019	CZSO, CSSA, SO SR

Source: Authors' own research based on (CSSA, 2020).
Note: i — country, t — time from 2020 to 2060, RA — retirement age.

The last variable from Table 2 is the Musgrave ratio. This calculation used equation (6). The π is 6.5% in Czechia and 4% in Slovakia and the pension benefit for both countries is in Table 2. The average of the Musgrave ratio is used for calculation DM.

Table 4 | Two approaches for calculation

Pension plan	Primary Budget $\boldsymbol{D_0 P = \pi_0 S}$	Path Dependence (base 2020)	Impact of change
Defined benefit (DB)	$\pi_1 = \pi_0 \frac{D_1}{D_0}$		Employees
Defined contribution (DC)	$\delta_1 = \delta_0 \frac{D_0}{D_1}$		Pensioners
Defined Musgrave (DM)	$\delta_1 = \delta_0 \frac{1}{1 + \delta_0 (D_1 - D_0)}$ $\pi_1 = \pi_0 \frac{D_1}{D_0 + \pi_0 (D_1 - D_0)}$		Share of impact on both groups

Source: Authors' own research

The objective of this contribution is to analyse a link between the expected demographic changes and the changes in the pension parameters in public PAYG schemes concerning intergenerational solidarity. Next, this analysis is applied to the cases of Czechia and Slovakia. For this objective, equations based on a pension plan are used and the paper uses two approaches. First, the primary Budget (PB) uses equation (1), which means that the pension account balance is 0. The second approach is Path Dependence (PD), which responds only to demographic changes against the base in 2020 (the pension account creates a saving or deficit at the end of the year). Table 4 shows both approaches for the calculation with equations.

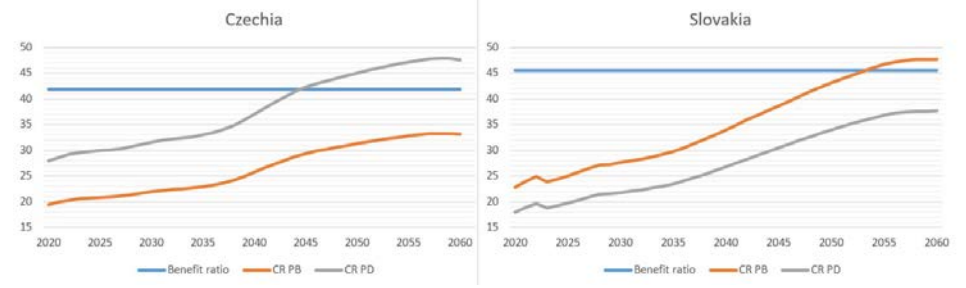
For calculations in this paper, Microsoft Excel was used. First, the population distribution between groups was used and then graphs were created in Excel. Statistical indicators are calculated in the Excel functions as a result of the pension plans.

4 Results and discussion

The results of this paper are shown in Graphs 3, 4, 5, and the comparison for 2020 and 2060 is in Table 5. Czechia and Slovakia are compared along with their public pension schemes. This paper analysed two important parameters and their level. In this part of the paper, both parameters are analysed with a view to the future and population ageing.

Graph 3 is the DB pension plan. Slovakia has a higher level of δ than Czechia. In this plan, π is the dependent variable. Based on this data, the Czech π is optimal until 2042 because π for a balanced account is lower than 28%. Then the Czech pension account can draw savings. When using the second approach, π increases from 28% to 48% of wages, which is unsustainable for workers. Concerning path-dependence, savings can grow.

Graph 3 | DB pension plan for 2020–2060



Source: Authors' own processing based on CZSO (2020a; 2020b), DRC (2020) and SOSR (2020).

In the case of Slovakia, there is a problem with π. Optimal π is 22.8% in 2020 but real π is just 18%. The data from Slovakia is clearer than Czech data because Slovakia uses the types of pension insurance so the problem with population ageing is more visible.

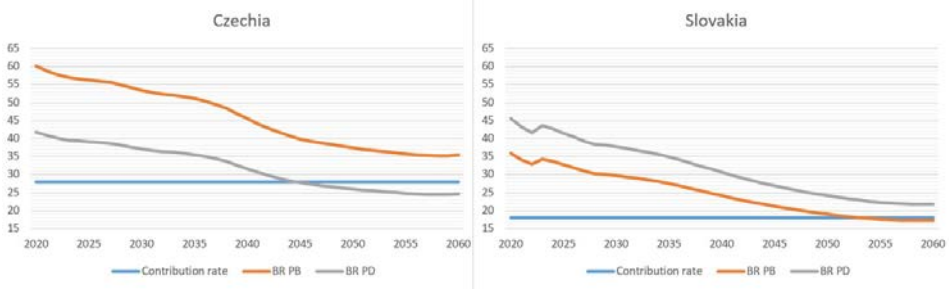
When using the DC pension plan in Graph 4, PB is higher in the Czech case. This means savings until 2042, and this corresponds with the DB pension plan. The aim of this approach is the same contribution with different δ. Again, the same impact can be observed

as in Graph 3. The difference between Graph 3 with the DB pension plan and Graph 4 with the DC pension plan is the impact of the population group.

In the DB pension plan, workers will feel the impact of ageing because π will increase and wages will decrease (although it depends on the ratio between the employer and the employee). On the other hand, the DC pension plan δ is dependent on a variable with a declining trend.

Another opinion is pension debt, but this type of debt must be eventually paid. In general, public debt has a negative impact on the economy, which is why it is important to solve the balanced budget of the pension account. A possibility is the second pillar, but this is not so popular, for example, the second pillar was established and abolished in Czechia, Hungary and Poland and modified in Slovakia. This type of financing is probably unpopular because the process of transforming the economy from centrally controlled to market is not without faults. Therefore, it is necessary to envisage a focus on the first pillar.

Graph 4 | DC pension plan for 2020–2060

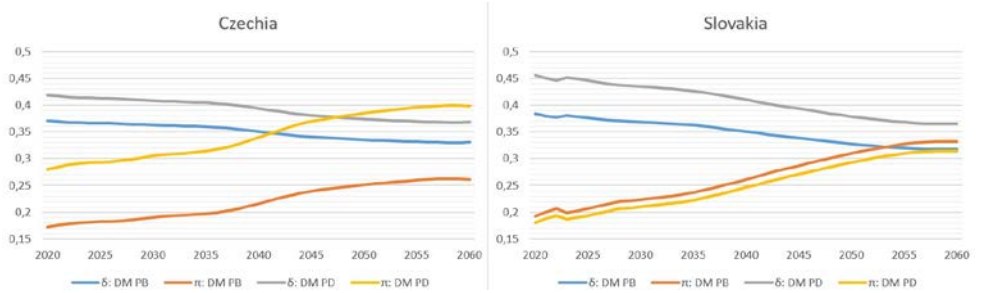


Source: Authors' own processing based on CZSO (2020a; 2020b), DRC (2020) and SOSR (2020).

The last version of the pension plan is the DM pension plan. Graph 5 shows the situation for the DM pension plan. DM PB shows a variant with the Musgrave ratio and with a balanced budget. Again, π is lower when DM PB, is used, but with a lower δ. Both variables of DM PB converge.

Concerning path-dependence, the variant DM PD respects population ageing without the Musgrave ratio and the balanced budget. This variant only describes the changes while the changes in the parameters are different. The greater impact of population ageing in the DM pension plan is for workers and the contributions they pay.

Graph 5 | DM pension plan for 2020–2060



Source: Authors' own processing based on CZSO (2020a; 2020b), DRC (2020) and SOSR (2020).

