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CONTENTS

THE EFFECT OF IMPORT ON EXPORT GROWTH AND CONVERGENCE: A SPATIAL ANALYSIS IN TÜRKIYE

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ABSTRACT

Recent studies tend to scrutinize the convergence and growth patterns of various socioeconomic variables among countries or regions, as well as their per capita income. This study as a new approach examines the growth rate and convergence inclination of real per capita exports among the 81 provinces of Türkiye for the period 2004–2021. The role of imports and their subcategories (intermediate, capital, and consumer goods) is also considered in this context. The results of the non-spatial panel model show that real per capita exports converge among provinces in both absolute and conditional terms. On the other hand, while total imports as well as imports of intermediate goods and capital goods contribute to export growth and convergence of the provinces, imports of consumer goods have no effect. According to the results, spatial interaction among provinces is notable. The results do not change significantly depending on the estimates of the DSAR model (Dynamic Spatial Autoregressive Model), identified as the appropriate specification.

KEY WORDS

spatial econometrics, convergence, export, import

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1 INTRODUCTION

Türkiye has been implementing an open trade policy for the last 30 years in order to both increase the domestic income and reduce regional development disparities. Following the export-led growth model adopted since the 1980s, the Turkish state has firmly encouraged exports across the country through various funding and support programs. As a result, in the country goods have become exportable from all provinces, per capita exports and imports have increased by 3.8% and 3.0% respectively in real terms for the last two decades. For this reason,

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we believe that exports should be considered as a determinant of economic growth and the convergence in income.

In this context, the aim of this study is to explore the effect of Turkish imports on its export growth and convergence between 2004 and 2021. For this purpose, we propose two major hypotheses based on the results obtained from previous income convergence studies for Türkiye. First, exports per capita in the country are supposed to be converged with spatial interaction. In studies, income convergence is commonly observed with spatial interaction between regions or provinces. Consequently, this convergence should also be expected for exports, which is a component of income. Moreover, trade figures show that Turkish exports and imports have advanced gradually and closely together for the last three decades, which confirms their adjacent dependence. Therefore, we should expect an impact of imports on the growth and convergence of exports. Accordingly, our study also examines the spatial convergence of exports and its dependence on imports as well as its sub-categories (intermediate, capital, and consumer goods) on the basis of provincial heterogeneity.

To test our suggestions, this study basically follows the model and method used by Kremer et al. (2022) to estimate absolute and conditional convergence on the basis of provisional heterogeneity. Following the model proposed by Barro and Sala-i-Martin (2004), they empirically re-examine the forms of intercountry convergence in the 1960–2017 period and use trade variables such as tariffs as well as income and fiscal variables. The fact that their research is one of the studies that rarely use trade variables in convergence analysis is among the most important reasons for us to follow them. In our study, however, real exports per capita are supposed as a factor that determines income in addition to the variables specified by them. On the other hand, the factor of imports is assumed to contribute to the growth and convergence of exports, which means that one of the major control variables that affect exports might be imports. Unlike Kremer et al. (2022), we don't consider the effect of exports on income growth and convergence. Their non-spatial study examines convergence between countries, whereas this spatial exercise explicitly emphases on the export growth and convergence across regions in Türkiye.

The study has several major findings. The results indicate absolute and conditional convergence in exports. Export-poor provinces show faster export growth than the rich. Accordingly, the poor provinces will catch up with the rich in terms of real per capita exports in approximately three decades. Second, the estimated models show that exports display spatial interactions among provinces. Third, the results show that imports of total, intermediate, and capital goods are effective for export growth and convergence. However, the exports or imports of neighboring provinces affect the exports of the province in question. In summary, there is spatial dependence in addition to the dependence of exports on imports.

This paper has several important contributions to literature. First of all, this is the first spatial study of export convergence on a provincial basis in Türkiye. Moreover, the spatial dependence of exports between provinces is estimated for short and long periods using both static and dynamic models. Unlike previous studies that focused on the country in general, this is the pioneer spatial study that measures the dependence of exports on imports on the basis of provincial heterogeneity.

The study is planned as follows: in the next section we explain theoretical background and our methodology; Section 3 presents the data and descriptive statistics; Section 4 section provides the results; the final section concludes with additional discussion.

2 THEORETICAL BACKGROUND AND METHODOLOGY

Concerning global trade, empirical exercises on the neoclassical growth model largely consider the factor of trade openness in income growth and convergence. For example, Frankel and Romer (1996) suggest that trade openness has a positive influence on per capita income and growth due to economies of scale and the diffusion of knowledge across various economies. Caselli et al. (1996) demonstrate that terms of trade is a determinant of income and growth across countries. Michelis and Neaime (2004) display that openness to international trade is the most statistically significant variable for sustained economic growth in the Asia-Pacific region. Cabral and Mollick (2012) find that trade has a positive influence on growth in the Mexican States. Andreano et al. (2013) test income convergence for the Middle East and North Africa (MENA) countries by using trade openness (i.e. exports and imports/GDP) and terms of trade (i.e. export price index/import price index) as control variables. Barro (2012) and Barro (2016) show in their long-term studies that openness and terms of trade are important variables for income convergence. Chapsa et al. (2015) verify that trade openness is one of the strong drivers of growth for the EU-15.

One of the few studies dealing with export convergence, Radiměřský and Hajko (2016) examine the convergence of trade volumes in EU countries for the period 2002–2014 by SITC (Standard International Trade Classification) sub-categories. They estimate both absolute and conditional convergence of about 5–6% and 14–16% respectively, depending on the sub-category in per capita exports. Another exceptional exercise by Kremer et al. (2022) considers global convergence trends in income and growth apart from the factors of determinants or the correlates of growth such as human capital, policies, institutions, and culture. Unlike other studies, they also explore whether there are changes or convergence in each of these growth variables. For this purpose, they gather more than 30 variables under different categories and examine the convergence of tariffs across countries under the heading of fiscal policy. They estimate an annual convergence rate of about 3.5% across countries for tariff rates (equal-weighted and value-weighted).

According to the literature, spatial (Gezici and Hewings, 2004; Yıldırım 2005; Yıldırım et al., 2009; Çelebioğlu and Dall'erba, 2010; Akçagün, 2017; Doğan and Kindap, 2019; Ursavaş and Mendez, 2022; Yamanoğlu, 2022) and non-spatial studies (Canova and Marcet, 1995; Filiztekin, 2018; Tansel and Güngör, 1998; Karaca, 2004) on Türkiye mostly focus on income convergence and income inequality at the regional level. Their majority determine the finding of convergence, while cases of divergence are also detected. The results might depend on the periods in which the study is conducted and the different methodologies used. This extensive literature review, however, reveals that there is no convergence study on trade variables for Türkiye.

Following Kremer et al. (2022), we employ the income convergence model framed by Barro and Sala-i-Martin (2004) in the economic growth literature. This model assumes that the growth in real per capita exports depends on the value of the previous period. We use a panel data set with fixed effects to measure absolute and conditional convergence dynamics. Then, our main model is extended by adding total imports and their subcomponents (i.e. intermediate, capital, and consumer goods) as control variables to explain the contribution of imports to export growth convergence on a provincial basis. In the final stage, the most appropriate panel specification is selected among SAC (Spatial Autocorrelation Model), SAR (Spatial Lag Model), SEM (Spatial Error Model), and SDM (Spatial Durbin Model) in order to estimate the spatial dependence of export convergence among provinces.

After adjusting the equation proposed by Barro and Sala-i-Martin (2004), we use the following model to examine the existence of

export convergence on the basis of provincial heterogeneity:

$$\ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] = \partial + \beta \ln \exp_{i(t-1)} + \mu_i + \eta_t + \upsilon_{it}. \quad (1)$$

The model suggests that provincial export growth depends on the value of the previous period. In the equation, exp stands for real per capita export value, υ_{it} is the error term varying according to provinces and time periods with a mean of zero, and μ_i and η_t represent unit and time fixed effects, respectively. The equation aims to capture convergence dynamics around the steady state. Consistent with recent studies, a panel data set with fixed effects is appropriate to capture the dynamics occurring at successive time intervals. The model allows us to obtain the estimate results for absolute and conditional convergence, which shows whether real exports per capita converge across provinces.

To examine the impact of imports on the convergence in export growth, we first extend the main equation (1) to include the total import variable:

$$\ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] = \partial + \beta \ln \exp_{i(t-1)} + \delta \ln \mathrm{imp}_{i(t-1)} + \mu_i + \eta_t + \upsilon_{it}. \quad (2)$$

Afterwards, the sub-categories (intermediate, capital, consumer goods[1]) of imports are included in the main equation (1):

$$\ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] = \partial + \beta \ln \exp_{i(t-1)} + \delta_1 \ln \mathrm{int}_{i(t-1)} + \delta_2 \ln \mathrm{cap}_{i(t-1)} + \delta_3 \ln \mathrm{con}_{i(t-1)} + \mu_i + \eta_t + \upsilon_{it}. \quad (3)$$

The models include the lagged values of the variables to eliminate the endogeneity problem. In the equations, imp stands for total per capita imports; int for per capita imports of intermediate goods; cap for per capita imports of capital goods; con for per capita imports of consumer goods. After finding estimated β values, the convergence rate (λ) can be calculated as follows (K is the lag-length):

$$\lambda = -\ln(1+\beta), \quad (4)$$

where

$$\beta = -\left(1 - e^{-\lambda K}\right) \quad \text{and} \quad K = 1. \quad (5)$$

The next step is to examine the presence of convergence in exports between provinces, if any, along with spatial dependence. Therefore, the most appropriate spatial model should be selected by estimating the SAC, SAR, SEM and SDM panel specifications. In the model selection, we apply the methods used by LeSage and Pace (2009) and Elhorst (2010), by starting with the general specification SDM and subsequently testing other models. SDM and dynamic SDM models are given below respectively:

$$\ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] = \partial + \beta \ln \exp_{i(t-1)} + \rho \sum_{j=1}^{N} \omega_{ij} \ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] + \delta_i \ln X_{i(t-1)} + \theta \sum_{j=1}^{N} \omega_{ij} \ln \exp_{i(t-1)} + \phi_i \sum_{j=1}^{N} \omega_{ij} \ln X_{i(t-1)} + \mu_i + \eta_t + \upsilon_{it}, \quad (6)$$

$$\ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] = \partial + \psi \ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] + \beta \ln \exp_{i(t-1)} + \rho \sum_{j=1}^{N} \omega_{ij} \ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right] + \delta_i \ln X_{i(t-1)} + \theta \sum_{j=1}^{N} \omega_{ij} \ln \exp_{i(t-1)} + \phi_i \sum_{j=1}^{N} \omega_{ij} \ln X_{i(t-1)} + \mu_i + \eta_t + \upsilon_{it}. \quad (7)$$

[1]The classification is according to the System of National Accounts (2008 SNA).

The symbol X expresses the control variable (total imports and their subcomponents of intermediate, capital, and consumer goods) that changes over time in the models. For the estimation of the models, we construct the weighted matrix of 81×81 based on the number of provinces, and then use the standardized matrix. In the matrix, neighboring provinces and non-neighboring provinces take the value 1 or 0, respectively.

The model selection is conducted according to the following restrictions: we choose the SAR model if $\theta = 0$, $\phi = 0$ and $\rho \neq 0$ whereas the SEM model if $\theta = \phi = -\beta\rho$. If both hypotheses are rejected, then we select the SDM model. If the first hypothesis cannot be rejected, the SAR model should be preferred, provided that the robust LM tests also point to the SAR model. Similarly, if the second hypothesis cannot be rejected, the SEM model best describes the data, provided that it is also indicated by the robust LM tests. If both hypotheses are rejected, the most appropriate model can be decided using an information criterion, since the SAC and SDM models are not nested.

3 DATA

The existence of convergence in exports for 81 provinces in Türkiye is tested by panel data analysis using spatial models for the period 2004–2021. Each lagged value included in our convergence model (Equation 1) obviously results in the loss of one observation (i.e. 2004) in the estimation sample. Therefore, the statistical analysis is made for 81 provinces and 17 years, which consists of 1,377 observations. All variables are in real per capita values. We obtain the export and import data from the "Foreign Trade Database" in dollars and the population data from the "Address Based Population Registration System (ADNKS)" published on a provincial basis by the Turkish Institute of Statistics (TurkStat). Nominal trade values are adjusted to real values by choosing 2010 as the base year. Since the data are in dollars, the U.S. consumer price index from the World Bank database is used for the conversion. The real values are divided by the population of each province to calculate real per capita exports and imports.

After taking the natural logarithms of the trade values, we create a short and balanced panel data set for the study. Tab. 1 presents descriptive statistics of the variables in the panel data, which consist of 1,377 observations for the period 2004–2021. According to the statistics, the variability in imports is slightly higher than that in exports whereas imports of intermediate goods have the highest variability.

3.1 Export Growth

As a result of the export-led growth model since the early 1980s, Türkiye's exports have grown faster than the national income so that the share of exports in the GDP has risen steadily. Between 1980 and 2021, Türkiye

Tab. 1: Descriptive Statistics

Variable	Observation	Mean	Std Error	Min	Max
$\ln \exp_{i(t-1)}$	1,377	5.3219	1.7922	0	8.9186
$\ln \mathrm{imp}_{i(t-1)}$	1,377	5.0038	1.8496	0	9.1620
$\ln \mathrm{int}_{i(t-1)}$	1,377	4.5755	2.0678	0	9.7766
$\ln \mathrm{cap}_{i(t-1)}$	1,377	3.0774	1.6159	0	7.5156
$\ln \mathrm{con}_{i(t-1)}$	1,377	2.2295	1.6005	0	7.4143
$\ln \left[\frac{\exp_{it}}{\exp_{i(t-1)}} \right]$	1,377	0.0818	0.4873	−4.5199	5.4178

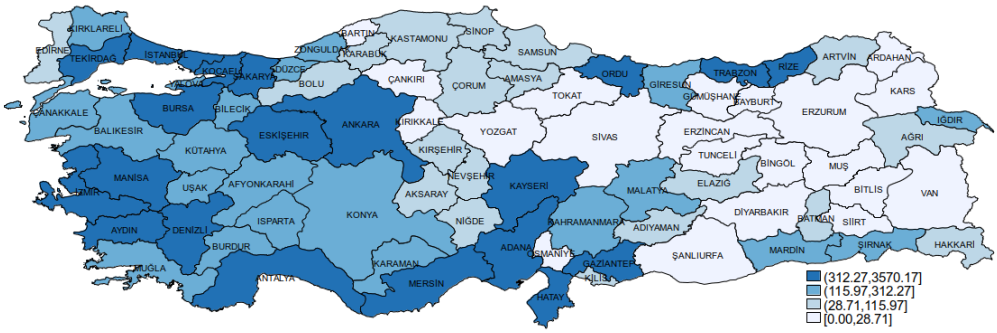

Fig. 1: Real Per Capita Exports (2004)

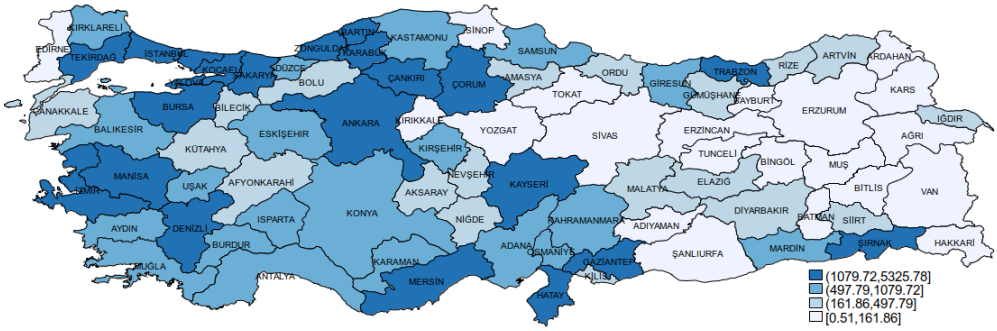

Fig. 2: Real Per Capita Exports (2021)

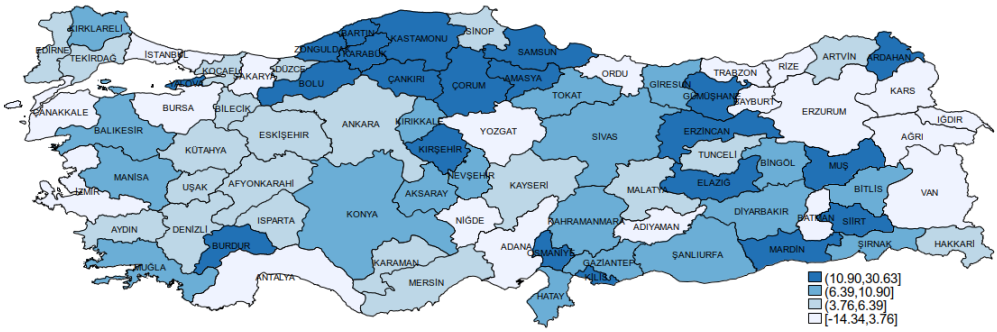

Fig. 3: Growth of Real Per Capita Exports (Average %, 2004–2021)

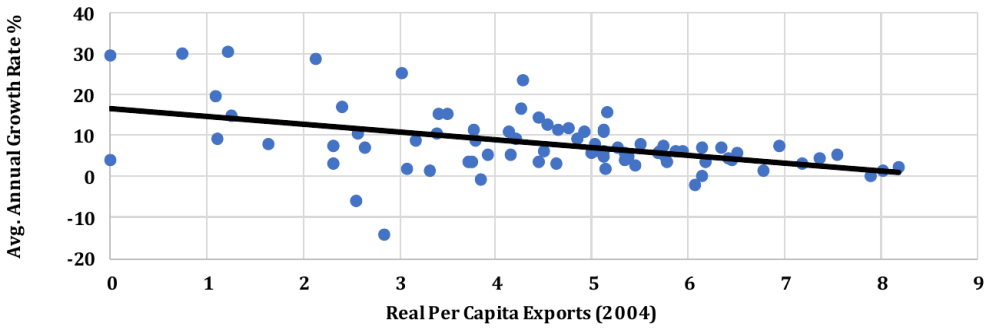

Fig. 4: Dispersion Diagram of Exports

almost doubled its real per capita income from 4,130 to 7,719 dollars whereas its real per capita exports skyrocketed from 175 to 2,030 dollars. Based on the data in our sample from 2004 to 2021, the real per capita exports yearly grew by an average of 3.8%, increasing from 1,072 to 2,030 dollars.

The growing trend, however, varies across the provinces during the same period. For instance, the number of provinces with real per capita exports above 1.000 dollars increased from 7 to 24. The number also grew from 16 to 31 for the provinces having real per capita exports between 250–1000 dollars. On the contrary, the number decreased from 58 to 26 for those with real per capita exports below 250 dollars. The real per capita exports of only 4 provinces (Ordu, Bayburt, Kars, and Ağrı) in northern and eastern parts of the country shrunk by between 6.6 and 130.2 dollars.

Fig. 1 and Fig. 2 are given to show how real exports per capita changed during the sampling period by province. They illustrate the real per capita export values for the beginning year (2004) and the ending year (2021) of the sampling period, respectively. Despite the general upward trend, both maps reveal that the country is divided into two parts by per capita exports. The provinces with the highest real per capita exports are generally situated in western and middle parts of the country, such as Istanbul, Kocaeli, Çorum, Sakarya, Denizli, Bursa, Yalova, Izmir, Hatay, and Kayseri. The eastern part, however, has the provinces with the lowest exports, such as Tokat, Ardahan, Ağrı, Erzurum, Bitlis, Van, Bingöl, Kars, Tunceli, and Bayburt. On the other hand, this figure developed faster in central northern and eastern provinces of the country than those western and central southern (Fig. 3). In other words, there is a general tendency for the per capita exports to increase faster in provinces with low export levels than in provinces with high export levels.

Fig. 4 shows the average annual growth rate of exports as a function of per capita export incomes over the period 2004–2021. In other words, the figure exhibits the average annual growth rate relative to real exports per capita in the initial year (i.e. 2004), since the starting level of income is important in the convergence process of the growth model. The figure actually confirms the above results: the growth rate decreases as the level of per capita real exports increases. For example, the average growth rate in provinces with lower exports reached 30% in 2004, growing about fourfold faster than in provinces with higher exports. These developments provide visible evidence of convergence in real per capita exports across the country.

3.2 Import Growth Relative to Exports

In the relevant period, per capita imports increased overall by 2.8% which is slightly slower than exports, though it expanded from 1,477 to 2,477 dollars, exceeding per capita exports (Fig. 5 and Fig. 6). Compared to exports, there are more provinces experiencing a decrease in their real per capita imports. However, the amount of decrease was 346.2 dollars for Bursa and 239.3 dollars for Artvin, while below 100 dollars for other provinces mostly in eastern and northern regions (Erzincan, Isparta, Ordu, Trabzon, Giresun, Bartın, Şırnak, Tokat, Kars, Bayburt, and Ardahan). The number of provinces having real per capita imports over 500 dollars increased from 13 to 26 while from 22 to 29 for the provinces with per capita imports between 100 and 500 dollars. On the contrary, the number of provinces with less than 100 dollars per capita imports decreased from 46 to 26. It is safe to say that the transition of provinces from lower groups of real imports per capita to upper groups is slower compared to real exports per capita.

The real per capita imports have been lowered in eastern regions since 2004. Moreover, the provinces in middle and western parts of the country such as Istanbul, Kocaeli, Karabük, Yalova, Hatay, Zonguldak, Sakarya, Bursa, Ankara, and Denizli continue to have the highest per capita imports. Located in the middle and eastern regions, Şırnak, Tokat, Tunceli, Erzincan, Gümüşhane, Bitlis, Kars, Bingöl, Bayburt, and Ardahan are among the provinces with the lowest imports. These re-

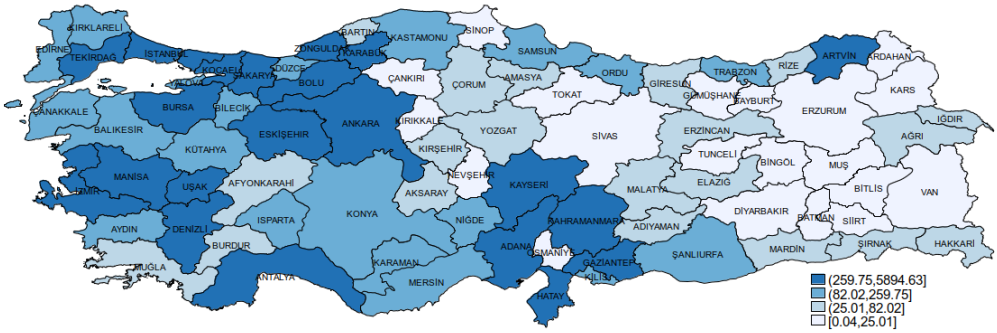

Fig. 5: Real Per Capita Imports (2004)

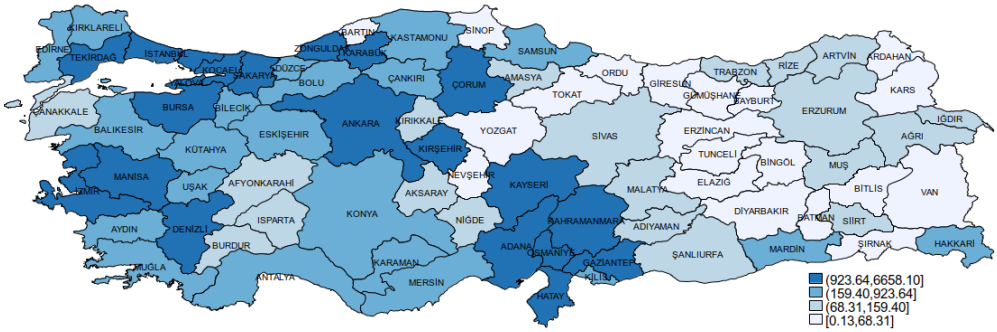

Fig. 6: Real Per Capita Imports (2021)

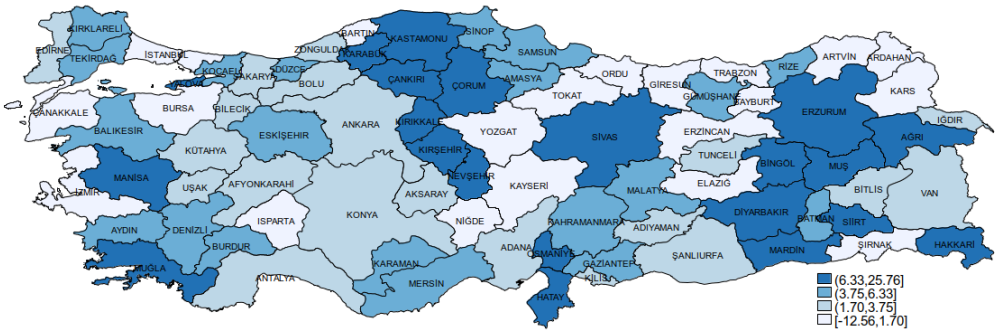

Fig. 7: Growth of Real Per Capita Imports (Average %, 2004–2021)

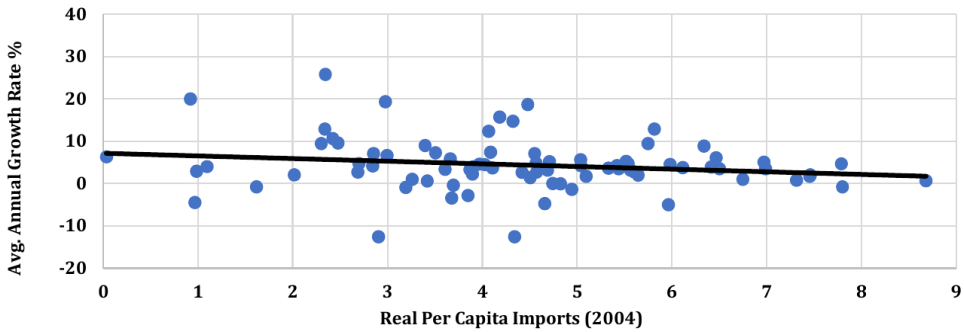

Fig. 8: Dispersion Diagram of Imports

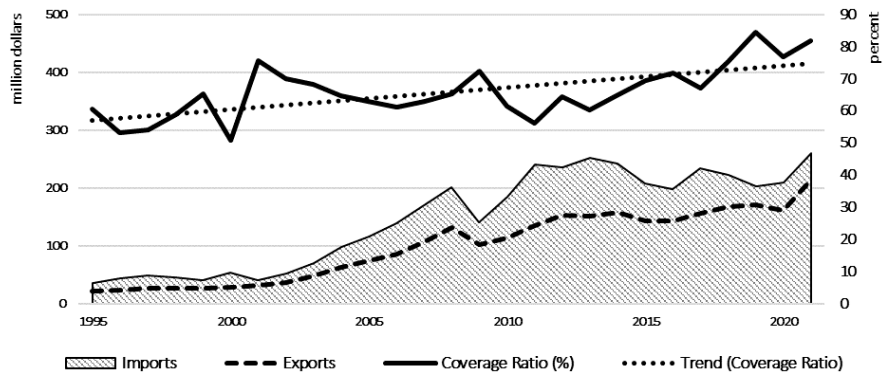

Fig. 9: Export and Import Coverage Ratio (%)

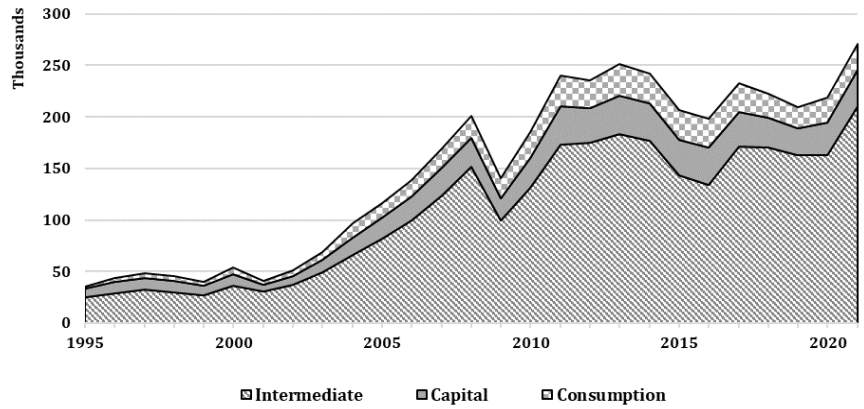

Fig. 10: Import Growth by Sub-Categories (1995–2021)

gions, however, experienced the fastest growth in per capita imports, such as Osmaniye, Muş, Bingöl, Çankırı, Çorum, Kırşehir, Erzurum, Karabük, Mardin, Kırıkkale, Siirt, Diyarbakır, Manisa, and Hakkari (Fig. 7). Fig. 8 confirms this progress by illustrating the existence of a negative relationship between the level of imports per capita and the average annual growth rate in per capita imports from 2004 to 2021. Nevertheless, the negative relationship is not as strong as in exports. All the evidence so far demonstrates a general tendency of convergence in the per capita imports.