The complete results are in Table 5. It can be seen that DB and DC plans have an impact on one group, meaning lower benefits or net wages. In the Primary Balance approach, Czechia has a lower increase π in the DB plan than Slovakia, but a higher decrease δ in the DC plan. Compromise in the DM plan shows smaller changes for both parameters meaning risk distribution between groups and less significant impacts on parameters. This can help with the continuation of the intergenerational contract and setting financial responsibility.

In the Path Dependence approach, primary balance is not respected, only the ageing population. In the DB plan, there are higher increases π for Czechia than the Primary Budget approach but lower increases for Slovakia. The opposite is for δ in the DC plan, where negative changes are higher in Slovakia. The DM plan again shows the distribution between the two groups. This change is higher against the DM plan with the Primary Budget approach. The disadvantage of this solution is the negative balance for the pension account of Slovakia. On the other hand, it means less burden on labour costs compared to the DM PB variant. In the Czech case of DM, PD is a different situation because this variant creates a positive balance for the pension account.

Table 5 | Results of calculation (in 2060 against 2020)

Country	Parameter	Primary Budget			Path Dependence		
		DB	DC	DM	DB	DC	DM
Czechia	contribution	13,63	c	8,91	19,60	c	11,80
	benefit	c	-24,80	-3,99	c	-17,24	-5,02
Slovakia	contribution	24,89	c	13,99	19,62	c	13,45
	benefit	c	-18,74	-6,64	c	-23,78	-9,09

Source: Authors' own calculations
Note: c = constant

Based on the above, the first approach for the calculation of DB, DC and DM pension plans is more important for Czechia. This time, Czechia has a better position in the demographic changes (without a change of population and slower population ageing), the employment rate, π (it is higher than Slovak π and in a better position for the pension system) and δ (lower than Slovak δ) and the risk of poverty is low in Czechia. This advantage can be used for eventual problems — for example, a crisis associated with the Coronavirus epidemic and a higher rate of unemployment. This result follows up and confirms the previous research (Pokorný & Hejduková, 2019).

The impact of demographic changes on pension parameters is in Table 5 where scenarios can be compared between DB, DC and the DM pension plan with both approaches. The DM plan can help to reduce negative results in society.

The current situation in Slovakia is not so optimal — a population decline with relatively fast population ageing and a lower employment rate than in Czechia. The second calculation approach is important for Slovakia. Moreover, it does not use the second pillar and reduces the members of this pillar in this study. It can help reduce the expenditure of the public pension scheme but is probably not so significant in the first decade of this prediction. A significant position for the second pillar can be expected in the last decade of this prediction concerning the retirement age. The second pillar was established in 2005 and is voluntary. Pension benefit can expect to be reduced by a maximum of 22.2% (4% from 18%) for someone who paid all their working life. This prediction is not contained in this study.

Based on our expectations, we can validate the process of the ageing population in Czechia and Slovakia in 2020–2060 and our previous research because the change in position of the Czechia pension account is in 2042. However, we cannot validate a similar scenario in Slovakia based on our results although Slovakia may have a positive change concerning the second pillar. Next, the DM plan offers a solution for types of sustainability because the ratio between benefit and net wage is preserved and the parameters are adjusted to the situation. In addition, the DB and DC plans offer a negative impact on one group while social sustainability is not supported by these scenarios.

Conclusions

The reaction against biometric risks, such as longevity and others, is the pension system. The design of the pension system can be viewed from a different perspective. Of importance to this study are management, the method of financing and pension plans. We use public unfunded pension schemes in this study, which can be further divided with respect to the pension plan.

The defined benefit and contribution pension plans are basic views. In the process of population ageing, these pension plans have different effects when using the balanced budget of the pension account. The DB plan increases the contribution rate, and the DC plan decreases the benefit ratio. This means that both plans have an impact on one group (workers or pensioners). Devolder and de Valeriola (2019) describe these variants as

extreme cases and add that the Musgrave ratio solution is an optimal solution for population ageing.

Musgrave (1981) responded to this negative load and defines the Musgrave ratio as the ratio between pension benefit and net wage. The defined Musgrave pension plan aims to maintain an intergenerational contract. The impact on the parameters is the lower increase in the contribution rate and the lower decrease in the benefit ratio.

The empirical part of this study is based on these three pension plans. Czechia and Slovakia are compared because these countries have a common history of the pension system and after their divorce, their pension systems had different designs. On the other hand, the public pension scheme is important for both systems.

Population decline and population ageing is the problem for Slovakia based on the prediction. Czechia has a problem with population ageing, but it is not at such a high level as in Slovakia. The next negatives for Slovakia are the lower employment rate, the contribution rate and a higher benefit ratio than in Czechia. These parameters have negative impacts on the calculation.

Two forms of pension plans are compared in the study. The balanced budget (PB) shows the maximum and minimum values based on the plan and the path-dependence (PD) shows the reaction to ageing.

PB for Czechia shows reserves for the pension account based on data, which means a higher contribution ratio in DB and a lower benefit ratio in DC than the current parameters until 2042. Reserves will not be created but will be drawn from 2043. In the case study of Slovakia, the PB scenario shows that the contribution rate is lower than necessary for the balanced account in DB and the benefit ratio is higher in DC.

The results of this study correspond with Halter and Hemming (1987). As a basis, these authors use 1980 and predictions for 2025, which means 45 years. Their study was aimed at changes in social security tax with raising the retirement age. The results of Halter and Hemming (1987) for West Germany, Japan, the United Kingdom and the United States are still similar to this study. The results were increasing social security tax by 45% – 190% without a change in retirement age.

DM shows a compromise between DB and DC. The contribution rate grows more slowly than in DB and the benefit ratio decreases more slowly than in DC. DM is a solution for balancing the pension account with respect to a slower increase in labour costs and a slower decline in pension benefit. The second pillar will affect Slovakia in the future although the importance of this is not so significant in the following decades.

The limitations of the research can be seen in the use of historical data. An example of this limitation is δ, where the assumption exists. On the other hand, historical data has been used for its informative values and the long-term trend towards this level (in Table 2). The next limitation of this paper is π — for Czechia, we use π 28%, but it is insurance for every type of pension. Slovakia uses two π — 3% for disability insurance and 18% for pension insurance.

Future research can focus on the role of the second pillar and its impact on reducing public pension expenditure. This research can use the case study of Slovakia because this system will gradually reduce public expenditure and will be replaced by expenditure from the second pillar. The related question is intrageneration solidarity and inequalities between members and non-members of the second pillar. In addition, the second pillar is further influenced by economic and political changes, which can be the objective of further research.

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THE ISSUE OF SHARED ACCOMMODATION USING THE EXAMPLE OF AIRBNB IN THE CZECH REPUBLIC

Dominika Šafrová, Pavlína Hejduková[8]

Abstract

The sharing economy has strongly developed in recent years. Income taxes and fees play an important role in the sharing economy and burden both providers and intermediary platforms. The accommodation area is among the most well-known areas of the sharing economy and this paper examines shared accommodation using the example of Airbnb in the Czech Republic. The paper assesses the use of shared accommodation from a tax perspective and determines the impact of this form of sharing on public budgets using calculations regarding taxes and local fees. The theoretical background provides an introduction to the issue, the offer of Airbnb in Prague, and the situation on the accommodation market. These enable the revenues and the impact on public budgets to be determined. Based on the data, tax revenues and accommodation fees are quantified and accompanied by a summary of the findings. For example, data from the AirDNA company and the Czech Statistical Office are used. To conclude, the article presents the impact on public budgets, the impact of taxation on the providers of shared accommodation and discusses the regulation of shared accommodation both in other countries and the Czech Republic.