Türkiye's exports and imports have moved together over the years, even though the ratio of exports to imports has improved since 1995 as a result of the faster growth of exports than imports (Fig. 9). We should therefore expect that the trade deficit will be closed in the future. This finding forms the source for the dependence of exports on imports, which is the second subject of our study. In the following sections, we also explore the existence of such dependence on a provincial basis.

Türkiye is administratively divided into provinces. However, there has been a rapid increase in the number of provinces over the years, which gradually reached 81 today after 2000s. Therefore, the study which is based on 81 provinces is able to use various data sets only for the period 2004–2021 due to their availability.

Despite the general trends in imports, the changes in the sub-categories of imports by the System of National Accounts (SNA 2008) have shown different characteristics. For example, per capita imports of intermediate goods rose

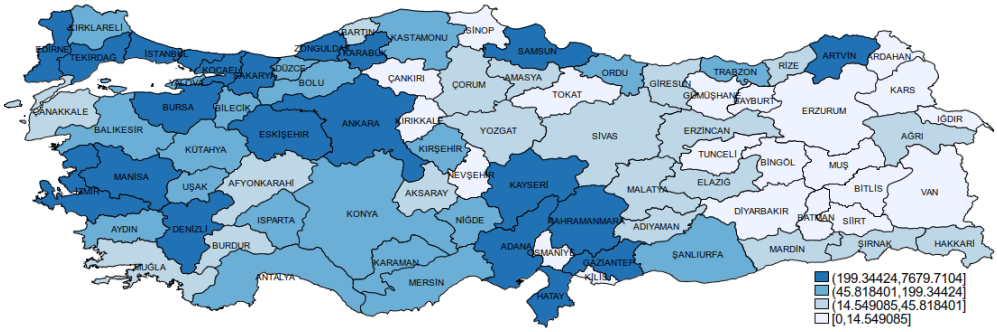

Fig. 11: Real Per Capita Imports (Intermediate Goods, 2004)

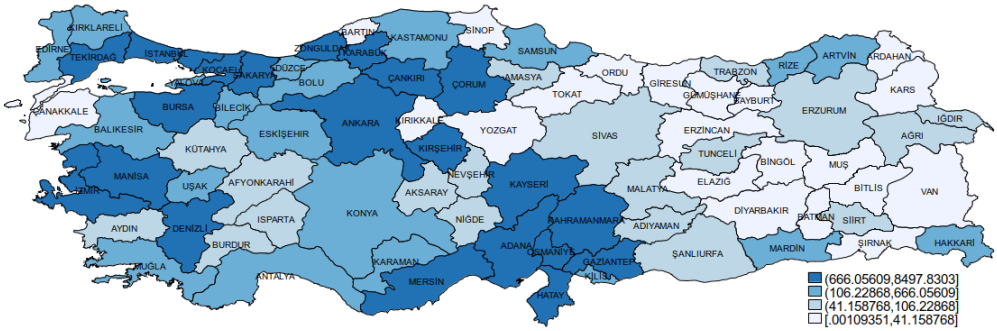

Fig. 12: Real Per Capita Imports (Intermediate Goods, 2021)

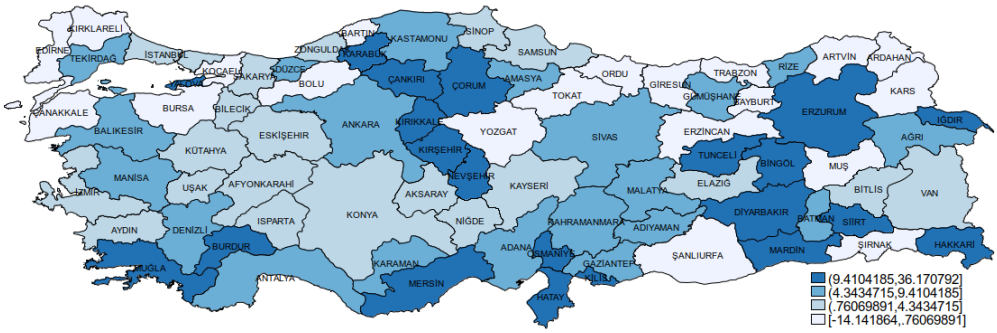

Fig. 13: Growth of Real Per Capita Imports (Average %, Intermediate Goods, 2004–2021)

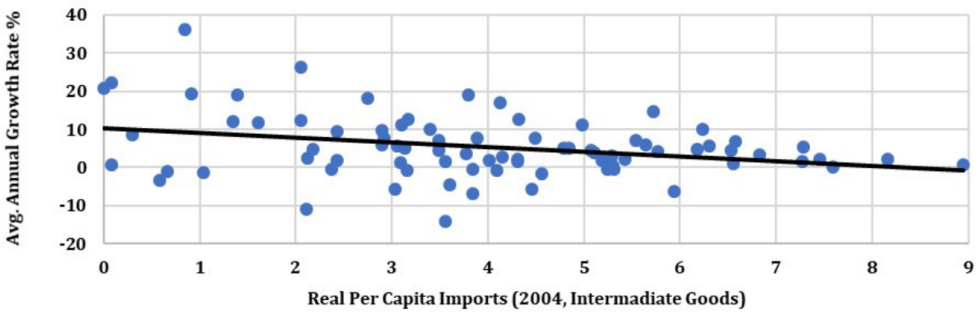

Fig. 14: Dispersion Diagram of Imports (Intermediate Goods)

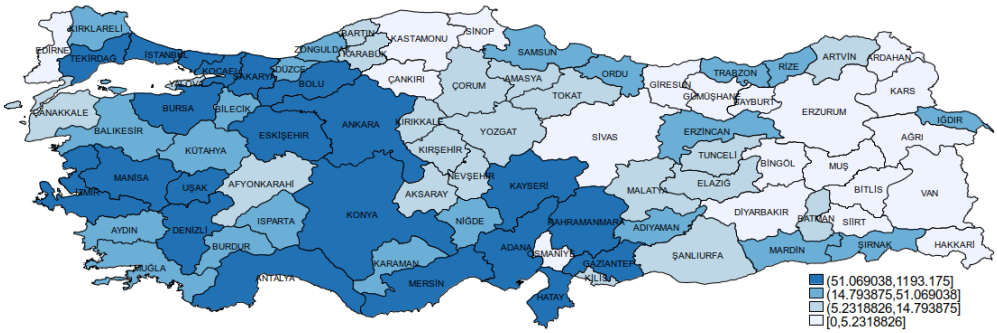

Fig. 15: Real Per Capita Imports (Capital Goods, 2004)

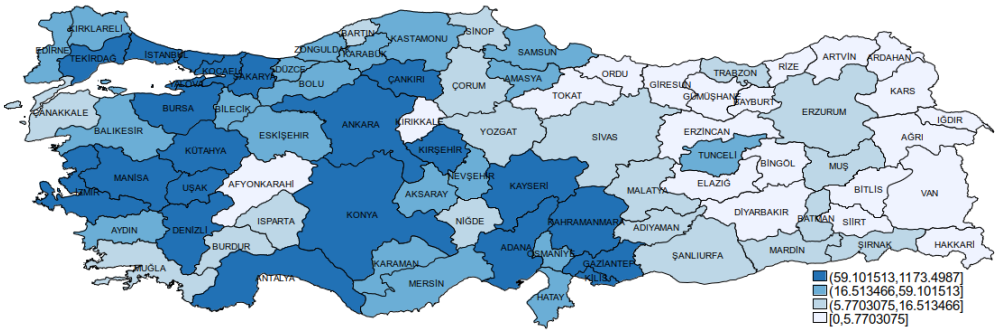

Fig. 16: Real Per Capita Imports (Capital Goods, 2021)

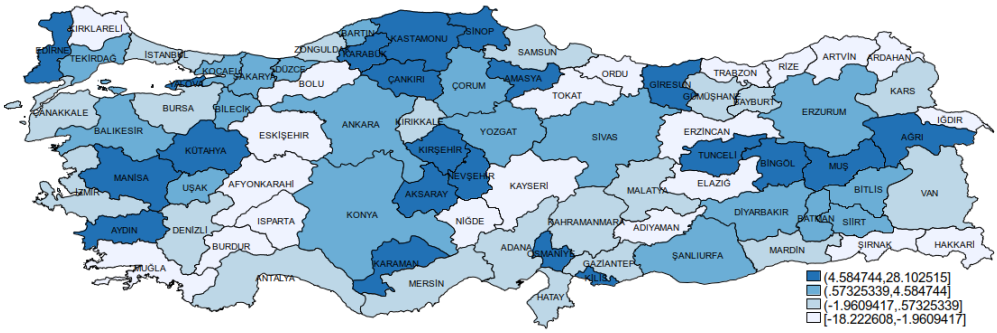

Fig. 17: Growth of Real Per Capita Imports (Average %, Capital Goods, 2004–2021)

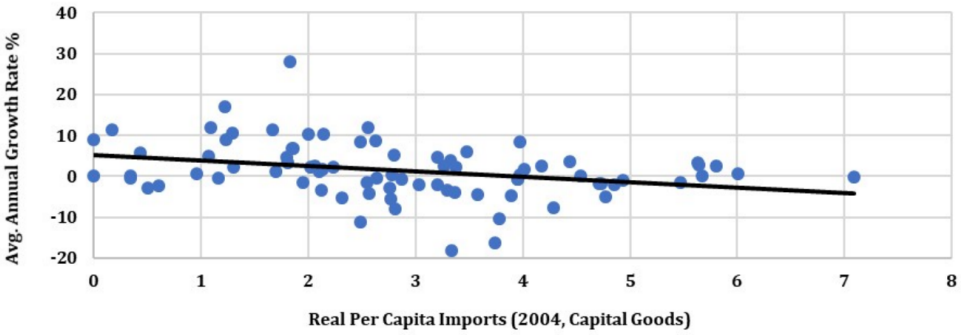

Fig. 18: Dispersion Diagram of Imports (Capital Goods)

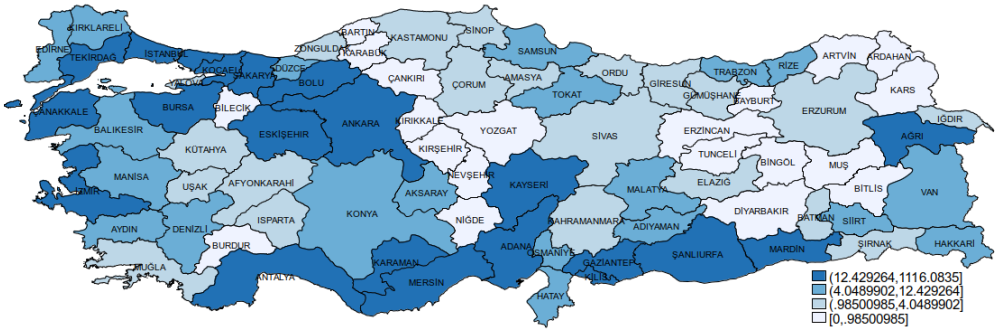

Fig. 19: Real Per Capita Imports (Consumer Goods, 2004)

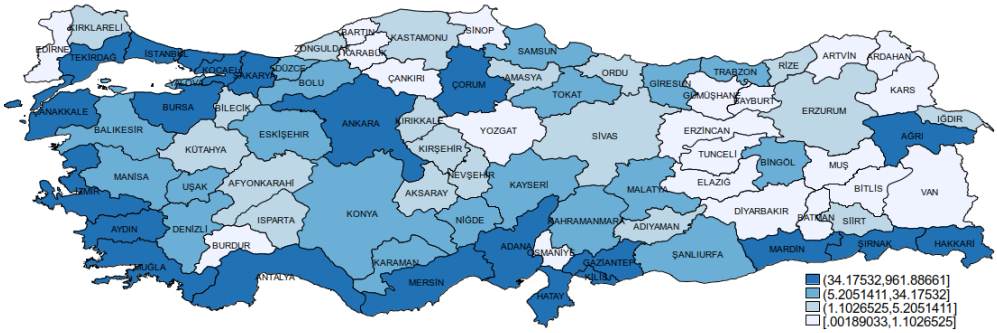

Fig. 20: Real Per Capita Imports (Consumer Goods, 2021)

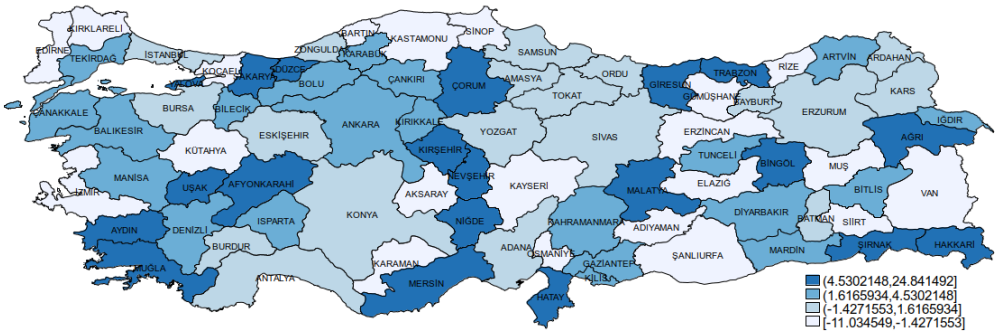

Fig. 21: Growth of Real Per Capita Imports (Average %, Consumer Goods, 2004–2021)

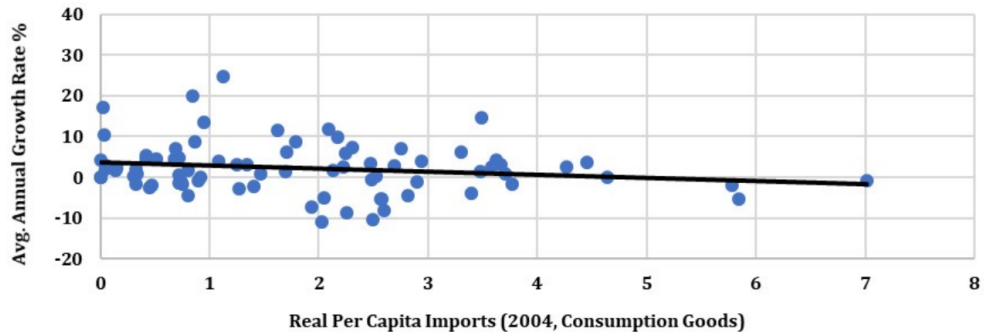

Fig. 22: Dispersion Diagram of Imports (Consumer Goods)

the fastest (3.4%), while the growth rate was slower (0.9%) for capital goods and almost none for consumer goods. By provinces, the per capita imports ranged between 1,115 and 1,997 dollars for intermediate goods, whereas they remained stable between 295 and 342 dollars for capital goods and the same (237 dollars) for consumer goods. For that reason, the share of intermediate goods in total imports has gradually increased from 70.3% in 1995 to 77.7% in 2021 (Fig. 10). The share also rose from 6.9% to 9.2% for consumer goods, while declining from 22.8% to 13.3% for capital goods in the relevant period. Fig. 10 also approves the direct relationship between Türkiye's exports and imported intermediate goods.

The per capita imports by the SNA sub-categories are not similar across provinces. In general, per capita imports of intermediate goods have remained higher in western and central regions such as Kocaeli, Istanbul, Bursa, Zonguldak, Ankara, Sakarya, Izmir, Kayseri and Tekirdağ (Fig. 11 and Fig. 12). Located mostly in the eastern part of the country, Artvin, Ordu, Bartın, Erzincan, Trabzon, Giresun, Bolu, Edirne, Yozgat, Şanlıurfa, Bayburt, Çanakkale, Şırnak, Ardahan, Tokat, Kars and Muş have the lowest real per capita imports of intermediate goods. At the same time, they experienced the fastest growth in their per capita imports between 2004 and 2021 (Fig. 13). Fig. 14 reveals the correlation that the average annual growth rate by provinces slows down as real per capita imports of intermediate goods increase.

The provinces with the highest per capita imports of capital goods are usually concentrated in western and central parts of the country (Fig. 15 and Fig. 16). However, we can't easily say that the provinces with the lowest per capita imports for this sub-category have the most rapid growth in the relevant period (Fig. 17). Although Fig. 18 illustrates a negative relationship between real per capita imports of capital goods and the average annual growth by provinces, this association is not as strong as for intermediate goods imports.

The trends in imports of consumer goods differ from both intermediate and capital goods. First of all, real per capita imports of consumer goods increased not only in western and central parts of the country, but also in the southeastern region (Fig. 19 and Fig. 20). The provinces with the highest or lowest increase in per capita imports of consumption goods are not concentrated in certain regions. Fig. 21 shows, for example, that there are provinces with the fastest growth in per capita imports in every region of the country. Moreover, the negative relationship between real per capita imports of consumer goods and the average annual growth rate is not as clear as for intermediate and capital goods (Fig. 22).

3.3 Exploratory Spatial Data Analysis

The Global Moran's I values, calculated to measure the spatial correlation of the variables in the model, are shown in Tab. 2. The Moran's I values for all years are positive and statistically significant at the 1% level. In the period 2004–2021, the correlation value for exports varies between 0.27–0.47, though it increases from 0.36 to 0.38. For imports, the value ranges between 0.43–0.57, rising from 0.43 to 0.49. The results reveal that the spatial correlation is higher for imports than for exports. The correlation coefficient for intermediate goods changes between 0.42 and 0.55 while increasing from 0.42 to 0.44 in the relevant period. However, it is estimated between 0.36 and 0.57 for capital goods, which increased significantly from 0.38 in 2004 to 0.57 in 2021. On the contrary, the estimated value for consumer goods declined from 0.33 to 0.27. This is the lowest value of the correlation coefficient, varying between 0.22 and 0.33.

However, the yearly growth in correlation coefficients is completely different than the values of exports and imports. For instance, the spatial correlation is statistically significant only in 2005, 2007, 2008, 2010, and 2017. Moreover, the correlation coefficients are generally not high or mostly negative and statistically significant. In conclusion, we find spatial dependence on the level values of exports and imports, whereas no such sound evidence is found for the growth rate of exports. Gezici and Hewings (2007) find similar results for the income variable according to their spatial exploratory analysis for Türkiye.

Tab. 2: Global Moran's I Values by Variables

Year	$\ln \mathbf{exp}_{i(t-1)}$	$\ln \mathbf{imp}_{i(t-1)}$	$\ln \mathbf{int}_{i(t-1)}$	$\ln \mathbf{cap}_{i(t-1)}$	$\ln \mathbf{con}_{i(t-1)}$	$\ln \left[\frac{\mathbf{exp}_{it}}{\mathbf{exp}_{i(t-1)}}\right]$
2004	0.363	0.432	0.425	0.383	0.333	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
2005	0.297	0.446	0.426	0.425	0.313	0.175
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)
2006	0.309	0.449	0.419	0.499	0.305	0.036
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.233)
2007	0.268	0.467	0.445	0.447	0.257	−0.204
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
2008	0.318	0.472	0.478	0.403	0.250	−0.115
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.050)
2009	0.287	0.439	0.490	0.364	0.305	0.064
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.127)
2010	0.335	0.510	0.512	0.393	0.296	−0.128
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.046)
2011	0.364	0.473	0.525	0.338	0.312	0.017
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.330)
2012	0.335	0.444	0.459	0.355	0.159	−0.030
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.393)
2013	0.336	0.509	0.487	0.397	0.262	0.042
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.218)
2014	0.353	0.501	0.481	0.510	0.282	0.011
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.368)
2015	0.380	0.568	0.552	0.541	0.265	−0.026
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.423)
2016	0.407	0.526	0.512	0.487	0.257	−0.043
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.318)
2017	0.413	0.477	0.476	0.440	0.270	−0.015
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.010)
2018	0.467	0.529	0.520	0.488	0.231	0.066
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.117)
2019	0.43	0.498	0.438	0.465	0.223	−0.068
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.213)
2020	0.367	0.499	0.460	0.509	0.257	0.018
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.319)
2021	0.379	0.486	0.441	0.572	0.266	−0.042
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.297)

Note: The numbers in parentheses are p-values.

4 RESULTS

We initially carry out sigma convergence analysis in order to see whether real per capita exports converge within the sampling period and on the basis of provinces. For this purpose, their coefficients of variation for the period 2004–2021 are calculated. Secondly, beta convergence analysis, which considers the period as a whole, is done by starting with standard panel models and then moving to spatial models.

4.1 Sigma Convergence

Sigma convergence explains intra-period trends more clearly in the distribution of export incomes. Fig. 23 shows the values of sigma convergence for exports in the relevant period. The coefficient of variation decreases from 0.41 in 2004 to 0.29 in 2021, which implies that the differences in per capita exports by provinces have

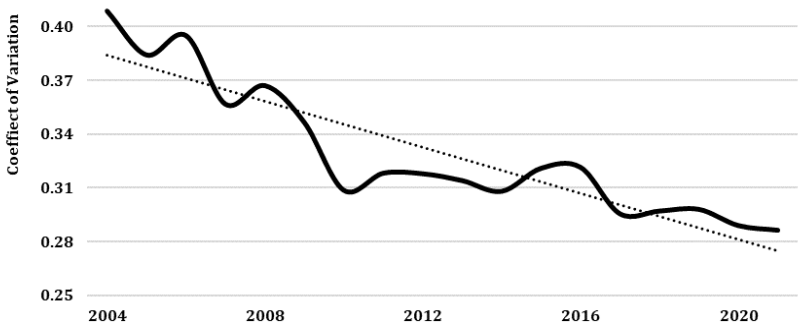

Fig. 23: Sigma Convergence

gradually declined over the period 2004–2021. The estimated values of the coefficient indicate that the gaps between export incomes at provincial level are closing as predicted by the regional economic approach based on the neoclassical growth model. In other words, it means a harmonization of regional economic output, or in our case, the export incomes at the provincial level in Türkiye.

According to Fig. 23, the trend of sigma convergence can be divided into two periods. The rapid convergence experienced between 2004 and 2010 has decelerated after 2010. This change in the convergence rate is generally attributed to the global financial crisis of 2009. In other words, provinces that are vulnerable to foreign markets due to their high export volume are expected to be more affected by the global crisis. Therefore, the growth rate of per capita exports by provinces with high export levels is likely to slow down due to such a crisis.

4.2 Beta Convergence

We estimate four different models for beta convergence and present their results in Tab. 3. The estimated beta coefficient from Model 1 in the first column of the Tab. 3 with only time effect represents absolute convergence. On the other hand, the betas calculated from three other models, which include time and unit fixed effects together, specify conditional convergence. Total imports and their subcategories are included in Model 3 and Model 4, respectively. F tests for time ($\sum \eta_t = 0$) and unit ($\sum \mu_t = 0$) fixed effects in all models give significant results at the 1% level.

According to the results from Model 1, we can conclude that per capita exports between provinces converge in absolute terms at a rate of 4% per year. At this rate of convergence, it would take about 33 years for the provinces to reach the same level of exports, which is two times the half-life period (i.e. 16.52).

The results in the second column of the table are obtained by including the unit fixed effects in Equation 1. In the model without any control variable, the convergence rate of per capita exports increases to 38%. It means that provinces are approaching their steady-state export levels at this average yearly rate. The panel data model in column 2 accounts for differences between provinces, after controlling the fixed effect term. Therefore, the estimation results provide enhanced evidence of conditional beta convergence. In consistent with recent studies, the results show that we should focus on conditional rather than absolute convergence when unit effects are included in the model. Moreover, convergence rates rise significantly after adding unit fixed effects to the model. As a result, provinces are expected to reach a steady state in 3.66 years, which is much shorter than absolute convergence.

After including the import variable in the model as shown in column 3 of Tab. 3, the convergence rate of exports increases to 41% and, on average, provinces are expected to reach their potential export levels in 3.4 years. However, if imports increase by 10%, provincial

Tab. 3: Models for Absolute and Conditional Beta Convergence

Explanatory Variables	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	0.4034* (0.0614)	1.6349* (0.1069)	1.6884* (0.1981)	1.6278* (0.2045)
$\ln \exp_{i(t-1)}$	−0.0411* (0.0072)	−0.3149* (0.0210)	−0.3359* (0.0225)	−0.3426* (0.0223)
$\ln \mathrm{imp}_{i(t-1)}$			0.0630* (0.0241)	
$\ln \mathrm{int}_{i(t-1)}$				0.0603* (0.0222)
$\ln \mathrm{cap}_{i(t-1)}$				0.0409** (0.0180)
$\ln \mathrm{con}_{i(t-1)}$				−0.0146 (0.0220)
Convergence Rate	4%	38%	41%	42%
Half-life Period	16.52	1.83	1.69	1.65
$\bar{R}^2$	0.072	0.162	0.166	0.171
Log-likelihood	−903.81	−791.17	−787.49	−782.59
AIC	1,843.63	1,778.35	1,773.00	1,767.19
BIC	1,937.72	2,290.66	2,290.53	2,295.19
Time FE	Yes	Yes	Yes	Yes
Unit FE	No	Yes	No	No
Test $\sum \eta_t = 0$	5.02 (0.000)	5.47 (0.000)	5.40 (0.000)	5.56 (0.000)
Test $\sum \mu_t = 0$		2.84 (0.000)	2.50 (0.000)	2.51 (0.000)
Moran I	−0.0508 (0.0047)	−0.0527 (0.0034)	−0.0527 (0.0034)	−0.0507 (0.0049)
LM_ρ	7.8184 (0.0052)	7.4563 (0.0063)	7.4563 (0.0063)	6.8636 (0.0088)
LM_ρ (robust)	262.4668 (0.0000)	1.5516 (0.2129)	1.5516 (0.2129)	1.5644 (0.2110)
LM_λ	11.1493 (0.0008)	10.0046 (0.0016)	10.0046 (0.0016)	9.6034 (0.0019)
LM_λ (robust)	265.7977 (0.0000)	4.0998 (0.0429)	4.0998 (0.0429)	4.3041 (0.0380)
$\mathrm{LM}\rho\lambda$	273.6161 (0.0000)	11.5561 (0.0031)	11.5561 (0.0031)	11.1677 (0.0038)

Note: It is statistically significant at the * 1%, ** 5% and *** 10% level. Values in parentheses below coefficient estimates represent robust standard errors. Values in parentheses represent probabilities in F-test and spatial autocorrelation tests.

export growth increases by 0.63%. Then, we replace total imports with their sub-categories in the model as presented in column 4 of the table. This replacement enlarges the convergence rate of exports slightly to 42%. However, the estimated coefficients for both imports of intermediate and capital goods are statistically significant, whereas it is not for imports of consumer goods. According to the estimated values, the export growth of the province increases by 0.6% and 0.4% respectively, when the imports of intermediate and capital goods increase by 10%. Moreover, the expected time period of reaching their potential export levels almost remain the same (i.e. 3.3 years).

Tab. 4: Estimation of Spatial Models for Imports

Model	SEM	SAR	SAC	SDM	DSAR	DSDM
$\ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right]$					0.0513***	0.0575**
					(0.0282)	(0.0283)
$\ln \exp_{i(t-1)}$	−0.3301*	−0.3331*	−0.3330*	−0.3362*	−0.3362*	−0.3723*
	(0.0215)	(0.0215)	(0.0215)	(0.0216)	(0.0282)	(0.0254)
$\ln \mathrm{imp}_{i(t-1)}$	0.0583*	0.0620*	0.0629*	0.0703*	0.0602**	0.0716*
	(0.0228)	(0.0230)	(0.0231)	(0.0236)	(0.0245)	(0.0251)
ρ		−0.1464*	−0.1989**	−0.1284*	−0.1623*	0.1391*
		(0.0412)	(0.0819)	(0.0430)	(0.0426)	(0.0446)
λ	−0.1285*		0.0128			
	(0.0432)		(0.0171)			
$\omega \ln \exp_{i(t-1)}$				0.0774		0.0999***
				(0.0491)		(0.0491)
$\omega \ln \mathrm{imp}_{i(t-1)}$				−0.0712		−0.0856***
				(0.0492)		(0.0518)
Convergence Rate	40%	41%	40%	41%	41%	47%
Half-life Period	1.73	1.71	1.71	1.69	1.69	1.49
Log-likelihood	−783.05	−781.18	−780.93	−779.43	−747.22	−745.21
AIC	1,574.11	1,570.37	1,571.86	1,570.86	1,504.45	1,504.43
BIC	1,595.02	1,591.29	1,598.00	1,602.22	1,530.28	1,540.60

Note: It is statistically significant at the * 1%, ** 5% and *** 10% level. Values in parentheses below coefficient estimates represent robust standard errors.

The estimation results in the table show that total imports and its two sub-categories (intermediate and capital goods) have positive effects on export convergence and growth. The variables not only accelerate inter-provincial export convergence, but also contribute to export growth by provinces. Conversely, no such relationship is found for imports of consumer goods. In conclusion, the results suggest that there is no overall dependence of exports on imports. Instead, the relationship between exports and imports depends on the category of import. The model selection criteria in the Table, namely the Adjusted R-squared ($\bar{R}^2$), the log-likelihood value, the Akaike Information Criteria (AIC) and the Bayesian Information Criteria (BIC), suggest that control variables as well as time and unit fixed effects generally contribute positively to the model. Tab. 3 also provides results whether spatial models are needed to test our hypotheses. The calculated Moran I and LM test values at the bottom of Tab. 3 enable us to examine the presence of spatial autocorrelation for all alternative models. The reported values indicate the presence of spatial errors and spatial lags in the models. Therefore, the next step will be the estimation of spatial models (i.e. SEM, SAR, SAC, SDM, DSDM, and DSAR). However, we follow the method used by LeSage and Pace (2009) and Elhorst (2010) in the next sections to select the spatially appropriate model.

For the estimation of efficient and unbiased coefficients in the estimation of export convergence, previously determined spatial effects should be included in the analysis (Anselin, 1988). We apply the Stata command "xsmle" which fits fixed and random-effects spatial models for our balanced panel data (Belotti et al., 2017). In this regard, we select the appropriate model after estimating statically and dynamically spatial models of SAR, SEM, SAC and SDM. The spatial models contain unit and time fixed effects, including the control variables (total imports as well as imports of intermediate, capital, and consumer goods) that change over time. Direct and indirect effects are calculated for all models and presented separately for comparison.

Tab. 5: Spatial Model Selection

	Imports		**Sub-Groups of Imports**	
	χ^2	***p*-value**	χ^2	*p*-value
SEM-SDM	7.28	0.0263	6.08	0.1930
SAR-SDM	3.51	0.1731	2.64	0.6192
SAR-DSAR	3.31	0.0690	4.46	0.0346
SDM-DSDM	4.12	0.0423	4.94	0.0262
DSAR-DSDM	4.93	0.0849	3.79	0.4354
SEM-DSDM	6.23	0.1011	6.46	0.2639

Tab. 4 provides results for the model which includes the total imports as a control variable. The parameters ρ, λ, and ω in the table indicate the spatial interaction depending on our models. Among the models, all coefficients of SEM and SAR static models are statistically significant, like the DSAR model. The comparison of all spatial models using the χ^2 test is presented in Tab. 5. It provides the chi-square results and their associated *p*-values separately for total imports and sub-categories of imports. As the model selection criteria based on the chi-square values favor the DSAR model in Tab. 5, we focus on the interpretations of the DSAR model. Compared with the non-spatial model, the convergence coefficient in the DSAR and SAR models does not change (i.e., 41%), while the convergence coefficient in the SEM model decreases to 40%. Since the ρ-coefficient in the DSAR model is negative and statistically significant, the per capita export growth of the province in question decreases by about 1.6% when the per capita export growth of neighboring provinces changes by 10%. This shows that the provinces decrease their exports at the expense of neighboring provinces. The previous period's export growth in the province in question has a positive effect on the current period. If the export growth of the previous period increased by 10%, the export growth of the current period increases by 0.5%.

The direct, indirect and total effects calculated from the DSAR model are statistically significant for all variables (Tab. 6). The differences between the direct effects and the estimation results obtained from the model are very small. Therefore, the feedback effect is not very important. Focusing on the direct effect in the short run, the export growth of the same province would increase by about 0.63% if the import of that province increases by 10%. In contrast, the short-run indirect effect is negative, but negligible (−0.01%). For the long-run effects, the above rates are almost similar to the short-run ones, 0.7% and −0.01%, respectively. Thus, if the imports of the province in question increase by 10%, the total effects in the short and long run increase by 0.57%, pointing at the same rate.

All coefficients in the static model SEM, which is closest to the DSAR option, are significant at the 1% level. According to the results of the model SEM, the estimated coefficients are quite close to the DSAR model and the convergence coefficient is 40%. Since the coefficient λ in the model is negative and significant, a 1% shock in neighboring provinces could reduce the export growth of that province by 0.13%. In the SEM model, the long-run direct effect of imports on exports is very similar to that in the DSAR model (i.e. 0.58%).

Tab. 7 shows the effects of imports of intermediate, capital, and consumer goods on export growth and convergence. Among these models, all coefficients of the static SEM and SAR models and the DSAR model are statistically significant, except for imports of consumer goods. However, the model selection criteria favor the DSAR model (Tab. 5). Compared to the non-spatial model, the convergence coefficient increased to 47% in the DSAR model and 41% in the SEM model. Since the coefficient ρ in the SAR model is negative and statistically significant, when the growth of per capita exports of neighboring provinces changes by 10%, the growth of per capita exports of the province in question decreases by about 1.6%. This leads to the same result from the model with total imports, whereas the export growth of neighboring provinces is negatively related to the export growth of neighboring provinces. However, the export growth of the previous period in the province in question has a positive effect on the current period. If the export growth of the previous period increased by 10%, the export growth of the current period increases by 0.6%.

Tab. 6: Short-Run and Long-Run Import Effects

Effects		**SAR**	**DSAR**	**SEM**	**SAC**	**SDM**	**DSDM**
Long-Run Period							
Direct	Exports	−0.3337*	−0.3898*	−0.3301*	−0.3350*	−0.3385*	−0.4013*
	Imports	0.0610*	0.0668*	0.0583*	0.0622*	0.0711*	0.0820*
Indirect	Exports	0.0424*	0.0586*		0.0546*	0.1141*	0.1479*
	Imports	−0.0077**	−0.0099**		−0.0102***	−0.0742***	−0.0932***
Total	Exports	−0.2913*	−0.3312*		−0.2804*	−0.2243*	−0.2533*
	Imports	0.0533*	0.0569*		0.0520*	−0.0030	0.0111
Short-Run Period							
Direct	Exports		−0.3696*				−0.3778*
	Imports		0.0634*				0.0771*
Indirect	Exports		0.0530*				0.1373*
	Imports		−0.0090**				−0.0877***
Total	Exports		−0.3112*				−0.2405*
	Imports		0.0569*				−0.0105

Note: It is statistically significant at the * 1%, ** 5% and *** 10% level.

Tab. 7: Estimation of Spatial Models for Imports of Sub-categories

Models	**SEM**	**SAR**	**SAC**	**SDM**	**DSAR**	**DSDM**
$\ln\left[\frac{\exp_{it}}{\exp_{i(t-1)}}\right]$					0.0600**	0.0633**
					(0.0284)	(0.0284)
$\ln \exp_{i(t-1)}$	−0.3377*	−0.3397*	−0.3394*	−0.3399*	−0.3759*	−0.3773*
	(0.0214)	(0.0213)	(0.0213)	(0.0213)	(0.0253)	(0.0253)
$\ln \text{int}_{i(t-1)}$	0.0581*	0.0595*	0.0598*	0.0607*	0.0615*	0.0641*
	(0.0210)	(0.0212)	(0.0213)	(0.0214)	(0.0231)	(0.0232)
$\ln \text{cap}_{i(t-1)}$	0.0395**	0.0400**	0.0397**	0.0406**	0.0408**	0.0425**
	(0.0210)	(0.0172)	(0.0172)	(0.0173)	(0.0181)	(0.0182)
$\ln \text{con}_{i(t-1)}$	−0.0120	−0.0135*	−0.0147	−0.0141	−0.0085	−0.0092
	(0.0210)	(0.0210)	(0.0211)	(0.0211)	(0.0224)	(0.0224)
ρ		−0.1448*	−0.1881**	−0.1295*	−0.1604*	0.1395*
		(0.0411)	(0.0819)	(0.0430)	(0.0425)	(0.0446)
λ	−0.1292*		0.0106			
	(0.0432)		(0.0172)			
$\omega \ln \exp_{i(t-1)}$				0.0628		0.0865***
				(0.0494)		(0.0525)
$\omega \ln \text{int}_{i(t-1)}$				−0.0365		−0.0493
				(0.0458)		(0.0491)
$\omega \ln \text{cap}_{i(t-1)}$				−0.0155		−0.0213
				(0.0373)		(0.0393)
$\omega \ln \text{con}_{i(t-1)}$				0.0488		0.0472
				(0.0477)		(0.0514)
Convergence Rate	41%	−42%	41%	42%	47%	47%
Half-life Period	1.68	1.67	1.67	1.67	1.47	1.46
Log-likelihood	−778.10	−776.39	−776.22	−775.07	−743.31	−741.66
AIC	1,568.20	1,564.79	1,566.44	1,570.14	1,500.63	1,505.33
BIC	1,599.57	1,596.16	1,603.03	1,622.42	1,536.80	1,562.16

Note: It is statistically significant at the * 1%, ** 5% and *** 10% level. Values in parentheses below coefficient estimates represent robust standard errors.

Tab. 8: Short-Run and Long-Run Import Effects (Intermediate, Capital, and Consumption Goods)

Effects		**SAR**	**DSAR**	**SEM**	**SAC**	**SDM**	**DSDM**
Long-Run Period							
Direct	Exports	−0.3404*	−0.4038*	−0.3377*	−0.4087*	−0.3417*	−0.3414*
	Intermediate	0.0587*	0.0686*	0.0581*	0.0731*	0.0607*	0.0593*
	Capital	0.0420**	0.0431**	0.0395**	0.0458**	0.0430**	0.0419**
	Consumption	−0.0136	−0.0095	−0.0120	−0.0119	−0.0154	−0.0149
Indirect	Exports	0.0439*	0.0595*		0.1397*	0.0967**	0.0549**
	Intermediate	−0.0075**	−0.0100**		−0.0583	−0.0381	−0.0095***
	Capital	−0.0054**	−0.0063**		−0.0277	−0.0198	−0.0066***
	Consumption	0.0017	0.0013		0.0511	0.0443	0.0025
Total	Exports	−0.2964*	−0.3442*		−0.2989*	−0.2450*	−0.2865*
	Intermediate	0.0511*	0.0586*		0.0148	0.0225	0.0497*
	Capital	0.0366**	0.0367**		0.0180	0.0231	0.0352**
	Consumption	−0.0118	−0.0082		0.0391	−0.3417*	−0.0123
Short-Run Period							
Direct	Exports		−0.3793*				−0.3824*
	Intermediate		0.0645*				0.0684*
	Capital		0.0405**				0.0428**
	Consumption		−0.0090				−0.0111
Indirect	Exports		0.0529*				0.1284*
	Intermediate		−0.0089**				−0.0543
	Capital		−0.0056***				−0.0257
	Consumption		0.0012				0.0481

Note: It is statistically significant at the * 1%, ** 5% and *** 10% level.

Observing the direct, indirect and total effects calculated on the basis of the DSAR model, we notice that they are statistically significant for other variables except for consumer goods. In the short and long run, the indirect effects are negative and significant except for consumption goods. For the long-run total effect, if the imports of intermediate goods and capital goods of a province increase by 10%, the export growth of that province would increase by about 0.59% and 0.37%, respectively. The overall short-term effects are expected to be 0.56% and 0.35%.

The results for beta convergence suggest that export-poor provinces tend to have higher growth rates compared to richer regions, which leads to closing the initial export income gap between them over time. This finding is evidently supported by the estimated sigma convergence in the previous section. Moreover, our results propose that other factors than control variables are more effective in the convergence process of the provinces. In other words, these factors can affect the convergence process, including differences in policies, institutions, natural resources and other structural features. Therefore, it is safe to say that our results are entirely in line with the neoclassical growth theory, which suggests that various factors such as declining returns on capital, diffusion of technology and institutional improvements could lead to faster income growth in less developed regions.

5 CONCLUSIONS

Turkish trade policy has undergone a radical transformation since 1980. The import substitution policy, which was mainly applied to industrial products before 1980, aimed at developing domestic production of intermediate and capital goods and expanding industrial ownership. On the other hand, the export-oriented growth policy after 1980 led to an increase in the volume of trade, especially in exports. This increase was supported by the liberal economic policies pursued after 1989. The country's exports shifted significantly from the agricultural sector to the industrial sector. While the share of capital goods in total imports declined, the share of intermediate goods increased rapidly. On the other hand, the share of consumer goods in imports increased slightly. Intermediate goods now account for more than 70% of total imports, indicating that exports are based on imports of intermediate goods. In the context of these developments, our study spatially analyzed the convergence of exports between provinces and the contribution of imports to this convergence. At the same time, our convergence model shows the effect of imports on the growth of exports. This effect provides an opportunity to measure the dependence of exports on imports in Türkiye using an alternative method.

The estimation results confirm our hypotheses determined within the scope of the study. Consistent with the first hypothesis, this study suggests that there is a tendency for convergence in per capita exports across 81 provinces in Türkiye at an average annual rate of 4% from 2004 to 2021. This rate is similar to the results revealed by Kremer et al. (2022) and Radiměřský and Hajko (2016) who study the convergence of trade between countries. The rate of absolute convergence in export growth estimated for Türkiye is twice as high as the "iron law" of 2%. In a recent study, Yamanoğlu (2022) shows that this absolute convergence rate is also valid for Türkiye in the period 2006–2020. Therefore, the results stated above show that exports per capita grow faster than per capita income. Moreover, provinces with low per capita exports show faster growth in exports during the relevant period. This rate of convergence suggests that provinces can reach the same per capita export level in the next 33 years. The previous studies approve higher rates for conditional than absolute convergence. The average conditional convergence rate of Türkiye's provinces shows that their steady state levels or potential export levels have constantly increased during the relevant period. However, they have been approaching their steady-state level at an average annual rate of 38%, which is supposed to take about 3.7 years. The sigma convergence analysis as well as the beta estimations confirm the convergence at the regional level in Türkiye. The coefficient of variation declined from 0.41 in 2004 to 0.27 in 2021. The result proposes that the dispersion of export values per capita by province is gradually shrinking.

The second step of the study is to examine the impact of imports on growth and the conditional convergence of exports. For this purpose, total imports and their sub-categories (intermediate, capital, and consumer goods) are included in the model as additional control variables. The estimation results show that total imports contribute positively to both export growth and convergence as suggested in our second hypothesis. When imports increase by 10%, provincial export growth rises by 0.63%. The convergence rate of exports grows to 41% and 42% after adding total imports and their sub-categories respectively. However, the results propose that the positive contribution is due to imports of intermediate and capital goods, while consumer goods have no impact on the growth of exports. For example, when imports of intermediate and capital goods grow by 10%, provincial export growth increases by 0.6% and 0.4%, respectively.

Afterward, the static and dynamic models (SEM, SAR, SAC, SDM, DSDM and DSAR) are estimated since the Moran I and LM statistics specify the existence of spatial interaction. The model selection criteria require us to select the DSAR model for estimating

both equations with total imports and their sub-categories. Compared to the non-spatial models, the convergence rate (41%) doesn't change in the model with total imports, while increasing to 47% in the model with imports of sub-categories. In all models, the negative spillover effect of total imports and imports of intermediate and capital goods on export growth is negligible (0.1%). In other words, while its own imports make a limited contribution to the growth of a province's exports, the imports of neighboring provinces do not contribute at all. The overall short-term and long-term effects of imports are not significant, either. To put it more clearly, when a province's imports per capita increase by 10%, the per capita export growth of that province rises only by 0.57%. This effect is estimated as 0.56% in the short run and 0.56% in the long run for intermediate goods whereas 0.37% and 0.35% for capital goods, respectively. These findings conclude that overall imports have a very small influence on Turkish growth of exports, both at the country level and at the provincial level.

Finally, the estimated coefficients for spillover effects varying between 0.053–0.060 are positive in the spatial models. In other words, when the initial export level of neighboring provinces increases by 10%, the growth in exports of a province is expected to be between 0.53–0.60%. The literature argues that such an effect is due to technological spillover effects on the convergence of per capita income. The results also show that the dependence of export growth on imports varies with respect to the sub-categories of imports.

The tendency for convergence is similar to the results revealed by Kremer et al. (2022) and Radiměřský and Hajko (2016) who study the convergence of trade between countries. On the other hand, our study differs from previous research in some respects. Considering the trade of SITC6 and STIC7 products in their studies for EU countries, Radiměřský and Hajko (2016) calculate the absolute and conditional convergence rates as 5.3–5.5% and 13.2–14.9%, respectively. In other words, they suggest that the conditional convergence rate is more than twice the absolute convergence rate. On the other hand, Kremer et al. (2022) propose that the absolute convergence rates of equal-weighted tariffs and value-weighted tariffs might not be different (i.e. 3.46% and 3.38%) based on their cross-country research. In our study, however, we find a 10-fold difference between these rates. It indicates that Türkiye is more heterogeneous at the regional level compared to EU countries in terms of export incomes. We believe that the difference between the model and the method used in our study and other studies might be the main reason why they are calculated differently. We employ spatial panel data models that include control variables with data on a regional basis, whereas the two studies apply country-based standard panel models that do not consider control variables.

Our findings provide some policy recommendations for decision makers and additional study topics for researchers. Policies for the development of exports should be given priority in order to ensure a balanced income distribution throughout the country, as the convergence in Turkish exports is faster than the total income. Considering that the western part of Turkey still has a higher export level than the eastern regions, it is important to focus on the eastern provinces in policies aimed at increasing exports. However, imports of intermediate and capital goods, which only contribute positively to the development of exports, should be prioritized in import-related policies. Moreover, the fact that conditional convergence in exports is faster than absolute convergence suggests that initial factors other than imports are effective in the convergence process. Studies that can identify the factors that really affect the convergence of exports will shed light on which factors should be evaluated in policies for export growth.

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FUZZY MODEL FOR DETECTION OF FRAUDULENT FINANCIAL STATEMENTS: A CASE STUDY OF LITHUANIAN MICRO AND SMALL ENTERPRISES

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ABSTRACT

90 per cent of enterprises in the European Union (EU), including Lithuania, are small enterprises that prepare the abridged financial statements. Verifying the fairness of these reports for stakeholders is challenged due to the lack of data. The aim of this research is to develop a novel model based on fuzzy logic for detecting fraudulent financial statements in micro and small enterprises by using financial ratios suitable for abridged financial statements. The results have shown that the developed fuzzy model enables estimation of the level of fraud in each individual element of accounting. Identifying each fraudulent accounting element allows us to gain insights into the areas where the enterprise has committed fraud. The proposed model has been designed to help small businesses reduce the risk, but it may also be used by public authorities as a tool for achieving greater business transparency.

KEY WORDS

accounting, financial statement, fraud, fuzzy

JEL CODES

G3, M41

1 INTRODUCTION

The users of financial statements in the EU face the challenge when performing the analysis of financial statements between enterprises of different sizes and between enterprises operating in different EU countries. It is not enough to be well acquainted with the Accounting Directive 2013/34/EU as certain differences in the financial statement information depend on the national legislation (Hýblová, 2019). There are two implications: the diversity of financial statement structures and the lack of an available financial statement analysis tool for micro and small enterprises that would account for the specifics of national legislation. Therefore,

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small businesses need a reliable innovative tool for detection of fraudulent financial statements. The present paper is the continuation of the research under the previous technical feasibility study "Feasibility study on development of an innovative tool for detection of falsification of financial statements" (2021, No. 01.2.1-MITA-T-851-02-0171).

Various studies have been conducted by researchers in this area. The listed companies that belong to the group of large undertakings and prepare the detailed version of financial statements are investigated in the studies related to detection of fraudulent financial statements (Rostamy-Malkhalifeh et al., 2021; Hakami et al., 2020; Aghghaleh et al., 2016; Chen et al., 2014; and others). Researchers often face barriers when collecting data on micro or small enterprises. As a result, the studies largely use the publicly available data on listed companies. Hence, the present research focuses on the data of financial statements of micro and small enterprises and aims at designing a model for detection of fraudulent financial statements that would be applicable to the abridged financial statement versions.

The aim of the research is to develop a novel model based on fuzzy logic for detecting fraudulent financial statements in micro and small enterprises by using financial ratios and models suitable for abridged financial statements. One of the added values of this empirical research is that the presented set of financial ratios and models is suitable for analysing abridged financial statements, as previous studies paid little attention to this and focused on the financial statements of large, listed companies. Another unique aspect of this empirical research is that cases of fraudulent financial statements can be identified from abridged financial statements without the need for additional non-publicly available information. Lastly, the designed fuzzy model for detection of fraudulent financial statements is easily applicable and useful in practice, as well as for conducting further scientific research.

The next section (Section 2) of the paper provides the overview of the selected financial ratios and models used for detection of financial fraud and innovative artificial intelligence (AI) research methods used for detection of fraudulent financial statements. Section 3 presents the research methodology, the proposed fuzzy model for detection of fraudulent financial statements. The results of the empirical analysis and discussion are presented in Section 4. The conclusions are presented in the last section.

2 LITERATURE REVIEW

2.1 Financial Ratios and Models Used for Detection of Fraudulent Financial Statements

Information provided in the financial statements enables fast assessment of the financial situation at an enterprise for decision-making purposes. Financial statements are aggregated in the financial accounting data that reveal no more than 50 per cent of effective information that is necessary when making financial decisions (Besusparienė et al., 2018). Financial information is nevertheless necessary in the managerial (Besusparienė et al., 2018), investment, and financial decision-making (Shakespeare, 2020). For the analysis and interpretation of financial statements, various financial ratios or model are commonly used for the cases discussed before.