Key words: shared accommodation; Airbnb; income tax; accommodation fee; impact; sharing economy; taxes

JEL Classification: O18, M13, M19, L26

Introduction

Sharing is something people have always known. But what goes beyond what is known is sharing services and items with strangers. The substance remains unchanged and sharing functions as an alternative to ownership, where access is gained to the benefits and costs of the owned item without the transfer of ownership. Sharing, as we know it today, is facilitated by digital platforms, which are used to connect offers by individuals with those in demand. Anything from a place through to an object and time can be included. Thus, a sharing economy can be defined as a business model, where sharing between users and providers takes place through digital platforms (Belk, 2007; EC, 2016; Cherry & Pidgeon, 2018).

The basis of the functioning of a sharing economy is the existence of an item or service, the willingness to share it, either intentionally or due to an inability to make full use of it, and the interest in using it. It follows that everything that is in surplus or for which is the owner is unable to use its capacity is offered for sharing. Now the development of information technology has made it possible to mediate sharing using digital platforms, so

[8] *University of West Bohemia, Faculty of Economics (dsafrova@students.zcu.cz; pahejdu@kfu.zcu.cz).*

there is a connection between an individual willing to share with an individual who is interested in its use, without having to know each other personally (Veber et al., 2016). Participation in a sharing economy provides the opportunity to raise money from owned assets that have not been fully utilised. A specific example is renting an apartment during an absence. This means that within the economic area, there is the possibility to reduce costs and to obtain an additional income, which can affect the lives of the participants (PWC, 2015; Kruliš, 2018).

In the case of shared accommodation, this is the provision of a home for short-term accommodation, whether the whole or part of the home. The best-known representative of shared accommodation is Airbnb. The company provides people who do not make full use of their property with the opportunity to offer it to people looking for a place to stay for some time. The person interested in the accommodation has a choice of many offers, which state the type of property, price, equipment, etc. (Kruliš & Rezková, 2016; Belyh, 2019). Airbnb was established in 2008 and its areas of activity include hospitality and tourism, in which it operates without ownership of real estate. Its operation can be compared to a brokerage firm receiving commissions for booking accommodation (Leick, Eklund, & Kivedal, 2020).

For the following part of the paper, it is necessary to create an overview of the situation in the accommodation market in the Czech Republic. Table 1 shows the development of the number of beds over the years, based on which it can be said that the accommodation market has grown. The data includes the number of beds for the whole of the Czech Republic and also for Prague.

Table 1 | Development of the number of beds 2016–2019

Area	2016	2017	2018	2019
Czech Republic	533 507	526 788	537 603	539 685
Prague	91 887	90 891	93 169	94 444

Source: Authors' own elaboration based on CZSO (2020).

However, the accommodation market is also affected by Airbnb, whose share in the Czech accommodation market according to data from 2017, was 5.6%. If the data only applied to the accommodation market in Prague, then this figure is about 23%. The comparison of shares includes traditional accommodation facilities and Airbnb, assuming year-round availability of the capacities of traditional accommodation facilities and limited availability in the case of Airbnb (Marek et al., 2017).

According to the analysis of the sharing economy and digital platforms, accommodation via Airbnb can be considered the most widespread in Prague. In May 2017, 18,586 accommodation facilities were registered within Airbnb with 71,600 beds (OGCR, 2017). There are currently 9,025 active rentals in Prague. The most common form is entire

homes (85%) while private rooms account for 14% and the remaining 1% for shared rooms. Airbnb is used in 87% of cases. Compared to Vrbo, where this figure is 6%, it can be considered more widespread. The remaining 7% are listed on both. It follows from the above that in the case of Airbnb there are 7,852 active rentals (AirDNA, 2020). Colliers International (2018b) shows a similar distribution of booked types of accommodation from 2017. Shared rooms are the least represented (1.1%) and private rooms account for 17.9 % of shared accommodation. The remaining 81% are whole homes. It can be said that the distribution of forms of shared accommodation has not changed significantly over the years. Regarding the comparison of the distribution of forms of shared accommodation in Prague with other European cities, it is a similar scenario. Shared rooms do not reach over 2% in any case. In most cities, the sharing of entire homes predominates, but exceptions such as Manchester can be found. Private rooms are the second most preferred form (Colliers International, 2018a).

Table 2 | Development of Airbnb in 2017

City	**Overnight stays**	**Increase** (%)	**Market share** (%)
Dublin	1,021,962	44.9	13.5
London	6,703,337	45.1	6.9
Amsterdam	2,080,488	25.2	11.8
Paris	6,449,404	28.5	15.2
Madrid	2,155,362	67.1	10.1
Berlin	2,159,999	24.5	6.5
Prague	6,449,404	61.1	14.7
Budapest	1,484,435	35.8	14.3
Milan	1,342,549	36.1	9.0
Barcelona	3,011,433	15.4	8.5

Source: Authors' own elaboration based on Colliers International (2018a).

Table 2 is used to characterise the situation in the accommodation market within Airbnb and shows the position of Prague in comparison with other selected cities. The total number of overnight stays in individual cities is followed by an increase in overnight stays compared to 2016. In the case of market share, this is Airbnb's share of the total number of overnight stays at the end of 2017 (Colliers International, 2018a).

As can be seen from the above, shared accommodation is an ever-evolving form of the sharing economy and allows its providers to earn additional income. The provision and use of shared accommodation also affect public budgets. Therefore, the article examines the revenues generated through shared accommodation in the form of accommodation fees and income taxes. The definition of a shared economy and shared accommodation, including acquaintance with the accommodation market, ensures that the issue is introduced. This based on the revenues for public budgets while the impact is discussed.

2 Data and methods

The paper assesses the use of shared accommodation from a tax perspective and determines the impact of this form of sharing on public budgets using calculations regarding taxes and local fees. The research is focused on the situation in Prague. First, an overview of the situation on the accommodation market in the Czech Republic and an analysis of the Airbnb offer in Prague was created, using data from AirDNA and the Czech Statistical Office (CZSO). The theoretical basis was created in this part.

In terms of public budgets and the tax aspects, income tax and local fees play an important role in revenue, so the following section focuses on this area. The Ministry of Interior of the Czech Republic (MICR) (2020) is already discussing the effects of taxes and the accommodation fee on public budgets. It presents these in terms of compensation for the use of infrastructure by temporary residents. Based on this perspective, the positive impact of revenues generated through shared accommodation on public budgets is assumed in the form of compensation. The Analysis and Research Results section uses the analysis and description method, including the relevant legal regulations governing the issue. Data from Marianovská and Němec (2018) and other research studies, AirDNA and the Czech Statistical Office was used. As far as legislation is concerned, Act No. 586/1992 Coll. was used (CR, 1992). Based on the above data, the income tax and the fee for accommodation in Prague are presented. Finally, the findings of the analysis are synthesised and the effects of the introduction of the accommodation fee and the effects of income tax are determined. The impacts of the analysed aspects on public budgets are also mentioned.

The issue of the sharing economy and specifically shared accommodation is a modern topic for professional research and student work. Most are focused on tourism or city management, such as Novotná and Hasoňová (2020), Marianovská and Němec (2018), and digital platforms and information sharing. The aforementioned Marianovská and Němec (2018) focus on shared accommodation using the City of Prague as an example and recommend using examples of good practice from other large cities abroad, where they already have well-established regulations for shared accommodation. In part, these authors touch on the tax aspects of the sharing economy. Novotná and Hasoňová (2020) look at the issue of shared accommodation more form the point of view of regional development and tourism and mention tax issues and the need to address the negative impacts of shared accommodation, ideally following the example of large cities abroad. Boháč (2019) supports the need to share information from digital platforms, especially for financial management

purposes. The Office of the Government of the Czech Republic (OGCR) (2017) is similar, drawing attention to the fact that the availability of data is crucial, both for regulation and monitoring the sharing economy. The aim should be to ensure user-friendly procedures and minimise administrative burdens. Legislative acts should focus on eliminating the information deficit. Marek et al. (2017) also support the system of financial administration and intermediaries in the sharing economy.