Since 2013, the European Union (EU) has merged and replaced the earlier accounting directives with the new Accounting Directive 2013/34/EU (Directive 2013/34/EU of the European Parliament ..., 2013). The major change is the diversification of the sets of financial statements according to the size of enterprises and simplifications applicable to micro and small undertakings (Deac, 2014). The Accounting Directive 2013/34/EU (Directive 2013/34/EU of the European Parliament ..., 2013) establishes that the Member States may permit small undertakings to prepare abridged

Tab. 1: Financial ratios used for detection of financial fraud

Financial ratio	Ratio threshold		Applicability to financial statements of small enterprises
	No fraud	Fraud	
Days' sales in receivables index (DSRI)	DSRI $\leq$ 1.030 DSRI $\leq$ 1.031	DSRI $\geq$ 1.460 1 $\leq$ DSRI $\leq$ 1.5 DSRI $\geq$ 1.465	YES
Gross margin index (GMI)	GMI $\leq$ 1.041	GMI $\geq$ 1.190 GMI $\geq$ 1.193 1 $\leq$ GMI $\leq$ 1.2	YES
Sales growth index (SGI)	SGI $\leq$ 1.134 SGI $\leq$ 1.1	SGI $\geq$ 1.610 SGI $\geq$ 1.6 SGI $\geq$ 1.607	YES
Sales, general and administrative expenses index (SGAI)	SGAI $\leq$ 1.001 SGAI $\leq$ 1.054	SGAI $\geq$ 1.041	YES
Net profit and gross profit ratio (GP)	GP $\geq$ 0.362	GP $\leq$ 0.086	YES
Asset quality index (AQI)	AQI $\leq$ 1.040 AQI $\leq$ 1.041	1 $\leq$ AQI $\leq$ 1.25 AQI $\geq$ 1.254 AQI $>$ 1	NO
Deprecation index (DEPI)	DEPI $\leq$ 1.001	DEPI $\geq$ 1.077 DEPI $>$ 1	NO
Total accruals to total assets index (TATA)	TATA $\leq$ 0.018 TATA $\leq$ 0.016	TATA $\geq$ 0.031	NO
Leverage index (LEVI)	LEVI $\leq$ 1.037	LEVI $\geq$ 1.111 LEVI $\geq$ 1	YES
Return on current assets (ROCA)	ROCA $\geq$ 0.299	ROCA $\leq$ 0.057	YES
Stable funding ratio (SFR)	SFR $\geq$ 0.586	SFR $\leq$ 0.453	YES
Asset turnover (ATO)	ATO $\leq$ 1.54	ATO $\geq$ 2.243	YES
Current assets to total assets ratio (CATA)	CATA $\leq$ 0.473	CATA $\geq$ 0.667	YES
Inventory to total assets ratio (ITA)	ITA $\leq$ 0.190	ITA $\geq$ 0.321	YES
Cash to total assets ratio (CTA)	CTA $\leq$ 0.035	CTA $\geq$ 0.091	YES

Source: Wells (2001); Kanapickienė and Grundienė (2014); Mamo and Shehu (2015); MacCarthy (2017); Bhavani and Amponsah (2017)

balance sheets and profit (loss) statements without any obligation to prepare other statements (e.g., cash flow statement or statement of change in equity). The differences lie not only in the sizes of enterprises, but also in the national legal frameworks (Hýblová, 2019).

Certain financial ratios or models are impossible to calculate due to the lack of detailed data in the abridged version balance sheets or of other information provided in other statements (e.g., changes in equity or cash flows statements), which are not prepared in the case of small enterprises. Following the analysis of previous studies, the financial ratios potentially signalling a financial statement fraud were identified. Possible calculation of these financial ratios based on the financial statements of small enterprises is provided below (see Tab. 1).

The literature analysis has shown that, in case small enterprises choose to prepare an abridged balance sheet, the asset quality index (AQI) cannot be calculated as the tangible fixed assets are presented in the aggregate amount, while the data on the amounts of real estate are not available. The depreciation index (DEPI) and total accruals to total assets index (TATA) also cannot be calculated. A balance sheet or profit (loss) statement does not provide information about depreciation in the abridged financial statements. Other financial ratios presented in Tab. 1 can be calculated based on the data in the financial statements of small enterprises.

Tab. 2: Financial models for detection of financial fraud

Financial ratio	Ratio threshold		Applicability to financial statements of small enterprises
	No fraud	Fraud	
Altman model Z score (Mavengere, 2015)	$Z > 2.67$	$Z < 1.81$	YES
Modified Altman model Z score (Bhavani and Amponsah, 2017; Mavengere, 2015)	$Z > 2.67$	$Z < 1.81$	YES
Modified Altman model Z score for non-manufacturing enterprises (Mavengere, 2015)	$Z > 2.6$	$Z < 1.1$	YES
Modified Altman model Z score for developing markets (Al Zaabi, 2011)	$Z > 2.6$	$Z < 1.1$	YES
Beneish model M score (Mamo and Shehu, 2015; MacCarthy, 2017)	$M < -2.22$	$M > -2.22$	NO
Beneish model M score (Halilbegovic et al., 2020)	$M < -1.78$	$M > -1.78$	NO
Linear regression model Y score for pharmacy and automotive enterprises (Taherinia et al., 2019)	$Y < 0.05$	$Y > 0.05$	NO
Logistic regression model P score (Kanapickienė and Grundienė, 2015)	$P < 0.5$	$P > 0.5$	YES
Dechow model F score (Aghghaleh et al., 2016; Hakami et al., 2020)	$F < 1$	$F > 1$	NO
CFEBT model (Drábková, 2016)	CFEBT > 0.05 CFEBT > 0.1	CFEBT < 0.05	NO

Difference between the thresholds of financial ratios has been noticed, and certain researchers leave a grey area (MacCarthy, 2017; Kanapickienė and Grundienė, 2014) when the financial ratios are between fraud and no-fraud. The researchers point out that the values of financial ratios may be affected not only by fraud, but also by legitimate extraordinary operations. For example, the DSRI rate may increase due to changes in the credit policy (Wells, 2001). Therefore, the researchers recommend setting a grey area as a compromise between fraud and no-fraud in the respective situations (Karas and Režňáková, 2020).

In detection of fraud in financial statements, the researchers often integrate financial ratios into the designed financial models for detection of financial fraud. The researchers usually use the Altman model (Aghghaleh et al., 2016; MacCarthy, 2017; Bhavani and Amponsah, 2017; Karas and Režňáková, 2020; Georgiev and Petrova, 2020) and Beneish model (Mamo and Shehu, 2015; Drábková, 2016; MacCarthy, 2017; Bhavani and Amponsah, 2017; Halilbegovic et al., 2020) to disclose fraud in financial statements, while other researchers adapt or modify these models by country or company sectors (Georgiev and Petrova, 2020). The researchers (Aghghaleh et al., 2016; Hakami et al., 2020) also propose applying the Dechow model, which differs from other models in the higher level of probability of fraud in financial statements. Other researchers (Kanapickienė and Grundienė, 2015; Drábková, 2016; Taherinia and Talebi, 2019) have been exploring new models. This demonstrates the diversity of financial models for detection of financial fraud. The score threshold of the models mentioned above is identified in Tab. 2.

However, due to the abridged version of the balance sheet and the lack of additional information result, it is impossible to calculate the majority of models. Therefore, only the Altman Z-score model and logistic regression P-score model have been identified as appropriate for detection of fraudulent financial statements in the case of small enterprises.

Tab. 3: Relationship between elements of accounting and financial ratios and models

	Effect of accounting elements to financial ratios and models					
Financial ratios and models	**Revenue**	**Expenses**	**Profit**	**Assets**	**Equity**	**Liability**
DSRI	+			+		
GMI	+	+				
SGI	+					
SGAI	+	+				
GP			+		+	
LEVI				+		+
ROCA			+	+	+	
SFR				+	+	+
ATO	+			+		
CATA				+		
ITA				+		
CTA				+		
P-score	+			+		+
Z-score	+		+	+	+	+

In summary, twelve financial ratios and two financial models were identified in various empirical studies for detection of fraudulent financial statements applicable to the cases of small enterprises. Depending on the financial data needed for the calculation, the ratios and models have been assigned to the main elements of accounting (see Tab. 3).

Tab. 4 presents the examples of sample sizes used in various financial research works. It can be noted that large data sets are required for application of neural networks. On the other hand, the neuro-fuzzy may use smaller data sets.

The classification presented in Tab. 3 is used in subsequent sections of the present research.

2.2 Innovative Research Methods for Detection of Fraudulent Financial Statements

The early studies of financial fraud were based on the traditional linear financial models presented in Section 2.1. However, there are diverse financial models and ratios. In certain cases, these financial models and ratios may complement each other, while in other cases, they show conflicting results. Therefore, in the recent years, researchers have been employing various AI techniques for fraudulent financial statement investigation. These techniques are used for exploring solutions to complex problems that often require sophisticated systems in order to evaluate the accumulated results based on past data. The key issue was to identify how the respective researchers use various AI techniques to solve financial problems.

Following the systematic literature review, the AI methods used for detection of fraudulent financial statements were identified, such as fuzzy logic (Arora and Saini, 2013; Maltoudoglou et al., 2015; Antonelli et al., 2016; Omar et al., 2017; Nawrocki, 2018; Čičak and Vašiček, 2019; Tiwari et al., 2020), neural networks (Antonelli et al., 2016; Omar et al., 2017; Tiwari et al., 2020), neuro-fuzzy (Arora and Saini, 2013; Antonelli et al., 2016; Rostamy-Malkhalifeh et al., 2021) and decision trees (Arora and Saini, 2013; Chen et al., 2014; Lin et al., 2015; Antonelli et al., 2016; Omar et al., 2017; Zhang, 2020). Hence, previous empirical studies on these AI methods were analysed for finding an appropriate method to us.

Fuzzy systems may be applied well to financial modelling, and they are based on fuzzy set theory and fuzzy multivalued logic (Tiwari et al., 2020). The advantage of application of the fuzzy logic in financial research is that the classical bivalent logic is abandoned and an

Tab. 4: Examples of studies applying neural networks

Type of study	Examples of samples sizes
Neural networks	The sample consists of 550 company data, of which 440 company data are used for neural network training, 110 company data are used for model testing (Omar et al., 2017).
	Data of listed companies on the Bombay Stock Exchange (BSE) from 07/02/2012 to 17/02/2016, of which 70 per cent are used for neural network training and 30 per cent for testing (Tiwari et al., 2020).
	The study sample size was 129 cases of companies' fraud between 1998 and 2010 and 447 companies without fraud according to the established criteria, and 69 companies as controls sample. 70 per cent of fraudulent and non-fraudulent companies were randomly selected and 30 per cent the data was selected for training the data set (Zhang, 2020).
Neuro-fuzzy network	The sample consisted of financial data of 10 listed companies for 2010–2018, of which 80 companies used data for training and 10 companies used data for testing (Rostamy-Malkhalifeh et al., 2021).
	Banking bankruptcies study used 2012 data for training and testing the data – 480 (Arora and Saini, 2013).

alternative way of thinking is chosen. This enables the researchers to model complex systems and use the existing knowledge and experience (Čičak and Vašiček, 2019). In summary, various empirical studies (Huda et al., 2015; Nawrocki, 2018; Čičak and Vašiček, 2019) apply a logical scheme to the financial research based on fuzzy logic. When deciding on the software to be used for fuzzy logic application, certain researchers (Maltoudoglou et al., 2015; Čičak and Vašiček, 2019; Rostamy-Malkhalifeh et al., 2021) tend to opt for MATLAB™ software as it contains several tools for applying of fuzzy logic (Čičak and Vašiček, 2019). In MATLAB™, two fuzzy logic models – Sugeno or Mamdani – may be selected. Compared to the Mamdani method, the Sugeno method is mathematically more efficient in model construction and is applied more frequently to the optimization problems. The Mamdani method seems to be more appropriate and flexible when used for the intuitive models based on human reasoning (Čičak and Vašiček, 2019). Therefore, the Mamdani method is preferred in financial research (Nawrocki, 2018; Čičak and Vašiček, 2019).

In practice, the fuzzy models usually operate with the IF-THEN-type rules when the input and output variables are specified (Nawrocki, 2018; Čičak and Vašiček, 2019). The output values are based on possible combinations of these weighted rules (Čičak and Vašiček, 2019). Huda et al. (2015) propose using the linguistic values for the fraudulence variable by applying a broad scale of the level: no fraud (weight 0.01–0.25), between no fraud and fraud (weight 0.26–0.40), fraud (weight 0.41–0.60), real fraud (weight 0.61–0.75), very real fraud (weight 0.76–1.00).

The other two widely used methods in the financial research are the neural networks and neuro-fuzzy (Arora and Saini, 2013; Omar et al., 2017; Tiwari et al., 2020; Zhang, 2020; Rostamy-Malkhalifeh et al., 2021). Neural networks differ from other research methods in that they are trained to perform certain tasks according to the sample data sets (Omar et al., 2017). The artificial neural networks constitute the input and output layers and between them we may assign one or more hidden layers. These layers include given number of neurons and their interconnections. The neurons are working in parallel thus ensuring more of computational power, flexibility, simplicity and efficiency (Tiwari et al., 2020; Rostamy-Malkhalifeh et al., 2021). In neuro-fuzzy models, in turn, the initial fuzzy models are fine-tuned with neural networks (Arora and Saini, 2013; Antonelli et al., 2016; Rostamy-Malkhalifeh et al., 2021).

The results of empirical research reveal the advantages and disadvantages of comparing the application of fuzzy logic, neural network or neuro-fuzzy network. Tiwari et al. (2020) confirm that the both methods – neural network and fuzzy logic – provide similar results, but the neural networks have performed better in

the studies with stock prices. Omar et al. (2017) observed more reliable results provided by neural networks in the case of the fraud financial statement study. Nonetheless, they faced limitations in data sampling size and highlighted the need to use larger data sets for neural network learning.

In the analysis of the fraudulent financial statements, decision trees may also be applied (Chen et al., 2014; Lin et al., 2015; Antonelli et al., 2016; Omar et al., 2017; Zhang, 2020). This method is used for classification or discrimination of the financial variable values. The results generally indicate a high degree of accuracy when company's fraudulent financial statements are assessed by using the available public financial data. However, the results may be different for small enterprises because their financial statements are not publicly available, and the research in relation thereof is insufficient (Omar et al., 2017). A decision tree is constructed by using certain classifying or discriminating elements for the variables (Lin et al., 2015) and then optimal associations between these classes are created (Antonelli et al., 2016). In this context, if-then classification rules are also created (Antonelli et al., 2016; Zhang, 2020) and, finally, the decision tree with the branches is obtained (Lin et al., 2015). The results concerning financial frauds reveal that the reliability of the decision tree is about 90 per cent, same as using the neural networks (Zhang, 2020).

Hence, the fuzzy logic method seems applicable to the problem setting in the context of the present research due to the linguistic variables and simple models. In addition, other methods such as the decision trees, may be applied.

3 METHODOLOGY AND DATA

3.1 Lithuania Case Study and Sampling Characteristic

It is important to mention that micro and small enterprises prevail on the EU market. They are also more vulnerable than medium-sized or large enterprises. Micro and small enterprises together account for about 99 per cent of the total business in the EU (Deac, 2014; European Commission, 2021). According to Eurostat, micro and small enterprises accounted for 98.8 per cent of all enterprises in Lithuania in 2019, same as in 2017 and 2018. According to the statistics, small businesses often failed. According to the data by Eurostat, the number of enterprise deaths was estimated at about 50k enterprises in 2018 in Lithuania. About 99 per cent of deaths among the small enterprises were micro enterprises (with less than four employees). According to the data by Eurostat for 2010–2017, an average of 16 per cent of the active enterprises per year were terminated the Lithuania. Since 2018, the death rate of enterprises started to increase. In 2018, the death rate was almost 18 per cent, and in 2019, more than 22 per cent.

According to the Lithuanian study (AVNT, 2018) based on the analysis of bankruptcy reports of the enterprises, the main reasons for bankruptcy identified were the following: excessive debts accumulated and excessive risks assumed (about 30 per cent); lack of working capital and credit problems (about 22 per cent); loss of market or partners (about 10 per cent); poor corporate governance (about 7 per cent). One of the reasons for debt growth or risk mismanagement may be the fraudulent financial statements.

The Authority of Audit, Accounting, Property Valuation and Insolvency Management (AVNT, 2020) reported the trend of decrease in the enterprise bankruptcy proceedings by about 23 to 30 per cent in 2019–2020. However, the COVID-19 virus, which has disrupted the normal life of society, the lockdown, and financial support measures for the business have influenced the decrease in the number of bankruptcy proceedings (AVNT, 2021).

Court cases on fraudulent accounting reveal the existing problems in Lithuanian enterprises caused by the financial data fraud. The contents of the court cases have revealed that financial

fraud occurs when enterprises fail to record the revenue received (Plungės ..., 2020), forge the payment documents (Klaipėdos ..., 2020), and commit other fraud on fixed assets, current assets, cash, or equity (Kauno apylinkės ..., 2021). The court cases have shown that the enterprises submitted fraudulent financial statements to the Register of Legal Entities and other parties (Kauno apygardos teismo teisėja, 2021; Kauno apygardos teismo Civilinių ..., 2021). Fraud in accounting data and financial statements leads not only the bankruptcy of the enterprises themselves, but also to the financial difficulties of the cooperating enterprises.

According to the data by Statistics Lithuania (the Lithuanian Department of Statistics) (eliminating the public sector), there were 101k enterprises with less than 250 employees at the beginning of 2019. For the research to have a 95 per cent confidence interval and meet the 0.06 error requirement, the sample of 383 companies had to be reached. The data were collected during preparation of the previous technical feasibility study "Feasibility study on development of an innovative tool for detection of falsification of financial statements" (2021, No. 01.2.1-MITA-T-851-02-0171) . Data of financial statements of 60 micro or small enterprises for the period 2017–2019 were collected. The error requirement for the research was 0.13 with 95 per cent confidence interval. Due to the variety of data, the financial statements of enterprises were collected by different life cycle; therefore, some of the sampled enterprises did not prepare any statements for each subsequent year in the period 2017–2019.

Of the sampled enterprises, only 11 enterprises prepared financial statements as micro enterprises (the abridged balance sheet and abridged profit (loss) statement by nature). In several cases, certain enterprises prepared different financial statements in different years of the respective period. The research was therefore limited to the version of financial statements intended for small enterprises. The data of the total of 129 financial statements (abridged balance sheet and profit (loss) statement by function) were collected: 33 enterprises in 2017, 46 enterprises in 2018, and 50 enterprises in 2019. After the review of the data of financial statements and selected financial ratios and models in Section 1, certain enterprises had to be excluded. In some cases, the SGAI financial ratio of certain enterprises could not be calculated as no sales and administrative expenses were provided in the profit (loss) statements. New enterprises had not earned sales revenue yet, and it was impossible to calculate the financial ratios of DSRI, GMI and SGI. Certain financial ratios required two years of data; therefore, the enterprises operating in the first year had to be eliminated. For certain enterprises, the logistic regression model by Kanapickienė and Grundienė (2015) could not be calculated as the enterprises did not have any fixed assets.

Following assessment of all the limitations of the present research, the data of 107 financial statements were used: data of 26 enterprises in 2017, 37 enterprises in 2018, 44 enterprises in 2019 (see Tab. 5). Due to the data protection regulation, depersonalised company data were obtained. It was therefore impossible to assess the companies by number of employees or by sector.

Tab. 5: Revenue and asset values in the financial statements used in this research ($N = 107$)

Year	**2017**	**2018**	**2019**
Enterprises (N)	26	37	44
Revenue, Euro			
>700k	50.0%	56.8%	54.5%
700k–8m	50.0%	40.5%	43.2%
8–40m	0.0%	2.7%	2.3%
Assets, Euro			
>350k	26.9%	37.8%	38.6%
350k–4m	69.2%	56.8%	56.8%
4m–20m	3.8%	2.7%	2.3%

The Accounting Directive 2013/34/EU (Directive 2013/34/EU of the European Parliament ..., 2013) of the EU provides for three criteria for assessment of the size of enterprises (revenue, assets, employees number), two of which shall be met within two years. The analysis of the mentioned criteria showed that the enterprises divided evenly into micro and small enterprises according to the revenue criterion. However, the analysis of assets showed

that the majority of the enterprises were small enterprises according to the asset criterion. Nevertheless, without any data on employees, it was impossible to make a definitive conclusion as to what share of enterprises were micro or small enterprises.

3.2 Research Methodology

The methodology of the present research was based on the financial ratios and models discussed in Section 2.1 as well as the use of the abridged financial statements intended for small enterprises. The research methods were discussed in Section 2.2. Fig. 1 presents the stages of the research.

First, as presented in Section 2.1, 12 financial ratios and two financial models suitable for the abridged financial statements of micro and small enterprises, were selected. Second, as presented in Tab. 3, the financial ratios and models were grouped into six groups by relationship between the elements of accounting and financial ratios and models. The six groups were transformed into six input variables. Third, the financial ratios and model were calculated with Microsoft Excel™. The results accounting for the thresholds of financial ratios and models were encoded (see Tab. 6) according to the thresholds in Section 2.1. The minimum and maximum values of the thresholds were encoded as no fraud (0) and fraud (1), respectively, and intermediate values, the so-called the grey area, were encoded as possible fraud (0.5).

Then, the average fraud rate was derived from the selected enterprises in each group of the accounting elements by these thresholds (see Tab. 6). The average fraud results of each group by elements of accounting (see Tab. 3) were the values of the six input variables presented in step 2 of our research scheme (see Fig. 1).

As indicated by the analysis in Section 2.2, the neural networks could not be applied in the present research due to the small data set. Therefore, the fuzzy logic was chosen. Stage 4 of the research methodology was dedicated to the design of the fuzzy model for detection of fraudulent financial statements. The analysis in Section 2.1 showed that the calculated level of fraud was not necessarily an indication of falsification of the data by the enterprise. In certain cases, deviation of the financial data may be influenced by other factors such as loss of markets, change in credit conditions, etc. Controversial results may also be obtained in case of detection of fraud for one element of accounting only. For the reasons mentioned above and based on the analysis of the literature in Section 2.2, the fuzzy model was considered to be the most appropriate for the research.

The MATLAB™ software and fuzzy logic toolbox were used. Application of the fuzzy logic method under the Mamdani method was selected. The six input variables (the level of fraud of revenue, expenses, profit (loss), assets, equity, and liabilities) and one output variable were formed to determine the level of the financial statement fraud. Weights were set for the input and output variables. The following weights of the input variables were set: 0.00–0.25 – no fraud; 0.25–0.60 – possible fraud; 0.40–1.00 – fraud. The following weights of the output variables were set: 0.00–0.25–0.40 – no fraud; 0.40–0.50–0.60 – between possible fraud and no fraud; 0.60-0.70-1.00 – fraud. It was noticed that, in practice, the financial statements were unlikely to be completely fraudulent, and the value of the investigation would be 1 (total fraud). Fraud is usually committed in relation to actual enterprise data; therefore, it is impossible to actually have a financial statement containing total fraud (weight 1). In the real world, it is also unlikely to find an enterprise, all ratios of which would indicate that financial statements are absolutely fair (weight 0). However, depending on the data set used, it is possible that the sample enterprises will not have a weight of 0, as on average, all enterprises feature a certain level of fraud. The results may also be affected by sectors. This could apply to service enterprises, where the level of assets is low and the ratios related to assets may indicate fraud, when, in fact, it does not exist.

A solution rule base consisting of 90 IF-THEN rules was created (see Tab. 7). The rules were designed on the basis application of double entry in accounting: a fraud of profit and (or) equity may be affected by a fraud of revenue and expenses; liabilities and (or) expenses and

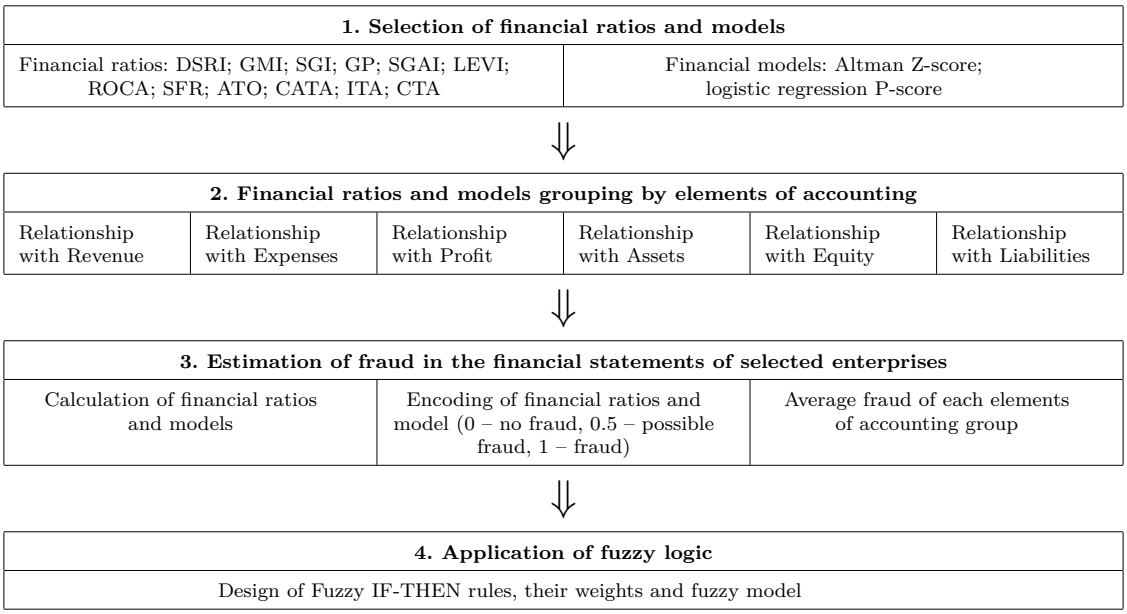

Fig. 1: Research scheme for detection of fraudulent financial statements

Tab. 6: Examples of financial ratios and models for encoding thresholds

Ratios and models encoding	**0 – no fraud**	**0.5 – possible fraud**	**1 – fraud**
DSRI	DSRI < 1.00	$1 <$ DSRI < 1.46	DSRI > 1.46
GMI	GMI < 1	$1 <$ GMI < 1.19	GMI > 1.19
SGI	SGI < 1.1	$1.1 <$ SGI < 1.6	GMI > 1.6
SGAI	SGAI < 1.001	$1.001 <$ SGAI < 1.041	SGAI > 1.041
GP	GP > 0.362	$0.086 <$ GP < 0.362	GP < 0.086
TATA	TATA < 0.016	$0.016 <$ TATA < 0.031	TATA > 0.031
LEVI	LEVI < 1	$1 <$ LEVI < 1.111	LEVI > 1.111
ROCA	ROCA > 0.299	$0.057 <$ ROCA < 0.299	ROCA < 0.057
SFR	SFR > 0.586	$0.453 <$ SFR < 0.586	SFR < 0.453
ATO	ATO < 1.54	$1.54 <$ ATO < 2.243	ATO > 2.243
CATA	CATA < 0.473	$0.473 <$ CATA < 0.667	CATA > 0.667
ITA	ITA < 0.19	$0.19 <$ ITA < 0.321	ITA > 0.321
CTA	CTA < 0.035	$0.035 <$ CTA < 0.091	CTA > 0.091
Z-score	Z > 2.6	$1.1 <$ Z < 2.6	Z < 1.1
P-score	P < 0.4	$0.4 <$ P < 0.5	P > 0.5

(or) equity may be affected by a fraud of assets; expenses and (or) assets may be affected by a fraud of liabilities; etc.

It should be noted that the number of rules drawn up may be determined by various factors such as the researcher's accounting experience, peculiarities of the national accounting framework, size of the enterprises, and other factors. The model developed by the authors of the present paper was applied to detection of fraudulent financial statements and interpretation of the results obtained in this research. The linguistic values (see Fig. 2) were used for determination of the fraudulence level.