There are also works and studies that focus on the tax aspects of shared accommodation. For example, Luková (2019) and Dalir and Olya (2020). Luková (2019) highlights the fact that Airbnb's regulation in the Czech Republic through income tax does not target professional hosts, but rather negatively effects hosts whose behaviour corresponds to sharing. Dalir and Olya (2020) refer to a seasonal tax as an approach to the taxation of shared accommodation. It is concluded that the application of seasonality affects the income of hosts who pay lower taxes and receive higher income per year. As stated in the instructions of the General Financial Directorate (GFD) (2017) for personal income tax, it is necessary to distinguish whether it is income from independent activities or income from the rental of real estate. If the provision of accommodation has the characteristics of the business, it is subject to tax as income from a separate activity. Then, for expenses determined by the percentage of income, it depends on whether they have a trade license. Based on these instructions, it is in agreement with the conclusions of Luková (2019), because if the provider does not hold a trade license, they can use lower expenses determined by a percentage of the income. According to Colliers International (2018a), some cities abroad regulate shared accommodation by limiting the number of days. For example, in the case of Paris, the host is obliged to register with the relevant authorities to be able to host legally. It is limited to 120 days.

Based on the above studies, the authors base their research topic on the following assumptions:

- Shared accommodation needs to be registered and taxed, thus reducing negative impacts such as tax evasion.
- In the Czech Republic, there is no uniform taxation of hotel-type accommodation and shared accommodation.
- In the Czech Republic, there is a new accommodation fee related to accommodation services.

Based on these assumptions, the following research questions are determined for the paper and the fulfilment of the objectives:

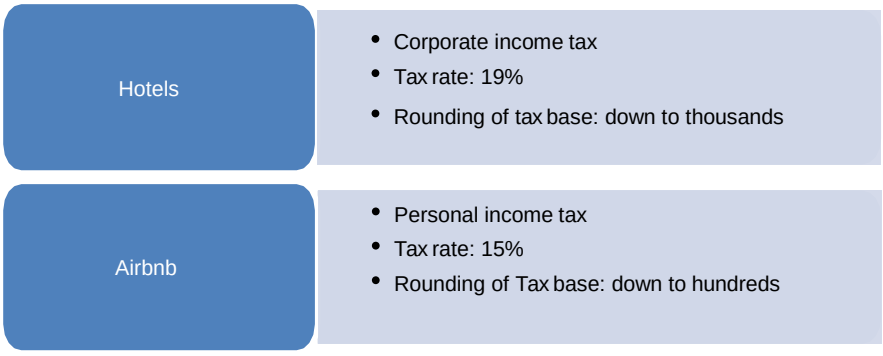
- **RQ 1**: How does the taxation of accommodation affect providers?
- **RQ 2**: Could another form of regulation based on foreign practice be more appropriate?

3 Analysis and results

The Analysis and Research Results represent the tax revenues to public budgets. Due to the different calculation of taxes, to highlight the differences between personal and corporate income taxes shown in Figure 1, three scenarios are chosen:

- Accommodation in Prague
- Hotels
- Airbnb

Figure 1 | Comparison of approaches to the tax burden of hotels vs Airbnb



Source: Authors' own elaboration based on (CR, 1992).

The first scenario includes the calculation of the tax burden on hotels and accommodation mediated through Airbnb in Prague in 2018. Based on the available data, the tax is calculated by Airbnb. Expenditures are determined as a percentage of income (40%) and then the personal income tax is determined. In Prague, 13,004 units were registered in 2018, which are offered via Airbnb and have an occupancy rate of 61%. The total number of beds is 52,378 and the number of rooms 17,306. The average daily rate within Airbnb is 1,734 CZK per unit. In 2018, there were 531 hotels in Prague. Together they provide a capacity of 35,508 rooms, i.e. 74,982 beds. During this period, the number of visitors is 1,345,087 and the average number of overnight stays is 2.35 nights. The average price per room is 2,300 CZK per night. The corporate income tax is determined based on the data. Expenditures similar to the previous case are assumed (40% of revenues). Tax revenues amounted to 866,247,865 CZK. The results are shown in Table 3.

Table 3 | Tax liability of hotels and Airbnb

Scenario 1			
Hotels	Amount in CZK	**Airbnb**	Amount in CZK
Revenues	3 635 097 618	**Revenues**	5 020 520 600

Expenses	1 454 039 047	**Expenses**	2 008 208 240
Tax base	2 181 058 000	**Tax base**	3 012 312 300
Tax	414 401 020	**Tax**	451 846 845

Source: Authors' own elaboration based on (CR, 1992).

In the second scenario, only hotels are assumed to exist. Guests are assumed to use hotels instead of Airbnb. Tax revenues amount to 1,306,412,260 CZK. The third scenario assumes that only Airbnb is used, i.e. all guests have accommodation mediated through Airbnb. Tax revenues amounted to 661,761,180 CZK. Table 4 shows the results (Marianovská & Němec, 2018; CZSO, 2020).

Table 4 | Tax liability

Scenario 2		Scenario 3	
Hotels	Amount in CZK	**Airbnb**	Amount in CZK
Revenues	11,459,756,670	**Revenues**	7,352,902,152
Expenses	4,583,902,668	**Expenses**	2,941,160,861
Tax base	6,875,854,000	**Tax base**	4,411,741,200
Tax	1,306,412,260	**Tax**	661,761,180

Source: Authors' own elaboration based on (CR, 1992).

With knowledge of the average price of a hotel room and the average daily rate per accommodation unit, the revenue to the public budget can be determined based on the relationship below. After recalculating the amount according to the annual attendance, annual revenues are obtained. Subsequently, the tax income of a given form of accommodation can be determined from the tax base by multiplying it by the tax rate, in this case, the rate for corporate income tax and the rate for personal income tax:

$$y_i = 2\,300 d_0 n_{i1} + 1\,734\, d_1 n_{i2},$$

where y = public budget; i = scenario 1, 2, 3; d_0 = corporate income tax rate; d_1 = personal income tax rate; n_{i1} = hotel attendance in the given scenario; n_{i2} = Airbnb attendance in the given scenario.

Subsequently, the analysis and research results focus on the current period and present the revenues to public budgets that shared accommodation brings, specifically in the form of income tax and accommodation fees. As follows from the above scenarios,

accommodation providers through Airbnb are subject to personal income tax. To determine the amount of tax liability of accommodation providers via Airbnb, an income of 27,800 CZK per month is used, which is obtained based on data from AirDNA (2020). For personal income tax, an annual income of 333,600 CZK is used. According to the GFD (2017), the provider has the option of using expenses determined as a percentage of income depending on whether they have (60%) or do not have (40%) a trade license. Furthermore, the law determines the method of rounding the tax base (down to hundreds) and the tax rate, which is 15% (CR, 1992).

Table 5 | Current tax liability

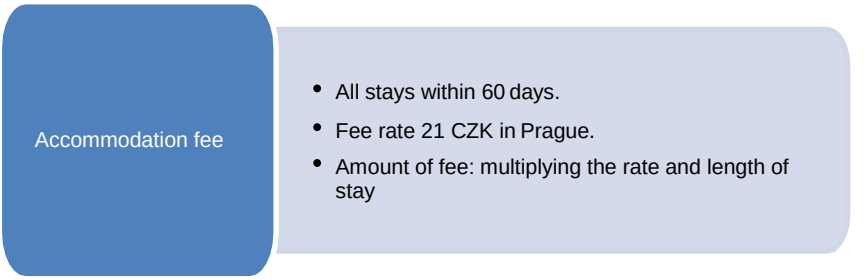
	Without trade license	With trade license
Annual income	333,600	333,600
Expenses	133,440	200,160
Tax base	200,100	133,400
Tax	30,015	20,010
Income tax	235,677,780	157,118,520

Source: Authors' own elaboration based on (CR, 1992).

The results of the calculations are shown in Table 5. First, the annual income is calculated, followed by the determination of the expenditure. By reducing income by expenses, the tax base is obtained from which the tax is determined. Based on data from AirDNA (monthly income and number of active rentals), the amount of income tax collected from Airbnb providers can be assumed. The calculation gives an idea of the amount of personal income tax within accommodation providers via Airbnb. Assuming the annual income of accommodation providers is 333,600 CZK and the number of active rentals is 7,852, the income tax amounts to 236 million CZK if it is assumed that the providers do not have a trade license. Assuming they have a trade license then income tax reaches 157 million CZK.

Attention will now be focused on the calculation of the accommodation fee, which now burdens part of the sharing economy, such as Airbnb. From 1 January 2020, there was a change in the law in the Czech Republic, which brought about the replacement of the fee for a spa or recreational stay and the fee for accommodation capacity. These have been replaced by an accommodation fee, in which case it does not matter the place and purpose of the stay and burdens all stays within 60 days. The change expanded the accommodation facilities to which the fee applies. Accommodation provided through digital platforms is also included (Žurovec, 2019).

Figure 2 | Specifics of the accommodation fee



Source: Authors' own based on Žurovec (2019) and Prague City Hall (2020).

The length of the stay and the rate of the fee is important for determining the amount of the accommodation fee. In the case of the length of stay, this is specifically the number of overnight stays and as far as the fee rate is concerned, it is 21 CZK in Prague. The amount of the fee can be obtained by multiplying the rate and length of stay (Prague City Hall, 2020):

$$7\ 852 \times 21 \times 3 = 494\ 676 \text{ CZK}$$
$$7\ 852 \times 21 \times 3 \times 5 = 2\ 473\ 380 \text{ CZK}$$

The amount of the accommodation fee, provided that the accommodation would be occupied by only one person after three nights, is 494,676 CZK, bud according to AirDNA (2020), the size of the stay is 4.7 people. Assuming that 5 people will stay in the accommodation after 3 nights, the amount of the accommodation fee will change.

Conclusions

The amount of revenues for public budgets in the form of income tax is shown in three scenarios. Assuming that, due to Airbnb, more people are generally interested in accommodation and travel, it can be said that shared accommodation brings revenue to public budgets. However, as can be seen from the calculations, if hotel prices were to retain the same interest in accommodation or travel, public budget revenues would be higher in terms of income taxes. An overview of the accommodation market in the Czech Republic is created to allow calculations of the income tax and accommodation fees. In the case of income tax, a similar income is assumed for all active rentals although the highest incomes can be assumed for whole homes, which in the case of the distribution of rental types reach the highest representation. Regarding the accommodation fee, the average number of overnight stays and subsequently the size of stay is used, which brings the amount of the accommodation fee in the case of a three-day stay and then in the case of the expected size of the stay while maintaining the length of stay.

As mentioned, a positive effect on public budgets can be expected, because public services are also used by temporary residents. Based on the calculations, a positive effect can be confirmed. Revenues in the form of accommodation fees and income taxes can be

seen as compensation for the use of infrastructure, as discussed by the MICR (2020). Specifically, in the current period, the implemented change in the law (accommodation fee) will be reflected in revenues to public budgets.

The answer to the first research question is emphasised by the calculations. The calculations of the tax burden in the current period, the results of which are shown in Table 5, show the difference concerning the taxation of providers with and without a trade license. Taxation of accommodation rather burdens the providers without a trade license. The higher burden is due to the possibility of applying a lower flat rate. The difference in the tax liability of providers is 78,559,260 CZK. If the maximum number of days were used within the Airbnb regulation in Prague as in foreign cities, the regulation would be directed more towards providers who are primarily engaged in providing accommodation. Paris is given as a specific example in the paper. Therefore, the first research question concludes that the taxation of shared accommodation in the Czech Republic is not aimed at professional providers. The authors agree with Luková (2019) that the taxation of shared accommodation in the Czech Republic burdens more individuals without a trade license.

However, from the point of view of short-term renting, it would certainly be possible to collect more revenues for public budgets if more appropriate regulations were set. Therefore, it can be confirmed that what Novotná and Hasoňová (2020) summarise is that Prague is still trying to regulate while facing the impact of the delayed implementation of measures with an increase in negative impacts. Based on the example of good practice, Prague should consider measures that operate in these cities in the future. The obligation to register and the maximum lease period could reduce the number of professional hosts and investors, whose impact is reflected in the price of long-term leases. An obligation to share information on hosts would help to improve tax enforcement and urban planning. The same is stated by other authors, for example, Marinovská and Němec (2018) who confirm that the focus of possible regulatory measures can be seen primarily in the obligation to register landlords with state or local government bodies so that the obligation to pay taxes and fees is easily enforceable.

In answering the second research question, the authors consider it more appropriate to direct the regulation to providers of shared accommodation who are primarily engaged in this activity. For example, the limitation of the number of days, which Luková (2019) herself mentions in her work. Furthermore, this measure is discussed by Novotná and Hasňová (2020), also in the sense of reducing the number of professional hosts.

A sharing economy can be accompanied by many benefits, despite the concerns it raises in some cases. Some of these are mentioned by Veber et al. (2016). This is, for example, security or doubts about sharing with strangers. On the other hand, the negatives of this phenomenon are also known, some of which are mentioned above. The topic of sharing opens up space for further possible research. Given that the presented paper was rather an overview study, it is possible in further research to address the issues of a sharing economy using advanced statistical analyses. The authors also see the possibility for further research in assessing the impact of the development of relevant forms of the sharing

economy on existing sectors. The paper presented the situation on the shared accommodation market, specifically Airbnb in Prague, and determined the differences and specifics of taxation of the hotel and shared accommodation, including the issue of local fees.

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PROJECT MANAGEMENT ISSUES IN FOREIGN INTERNSHIP: A CASE STUDY OF ADTALEM EDUCACIONAL DO BRASIL

Radovan Kouřil, Marie Černá[9]

Abstract

This paper addresses the issue of foreign internship project implementation in selected organisations. The authors focus on finding new ways of setting the rules regarding foreign internship projects that will result in fulfilling the organisation's goal as defined in the paper. The paper describes the current situation in foreign internship management in Brazil and introduces meaningful improvements through knowledge of the differences between foreign internship project management in Brazil and the Czech Republic. The data used was obtained as the output of the authors' original qualitative research in both countries. The objective of this paper is to compile a case study focused on the project implementation of a foreign work internship in the analysed organisation. The methods used for reaching the objective are literary research, an analysis of Adtalem Educacional do Brasil internal documents, Ikigai, an analysis of ABIPE internal documents and the qualitative research further specified in the article

Key words: foreign internship; Ikigai; project management
JEL Classification: M1, M3

Introduction

Since the beginning of recorded history, people have intuitively worked with activities, which from the current point of view, could be included under the concept of project management. The nature of the projects and the environment have changed since the times of project management development. Modern projects involving Nicholas and Steyn (2020):

- Technical complexity.
- Challenges (directing large temporary organisations concerning constraint resources, limited time schedules, environmental uncertainty).