Tab. 7: The fuzzy input and output values used in the authors' Mamdani model

Code: 1 – no fraud; 2 – possible fraud; 3 – fraud Input: column 1 revenue; 2 – expenses; 3 – profit; 4 – assets; 5 – equity; 6 – liabilities Output: column 7 – fraudulence level				
R1: 1 1 1 1 1 1, 1	R19: 1 3 2 1 1 2, 2	R37: 3 1 3 1 3 1, 3	R55: 1 1 1 2 2 1, 2	R73: 1 1 1 3 2 1, 2
R2: 2 1 1 1 1 1, 1	R20: 2 1 3 2 1 1, 2	R38: 3 1 3 1 1 3, 3	R56: 1 1 1 2 3 1, 3	R74: 1 1 1 3 3 1, 3
R3: 1 2 1 1 1 1, 1	R21: 2 1 3 1 2 1, 2	R39: 1 3 3 3 1 1, 3	R57: 1 1 1 3 2 1, 3	R75: 1 1 1 1 2 2, 2
R4: 1 1 2 1 1 1, 1	R22: 2 1 3 1 1 2, 2	R40: 3 1 1 3 1 1, 3	R58: 1 1 1 3 1 3, 3	R76: 1 1 1 1 2 3, 2
R5: 1 1 1 2 1 1, 1	R23: 1 2 3 2 1 1, 2	R41: 3 3 3 3 3 3, 3	R59: 1 1 1 2 1 3, 3	R77: 1 1 1 1 3 2, 2
R6: 1 1 1 1 2 1, 1	R24: 1 2 3 1 2 1, 2	R42: 3 3 3 3 3 2, 3	R60: 1 1 1 3 1 2, 3	R78: 1 1 1 1 3 3, 3
R7: 1 1 1 1 1 2, 1	R25: 1 2 3 1 1 2, 2	R43: 3 3 3 3 3 1, 3	R61: 1 1 1 2 1 2, 2	R79: 2 2 2 2 1 1, 2
R8: 2 1 2 2 1 1, 2	R26: 2 1 2 3 1 1, 2	R44: 3 3 3 2 3 3, 3	R62: 1 2 1 2 1 1, 2	R80: 2 2 2 3 1 1, 2
R9: 2 1 2 1 2 1, 2	R27: 2 1 2 1 3 1, 2	R45: 3 3 3 2 2 3, 3	R63: 1 3 1 2 1 1, 3	R81: 2 3 2 3 1 1, 3
R10: 2 1 2 1 1 2, 2	R28: 2 1 2 1 1 3, 2	R46: 3 3 3 2 1 3, 3	R64: 1 2 1 3 1 1, 3	R82: 2 3 3 3 1 1, 3
R11: 1 2 2 2 1 1, 2	R29: 1 2 2 3 1 1, 2	R47: 3 3 2 1 1 2, 3	R65: 1 3 1 3 1 1, 3	R83: 3 3 3 3 1 1, 3
R12: 1 2 2 1 2 1, 2	R30: 1 2 2 1 3 1, 2	R48: 3 3 3 1 1 2, 3	R66: 2 1 1 2 1 1, 2	R84: 2 2 2 1 2 1, 2
R13: 1 2 2 1 1 2, 2	R31: 1 2 2 1 1 3, 2	R49: 3 3 3 1 1 3, 3	R67: 2 1 1 3 1 1, 3	R85: 3 2 2 1 2 1, 2
R14: 3 1 2 2 1 1, 2	R32: 3 1 2 1 3 1, 3	R50: 1 1 1 2 2 2, 2	R68: 3 1 1 2 1 1, 3	R86: 3 3 2 1 2 1, 3
R15: 3 1 2 1 2 1, 2	R33: 3 1 2 1 1 3, 3	R51: 1 1 1 3 2 2, 2	R69: 1 3 3 1 3 1, 3	R87: 3 3 3 1 2 1, 3
R16: 3 1 2 1 1 2, 2	R34: 1 3 2 3 1 1, 3	R52: 1 1 1 3 3 2, 3	R70: 1 3 3 1 1 3, 3	R88: 3 3 3 1 3 1, 3
R17: 1 3 2 2 1 1, 2	R35: 1 3 2 1 3 1, 3	R53: 1 1 1 3 3 3, 3	R71: 1 1 1 2 2 1, 2	R89: 2 2 2 1 1 2, 2
R18: 1 3 2 1 2 1, 2	R36: 1 3 2 1 1 3, 3	R54: 1 1 1 3 3 1, 3	R72: 1 1 1 2 3 1, 2	R90: 3 2 2 1 1 2, 2

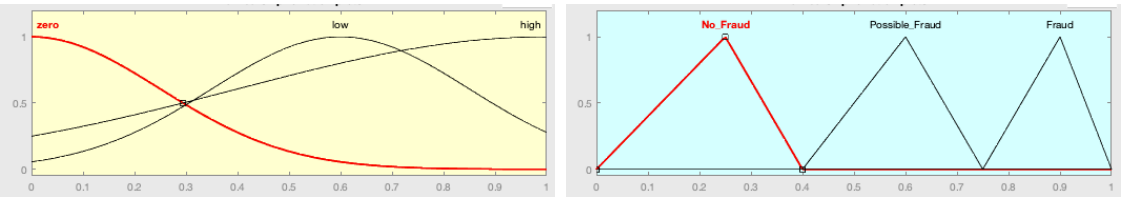

Fig. 2: The fuzzy input and output values used in the authors' Mamdani model

4 RESULTS

4.1 Methods of Analysis and Research Results

Three methods of data analysis were used: fuzzy reasoning, conventional statistics, and the generalized mean (Dyckhoff and Pedrycz, 1984). The input data were collected as mentioned above. Meanwhile, the corresponding outputs for the variable risk of fraudulence, namely, the fraudulence level, were first generated by applying the authors' fuzzy rule-based Mamdani model that included 90 rules altogether (Mamdani and Assilian, 1975). The rules had the following form:

If Revenue is _ and Expenses are _ and Profit is _ and Assets are _ and Equity is _ and Liability is _, then Fraudulence level is _. (1)

Linguistic variable values zero, low and high for the Fraudulence level were used. For example:

If Revenue is high and Expenses are low and Profit low and Assets are zero and Equity is zero and Liability is zero, then Fraudulence level is high. (2)

The fuzzy model was applied to the empirical input data during calculation of the fraudulence levels. The augmented data set was used in the investigations below (Fig. 3, Tab. 7).

The mean was noticed to be approximately 0.64. The range and standard deviation were quite small in the case of the fraudulence levels (see Tab. 8).

Various intercorrelations prevailed between the variables due to their expected real in-

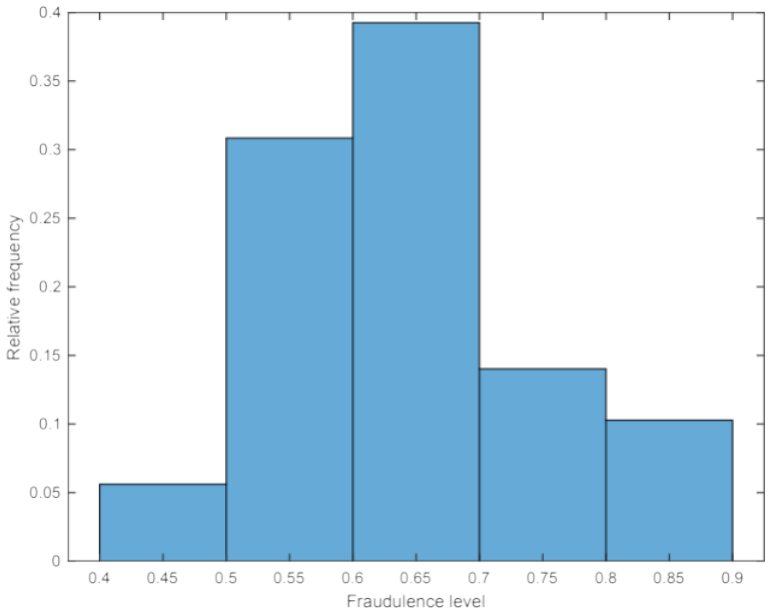

Fig. 3: Fuzzy Mamdani model outputs for fraudulence level with the research data

Tab. 8: Descriptive statistics of the research data ($N = 107$)

	Minimum	**Maximum**	**Mean**	**Std. deviation**
Revenue	0.0000	0.6875	0.349883	0.1575675
Expenses	0.0000	1.0000	0.460300	0.3636600
Profit	0.0000	1.0000	0.510125	0.2155846
Assets	0.0789	0.7632	0.374570	0.1571723
Equity	0.0000	1.0000	0.490654	0.2198513
Liabilities	0.0000	1.0000	0.273364	0.2445640
Fraudulence level	0.4355	0.8811	0.640106	0.1073657

Tab. 9: Intercorrelations between the variables ($N = 107$)

		Revenue	**Expenses**	**Profit**	**Assets**	**Equity**	**Liabilities**	**Fraudulence level**
Revenue	Pearson Correlation	–						
Expenses	Pearson Correlation	0.536	–					
	Sig. (2-tailed)	< 0.011						
Profit	Pearson Correlation	0.061	0.090	–				
	Sig. (2-tailed)	0.532	0.354					
Assets	Pearson Correlation	0.682	0.105	0.308	–			
	Sig. (2-tailed)	< 0.001	0.280	0.001				
Equity	Pearson Correlation	0.201	0.132	0.900	0.519	–		
	Sig. (2-tailed)	0.030	0.176	< 0.001	< 0.001			
Liabilities	Pearson Correlation	0.525	0.059	0.516	0.774	0.719	–	
	Sig. (2-tailed)	< 0.001	0.549	< 0.001	< 0.001	< 0.001		
Fraudulence level	Pearson Correlation	0.523	0.398	0.797	0.623	0.865	0.753	–
	Sig. (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	

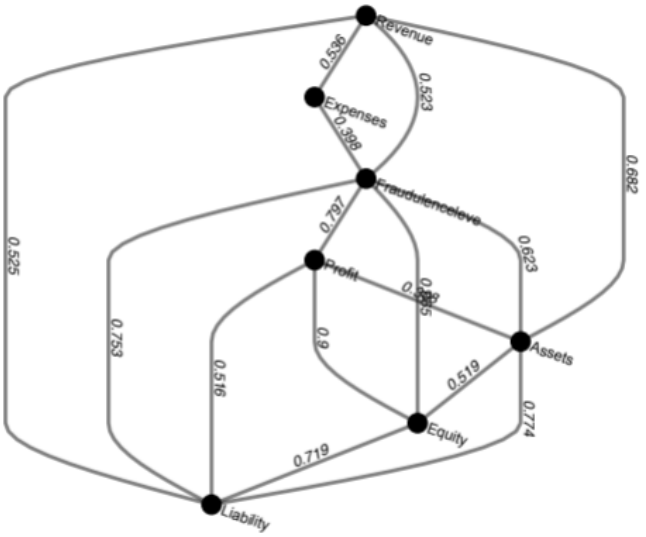

Fig. 4: Depiction of intercorrelations between the research variables

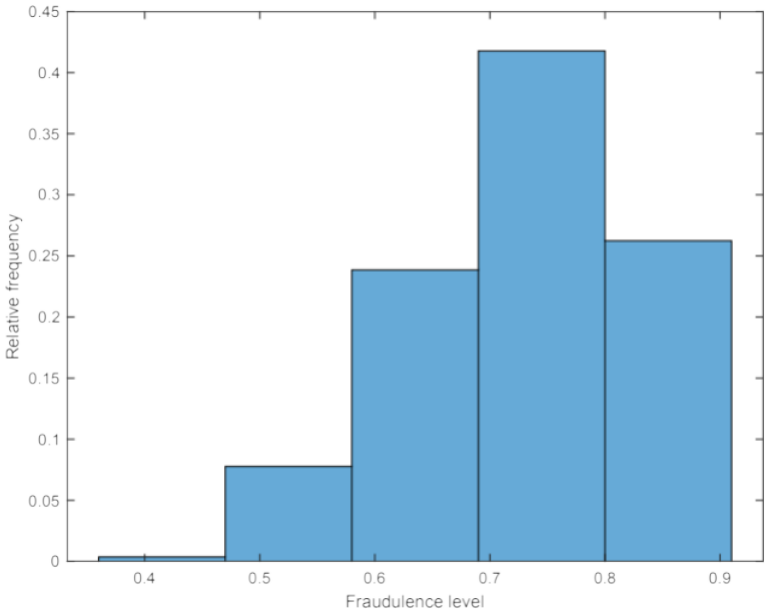

Fig. 5: Fuzzy Mamdani model outputs for the fraudulence level with 200,000 random input vectors

terconnections. It was nevertheless decided to keep all the original variables in the model design (Fig. 4, Tab. 9). For example, it is a well-known fact in accounting that assets and equity will eventually have a strong connection. Generally, everything seems to depend on everything else in this problem setting. Hence, to study the real essence of fraudulence, possible interactions between the variables also had to be considered.

For better justification of the fuzzy model proposed by the authors, testing simulations were performed with 200,000 random input vectors, the component values of which ranged from 0 to 1. The outputs obtained ranged from 0.395 to 0.882 and the expected value thereof

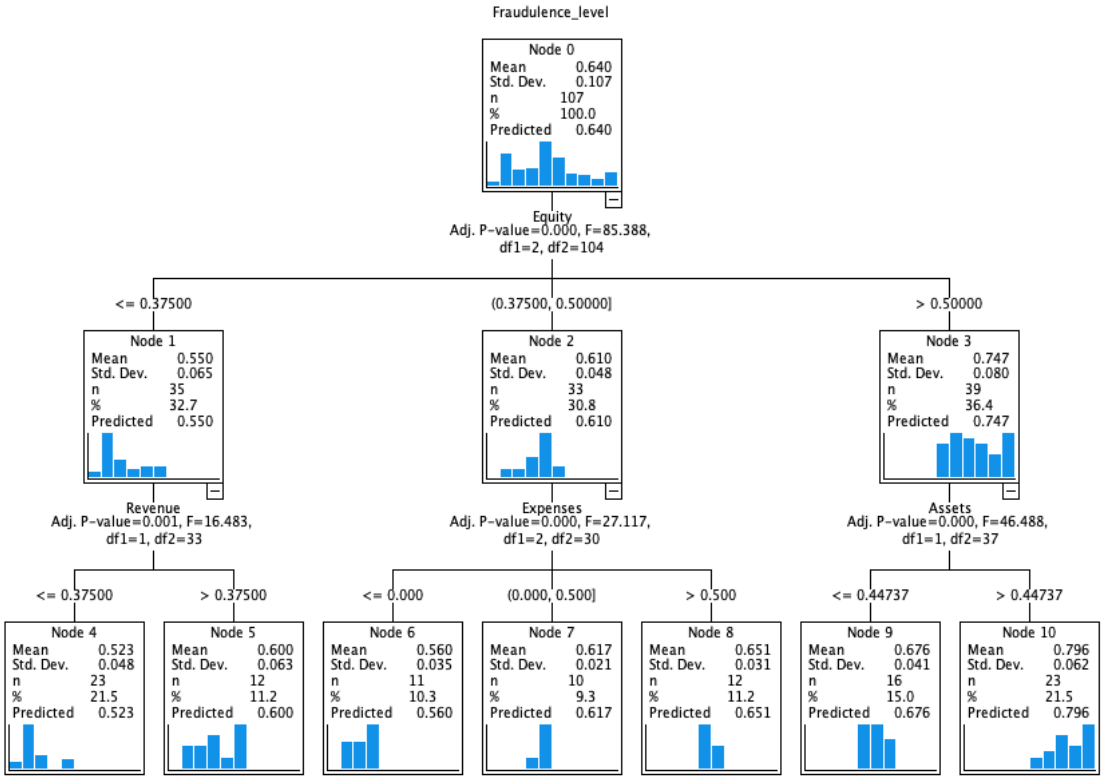

Fig. 6: Decision tree for fraudulence levels with the research data

was 0.726 with the standard deviation of 0.095 (Fig. 5). The quartile values thereof were 0.672, 0.723 (median) and 0.805, respectively. The fuzzy model proposed by the authors thus seems to have yielded a somewhat negatively skewed normal distribution for the fraudulence level values.

Since the fuzzy model proposed by the authors was based on the data of the selected Lithuanian enterprises, this may explain why the fraudulence level results were not higher than 0.9. In fact, very high fraudulence levels would have indicated that the given financial statements were false. This situation seems counterfactual in the real world because the statements are issued according to the financial accounting data of the enterprises. Hence, very high fraudulence level values in the authors' model seem to suggest that the input data provided are not based on the actual accounting data.

On the other hand, the fraudulence values may be affected by human factors such as accounting errors. These factors may be the possible causes behind the failure of the proposed fuzzy model to yield fraudulence level values less than 0.4. It is therefore assumed that the proposed fuzzy model seems to be appropriate for analysis of the fraudulence levels in the above-mentioned context.

The decision tree analysis under the exhaustive CHAID method was applied by using SPSSTM for the examination of how the discrimination of the empirical data was performed with respect to the fraudulence levels (Fig. 6). In the model proposed, which only allowed three classes of the variables, the risk of erroneous predictions was only 0.2 per cent. Hence, in the

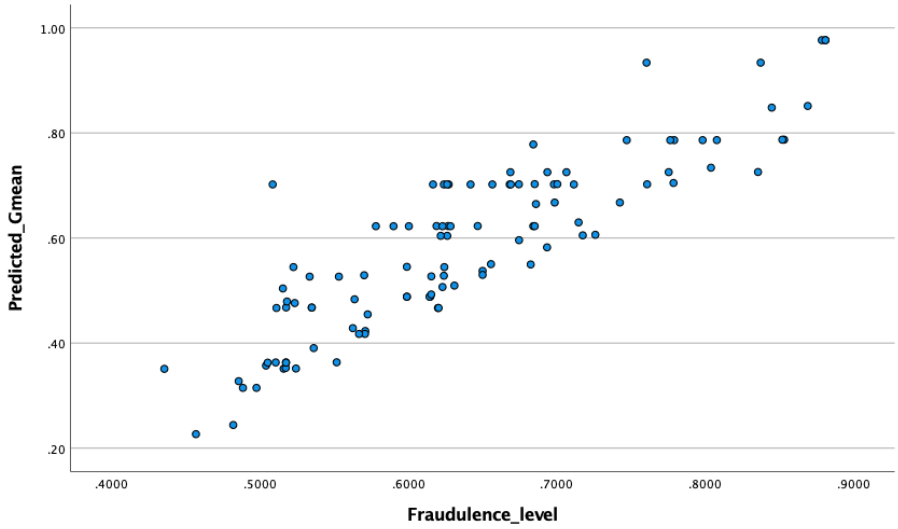

Fig. 7: Predicted vs. observed values in the generalized mean model

decision model, these paths yielded the highest fraudulence levels:

$$\begin{aligned}&\text{If Equity} \leq 0.375 \\ &\text{and Revenue} > 0.375, \\ &\text{mean Fraudulence level} = 0.6\end{aligned} \tag{3}$$

$$\begin{aligned}&\text{If } 0.375 < \text{Equity} \leq 0.5 \\ &\text{and Expenses} > 0.5, \\ &\text{mean Fraudulence level} = 0.651\end{aligned} \tag{4}$$

$$\begin{aligned}&\text{If Equity} > 0.5 \\ &\text{and Assets} > 0.447, \\ &\text{mean Fraudulence level} = 0.796\end{aligned} \tag{5}$$

On the other hand, the path for the lowest fraudulence levels was:

$$\begin{aligned}&\text{If Equity} < 0.375 \\ &\text{and Revenue} < 0.375, \\ &\text{mean Fraudulence level} = 0.523\end{aligned} \tag{6}$$

The decision tree proposed seems to confirm the basic principle of accounting, namely, Assets = Liabilities + Equity. Hence, when Equity increases, Assets increase as well. This connection may be explained by the fact in accounting that a fraudulent change in the value of its assets by an enterprise will also lead to a change in the amount of equity.

Finally, the generalized mean was applied as an aggregation operator because this method may reveal how the input variables, X, were weighted and compensated with respect to the output variable, Y (Yager, 1988). In this sense, this operation represents descriptive multi-criteria decision-making assessment. The following formula may thus be applied:

$$Y = \left(\sum_i W_i \times X_i^p \right)^{1/p}, \tag{7}$$

$$0 \leq X_i \leq 1, \quad \sum_i W_i = 1, \quad p \in \mathbb{R},$$

in which weights, W, and degree of compensation, p, are optimized.

Hence, for example, the following interpretations may be made:

$$\begin{aligned}&\text{If } p \to -\infty,\ Y = \min(X_i) \\ &\text{If } p = -1,\ Y = \text{harmonic mean of } X_i \\ &\text{If } p = 0,\ Y = \text{geometric mean of } X_i \\ &\text{If } p = 1,\ Y = \text{mean of } X_i \\ &\text{If } p = 2,\ Y = \text{quadratic mean of } X_i \\ &\text{If } p \to \infty,\ Y = \max(X_i)\end{aligned} \tag{8}$$

In the case considered, the genetic algorithm of MATLAB™ was applied first, and then the parameters were fine-tuned with the Levenberg-Marquart algorithm. These methods were used several times to verify the stability of the parameter values. It was noticed that the generalized mean models yielded RMSEs < 0.01

and variables Assets and Equity were the most important factors with their approximate weight values of 0.3. Meanwhile, the weights of other variables were close to zero. The degree of compensation, p, was greater than 20, and the highest input variable values thus seemed to have the strongest effect on the fraudulence level values (Fig. 7).

The above outcomes, namely, the highest input vector values, which had the strongest effect on the fraudulence levels, were also obtained with the OWA compensation operator that was applied in order to double-check the nature of compensation (Yager, 1988). Under the OWA method, both the weights, W, and the input vector values, X, were first ordered, and then the weighted mean of inputs, Y, were calculated:

$$Y = \left(\sum_i W_i \times X_i \right), \tag{9}$$

$$0 \leq W_i \leq 1, \quad \sum_i W_i = 1.$$

Hence, the highest weights were used for the highest input values and vice versa. The model yielded RMSE = 0.01 with the above optimization methods and the parameters, W. The highest inputs generated the approximate weight values of 0.45 in the computer simulations performed.

A checking data set, which was not used in the fuzzy model construction, was also collected for more thorough examination of the model proposed. However, since only the input values were available, their output values, the fraudulence levels, were calculated again with the proposed fuzzy Mamdani model (Tab. 10). It was therefore impossible to use the actual checking data for cross-validation.

In this context, the highest input variable values were also noticed to have the strongest effect on the fraudulence level estimation when the generalized mean and OWA methods were applied to the optimization simulations performed.

As mentioned above, the rules used in the fuzzy model proposed were based on the principle of double entry. Therefore, if two elements of accounting indicated a higher level of fraudulence, fraudulent financial statements were detected. Case 6 in the checking data (Tab. 10) may confirm this idea. If the profit had been fraudulent (0.67) under the double entry, the change would have been visible in equity (0.75). When similar relationship was detected, it could be concluded that the financial statements would be fraudulent (0.67). When using the linguistic variables (Huda et al., 2015), this meant the real fraud (weight 0.61–0.75). Case 3 in the checking data (Tab. 10), in turn, showed different situation at the enterprise. Fraud in expenses could be seen (weight 0.41–0.60), but other accounting elements indicated (Huda et al., 2015) that the fraud did not exist (weight 0.01–0.25). Based on the linguistic variables, this cannot be claimed to be a real fraud. In case of checking data number 3, it could potentially be claimed to be a fraud, because the changes in profit were not reflected in another elements of accounting under the double entry.

The limitation of our research is that we did not have the possibilities to check the financial data of those enterprises which were punished by court for financial crimes. The object of our research was micro and small enterprises that are not public and thus in court cases for financial fraud the names of enterprises and their owners as well as managers are not disclosed in publicly due to the data protection regulation.

Summarizing the results of our research, it could be stated that, in the case of the Lithuanian micro and small enterprises, the developed fuzzy model based on the selected financial ratios and models can be used for determination of the level of fraud. Based on the selected enterprises sample ($N = 107$) in the present research, the level of fraudulence in different enterprises ranged from 0.4 to 0.9. Similar results were obtained using the checking data. In the case of checking data ($N = 13$), the level of fraud ranged approximately from 0.4 to 0.7. Based on the linguistic variables, a real fraud can be considered to exist when then fraudulence levels rise to 0.61. The developed fuzzy model for detection of fraudulent financial

Tab. 10: Checking data inputs and the predicted fraudulence levels thereof

N	Revenue	Expenses	Profit	Assets	Equity	Liabilities	Fraudulence
1	0.19	0.00	0.58	0.42	0.44	0.13	0.52
2	0.44	0.50	0.33	0.55	0.31	0.38	0.62
3	0.25	0.50	0.08	0.13	0.06	0.13	0.44
4	0.19	0.00	0.08	0.24	0.31	0.25	0.50
5	0.50	0.50	0.08	0.37	0.06	0.19	0.58
6	0.13	0.00	0.67	0.29	0.75	0.25	0.67
7	0.31	0.00	0.08	0.39	0.06	0.25	0.52
8	0.19	0.00	0.08	0.34	0.06	0.13	0.47
9	0.19	0.25	0.67	0.18	0.50	0.00	0.61
10	0.13	0.00	0.67	0.26	0.50	0.00	0.59
11	0.38	0.00	0.58	0.42	0.56	0.31	0.61
12	0.44	0.50	0.67	0.45	0.63	0.38	0.72
13	0.13	0.00	0.33	0.37	0.31	0.06	0.51

statements enables determination of not only the level of fraud in the financial statements, but also estimation of the level of fraud in each individual element of accounting. This provided additional information and the possibility to determine what manipulations might have taken place at the enterprise in order to prepare the fraudulent financial statements.

5 DISCUSSION

The study presented in the paper pursued the second objective and focused on the design of a model that would enable detection of the fraudulence level of a financial statement. The advantage of the model proposed is that the model is based on the financial ratios and models which are available for the financial statements of enterprises. In terms of practical application, the model facilitates the detection of fraudulent financial statements as it eliminates the need for additional non-financial indicators. Certain researchers have proposed the Beneish M-score (Mamo and Shehu, 2015; Mavengere, 2015; Aghghaleh et al., 2016; MacCarthy, 2017; Bhavani and Amponsah, 2017; Teherinia et al., 2019; Halilbegovic et al., 2020) and Dechow F-score (Aghghaleh et al., 2016) financial models that are characterised by fairly high reliability. In the case of the present study, however, these models could not be applied to micro and small enterprises due to the abridged financial statements used by them. The authors therefore explored other options and proposed a fuzzy model for detection of fraudulent financial statements.