Project management has also developed in line with the development of technologies. Henry Gannt and his Gannt chart representing 'the way of realising mind mapping for project management purposes' (Rastogi, 2015, p. 1), which is still used as an effective project management tool for assisting in designing and planning projects, was followed by further levels of project management. In current times, project management has become more sophisticated (Wawak & Wozniak, 2020). Projects are usually managed and fulfilled, and

[9] *University of West Bohemia, Faculty of Economics (kourilr@kfu.zcu.cz; macerna@kfu.zcu.cz).*

their limitations are due to time, technologies and other factors. A vital aspect of project management is the adequate management of key sources. Project management success is always associated with the project manager (Söderlund, 2005), who has considerable influence on its correct and effective implementation. They must react flexibly to individual changes caused by external and internal environments. However, project management does not involve certain methods and techniques, which the project manager must know, but a particular way of thinking (Ding, 2016).

Manufacturing companies, service providers, non-profit making organisations etc., often consider using a variety of methods to improve their programmes and projects. These include: Lean; Six Sigma; Lean Six Sigma; Ikigai (Singh & Singh, 2020).

Ikigai is not a direct method of project management but is a way of life whose principles can be applied in an organisation and to project managements (García & Mirales, 2016). This philosophy is used in the company Adtalem, which is described in the part of this article dealing with the qualitative research background.

1 Objective and research methods

Effective company management presupposes defining the goal that specifies the purpose of company existence and selecting suitable methods for reaching this goal.

1.1 Objective

The goal defined by the analysed organisation, Adtalem Educacional do Brasil, is to ensure the future competitiveness of its students in the labour market. A tool that should lead to fulfilling this goal is foreign internship project implementation (Adtalem Global Education, 2020).

Therefore, the objective of this paper is to compile a case study focused on the project implementation of foreign work internship in the analysed organisation. The paper defines the steps required to improve the management of a foreign internship project taking into account the experience of one of the authors while conducting research in Brazil and the Czech Republic. This research is described further in the paper.

1.2 Research methods

The research had the nature of qualitative research and was based on the authors' knowledge supported by the literary research of project management in the field of foreign internships. To compile the article, the following methods and tools were used:

- literary research,
- analysis of Adtalem Educacional do Brasil internal documents,
- Ikigai as Adtalem Student's Development Project,
- analysis of ABIPE internal documents,
- qualitative research (personal interviews with employees and students),
- Microsoft Office,
- Canva.

The students who participated in the qualitative research were selected based on the Ikigai Student Development Project. The Japanese concept of Ikigai is considered as a project management tool (IPMA, 2017). Ikigai is used for student development in the analysed company. In practical terms, 4–6th semester students are recommended to apply for a foreign internship. Twelve students from this segment that were interested in the IAESTE project were chosen to participate in the research (Table 1).

Table 1 | Adtalem student participants in qualitative research

No.	Age	Adtalem institution	Field of study	Semester of study
1.	20	Ibmec São Paulo	Civil Engineering	4th
2.	20	Wyden UniMetrocamp	Biomedicine	4th
3.	21	Ibmec São Paulo	Business Economy	4th
4.	20	Wyden Facimp	Electrical Engineering	4th
5.	20	Wyden Facimp	Civil Engineering	4th
6.	21	Wyden UniFanor	Chemical Engineering	4th
7.	22	Wyden UniMetrocamp	Graphic Design	6th
8.	22	Wyden UniRuy	Computer Science	6th
9.	23	Ibmec Rio de Janeiro	Accounting	6th
10.	22	Ibmec Belo Horizonte	Architecture	6th
11.	23	Wyden UniRuy	Industrial Automation	6th
12.	22	Wyden UniMetrocamp	Biomedicine	6th

Source: Authors' own processing

The following part of this paper examines the research, background and results.

2 Qualitative research

The qualitative research was based on one of the authors' personal experience acquired in the analysed organisation during a work internship provided by IAESTE Czech Republic. This internship took place in São Paulo, Brazil, where the headquarters of the company is located. The duration of the internship was three months (July 2019 – September 2019). At the beginning of the research, the author conducted an analysis of Adtalem Brasil and the management of the IAESTE project in Brazil.

2.1 Adtalem Educacional do Brasil

After completing the internship, Adtalem was acquired by the YDUQS company, the second-largest private education group in Brazil. For purposes of this paper, the original name of the company – Adtalem Educacional do Brasil – will be used as the research was conducted before the acquisition came into force. Adtalem Educacional do Brasil originally operated three university brands: Ibmec, Wyden Educacional, and Damásio.

Currently, YDUQS still operates these brands, which is why the acquisition had no impact on planning and leading international internships, which are key to the authors' research.

The above-mentioned brands educate more than 102,000 students in 11 of the 27 federal districts of Columbia. Each brand is different and focuses on a different group of students.

Ibmec is one of the top private economic universities in the country. Besides courses focused on economics, they currently offer courses in architecture, civil engineering, electrotechnics, international relations, journalism, law and production engineering. Ibmec provides a high standard of education for its students by paid courses offered on five campuses. The courses are highly valued by the students.

In comparison with Ibmec, Wyden offers education in more institutions (11) to a wider range of students at lower prices per course. Students at Wyden represent more than 50% of all students of Adtalem Educacional do Brasil with more than 52,000 students. Wyden has belonged to the group of education providers since its foundation in 2009 (Ibmec later joined the group in 2015).

The third university brand is Damásio, which combines Damásio Educacional (which joined the group in 2014) and SJT Edução Médica (which joined the group in 2017). They both offer preparatory courses — Damásio Educacional in law and SJT Edução Médica in health. More than 180 educational institutions in Brazil offer Damásio Educacional services through franchising Damásio software. The goal of Adtalem Educacional do Brasil defined in the text above is being achieved by implementing the projects offered to students by the international office (Kouřil, 2020).

The quality of the courses is not the only important aspect of university education in the analysed group. In this time of internationalisation, having international experience is highly appreciated. The demand for overseas education is viewed as a pathway to a job with a higher salary (Barron & Dasli, 2010). This is the main reason why the international office offers its students a range of international projects. At the beginning of 2019, this department of Adtalem Educacional do Brasil was only offering students educational projects. Later that year, the company concluded a partnership with the Abipe non-profit organisation whose headquarters are also located in São Paulo. The decision was made so there is the option to extend projects with an international paid internship project called IAESTE, which Abipe operates in Brazil.

2.2 The current state of foreign projects provided in Brazil by Adtalem

In the age of globalisation and internationalisation, it is useful to gain experience in foreign countries. Adtalem takes into account that the international experience of their students increases their competitiveness in the current labour market. Therefore, the IO (International Office) mediates to their students the possibility to travel abroad and gain such experience. IO, located in São Paulo, is the department where one of the authors of this article undertook an internship. Based on IO, internal information was compiled of the next list of foreign projects provided by Adtalem (Table 2).