The fuzzy model proposed is intended to be used as a tool for managerial decision-making at enterprises. Meanwhile, the models proposed by other researchers are based on the listed enterprises and focus more on support to the investment process (Nawrocki, 2018). The fuzzy model proposed here may help the owners and managers of micro and small enterprises detect fraud of business partners and reduce the business risk. This study may be helpful to the regulators for identification of the fraudulence level in the financial statements. The model presented may be used as a prevention tool to reduce unfair business practice and to help fair businesses compete on the market.

With the larger set of variables in the fuzzy model proposed, the model is believed to ensure more reliable results. Twelve financial ratios and two financial models were combined and grouped by elements of accounting. Compared to other studies, larger number of indicators was

selected, although there were certain limitations related to the abridged version of financial statements. Meanwhile, different numbers of financial variables were found in other studies. In these studies (Čičak and Vašiček, 2019; Rostamy-Malkhalifed et al., 2021), six financial variables were used, in study (Chen et al., 2014) – seven financial variables, and in (Omar et al., 2017) – ten financial variables. Certain studies were different in that they focused on the tax issue and included the taxation-related variables (Čičak and Vašiček, 2019). The study presented in the paper did not investigate the compatibility of tax rules with accounting rules and its effects on the fraud in financial statements. This could be a new direction in the future research.

Only a few studies used a larger number of financial variables: fourteen in (Maltoudoglou et al., 2015) and fifteen in (Nawrocki, 2018). The studies with larger number of financial ratios often applied the fuzzy logic models (Maltoudoglou et al., 2015; Nawrocki, 2018), but the applied financial ratios differed from the ones in the present research as the former used the listed enterprises. The main difference of the fuzzy model proposed here and the ones proposed in the previous research was the number of fuzzy rules: 90 rules used in the present study versus 27 fuzzy rules in (Nawrocki, 2018) and 81 rules in (Čičak and Vašiček, 2019).

In summary, the proposed model has the following advantages. First, the model is based on larger number of financial ratios and models which are applicable in practice. Second, it can be applied to micro and small enterprises both as a decision-making tool and as a regulatory prevention tool for fair activity of the enterprises. Third, the fuzzy model is more reliable due to the large number of fuzzy rules, thus enabling it to identify correctly small deviations in fraudulent financial statements. Hence, the large number of fuzzy rules will avoid better the misinterpretations stemming from the grey area. The results suggest that the proposed model can be improved with a larger sample size and using neural networks in the future research.

6 CONCLUSIONS

In this paper, a fuzzy model for detection of fraudulent financial statements was proposed based on fourteen financial indicators combined into six input variables according to the relationships with the elements of accounting (revenue, expenses, profit, assets, equity, liabilities). Such a combination of variables provides insights into possible cases of fraud in relation to these elements of accounting, and not just assessment of fraud in financial statements in general. The uniqueness of the present research lies in that it focuses on micro and small enterprises rather than on the listed enterprises (available as public data) used by the previous study. A major limitation of the research presented was that it was impossible to include non-financial indicators (number of employees, business sector, etc.) in the model as depersonalized information about the enterprises was used in line with the General Data Protection Regulation. For this reason, we were also unable to test the model with the actual confirmed fraudulent financial statements. In the future research, we will look for possibilities to obtain depersonalized cases of financial crime in a micro and small enterprises to improve our proposed model.

A larger sample of data of micro and small enterprises could not be collected for the research; therefore, the neural network approach was not applied. Based on the scientific literature, fuzzy logic was chosen. It enabled the authors to identify a model for detection of fraudulent financial statements. The results of the designed fuzzy logic model were tested using the decision tree. Although this test have shown that the results were close to each other. Although the model was designed for micro and small enterprises, it could also be applied to medium-sized and large enterprises. The model cannot be applied to micro enterprises if they choose to prepare profit (loss) statements by nature. In practice, the model proposed has been designed to help

small businesses reduce the risk, but it may also be used by public authorities as a tool for achieving greater business transparency. The proposed fuzzy model for detection of fraudulent financial statements can be adapted to other countries to take into account the national differences in financial statements. Future work include exploration of a new fuzzy model for detection of financial statement fraudulence taking in account the type of enterprise activity (services, trade, manufacturing) and industry sector. These aspects may influence the selection of financial indicators for design of the fuzzy model, while differences in the results may be influenced by the mentioned aspects (activity and sector).

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CAUSE-RELATED MARKETING AS A CORPORATE SOCIAL RESPONSIBILITY INITIATIVE: CONSUMER PERCEPTIONS OF THE CAMPAIGN

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ABSTRACT

As society becomes more and more socially conscious, corporate social responsibility may be one of the factors influencing the decision to buy. In the 21st century, cause-related marketing as one of the possible initiatives of a socially responsible approach became a common part of building a relationship with customers. But what are the differences in the perception of a cause-related marketing campaign among consumers with different levels of donation size with regard to gender distribution? Using existing studies, the responses concerning the perception of the campaign supporting a collection for the Zoo in the Czech capital were evaluated through a questionnaire survey. The data were factor-analyzed to determine the dimensions of the perception of the cause-related marketing campaign. The results show a two-factor solution: consumer attitudes towards the product and the company involved in the cause-related marketing campaign and consumer attitudes towards cause-related marketing in relation to a non-profit organization. The impact of donation size and gender on the resulting factors is assessed after.

KEY WORDS

campaign, perceptions, attitude, donation size, factor analysis, Czech Republic

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1 INTRODUCTION

Over the past century, marketing has developed into the concept of social marketing (Kotler et al., 2007), where companies identify the needs, wishes and interests of their target markets and are able to satisfy their customer's needs more effectively than their competitors so as to maintain, or even increase, the benefit to the customer and society as a whole. Their focus is therefore on solving the current problems of society in order to improve the quality

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of life, social responsibility and achieve social change (Truong and Hall, 2017; Truong, 2014). Corporate social responsibility is the expression of how business entities can influence the interests of society and corporate interest groups responsibly while taking into account sustainable behavior (Kvasničková Stanislavská et al., 2020; Ashrafi et al., 2020).

1.1 Cause-Related Marketing as One of the Dimensions of Corporate Social Responsibility

Interest in the topic of corporate social responsibility is not a recent phenomenon; it attracts the attention of not only practitioners, but also scholars (Hahn et al., 2017; Duarte et al., 2010). Corporate social responsibility can be also described as a combination of social benefit and economic gains, in which a certain situation in society is improved as a result of the efforts of businesses (Davis, 1973). Corporate social responsibility can be characterized as ensuring social benefit beyond the interests of the company and what is required by the law (Ali and Anwar, 2021; McWilliams and Siegel, 2001) and includes matters related to the behaviour of the company in its social environment, and not only within the sphere of its economic activity (Ahmad et al., 2021; Parada Daza, 2009). The benefits of CSR for businesses and society are widely recognised by consumers, non-profit organizations (Kerr et al., 2008) and employees (LeBaron et al., 2022), and are an appropriate vehicle for the marketing efforts of most businesses (Hildebrand et al., 2011).

Corporate social responsibility initiatives can take many forms (Chapple and Moon, 2005). One of the ways to meet the corporate social responsibility principle is to link the product with the cause, which is named cause-related marketing (Brønn and Vrioni, 2001; Nan and Heo, 2007). Cause-related marketing campaigns are often the first form of corporate social responsibility initiative that is used (Chapple and Moon, 2005) in order to increase customers' interest in buying a product and influence their positive perception of the company (Patel et al., 2017) and the brand (Mora and Vila, 2020), as well as to improve the image of the company using it (Rosak-Szyrocka et al., 2022). Cause-related marketing is a specific form of corporate social responsibility that can operate on the principle of "win-win-win": for the company, the cause, and for the customer (Folse et al., 2010; Nejati, 2014). The terms corporate social responsibility and cause-related marketing are conceptually different but closely related to each other and are often treated as being synonymous with one another. Cause-related marketing is one of the dimensions of corporate social responsibility (Chaabouni et al., 2021; Heydari and Mosanna, 2018), which can be called a specificity (or causal specificity) of corporate social responsibility. While cause-related marketing may constitute part of corporate social responsibility, it cannot, in itself, fully embody corporate social responsibility (Sheikh and Beise-Zee, 2011).

The origins of cause-related marketing date back to the 1980s, with American Express (Du et al., 2008; Chang and Liu, 2012). In the period from 1980 to 1984, American Express used the principle of cause-related marketing to support more than forty-five local or national projects (Daw, 2006). A large number of studies on the topic have already been performed in developed countries such as USA, Great Britain and Korea (Baek et al., 2020; Wei et al., 2020), while the topic is also being given an increasing amount of attention in South Asia (Amawate and Deb, 2021) or North Africa (Chaabouni et al., 2021). The phenomenon of cause-related marketing is influenced by cultural specificities and traditional factors related to specific geographical areas, and it is therefore not possible to generalize the results for all countries (Natarajan et al., 2016).

From an academic point of view, cause-related marketing was first characterized in 1988 by the authors Varadarajan and Menon (Svensson and Wood, 2011; Christofi et al., 2014), who stated that "cause-related marketing is a process of formulating and implementing activities that are characterized by the company's offer to contribute a specific amount to a specified cause, and where customers engage in this process, which provides income (value)

while at the same time satisfying organizational and individual goals". This partnership supports the profits and interests of both parties involved (Furman and Maison, 2020; Christofi et al., 2014).

Cause-related marketing is a mutually beneficial collaboration between a company and a non-profit organization (Hartmann et al., 2015; Liston-Heyes and Liu, 2013). The most frequent example is the offer of company products with the contribution of a specific amount for a given cause in order to increase the company's performance (e.g. sales) as well as to help a suitable cause so as to make them useful (Du et al., 2008; Pracejus and Olsen, 2004). Cause-related marketing involves cooperation between a commercial company and a non-profit organization (Liston-Heyes and Liu, 2013), where donation is conditional on the sale of a certain product, i.e. the company donates a sum to the charity every time a consumer makes a purchase (Chaney and Dolli, 2001; Nan and Heo, 2007). The specific objective of a cause-related marketing campaign is to generate sales. The amount donated may be variable and depends on the volume of sales (Polonsky and Speed, 2001).

Cause-related marketing campaigns can be viewed from different perspectives. From the customer's point of view, it depends on whether the consumer has to participate in the transaction with the company or not – and it is precisely through the transaction that the campaign is realized (Folse et al., 2014). From the point of view of cooperation between a company and a non-profit organization, transactional programs, message promotion programs (Berglind and Nakata, 2005) and licensing programs can be used (Berglind and Nakata, 2005; Liu and Ko, 2011). With this transaction type, the commercial company undertakes to donate a specific sum of money as a direct share of the proceeds from a sale (the company's contribution is proportional to the sale of the products). Information type means a combination of a commercial company and a non-profit organization in order to promote a common topic. With this licensing type, a non-profit organization authorizes the use of its logo or name to a commercial enterprise (usually in return for payment), for example, for advertising purposes, a licensing agreement (Adkins, 2011). Other formats may include sponsorship or in-kind donations (Wymer and Samu, 2003; Liu and Ko, 2011), but it is the transactional programs that describe the essence of cause-related marketing campaigns due to the use of a financial contribution (Ye et al., 2021; Till and Nowak, 2000).

Researches identify customer participation as a primary variable in donation (Ye et al., 2021; Gadhavi et al., 2014) which is why the authors endeavour to understand consumer's intention to participate in a campaign (Ross et al., 1992; Sen and Bhattacharya, 2001), because the success of a cause-related marketing campaign depends on the involvement of consumers, which depends on their perception of the cause (Singh et al., 2020; Singh and Duque, 2020).

1.2 Determinants of Cause-Related Marketing Consumer Perceptions

1.2.1 Donation Size

Donation size is defined as the absolute amount in a specific currency provided by a company for charitable purposes for every transaction made by a consumer (Folse et al., 2010), while it also affects the consumer perception of the cause (Rapert et al., 2021; Huang and Fitzpatrick, 2018). The donation size can be expressed as a fixed amount paid to the non-profit organization for each purchase made by the consumer or as a percentage of the sale price (Chang, 2008). According to previous findings (Dahl and Lavack, 1995), the acceptance of cause-related marketing campaigns by consumers is relatively high, but it depends on the sensitivity of customers to the price and their purchasing behaviour (Li et al., 2021).

Several studies have assessed the impact of donation size in cause-related marketing. Donation size affects consumer awareness and attitudes to a given cause (Wei et al., 2020; Moosmayer and Fuljahn, 2010), or the success of the campaign (Natarajan et al., 2016). A number of studies indicate that consumers

rate cause-related marketing campaigns more positively if the company donates a higher amount (Dahl and Lavack, 1995; Chang, 2011). A lower donation size may give the impression of misuse of a non-profit organization by the company (Dahl and Lavack, 1995), raises skepticism, and may be perceived as a marketing trick (Strahilevitz, 1999; Natarajan et al., 2016). According to other researchers (Natarajan et al., 2016), consumers tend to develop a favourable attitude towards a campaign with a higher donation size. Customer loyalty to products that support cause-related marketing campaigns also increases. However, recent research indicates that higher donations may encourage customer skepticism and, conversely, they rate a lower amount better (Terblanche et al., 2023; Chaabouni et al., 2021; Tsiros and Irmak, 2020).

Based on previous studies, the following research question is formulated: What is the perception of the cause-related marketing campaign by consumers in the Czech Republic with regard to different levels of donation size?

1.2.2 Consumer Demographics: Gender

The impact of gender on consumer response to marketing activities has been addressed in a number of studies over the past three decades (Nelson and Vilela, 2017; Galan Ladero et al., 2015), with men and women showing significant differences in the purchasing decision process (Wood, 1998). Consumers' attitudes and willingness to participate in a cause-related marketing campaign are affected by their gender (Chéron et al., 2012; Moosmayer and Fuljahn, 2010). Women are more likely to participate in cause-related marketing activities than men (Amawate and Deb, 2021; Moosmayer and Fuljahn, 2010). The attitude of women towards the company and a charity using cause-related marketing was more favourable than that of men (Ross et al., 1992), and at the same time, it was identified that women perceive cause-related marketing campaigns more positively than men (Amawate and Deb, 2021; Chéron et al., 2012). However recent studies on the topic of cause-related marketing indicate that gender has no significant impact on attitudes toward a campaign and its credibility (Thomas et al., 2022; Patel et al., 2023).

Based on previous studies, the following research question is formulated: What is the perception of the cause-related marketing campaign by consumers in the Czech Republic with regard to gender distribution?

Our study is the first to deal with the perception of the cause-related marketing campaign from the perspective of consumers in the Czech Republic. The results of the study discuss gender and donation size as determinants of the perception of a cause-related marketing campaign towards other variables. A total of 223 respondents participated in the study, which identifies the factorial structure and evaluates the perception of the campaign with regard to different levels of donation size and gender distribution.

2 METHODOLOGY AND DATA

This study replicated the experiment by Moosmayer and Fuljahn (2010), which was based on the studies of Ross et al. (1992) and Dahl and Lavack (1995). The study by Ross et al. (1992) investigated gender and proximity effects in cause-related marketing. This study analyzed the consumer's attitudes toward the company that sponsors a local cause compared to the firm that sponsors a national cause. The questionnaire survey contained 6 items about the firm/cause, which were adopted in Moosmayer's and Fuljahn's experiment (2010). These items are presented in Tab. 3 or Tab. 4.

The study by Dahl and Lavack (1995) investigated the impact of the size of corporate donations and the size of cause-related promotion on consumer perceptions and participation. This study assessed the perception of cause-related marketing from the point of view of exploitation of the non-profit organization considering donation size and corporate promotion, of the relation between donation size a corporate pro-

motion and from the perspective of consumer perception of the product considering donation size. The scenario of the study made by Dahl and Lavack (1995) presented to consumers was that a new product would be introduced across North America, and they were soliciting consumer opinions on some aspects of this new product (product characteristics were listed as flavours, price, size, and availability). The scenario explained that every product that was sold throughout the campaign donated to Rainforest Survival. The questionnaire survey contained 12 items from which those used in Moosmayer's and Fuljahn's experiment (2010) were selected. These selected items are presented in Tab. 3 or Tab. 4.

In this study, through an online survey, consumers' opinions on the said cause-related marketing campaign were investigated. Consumers were presented with a new creamy dairy dessert made by a popular Czech producer. The advertising campaign explained that for each cup sold, the manufacturer would donate a predetermined amount to support a collection for the non-profit organization Zoologická zahrada Praha (Prague Zoo), which is very popular in the Czech Republic. The donation size was either 0.25 hellers or 10 hellers. Respondents were asked to rate the six items from the study by Ross et al. (1992), see Tab. 3 or Tab. 4. After this first step, respondents were presented with the same advertising campaign again, together with additional information on the product replicating the scenario by Dahl and Lavack (1995): the product would soon be launched, one cup contains 130 g, the sale price is 39 CZK per three-pack, the product would be available in all large retail chains in the Czech Republic, the product is made from Czech milk, did not contain artificial colorings, and had reduced sugar content. Subsequently, respondents were asked to rate the six items applied by Dahl and Lavack (1995), see Tab. 3 or Tab. 4. This approach is summarized in Fig. 1 and Fig. 2.

Many previous studies on cause-related marketing have used "student samples" (Dahl and Lavack, 1995; Moosmayer and Fuljahn, 2010; Chéron et al., 2012; Heidarzadeh Hanzaee et al., 2019), which allows the comparison of the results with previous research. Students are a suitable research sample that has relatively low sociodemographic variation compared to the general public (Moosmayer and Fuljahn, 2013). As part of the study, a link to the questionnaire survey was sent via e-mail to students who attended seminars specializing in marketing, marketing communication, marketing research, and public relations at a university in the Czech Republic in the 2021/2022 academic year. A link was sent in August 2022, and it was accessible in September 2022, too.

Two surveys were conducted as part of the research, these were two independent sample surveys. The first survey with a donation size of 0.25 hellers and the second survey with a donation size of 10 hellers. In total, 223 people participated in the survey, including 108 people in the first survey (48.3%) and 115 people in the second survey (51.7%). From the list of potential respondents, the sample was collected randomly with regard to gender distribution. The total average age of respondents was 22.9 years. The description of the respondents is presented in Tab. 1.

Tab. 1: Description of respondents

	Donation size					
	0.25 hellers		**10 hellers**		**Total**	
Gender	n	**%**	n	**%**	n	**%**
Women	55	50.9%	62	53.9%	117	52.5%
Men	53	49.1%	53	46.1%	106	47.5%
Total	108	100.0%	115	100.0%	223	100.0%

Data were processed within the IBM SPSS Statistics 23 software. The study evaluates the perception of a cause-related marketing campaign, respectively whether the perception of a cause-related marketing campaign by the consumer differs between genders. And the second perspective combines the perception of cause-related marketing and donation size, respectively whether this perception differs in the case of two different donation sizes.

The following hypothesis is formulated:

- H_{1_0}: Perception of the cause-related marketing campaign does not differ between two donation sizes.

Fig. 1: The first presentation of the advertising campaign: Manipulation of donation size 0.25 or 10 hellers, presentation of the first scale (Ross et al., 1992; Alimpex Food, 2017)

Fig. 2: The second presentation of the advertising campaign: Supply of additional product information, presentation of the second scale (Dahl and Lavack, 1995; Alimpex Food, 2017)

- H_{1_1}: Perception of the cause-related marketing campaign differs between two donation sizes.
- H_{2_0}: Perception of the cause-related marketing campaign does not differ between genders.
- H_{2_1}: Perception of the cause-related marketing campaign differs between genders.

The gender distribution between the surveys was compared using Fisher's exact test. Fisher's exact test assesses the independence between two variables between two groups. It assesses the null hypothesis, that is the variables are independent (Molnár et al., 2012). The questionnaire concerning consumer perception of cause-related marketing campaign is composed of 12 questions. All questions are evaluated on the seven-point Likert scale, where 0 = "does not apply at all" up to 6 = "thoroughly applies" (Moosmayer and Fuljahn, 2010).

Since this is an ordinal variable, the basic statistical characteristics were first calculated for individual variables. Differences between groups according to donation size and gender were tested using statistical tests. A non-parametric two-choice Mann-Whitney test was applied to ordinal variables (for two independent selections, to verify the same level of two small selections from unknown distributions, also applicable to ordinal variables). The test hypothesis monitors the concordance of the medians or the concordance of the level of distribution, and is verified by comparing the resultant p-value with the level of significance, which is most often $\alpha = 5\%$. If the p-value is higher than the level of significance determined by us, the tested hypothesis of the same level in the monitored groups is not rejected (Pecáková, 2008).

The test criterion U is the number of all cases in which, in ascending order of all observations, the values of one sample precede the values of the other sample. Finding the number of these cases for both selections (U_1 and U_2) is as follows. If in the set consisting of both samples (groups) with the range $n = n_1 + n_2$, each value is assigned an ascending ordinal number and these orders are then separately added up in each sample (the sums of R_1 and R_2 for each group), then the following equations apply (Pecáková, 2008):

$$U_1 = R_1 - \frac{n_1\,(n_1+1)}{2},$$

$$U_2 = R_2 - \frac{n_2\,(n_2+1)}{2}$$

and that

$$R_1 + R_2 = \frac{n\,(n+1)}{2},$$

than applies

$$U_1 + U_2 = R_1 - \frac{n_1\,(n_1+1)}{2} + R_2 - \frac{n_2\,(n_2+1)}{2}.$$

For larger samples (more than 20 units), the normal approximation with mean and variance can be used (Pecáková, 2008):

$$E(U) = \frac{n_1 n_2}{2} \quad \text{and} \quad D(U) = \frac{n_1 n_2\,(n+1)}{12}.$$

Subsequently, the data were factor-analyzed to determine the key dimensions of the perception of cause-related marketing campaigns. Factor analysis is one of the methods of data reduction. It is based on the covariate or correlation matrix of the original variables, and thus monitors the relationships between them. The aim is to create uncorrelated groups of strongly correlated variables based on the interpretation of common factors that are considered to be hidden causes of correlated variables. Factor analysis tries to derive and create common factors (defined as linear combinations of original variables) so as to explain and elucidate the observed dependencies in the best and simplest way possible. The factor analysis procedure is not applied to the examined basic set, but only to the selection from this set, and therefore the results of factor analysis are only estimates of actual factors (Hebák, 2013).

The prerequisites for using factor analysis are numeric variables, low cross-correlations, and non-zero correlations. The task of factor analysis is the estimation of factor loadings. The factor analysis model expresses each observed variable X_j, $j = 1, 2, \ldots, p$ as a linear combination of R common factors $F_1, F_2, \ldots, F_R$

and describes the observations by the following equations (Pecáková, 2008):

$$X_j = \mu_0 + \gamma_{j1}\, F_1 + \gamma_{j2}\, F_2 + \ldots + \gamma_{jR}\, F_R + \epsilon_j,$$

where $X_1, X_2, \ldots, X_j$ are the observed variables; $\epsilon_1, \epsilon_2, \ldots, \epsilon_j$ are the specific factors representing random deviations; γ_{jk}, $j = 1, 2, \ldots, p$ and $k = 1, 2, \ldots, R$ are the factor loads; μ_0 are constants.

The Kaiser-Meyer-Olkin (KMO) metric and Bartlett's Test of Sphericity are used to assess the suitability of factor analysis. Kaiser-Meyer-Olkin is among the most common statistics used to assess the suitability of data in factor analysis (Abba et al., 2020). The KMO coefficient, the most commonly used indicator, can theoretically take values between 0 and 1. KMO values between 0.9 and 1 are excellent for use in factor analysis (Abba et al., 2020; Hebák, 2013):

$$\text{KMO} = \frac{\sum\sum_{j \neq k} r_{jk}^2}{\sum\sum_{j \neq k} r_{jk}^2 + \sum\sum_{j \neq k} p_{jk}^2},$$

where $\sum\sum_{j \neq k} r_{jk}^2$ is sum of the squares of the correlation coefficients and $\sum\sum_{j \neq k} p_{jk}^2$ is sum of the squares of partial coefficients.

Bartlett's Test of Sphericity is a statistic used to verify the null hypothesis, representing a variation between 0 and 1. Lower values indicate that factor analysis would not be appropriate because other variables cannot explain the correlations between pairs of variables (Rojas-Kramer et al., 2015). Based on the above tests, using the breakdown of questions according to factor scales, factors were identified and marked, and the Varimax method was chosen as the rotation method. The Scree fence, in which the difference between a group of sharply decreasing large values of characteristic numbers (specific characteristics used to calculate the main components) and the rest of tiny (meaningless) characteristic numbers (Hebák, 2013) is visible, is then introduced. For individual factors, the internal consistency coefficient (Cronbach's Alpha) is expressed. Cronbach's Alpha represents a coefficient that is oriented to determine the reliability of the data. The value of this coefficient ranges from 0 to 1, and the analysis criterion is that the closer the value is to 1 the greater the reliability, where the acceptable level of reliability begins at 0.80 (Rojas-Kramer et al., 2015).

In our study, two factors emerged from the factor analysis. With regard to the results of Cronbach's Alpha (factors have a high internal consistency), the gross scores were subsequently expressed as averages of items in a given factor. These gross scores of individual factors (gross score of consumer attitudes to the product and the company; gross score of consumer attitudes to cause-related marketing in relation to a non-profit organization) have the character of a numerical variable, therefore the Shapiro-Wilk test was first used to verify the normality of the data. The tested hypothesis in the Shapiro-Wilk test is that the numerical variable is normally distributed (Pecáková, 2008). Due to selections from unknown distributions a non-parametric two-sample Mann-Whitney test is applied to verify statistically significant differences.

The H_{1_0} (H_{1_1}) hypothesis is further formulated:

- $H_{1.1_0}$: Consumer attitudes to the product and the company participating in the cause-related marketing campaign do not differ between two donation sizes.
- $H_{1.1_1}$: Consumer attitudes to the product and the company participating in the cause-related marketing campaign differ between two donation sizes.
- $H_{1.2_0}$: Consumer attitudes to cause-related marketing in relation to a non-profit organization do not differ between two donation sizes.
- $H_{1.2_1}$: Consumer attitudes to cause-related marketing in relation to a non-profit organization differ between two donation sizes.

The H_{2_0} (H_{2_1}) hypothesis is further formulated:

- $H_{2.1_0}$: Consumer attitudes to the product and the company participating in the cause-related marketing campaign do not differ between genders.

- $H_{2.1_1}$: Consumer attitudes to the product and the company participating in the cause-related marketing campaign differ between genders.
- $H_{2.2_0}$: Consumer attitudes to cause-related marketing in relation to a non-profit organization do not differ between genders.
- $H_{2.2_1}$: Consumer attitudes to cause-related marketing in relation to a non-profit organization differ between genders.