Table 2 | **Foreign projects provided by Adtalem**

Project title	Key project information project
Semester abroad	For all Adtalem students. Equivalent of European ERASMUS. 1–2 semesters abroad. No scholarship for students *(students pay for studies — to the home university and for tickets)*. Partner universities mainly in Europe. Option to choose from three universities *(identification of student's priorities)*. Method for selection of students: - personal interview, - scoring scale for additional activities and conditions. Annually selected for the project: *80–90 students*
International module	For Ibmec students. Partner universities: - Babson College (economics), - University of Chicago (law). Method for selection of students: - condition of completed attendance of 50% of courses by the student, - scoring scale for additional activities and conditions. Annually selected for the project: *120 students*
Academic awards	For all Adtalem students. Held 2 x per year. Fully paid by Adtalem. Dedicated to students with the best academic record. Method for selection of students: - reach the required project average, - scoring scale for additional activities and conditions. Annually selected for the project: *70 students*
International journeys	For Ibmec students. Partner universities mainly in China, USA, Netherlands, Israel. Option to choose university – tailored courses for students. Method for selection of students: - scoring scale for additional activities and conditions. Annually selected for the project: *40–50 students*
IAESTE Internships	Project mediated by IASTE. Partner universities in 87 states. Form of paid foreign internship. Annually selected for the project: *10–15 students* *More in the next chapter.*

Santander Scholarship	For all Adtalem students in cooperation with Santander bank. Fully paid by Adtalem. Method for selection of students: - scoring scale for additional activities and conditions. Annually selected for the project: *5 students*
Ibmec + Sorbonne	For all Adtalem students in cooperation with Sorbonne (France). Double diploma study. Fully paid by the student. Method for selection of students: - personal interview, - scoring scale for additional activities and conditions. Annually selected for the project: *10 students*
Incoming students	For incoming students. Annually selected for the project: *270 students*

Source: Authors' own processing

2.3 Internships provided in Brazil in cooperation with IAESTE

This project differs from other projects implemented by Adtalem. This internship takes the form of paid foreign internship — work experience, which has been implemented since 2019. This means that this form of cooperation is new for Adtalem.

To implement such a project, Adtalem has to conclude cooperation with the non-profit organization ABIPE (Associação Brasileira de Intercâmbio Profissional e Estudantil), which has been managing the activities of IAESTE in Brazil since 1982 (ABIPE, 2020). Adtalem is currently able to provide professional internships in the length of 1–12 months.

The objectives of these (student-focused) internships are (IAESTE, 2020):

- to promote international understanding, cooperation and trust among students, academic institutions, employers and the wider community,
- to operate a high-quality practical training exchange programmes between members to enhance technical and professional development,
- to operate irrespective of race, colour, gender, culture, religious or political beliefs, disability, sexual orientation, gender identity or expression.

As written above, these internships are remunerated. The amount of remuneration depends on a minimum wage in a given state and the complexity of the activities performed by the student — research and development (53% of internships), office work (40% of internships), fieldwork (7% of internships) (IAESTE, 2020). In 2019, ABIPE nominated 175 students from Brazil to pass the foreign internship and 270 students were accepted for an internship in Brazil.

The selection process of students for IAESTE internships is based on a scoring system with the following criteria (ABIPE, 2020):

- an offer of an internship in a company (100 points),
- an offer of an internship in an educational institution (80 points),
- accommodation offer (50 points),
- the organisation of social activities (30 points),
- recommendation of internship to another student (80 points),
- conclusion of a new partnership with the university (150 points),
- presentation of the project (20 points),
- picking up a foreign student at the airport/bus station (80/50 points).

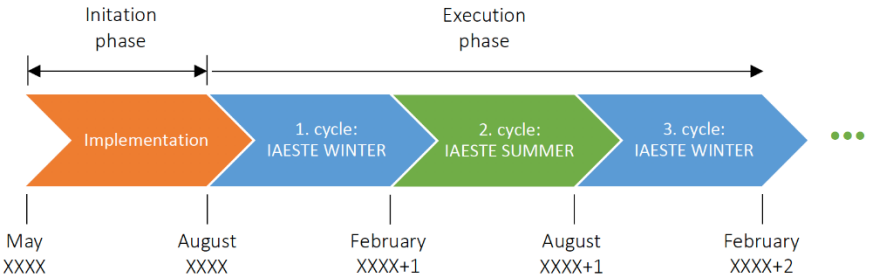
More points mean a better chance to get an internship. Students registered in the project applying for AC offers can choose up to 10 internships from the IAESTE online platform at the beginning of February. They sort the offers based on their preferences and these are given out to students based on the number of points they score in the scoring system.

2.4 Implementation of an IAESTE project based on qualitative research

One of the authors of this article had their own experience from the analysed area. The main goal of their internship was the implementation of a new project in Adtalem Educacional do Brasil. Based on research, a project schedule, life cycle, promotion plan and proposals to improve foreign internship project management were prepared.

The initiation phase of the IAESTE project in the analysed company included the author's research and implementation. In the first implementation step, the life cycle of the project was suggested as shown in Figure 1.

Figure 1 | Life cycle of the project



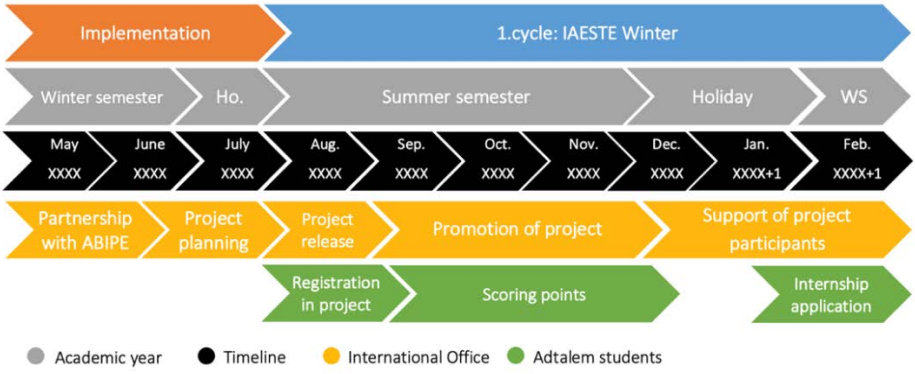
Source: Authors' own processing

At the time that Adtalem Educacional do Brasil became interested in this project and started partnership negotiations with ABIPE, the original plan of the company was to provide AC

offers only. These are represented by IAESTE Winter in the cycle. The registration period for this type of offer starts in August and ends before the AC conference in January. Internship duration lasts from July to August. As the seasons in the southern hemisphere are opposite to Europe, Brazilian students have their winter holiday in this period, which is the reason why AC offers are called IAESTE Winter. As shown in the project cycle, it is evident that the author's suggestion was also to operate with COBE, which stands for Continued Online Base Exchange where the registration period is open throughout the whole year. The worldwide duration of IAESTE internship may be 4 to 52 weeks. The suggestion was supported by the organisation of the Brazilian academic year where two months summer holidays take place in December and January. During this period, Brazilian students can only attend COBE offers. The suggested project life cycle offers the option to combine cycles of AC and COBE offers until the management of the company stops the operation of this project.

Thorough initiation is the key to the success of every project. Figure 2 shows further details of the project initiation phase, the first cycle of AC offers and represents the project schedule. It shows the timeline of the academic year concerning the months of the year and includes the project tasks of IO workers and the steps by students for successful project application in the 1. cycle.

Figure 2 | Project schedule



Source: Authors' own processing

To manage an internship project successfully and attract the target group, it is necessary to ensure it is advertised. The current situation in Brazil is far from this standard. Project managers do not use this marketing tool correctly. Therefore, steps to improve the advertising and let the students know what the provided internship means to them are required first. As it is primarily a work rather than a study project offered by IO, there is a need to explain this difference to students. Project conditions to avoid students' fear of an internship due to distorted ideas about internship financing or the necessity to use a foreign language have to be explained. The most important information about projects, its

requirements, process and advantages should be covered in the suggested promotion plan in Table 3.