To test the hypotheses $H_{1.1_0}$ ($H_{1.1_1}$), $H_{1.2_0}$ ($H_{1.2_1}$), $H_{2.1_0}$ ($H_{2.1_1}$), $H_{2.2_0}$ ($H_{2.2_1}$), the General linear model (GLM) was used. For use to variables that are not normally distributed, the model refers to the dependence on potentially more than one explanatory variable (Turner, 2008):

$$y_i = \beta_0 + \beta_1 \, x_{1i} + \ldots + \beta_p \, x_{pi} + \epsilon_i,$$

where the response y_i, $i = 1, 2, \ldots, n$ is modelled by a linear function of explanatory variables $j = 1, 2, \ldots, p$ plus an error term.

In our study, two GLM models were done:

Gross score of consumer attitudes to the product and the company ∼ donation size + gender,

Gross score of consumer attitudes to cause-related marketing in relation to a non-profit organization ∼ donation size + gender,

where consumer attitudes to the product and the company and consumer attitudes to cause-related marketing in relation to a non-profit organization = individual factors; donation size = 0.25 hellers or 10 hellers; gender = women or men.

3 RESULTS

The gender distribution between the surveys is statistically insignificant (Fisher's exact test; p-value = 0.689), so the null hypothesis in Fisher's exact test cannot be rejected. Average results and median values by donation size and gender and differences between groups are shown in Tab. 3. In the case of differences between groups according to donation size, based on a comparison of p-values with a significance level of $\alpha = 5\%$, the tested hypothesis H_{1_0} can be rejected only for the statement: "The NPO is acting responsibly by using cause-related marketing to raise funds" (p-value = 0.038; Effect size 0.154). In this case, respondents more often agree with the statement on the campaign with a donation size of 0.25 hellers. In the case of statistically significant differences between groups by gender, the tested hypothesis H_{2_0} at the level of significance $\alpha = 5$ can be rejected only in the case of the statement: "The product will do a very good job of supporting and promoting the NPO" (p-value = 0.049; Effect size 0.146), where the statement is more often agreed with by men. In general, the perception of the cause-related marketing campaign by consumers based on the assessment of individual issues does not differ between gender groups and it does not differ between two donation sizes, except for the two statements above.

The input values can be considered very suitable for use in factor analysis. The KMO criterion is higher than 0.9 and Bartlett's Test of Sphericity is also suitable (p-value < 0.001).

Tab. 2: KMO criterion and Bartlett's test

KMO criterion	0.915
Bartlett's Test of Sphericity	
test criterion	1673.4
degrees of freedom	66
p-value	< 0.001

The result of factor analysis based on our own (characteristic) numbers are two factors: the consumer attitudes towards the product and the company (Factor 1) and the consumer attitudes towards cause-related marketing in relation to a non-profit organization (Factor 2). The breakdown of questions by factor scales is given in Tab. 4. Cronbach's alpha achieves very good reliability and internal consistency in both resulting factors (Attitude to the product and the company – value 0.916; Attitude to cause-related marketing in relation to a non-profit organization – value 0.805). Fig. 3 presents Scree plot.

Tab. 3: Summary table of average results and median values by donation size and gender

	Overall sample (n = 223)		Donation size: 0.25 hellers (n = 108)		Donation size: 10 hellers (n = 115)		Effect size	Gender: Women (n = 117)		Gender: Men (n = 106)		Effect size
	Mean	**Median**	**Mean**	**Median**	**Mean**	**Median**		**Mean**	**Median**	**Mean**	**Median**	
1. Cause-related marketing is a good way to raise money for this cause (Ross et al., 1992).	4.4	5.0	4.4	5.0	4.4	5.0	0.035	4.5	5.0	4.3	4.5	0.068
2. The NPO is acting responsibly by using cause-related marketing to raise funds (Ross et al., 1992).	4.5	5.0	4.6	5.0	4.3	5.0	0.154*	4.6	5.0	4.3	5.0	0.096
3. The firm is more interested in supporting than in exploiting the NPO (Ross et al., 1992).	3.9	4.0	3.9	4.0	3.8	4.0	0.090	3.8	4.0	3.9	4.0	0.066
4. The firm is acting in a socially responsible manner (Ross et al., 1992).	4.1	4.0	4.1	4.0	4.1	4.0	0.030	4.0	4.0	4.1	4.0	0.086
5. After reading this advertising, I am more willing to support the NPO (Ross et al., 1992).	4.1	4.0	4.2	4.0	4.0	4.0	0.091	4.2	4.0	4.1	4.0	0.020
6. The ad makes me more willing to purchase the product (Ross et al., 1992).	3.9	4.0	3.9	4.0	3.9	4.0	0.048	4.0	4.0	3.9	4.0	0.012
7. The product is very appealing to me (Dahl and Lavack, 1995).	3.6	4.0	3.7	4.0	3.6	4.0	0.031	3.5	4.0	3.7	4.0	0.090
8. I would be very likely to purchase the product if I saw it on sale in a supermarket (Dahl and Lavack, 1995).	3.8	4.0	3.8	4.0	3.9	4.0	0.027	3.8	4.0	3.9	4.0	0.082
9. Based on what I know so far, I would expect the quality of the product to be very high (Dahl and Lavack, 1995).	3.7	4.0	3.6	4.0	3.9	4.0	0.099	3.7	4.0	3.8	4.0	0.064
10. The product will benefit a lot from the relationship with NPO (Dahl and Lavack, 1995).	4.3	4.0	4.4	4.0	4.3	4.0	0.054	4.4	4.0	4.3	4.0	0.008
11. The product will do a very good job of supporting and promoting the NPO (Dahl and Lavack, 1995).	4.0	4.0	4.1	4.0	4.0	4.0	0.095	3.9	4.0	4.2	4.0	0.146*
12. The NPO will benefit a lot from the relationship with the product (Dahl and Lavack, 1995).	4.3	4.0	4.4	4.0	4.2	4.0	0.083	4.3	4.0	4.3	4.5	0.069

Note: * Statistically significant differences

Tab. 4: Factor score for two factors

Items	Factor	
	Attitude to the product and the company	**Attitude to CRM in relation to NPOs**
1. Cause-related marketing is a good way to raise money for this cause (Ross et al., 1992).		0.857
2. The NPO is acting responsibly by using cause-related marketing to raise funds (Ross et al., 1992).		0.860
3. The firm is more interested in supporting than in exploiting the NPO (Ross et al., 1992).	0.760	
4. The firm is acting in a socially responsible manner (Ross et al., 1992).	0.689	
5. After reading this advertising, I am more willing to support the NPO (Ross et al., 1992).	0.651	
6. The ad makes me more willing to purchase the product (Ross et al., 1992).	0.648	
7. The product is very appealing to me (Dahl and Lavack, 1995).	0.802	
8. I would be very likely to purchase the product if I saw it on sale in a supermarket (Dahl and Lavack, 1995).	0.837	
9. Based on what I know so far, I would expect the quality of the product to be very high (Dahl and Lavack, 1995).	0.827	
10. The product will benefit a lot from the relationship with NPO (Dahl and Lavack, 1995).		0.585
11. The product will do a very good job of supporting and promoting the NPO (Dahl and Lavack, 1995).	0.711	
12. The NPO will benefit a lot from the relationship with the product (Dahl and Lavack, 1995).		0.563

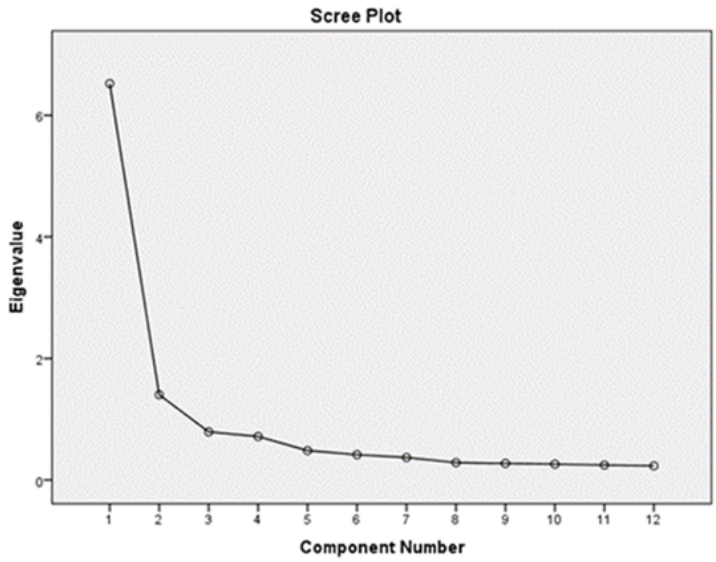

Fig. 3: Scree plot presenting eigenvalues

Tab. 5: Descriptive statistics of gross scores by gender and donation size

		Donation size		Gender	
	Overall sample	**0.25 hellers**	**10 hellers**	**Women**	**Men**
Attitude to the product and company					
n	223	108	115	117	106
Average	3.9	3.9	3.9	3.9	4.0
Median	4.0	4.1	4.0	4.0	4.3
Standard deviation	1.1	1.3	0.8	1.0	1.2
Standard error average	0.1	0.1	0.1	0.1	0.1
Attitude to cause-related marketing in relation to NPOs					
n	223	108	115	117	106
Average	4.4	4.5	4.3	4.4	4.3
Median	4.5	4.7	4.5	4.5	4.5
Standard deviation	1.0	1.0	0.9	0.8	1.1
Standard error average	0.1	0.1	0.1	0.1	0.1

Tab. 5 shows the rating of gross scores according to donation size and gender. Respondents agree to a greater extent with the benefit of cause-related marketing for the non-profit organization than that the campaign would have an impact on their positive attitude towards the product and the company participating in the campaign.

The results of data normality verification are shown in Tab. 6 (p-values < 0.05).

Tab. 6: Shapiro-Wilk normality test

Factors	**Test criterion**	**Degrees of freedom**	p**-value**
Attitude to the product and company			
0.25 hellers	0.941	108	<0.001*
10 hellers	0.952	115	<0.001*
Attitude to CRM in relation to NPOs			
0.25 hellers	0.893	108	<0.001*
10 hellers	0.945	115	<0.001*
Attitude to the product and company			
Men	0.955	117	<0.001*
Women	0.942	106	<0.001*
Attitude to CRM in relation to NPOs			
Men	0.931	117	<0.001*
Women	0.930	106	<0.001*

Note: the data are derived from a non-normal distribution at a significance level of $\alpha = 5\%$.

The evaluation of attitudes towards the product and the company that are involved in the cause-related marketing campaign and the evaluation of attitudes towards the cause-related marketing in relation to the non-profit organization involved in the campaign do not differ between donation sizes and genders. In general, the attitudes of consumers towards the product and the company and the attitudes towards cause-related marketing in relation to a non-profit organization do not differ between gender groups and do not differ between the donation sizes.

The results of Mann-Whitney tests are shown in Tab. 7. The tested hypothesis $H_{1.1_0}$, $H_{1.2_0}$, $H_{2.1_0}$ and $H_{2.2_0}$ cannot be rejected.

Our study did not confirm that the larger the donation size, the better the perception of the campaign by the consumer (respectively, the more positive the consumer attitudes to the product and company participating in the cause-related marketing campaign and the more consumers agree to the extent of cause-related marketing for a non-profit organization). Our study did not confirm that compared to men, women have a more positive consumer perception of a cause-related marketing campaign (respectively, women have a more positive attitude to the product and company participating in the cause-related marketing campaign and are more likely to agree with the extent of cause-

Tab. 7: Results of Mann-Whitney tests

	Donation size		Gender	
Factors	**Test criterion**	***p*-value**	**Test criterion**	***p*-value**
Attitude to the product and company	5755.5	0.345	5553.5	0.178
Attitude to cause-related marketing in relation to NPOs	5504.0	0.141	6053.0	0.757

related marketing for a non-profit organization).

Donation size and gender have been discussed as determinants of consumer attitudes to cause-related marketing. The results of the GLM method confirm the above results of our study. Donation size and gender do not determine the attitudes towards the product and the company (p-value = 0.932; p-value = 0.815) and the attitudes towards cause-related marketing in relation to a non-profit organization (p-value = 0.616; p-value = 0.675). In the case of comparing the differences of group means, the differences are obvious in both individual factors, as we show in Fig. 4 and Fig. 5, and these results are interesting. But the effect of donation size and gender is insignificant, and this impact is indeed limited for all respondents.

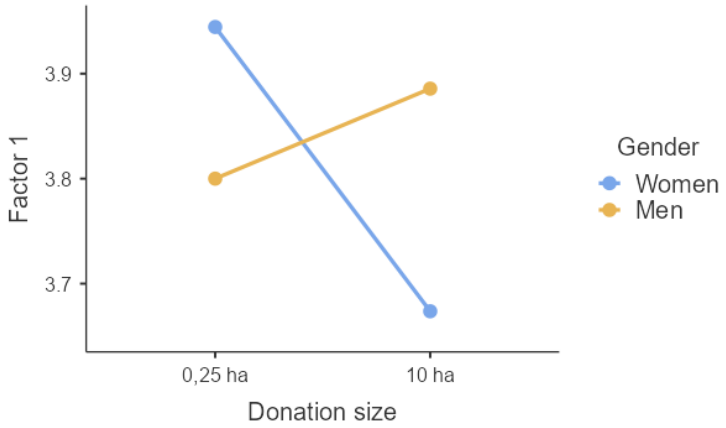

Fig. 4: The moderating effect of gender on donation size impact: consumer attitudes to the product and the company

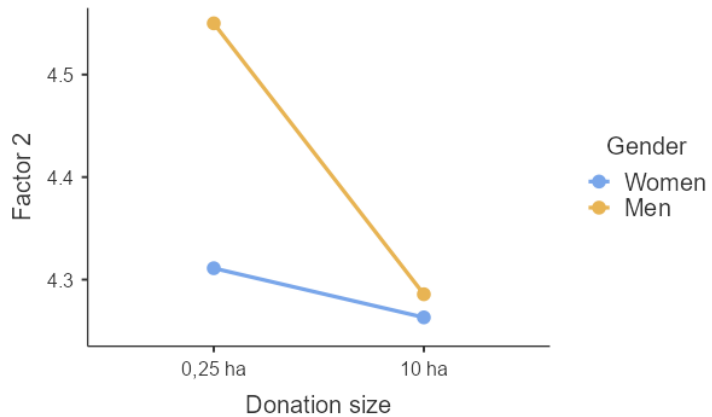

Fig. 5: The moderating effect of gender on donation size impact: consumer attitudes to cause-related marketing in relation to a non-profit organization

4 DISCUSSION AND CONCLUSIONS

The goal of the study was to evaluate the perception of a cause-related marketing campaign by a specific group of consumers in the Czech Republic, which were university students. Using unchanged items from Ross et al. (1992) and Dahl and Lavack (1995) a factorial structure was identified and the effect of gender and donation size on the attitudes of consumers to the product and the company involved in the cause-related marketing campaign and the attitudes of consumers to cause-related marketing in relation to the non-profit organization involved in the campaign was assessed. These factors present dimensions that are used to understand the perception of the cause-related marketing campaign by consumers in the Czech Republic. This study thus reflects studies regarding cause-related marketing that claim that it is not possible to generalize the results found for all countries (Furman and Maison, 2020; Natarajan et al., 2016). Respondents from the Czech Republic agree to a greater extent with the benefit of cause-related marketing for a non-profit organization than that the campaign would have an impact on their positive attitude towards the product and the company. While the Moosmayer and Fuljahn study (2010) identified five factors used to understand the perception of cause-related marketing by consumers in Germany (consumer perception of company behaviour, consumer attitude to product, consumer goodwill towards the cause-related marketing campaign, consumer perception of the benefit to the non-profit organization and consumer attitude toward cause-related marketing), in the Czech Republic two factors mentioned above serve to understand the perception of the cause-related marketing campaign. In this case, customer attitudes can be divided into those who perceive the benefit of the campaign in relation to a non-profit organization, and only then do potential customers focus on the company and the product involved in the campaign.

Contrary to the results of other research (Ross et al., 1992; Moosmayer and Fuljahn, 2010; Chéron et al., 2012), this study did not confirm the effect of gender on the attitudes of consumers to the product and the company involved in the cause-related marketing campaign and on the attituded towards cause-related marketing in relation to the non-profit organization participating in the campaign. The attitudes of consumers towards the product and the company and the attitudes towards cause-related marketing in relation to the non-profit organization do not differ between gender groups and between the different levels of donation sizes, which is pointed out by current research (Thomas et al., 2022; Patel et al., 2023).

The results of some studies (Dahl and Lavack, 1995; Strahilevitz, 1999; Chang, 2011; Natarajan et al., 2016) show that consumers rate cause-related marketing campaigns more positively if the company donates a higher amount. Previous studies investigated three levels of donation size and discovered that larger donations did not result in "greater positive behavioral intentions" (Holmes and Kilbane, 1993). According to another study, a higher donation size gives the impression that the company is supporting a good cause than a lower donation amount (Dahl and Lavack, 1995). However, the implications were minimal, and cause-related marketing's importance has grown dramatically since then.

Conversely, some studies express a degree of skepticism about donation size. Customers rate lower donation sizes much better (Terblanche et al., 2023; Chaabouni et al., 2021; Tsiros and Irmak, 2020). These results do not support a single position in the debate. The above claims are not confirmed by the fact that donation size does not affect attitudes towards the product and the company or attitudes towards cause-related marketing in relation to a non-profit organization. This also makes it impossible to confirm previous studies, which claim that donation size affects consumer awareness and attitudes toward a cause (Wei et al., 2020; Moosmayer and Fuljahn, 2010). This study thus confirms the specific assertions that a higher donated amount may not increase the willingness of consumers to pay for products

involved in a cause-related marketing campaign (Koschate-Fischer et al., 2012) and the assertion that a higher donated amount may not lead to positive results for cause-related marketing (Müller et al., 2014).

Our study presents the dimensions of the perception of cause-related marketing campaign in the Czech Republic, the results related to a specific group of respondents (university students) in a specific country, and extends the existing literature on understanding consumer attitudes toward cause-related marketing. The study has shown that there are two groups of resulting areas of interest to respondents, which can be divided into a group more focused on the benefit of the non-profit organization, which they contribute to through donations. The second group is then more focused on the company using cause-related marketing and its products. Many previous studies on cause-related marketing have used "student samples" because of relatively low sociodemographic variation compared to the general public (Moosmayer and Fuljahn, 2013). The average age of the respondents in our study was 22.9 years, therefore they can be included (Weiss and Zhang, 2020) in the so-called "young people" group (20–39 years). Therefore, the obtained results of our study cannot be generalized for the entire population in the Czech Republic. Our results can be applied to a specific group of consumers.

The study offers insights for companies to design their cause-related marketing activities with respect to important elements of the campaign in order to increase their overall effect. Companies can monitor the importance of consumers' attitudes towards themselves and their products involved in the campaign and the importance of attitudes towards the perceived benefit of cause-related marketing for a non-profit organization. The study reports findings on how the size of the donation and gender influence the perception of a cause-related marketing campaign. Gender and donation size do not affect respondents' attitudes towards a cause-related marketing campaign in the Czech Republic. At the same time, even a higher amount donated will not give a better impression of the use of cause-related marketing.

A possible starting point for further research would be a comparison of the results of different generations over the past three decades, which could reveal generational differences in the perception of donations as a cause-related marketing tool for consumers. Future research could focus on the perception of the cause-related marketing campaign among customer segments who are a specific target group for purchasing a product that would be presented as part of a cause-related marketing campaign. Related to this is the possibility of expanding the study to provide direct evidence regarding purchase decision making, i.e. whether a cause-related marketing campaign leads to a direct purchase of a product. This proposed research project would contribute to companies making decisions about choosing a non-profit organization as a partner in cause-related marketing or communication strategy.

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A MODEL FOR ASSESSING DIGITAL TRANSFORMATION MATURITY FOR SERVICE PROVIDER ORGANIZATIONS

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ABSTRACT

The research presented aims to close a gap in the measurement of digital maturity for the domain of service which was identified through a systematic literature review. The study provides a holistic Digital Service Transformation Maturity Self-Assessment Model for service provider companies in a B2B-context based on analysis of different digital maturity models and by means of a qualitative approach through expert feedback in a Delphi-process and additional complementary literature review to define maturity assessment items. The presented Digital Service Transformation Maturity Model comprises 8 factors, 27 subfactors and 403 related specific assessment items describing digital maturity from a holistic point of view. The model has been further converted into a simple and practical tool to self-assess and visualize current state of digital maturity. The assessment model finally was pilot tested and the outcomes are also outlined in this article. The designed model provides practical implications for the ease of evaluating and improving digital maturity levels in every aspect of its factors and contributes to the successful management of digital transformation in service provider organizations by offering effective guidance how to move to the desired future maturity level based on a solid understanding of current digital maturity accomplishments.

KEY WORDS

digital transformation, digital service transformation, digital maturity, digital maturity assessment model, digital maturity matrix

JEL CODES

M14, M15, O31, O32

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1 INTRODUCTION

Digital technology causes disruptions and calls for strategic responses from organizations that change the value creation (Vial, 2019). By 2030 it is estimated that approximately 70% of new value creation in the economy will be reliant on digitally enabled platform business models (World Economic Forum, 2020). Hence, embracing emerging new opportunities coming from digital technologies and new industries require companies to continuously transform (Gimpel et al., 2018) to stay competitive. So digital transformation will stay an ongoing and increasingly complex journey for organizations (Verhoef et al., 2021) involving different aspects. Technology is just one part of it (Vial, 2019) but the first stage towards digital transformation (Ragnedda, 2017; van Deursen and van Dijk, 2019). Moreover, digital transformation needs a comprehensive view (Peter et al., 2020) involving several dimensions like strategy, HR, culture, process management, IT and others (Neff et al., 2014; DXC Technology Company, 2017). Peter et al. (2020) identified in their research study seven strategic action fields for digital transformation, where just two are linked to technology. A survey with 1700 respondents across different countries reported that 62% of respondents consider especially culture as the number one hurdle to digital transformation (Buvat et al., 2017; Leipzig et al., 2017). Hence, it is inevitable for organizations to address and manage the different dimensions of digital transformation and to view the progress and achievement of digital transformation in a holistic way (Haryanti et al., 2023).

Still today a lot of companies do not know where they exactly stand with regards to digital transformation and lack a distinct plan and path for their transformation initiatives. Some research states that executives are aware of the urgency but are not sure how to develop and deploy a digital agenda as there is a lack of guidance to determine the right course of action (Bughin and van Zeebroeck, 2017). Other research identified a lack of an integrated approach when formulating a company-wide digital transformation strategy (Hess et al., 2016; Hyvönen, 2018; Ismail et al., 2017). Digital immaturity as a consequence can potentially turn into a business problem, especially for companies in traditional industries as improvements regarding digital maturity have been made less rapid than in industries like software industry (Štolfa et al., 2019) – due to the fact that these companies have been quite successful in the past and they have not been realizing the benefits of digitalization (Fitzgerald et al., 2013). Also, in some cases managers do not know how to approach digitalization and how to respond to it (Hess et al., 2016; Bumann and Peter, 2019) and therefore start initiatives very isolated (Tumbas et al., 2017).

Thus, the need to systematically assess the status of digital maturity and to develop a clear strategy and roadmap for the required future transformation to stay competitive is notably growing in companies. There is evidence that companies which achieve higher digital maturity and therefore manage their transformation more effectively, have a digital advantage and outperform competitors related to financial performance (Westerman and McAfee, 2012). However, despite of the awareness that digital transformation provides potential advantages, a lot of companies have been facing challenges in creating a clear roadmap to adapt existing processes and business models in line with new digital technologies (Gökalp and Martinez, 2021).

In this context models to evaluate digital maturity are gaining importance and are developed to guide companies by providing a comprehensive roadmap for improvement (Gökalp and Martinez, 2021). Today it is a necessity to measure the maturity level of digital transformation as a kind of guidance for companies (Haryanti et al., 2023) through systematically assessing the status-quo (Becker et al., 2009) and to develop a distinct strategy and roadmap related to required digital transformation activities to reach a desired future state (Berghaus and Back, 2016; Pöppelbuß and Röglinger, 2011; Paulk et al., 1993). More specifically a digital maturity model helps companies to better understand the capabilities needed to encounter and success-

Tab. 1: Digital maturity models developed by practitioner and academia (Teichert, 2019)

Study	Model character. (# dimensions / # maturity levels)	Model approach (focus of model, maturing approach, application method)	Domain	Culture
Practitioner				
Valdez-de-Leon (2016)	7 / 6 stages	Domain specific, linear, self-assessment	Service	Yes
Kane et al. (2017)	4 / 3 arch.typ.	General, n.a, n.a		Yes
Westerman and McAfee (2012)	6 / 4 arch.typ.	General, non-linear, self-assessment		No
Geissbauer et al. (2016)	7 / 4 stages	Domain specific, linear, 3rd party assisted	Manufac.	Yes
Gill and van Boskirk (2016)	4 / 4 arch.typ.	General, linear, self-assessment		Yes
Catlin et al. (2015)	4 / "Dig. Quotient"	General, non-linear, 3rd party assisted		Yes
Bloching et al. (2015)	4 / "Digital Gap"	General, linear, 3rd party assisted	Industry	No
Friedrich et al. (2011)	4 / "Digitiz. Index"	General, linear, 3rd party assisted	Industry	No
Azhari et al. (2014)	8 / 5 stages	General, linear, 3rd party assisted		Yes
Shahiduzzamann et al. (2017)	9 / 4 arch.typ.	General, non-linear, self-assessment		Yes
Academia				
Lichtblau et al. (2015)	6 / 6 stages	Domain specific, linear, 3rd party assisted	Manufac.	No
Erol et al. (2016)	9 / 5 stages	Domain specific, non-linear, self-assessment	Manufac.	Yes
Colli et al. (2018)	5 / 6 stages	Domain specific, non-linear, self-assessment	Manufac.	No
Remane et al. (2017)	2 / 5 clusters	General, non-linear, self-assessment		No
Berghaus and Back (2016)	9 / 5 stages	General, linear, self-assessment		Yes
Canetta et al. (2018)	5 / n.a.	Domain specific, non-linear, self-assessment	Manufac.	No
Uhl and Gollenia (2016)	6 / 4 stages	General, linear, self-assessment		No
Sharma et al. (2016)	7 / 4 arch.typ.	General, non-linear, self-assessment		Yes
Leyh et al. (2016)	4 / 5 stages	Domain specific, linear, 3rd party assisted	Manufac.	No
De Carolis et al. (2017)	4 / 5 stages	Domain specific, linear, self-assessment	Manufac.	No
Leino et al. (2017)	6 / 4 stages	General, non-linear, self-assessment		Yes
Schuh et al. (2017)	4 / 6 stages	Domain specific, linear, 3rd party assisted	Manufac.	Yes

fully manage digital transformation holistically as per various dimensions, criteria and maturity levels, which indicate a pathway towards desired maturity (Berghaus and Back, 2016).