Table 3 | Promotion plan

Date	Medium	Specification	Target group	Notes
12. 8. XXXX	Presentation	Welcome day	Ibmec	Project presentation
12. 8. XXXX	Presentation	Welcome day	Wyden	Project presentation
12. 8. XXXX — 29. 2. XXXX	LCD		Ibmec and Wyden	Screens in individual institutions
12. 8. XXXX — 29. 2. XXXX	PC	Screen saver	Ibmec and Wyden	Public PCs in individual institutions
12. 8. XXXX — (no limitation)	Web pages	International Office Web	Ibmec and Wyden	Information about project11RR
28. 8. XXXX	Bulk email #1	IAESTE International internships	Ibmec and Wyden	Project introduction + fees
2. 9. XXXX — 10. 9. XXXX	Webinars	EnglishPro	Wyden	Project introduction during EnglishPro webinar
11. 9. XXXX	Presentation	Meet IAESTE trainees	Ibmec	Presentation prepared by trainees
1. 10. XXXX	Bulk email #2	Registration for project	Ibmec and Wyden	Information about registration
15. 10. XXXX	Bulk email #3	Scoring system	Ibmec and Wyden	Information about the scoring system
15. 10. XXXX — 15. 11. XXXX	Instagram	Instagram Story	Ibmec and Wyden	Paid advertisement
15. 11. XXXX	Bulk email #4	Registration deadline	Ibmec and Wyden	Reminder

Source: Authors' own processing

2.5 Proposals to improve foreign internship project management in Adtalem

One part of the concluded research contained a comparison of IAESTE foreign internship project management in Brazil provided by ABIPE and in the Czech Republic provided by IAESTE Czech Republic. This comparison supported the author's knowledge of project management and leadership of the IAESTE project in Brazil to ensure better decision making in implementing this project in Adtalem. Even if IAESTE foreign internships are organised similarly in Brazil and the Czech Republic, some variations can be identified.

Table 4 summarises the variations and similarities of the Czech and Brazilian IAESTE foreign internships.

Table 4 | Variations and similarities of the Czech and Brazilian IAESTE foreign internships

	ABIPE	IAESTE Czech Republic
General information		
Conditions for participation in the project	- Student for the whole time of the internship. - To be able to speak another language than Portuguese. - Good study results.	- To be a student at a university or a graduate within one year after graduation.
Length of internship	4–52 weeks	6–52 weeks
Internships provided	AC and COBE internships	AC and COBE internships
Number of internships per student	Unlimited	2 internships, not in the same academic year
Process	**AC internships:** • registration, • scoring system, • release of available internships, • internship selection, • allocation of internships, • nomination, • acceptance, • departure, • internship, • feedback. **COBE internships:** • registration, • signing up for an internship, • nomination, • acceptance, • departure, • internship, • feedback.	**AC internships:** • registration, • release of available internships, • signing up for an internship, • interview, • nomination, • acceptance, • departure, • internship, • feedback. **COBE internships:** • registration, • signing up for an internship, • nomination, • acceptance, • departure, • internship, • feedback.
Visa	IAESTE provides the relevant documents; the student applies for a visa at their own cost.	IAESTE provides the relevant documents; the student applies for a visa at their own cost.
Fees		
Price of internship	**AC internship:** • Registration fee R$ 90 (425 CZK), • Internship fee R$ 2 650 (12 500 CZK). **COBE internship:** • Registration fee R$ 90 (425 CZK), • Internship fee R$ 2 500 (11 790 CZK).	**AC internship:** • 5 000 CZK. **COBE internship:** • 5 000 CZK.

Due date	• R$ 90 during system registration **AC internship:** • R$ 2 650 nomination. **COBE internship:** • R$ 200 nomination, • R$ 2 300 after acceptance.	**AC internship:** • during sending the nomination. **COBE internship:** • 2 000 CZK prior to the nomination, • 3 000 CZK after acceptance.
Refund	**80% of fee refunded if:** • position cancelled by the employer, • no reaction from the employer, • internship declined by the student before nomination. **50% of fee refunded if:** • requirements of O-form not met by the student, • internship declined by student after nomination. **0% fee refund if:** • internship declined by student after acceptance by the employer.	**Refund of 4 700 CZK — AC internship if:** • no acceptance of the student to an internship, • work position cancelled, • medical reasons (on the side of the student), • IAESTE does not provide the necessary documents. **Refund of 2 000 CZK — COBE internship if:** • no acceptance by the student. After acceptance — the same conditions as for AC internships. **Refund of 2 000 CZK:** • after the internship and completing feedback.
Organisational information		
IAESTE A.s.b.l. membership	1982 – present	1948–1949, 1965 – present, 1 of 10 founding states.
Statutory authority	President	National secretary
National committee	4 members (executive director, internships manager, 2 assistants for international internships)	9 members (4 x national exchange, national public relations, national corporate relations, national human resources, national international relations, national IT)
Local committees	No local committees.	8 local committees.
Volunteers	Students interested in foreign internships.	Members of the organisation — students or graduates within one year after graduation.
Accommodation	Accommodation in host families provided by the national centre or trainees through the scoring system.	Accommodation in university dormitories provided by members of the organization.
Internship job raising	Ensured by national committee or trainees through the scoring system.	Ensured by members of the local committee.
Number of incoming students	270 in 2019	82 in 2019

Number of outgoing students	175 in 2019	63 in 2019

Source: Authors' own processing

Based on the understanding of foreign internship management in Brazil in comparison to other IAESTE member countries, recommendations to improve Adtalem's original project management plan were proposed. The proposals in Table 5 should lead to gaining a competitive advantage compared to the other ABIPE partner institutions

Table 5 | **Proposals to improve foreign internship projects provided by Adtalem**

Proposal	Description of the proposal
Presentation of project advantages	Better setting of project promotion, emphasis on advantages: remuneration for students, valuable experience, increase language skills, learn new culture habits, new international contacts, continuous support by IAESTE local committee.
Explanation of the benefits of the scoring system	Offer of internships in the company, offer of internships in the educational institution, accommodation offer, organization of social activities, recommendation of internship to another student, conclusion of a new partnership with the university, presentation of the project, picking up a foreign student at the airport/bus station.
Adjustment of the obtained score due to partnership	Based on the ABIPE partnership, there is the potential to earn a certain number of points for Ibmec and Wyden students within the scoring system as a partnership benefit.
Improvement in providing AC and COBE internships	Operation of both AC and COBE offers. Securing opportunities for internships at the time of the Brazilian summer holidays (December–January), when AC internships are not yet published.
Selection of institutions	Providing projects for Ibmec and Wyden students only. This will avoid the potential sunk costs as the IAESTE project does not offer internships in the field of law.
Presentation of internships	Currently, the most effective way is to promote the project through social networks such as Facebook and Instagram, concerning the target group of students who are in the age group 20–22 years. Paid advertising, bulk emails.
Supporting project participants	Internship evaluation by credits, Scholarship award — payment for tickets by the educational organisation.

Source: Authors' own processing

It is expected that the implementation of a foreign internship project in Adtalem will raise the number of students registering for the project through the ABIPE online platform. This assumption seems to be justified because the number of applicants from Adtalem institution, who earned enough points in the scoring system was represented by 11 in the summer semester 2019/2020.

Conclusions

This paper has addressed the issue of international project implementation in a Brazilian organisation. Based on information obtained directly in Brazil, a project schedule and the life cycle were prepared, which led to the successful implementation of a new foreign internship project. To achieve the goal of the company department (to raise awareness of the project among Adtalem students) the promotion plan proposed in this paper should be implemented.

Qualitative research was supported by one of the authors' personal experience of a foreign internship project in IAESTE Czech Republic throughs volunteering in the organisation. A comparison of methods of leading and managing IAESTE projects across Brazil and the Czech Republic resulted in proposals for improving project implementation in the new Brazilian institution.

An appropriate next step would be to evaluate the impact of the new implementation rules over a longer period and decide if the measures taken were sufficient. The results obtained in the observed period were, with absolute certainty, influenced by the global concerns about the Covid-19 pandemic. This fact opens the opportunity for further surveys of this issue.

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