A systematic literature review (Tab. 1) as part of this work identified 22 various digital maturity models, which were analysed in detail regarding domains addressed, type of dimensions used, and specific cultural attributes included in the different models.

The findings showed that domain-specific models focus more on the digital-technological aspect and related capabilities, and that general digital maturity models address more the managerial aspect and related transformational capabilities in the assessment of digital maturity of an organization. A few of the identified general models (Westerman et al., 2012; Shahiduzzamann et al., 2017; Berghaus and Back, 2016) include already both aspects and cluster their dimensions accordingly, which clearly underlines the importance of the more soft and transformational aspect of digital transformation. These models propose a comprehensive description of digital maturity and were used as guiding models for this research. Out of the 22 identified digital maturity models just half of it addresses "Culture" as a dimension, although organizational culture is seen as a critical enabler for a successful digital transformation (Buvat et al., 2017; Leipzig et al., 2017). Among the examined digital maturity models just one is addressing specifically the domain of service (Valdez-de-Leon, 2016). This fact is surprising, because more and more industrial companies started to shift their focus from goods-centric offerings to service as digital technology and advanced analytics are especially revolutionizing services and are creating new sources of value for industrial companies (Ananthakrishnan et al., 2018). Also, the aspect of digital business model is hardly addressed in any of the 22 reviewed digital maturity models.

This research aims to close the identified gap in the measurement of digital maturity for the domain of service. The study provides a Digital Service Transformation Maturity Self-

Assessment Model for service provider companies in a B2B-context based on analysis of different digital maturity models and a qualitative approach through expert feedback in a Delphi-process. It addresses 3 research questions regarding digital transformation maturity:

1. How the "as-is" position should be assessed in a holistic way for service provider companies (diagnostic function)?
2. How the "to-be" position should be determined to develop a roadmap for improving the position from the "as-is" to their desired "to-be" position (roadmap function)?
3. How critical attributes of a digital culture should be addressed to reflect the criticality of organizational culture for the success of digital transformation efforts?

The paper is structured as follows. In Section 2 the adopted development framework and the designed DSTM-Meta Model are presented. Furthermore, the Delphi-process applied is outlined. In Section 3 the DSTM-Assessment Model and related details as result of this research are introduced. In Section 4 the findings from pilot-testing the model in several service provider companies are outlined. Section 5 continues with the discussion of the research work. Finally, the conclusion about the main findings, the limitations of the model and recommendations for future research will be found in Section 6.

2 METHODOLOGY

A proven standard development framework used to guide the design of maturity models in other domains (de Bruin et al., 2005) was adopted (Fig. 1).

The scope of this research was limited to the first four phases of the framework. In phase "Scope" and phase "Design" the meta-model for the DSTM was developed. The proposed basic design of the DSTM-Meta Model is consisting of factors, subfactors and 6 well defined maturity stages including a default level zero which reflects business-as-usual and a "state of inactivity trying to keep the status-quo and believing that it remains the solution to digital relevance" (Solis, 2016). The factors are describing the success-crucial levers of digital transformation. The number of factors for this model was limited to a maximum of 10 factors to avoid complexity. The factors are further broken down into subfactors, which represent the critical abilities and enablers within a factor and specify what should be measured by the model for each factor. The number of subfactors per factor was limited to a maximum of 5 factors. Hence, the proposed model can represent a maximum of 50 subfactors describing digital maturity and therefore enable a quite comprehensive assessment of digital maturity.

After defining scope and design of the model, in the phase "Populate" the content of the maturity model was decided. The goal of this phase is to decide what needs to be measured in the maturity assessment and how this can be measured. The outcome are the factors and subfactors that are mutually exclusive. Due to the fact, that the domain of digital transformation maturity for service-provider organizations was not established properly and that there was not sufficient literature available, a Delphi method with an expert panel was applied to develop the critical success factors (levers

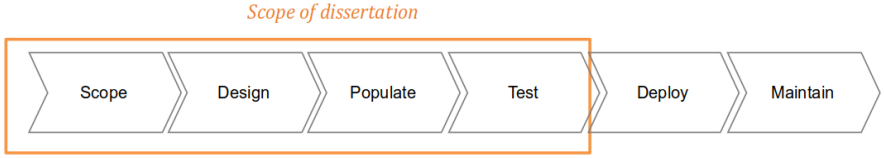

Fig. 1: Development framework and scope of research work (de Bruin et al., 2005)

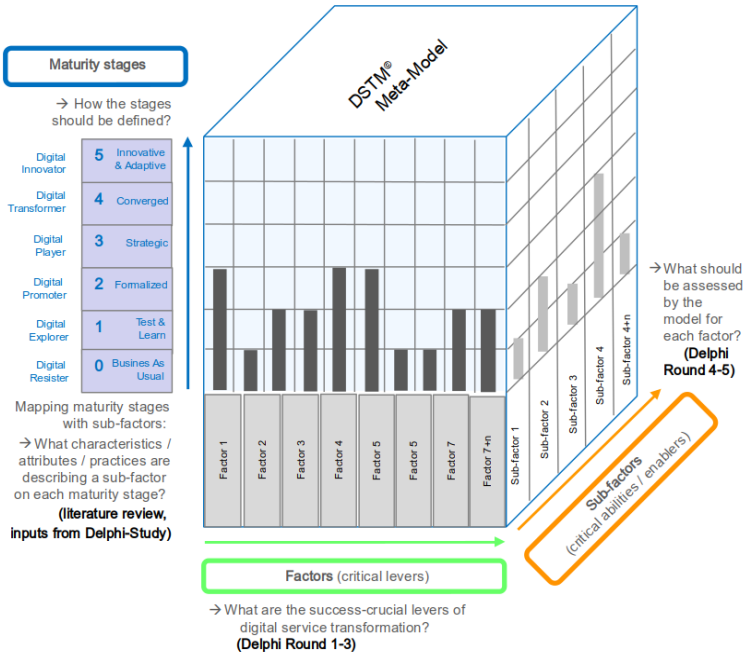

Fig. 2: Proposed Digital Service Transformation Maturity (DSTM) Meta Model

Tab. 2: Expert panel for Delphi-study

Company (Country)	Industry	#	Role of participants
Company A (Austria)	Elevator and Escalator products & Services	2	P1: Director Sales & Marketing P2: Director Field Operations
Company B (Austria)	High-end Domestic Appliances and Commercial Equipment & Services	1	P1: Director Technical Services
Company C (Austria)	Print and digital document products & Services	2	P1: Managing Director P2: Customer Service Expert
Company D (Austria)	Building Technology & Solutions	1	P1: Business Development Manager
Company E (Austria)	Ventilation, Heating, Air-Conditioning, Commercial Refrigeration, Equipment & Services	2	P1: Managing Director P2: Director Customer Services
Company F (Germany)	Automatic Door Systems & Services	1	P1: Business Unit Manager
Company G (Austria)	Food & Beverages B2B	1	P1: Director B2B
Company H (Germany)	Facility Management	1	P1: Technology & CDO, Member of Executive Board
Company I (Austria)	Automation Solutions for Production & Logistics	1	P1: Corporate Head of Service Relation Mgmt.
University of Applied Science A (Austria)	Institute Industrial Engineering & Innovation	1	P1: Professor Industrial Engineering
University of Applied Science B (Austria)	Institute Industrial Engineering & Innovation	1	P1: Professor Industrial Engineering
Consulting Company A (Austria)	Innovation Strategy Consulting	1	P1: Managing Director
Consulting Company B (Austria)	Customer Experience & Service Consulting	1	P1: Managing Director

Tab. 3: Delphi process applied to develop the DSTM-Model

Researcher	Export Panel	Time
Round 1 • Request 5 success-factors and hinders/barriers considered critical for digital transformation efforts	*Round 1* • Propose 5 success-factors and hinders/barriers considered critical for digital transformation efforts in service organizations	15 work days
Round 2 • Consolidate success-factors and hinders/barriers considered critical (maximum 10) → derive list of factors for model • Compare, match and complement with list of model factors identified in a systematic literature review (Teichert, 2019) • Propose a consolidated list of model factors (maximum 20)	*Round 2* • Rate list of consolidated factors for the model • Provide commentaries, suggestions and other important input	18 work days
Round 3 • Propose final list of factors for the model based on ratings and commentaries provided (maximum 10) • Request factor definition and identification of critical elements to be included in each factor (max 5 per factor)	*Round 3* • Inform about final list of factors based on ratings • Rate satisfaction of final factors and provide comments and suggestions • Propose definition for final factors by identifying elements considered critical for inclusion in factors (max 5 per factor)	21 work days
Round 4 • Consolidate/aggregated elements considered critical for inclusion in factor definition (maximum 10 per factor) • Provide aggregated themes per factor and propose first draft of definition per factor to review	*Round 4* • Review aggregated list of elements considered critical for definition • Review and comment on first draft of definition per factor • Propose critical abilities and enablers within the factors to be included and assessed in the model	33 work days
Round 5 • Consolidate comments and suggestions related to definitions per factor • Propose revised definitions per factor • Consolidate critical abilities/enablers (subfactors) within the factors to be included and assessed in the model • Propose a consolidated list of critical abilities/enablers (subfactors; max 5 per factor)	*Round 5* • Review revised definitions per factor • Review consolidated list of critical abilities/enablers (subfactors) within the factors to be included and assessed in the model • Comment on proposed list of critical abilities/enablers (subfactors) • Rate satisfaction per factor with final results and provide comments and further suggestions (factors, definition, subfactors)	30 work days
Summarize findings • Summarize final factors and definition (critical levers for digital transformation maturity) • Summarize final list of subfactors (areas within the factors for assessment by the model → critical abilities/enablers)	*Information about findings* • Information about final list of factors and definitions • Information about final list of subfactors (areas within the factors for assessment by the model → critical abilities/enablers)	10 work days

for digital transformation) and its subfactors (capabilities/characteristics) in more detail.

The DSTM-Meta Model was the guiding model for the Delphi-process to establish a common understanding and language among the experts and to provide overview and orientation related to the scope and tasks for each Delphi-round. The factors and subfactors were derived from clusters of themes generated by the experts during the process. The DSTM-Meta Model and the elements addressed by each of the Delphi-rounds are illustrated in Fig. 2.

Along the five Delphi-rounds 16 experts reflecting 10 different companies and two Universities of Applied Sciences were involved. To link the model to the context of a service-provider organization the expert panel (Tab. 2) was recruited mainly from service provider companies. Due to the innovativeness of the model to be developed and the lack of research in the domain of DSTM, the focus was laid on practitioners (76% industry, 12% consultants, 12% academia). All selected practitioners from industry offer a product-service system to their

customers. The functions in the expert panel vary from managing directors, country managers, service managers and technical service specialists to consultants. Three experts are from Germany, the rest is Austrian.

In the first 3 rounds the factors reflecting the critical levers for the digital transformation in service were developed. In round 4–5 the subfactors reflecting critical abilities and enablers per factor were clustered and mapped out. The entire Delphi process applied to develop the DSTM-Model is summarized in Tab. 3.

The average duration of each Delphi-round was 24 days and the average response rate was at 89%. The outcome of the Delphi process were factors, their definition and related subfactors described by associated topics and themes generated by the experts.

The overall satisfaction of the expert panel with all developed factors, subfactors and their definition along the Delphi-process was quite high, with 74% of respondents being very satisfied, 25% quite satisfied and 1% being neutral.

The mapping of each subfactor with 5 maturity stages, which represents the third dimension of the model, was the last step to finalize the DSTM-Model. By using the specific inputs from the Delphi-study and from a complementing literature review related to each subfactor, all identified subfactors were described and characterized by specific and assessable attributes for each of the maturity stages. Because of this granularity the model is on the one hand descriptive, which is important for understanding the status-quo of digital maturity ("as-is" position), and on the other hand prescriptive ("to-be" position), what is important for developing specific paths and action plans to improve digital maturity. This model approach enables a very comprehensive and holistic view of digital transformation for service provider organizations.

In phase "Test" the maturity model and the assessment instrument of the model were pilot tested by members of the expert panel involved in the Delphi-study. In this way the application could be tested, and the achievement of the desired design objectives was validated. The digital maturity levels of the participating companies were evaluated and visualized in the Digital Maturity Matrix. The deployment in the industry and ongoing maintenance of the DSTM-Model were not in the scope of this research. In the following chapters the developed DSTM-Assessment Model and the first pilot-test result as outcome of this research work are presented.

3 RESULTS

3.1 Factors and Subfactors of the Digital Service Transformation Maturity Model

Finally, 8 factors and 27 subfactors describing "Digital Service Transformation Maturity" were developed during the Delphi-study. All 8 factors and associated subfactors were further grouped into two main dimensions reflecting digital enabler (technological aspect) and transformation enabler (managerial aspect) as proposed by some comprehensive digital maturity models (Shahiduzzaman et al., 2017; Westerman and McAfee, 2012) identified in the systematic literature review (Teichert, 2019). Finally, the two dimensions adopted to measure digital maturity are "Digital Capabilities" and "Digital Impact", in line with the digital maturity model of PWC (Shahiduzzaman et al., 2017). This model was used as a guiding model for the "Digital Service Transformation Maturity Model" developed in this research work, as it is one of the most comprehensive models identified in the systematic literature review (Teichert, 2019). This allows that digital maturity is measured in these two dimensions and therefore guarantees a more holistic approach of digital maturity also underlining the criticality of the managerial and "soft" aspects for the success of digital transformation initiatives. "Digital Capability" should reflect "the strength of the organization's digital foundation", and "Digital Impact" how "digital technology is leveraged in the organization to respond to customer demand and changes in

Tab. 4: Digital Capability Indicators (Source: Delphi-study)

Factors	Subfactors	Number of assessment items
Digital Service Strategy	Digital transformation scenario for service	12
	Market analysis of digitalization in service	12
	Digitalization fields in service	9
	Roadmap for digitalization	9
Digital Competence	Profiles of digital competence	23
	Digital talents	17
	HR-development agenda for digitalization	13
Customer Experience	Personalization of service	17
	Simplification of interactions	17
	Management of expectations	23
Digital Technology	Adoption of new digital technology	14
	Digital IT-architecture	10

Tab. 5: Digital Impact Indicators (Source: Delphi-study)

Factors	Subfactors	Number of assessment items
Digital Service Business Model	Framework of digital service business model	19
	Service Engineering & Innovation	21
	Digital service ecosystem	24
Smart Services	Smart product	12
	Smart data	11
	Digital service platform	12
Digital Leadership & Organization	Creating the organizational frame	14
	Providing orientation	15
	Managing change	18
	Digital savvy	15
Digital Culture	Digital-first mindset	7
	Innovation	15
	Agility	10
	Data-driven decisions	21
	Collaboration	13

the environment through new product and service offerings and hence make transformation impact in the market" (Shahiduzzaman et al., 2017). "Organizations reach the highest level of maturity when they have both a strong digital foundation and a good understanding of how to leverage this foundation for a strategic business advantage" (Shahiduzzaman et al., 2017). Final grouping of factors and related subfactors into Digital Capability Indicators and Digital Impact Indicators is outlined in Tab. 4 and Tab. 5.

3.2 Maturity Levels

To define the digital maturity levels of the DSTM-Model three digital maturity models addressing different perspectives were adopted. Two of the applied models were identified during the systematic literature review (Teichert, 2019). The third model adopted was identified during additional literature research and reflects more the perspective of business and IT alignment to drive digital transformation. The first underlaying model developed

Tab. 6: Digital Maturity Levels (Solis, 2016; Whalen, 2015; Valdez-de-Leon, 2016; adopted by the author)

Stages	Description of stages
Level 0 Business-as-Usual	• *Organization:* Organization operates with an intimate legacy perspective of customers, processes, metrics, business models and technology, believing that it will remain the answer and solution to digital transformation. • *Digital Initiatives:* No steps taken by the organization yet to transform. • *Business and IT alignment:* There is a disconnect between business and IT digital initiatives, which are also poorly aligned with company strategy. Customer experience is not focused at all. • *Business Outcome:* Business provides weak customer experiences. Digital technology is just used to riposte threats.
Level 1 Testing & Learning	• *Organization:* Imagination and experimentation is triggered by new technology. Experimentation is driving digital skills and creativity throughout the organization, although disparately, while aiming to improve specific touchpoints and processes. • *Digital Initiatives:* The organization is taking intentionally first steps to move toward a digital business. • *Business and IT alignment:* The organization has discovered the need to evolve a digitally enhanced business strategy. Execution still is on a project basis and progress cannot be predicted or repeated. • *Business Outcome:* Digital enabled customer experiences, products and services are inconsistent and poorly integrated.
Level 2 Formalized & Enabling	• *Organization:* Sense of urgency accelerates, more formalized investments with greater impact. Programs become more intentional. More organized and cross-functional pilots. Digital literacy becomes primary focus. Executive sponsor for DT is established. • *Digital Initiatives:* The organization is implementing initiatives within the factor that will form the foundation of its digital business. • *Business and IT alignment:* Organization has started to evolve a digitally enhanced business strategy in a more formal way. Execution is on a more intentional and programmatic basis by connecting business and digital IT initiatives. • *Business Outcome:* Digital enabled customer experiences, products and services are more consistent and better integrated.
Level 3 Strategic & Integrated	• *Organization:* Strive for relevance escalates. Change starts to be recognized and appreciated by the entire organization. DT becomes intentional with short- and long-term goals supported by investment and infrastructure. More ambitious efforts formally organized. DT efforts span every category (DCX, sales, service….). Digital literacy is a mandate. • *Digital Initiatives:* To support end-to-end capabilities all digital initiatives are being integrated across the business. • *Business and IT alignment:* Business and IT goals are aligned at company level related to the creation of digital products, services and experiences. Business is still not focussing on the disruptive potential of digital initiatives. • *Business Outcome:* Products, services, and experiences are provided consistently but they are not truly innovative.
Level 4 Converged & Managed	• *Organization:* To guide strategy and operations a dedicated transformation team is formed. The new organizational structure takes shape. Roles, models, processes and systems to support transformation gets consolidated. • *Digital Initiatives:* Digital initiatives are being fine-tuned and utilized to further drive overall business performance. • *Business and IT alignment:* Integrated business and IT management disciplines exploit synergies and deliver digitally enabled products, services and experiences on a continuous basis. • *Business Outcome:* Business is providing world-class digital products, services, and experiences and is a leader in its markets.
Level 5 Innovative & Adaptive	• *Organization:* Digital transformation becomes a way of business for the organization and its executives. A new ecosystem is established to identify and act upon technology and market trends in pilot and eventually in scale. Culture of innovation becomes a priority. • *Digital Initiatives:* The organization is breaking new ground with its digital initiatives and is advancing the state of the practice within the factor. • *Business and IT alignment:* The organization is very disruptive in the use of new digital technologies and business models. Ecosystem awareness and feedback drives business innovation continuously. • *Business Outcome:* Business renews existing markets and develops new ones to its own advantages. The company is a fast-moving target for competitors.

Tab. 7: Example of assessment attributes per level for subfactor "Profiles of Digital Competence" (ability of the service company to develop systematic digital skills management to identify existing and future required digital skills and to implement targeted measures to close the identified skills gaps)

Maturity	Description
Level 0	• There is no awareness of required digital capabilities in the service company and no effort to address them.
Level 1	• The awareness of and need for individual digital skills is recognized ad hoc during the first digital pilot projects. • Digital "hard skills" or more technologically oriented skills are in the foreground (e.g. cloud computing, analytics, big data, digital tools). • It is recognized that employee profiles need to be updated in terms of their digital skills. Job descriptions need to reflect the required digital skills.
Level 2	• The systematic assessment of digital skills is initiated and driven forward at management level. • A recognized digital skills framework is used to ensure currency and completeness (hard/soft digital skills) of digital skills. • A thorough inventory of digital skills that already exist in the service company is available. • Required digital skills for the relevant functions are defined in light of the first planned digitalization initiatives and programs.
Level 3	• The service company sees digital skills for employees and managers as a key enabler for the digital strategy and a competitive factor. • In addition to digital "hard" skills (e.g. cloud computing, analytics, big data, etc.), digital "soft" skills (e.g. collaboration, change management, etc.) and digital leadership skills are playing an increasingly important role. • Digital skills are anchored in job/function descriptions based on a unified digital skills framework. • Digital skills required in the future are derived from the digital strategy. • The majority of employees and managers conduct a self-assessment of their existing and required digital skills. • Descriptions of digital skills and their assessment play an important role in the recruiting process.
Level 4	• Considering external trends and functional strategies, a clear understanding of areas in the service business is created, that provides insights as to which specific digital skills are needed and where they have the greatest impact (e.g. Advanced Analytics, Service 4.0, Agility, Digital Business, Digital Marketing). • The digital job profiles and functions that the service company needs for digital transformation and the related digital initiatives in the next 1–2 years are identified (e.g. Data Scientist, Marketing Automation, UI/UE Designer). • Management can pinpoint the risks posed by the lack of or gaps in required critical digital skills, (e.g. delay in digital transformation, cyber security risks). • Required digital skills and skill levels for existing job/function profiles in the service organization are identified and specified in a digital skills matrix. A systematic assessment of existing digital skills and skill gaps is carried out regularly. • A majority of employees see the gap between existing and required digital skills for their current job and future career path.
Level 5	• The digital skills matrix is updated on an ongoing basis to reflect key external trends, service market requirements and changes in strategy. • Required digital job profiles (e.g. digital product manager, UX/CX designer) and digital soft skills (e.g. collaboration, change management, customer centricity, data-driven decision making, …) for the development of innovative/disruptive services / business models take centre stage and are mapped in the digital skills matrix. • Most employees have an individual development plan that targets the existing digital skills gap and development goals for potential future jobs. • Contractual partners/service providers/suppliers are evaluated and selected based on the digital skills framework used in terms of their digital skills, skill levels and experience.

by Alimeter (Solis, 2016) describes digital transformation in six stages. This model claims that "companies typically pursue change from a known, safe approach correlating with business-as-usual practices. Operating within the confines of traditional paradigms without purpose or far-seeing vision eventually challenges the direction, capacity, and agility for thriving in our digital economy" (Solis, 2016). Building on interviews of companies engaging in digital transformation the researchers have found a "series of patterns, components, and processes that form a strong foundation for change" (Solis, 2016). These phases represent a kind of

Tab. 8: Comparing DSTM-Model with other digital maturity models

Model	Domain	# of factors/ dimensions	# of subfactors	# of maturity levels/stages	# of attributes/ characteristics specifying maturity
"Digital Service Transformation Maturity Model" (Teichert, 2019)	Service	8	27	5 (plus default level "zero")	403
"Digital Maturity Model for Telecommunication Service Providers" (Valdez-de-Leon, 2016)	Service	7	–	5 (plus default level "zero")	129
"Value Centric Maturity Model" (Shahiduzzaman et al., 2017)	General	13	–	4	62
"St. Gallen-Model" (Berghaus and Back, 2016)	General	9	–	5	60

blueprint for digital maturity to guide effectively digital transformation efforts and were used as underlaying digital maturity level model to address the organizational perspective of digital transformation. The next model adopted is a specific digital maturity model for service providers acting in the telecommunication industry (Valdez-de-Leon, 2016). It was the only domain specific model for service providers identified in the systematic literature review (Teichert, 2019). In this model "maturity in each dimension is assessed across five levels plus a default level zero reflecting a state of inaction" (Valdez-de-Leon, 2016). Each of the proposed levels in this model builds on the previous one and especially addresses the perspective of digital initiatives for service organizations to drive digital transformation. To reflect the IT perspective of digital transformation the DSTM-Model was complemented with IDC's "Information Digital Transformation Maturity Scape" model (Whalen, 2015). The IDC model especially addresses the perspective of business and IT-alignment with specific business outcomes of digital transformation. Finally, the overall maturity level model adopted and the description for each level and different perspectives (organization, digital initiatives, business & IT alignment, business outcome) are outlined in Tab. 6. Based on this adopted digital maturity level model, all subfactors were specified and described in detail with specific attributes and characteristics for each maturity level to enable a distinct assessment of maturity per subfactor. In addition to the systematic literature review (Teichert, 2019) and the input from the Delphi-study, further literature, reports, concepts, and generic models related to the subfactor topic were reviewed to support the development and definition of attributes for each maturity level. The attributes were created step by step by the author, starting with the description of the first level of maturity (Business-as-Usual) and then formulating the attributes and characteristics of the next higher level. In this way, every maturity level is building on the previous level. Attributes of digital maturity identified in specific literature related to a subfactor were integrated into the maturity level description accordingly. All attributes always were compared and matched with the guiding overall digital maturity level framework (Tab. 6) to ensure alignment. The whole development process was iterative to ensure consistency and differentiation between the maturity levels. Eventually 403 specific items to assess the maturity of all subfactors were created (Tab. 4 and Tab. 5). For example, for the subfactor "Profiles of Digital Competence" within the factor "Digital Competence" the specific attributes per maturity level are illustrated in Tab. 7. Building on these attributes each subfactor will be rated between "Level 1" and "Level 5" depending on what level best describes the current state of DSTM of the service company.

This detailed description of digital maturity per subfactor and per level provides also good guidance and orientation for stepping up to the next level of digital maturity. Even if

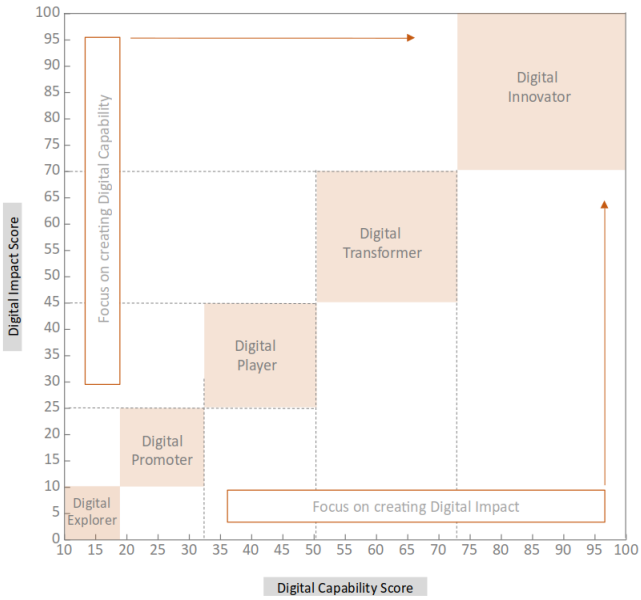

Fig. 3: Digital Transformation Maturity Matrix

actions to improve digital maturity are not fully prescribed in the model, the way attributes are formulated provides already a good informative basis for discussing and deriving possible course of actions from each attribute.

Compared with other examined digital maturity models the presented DSTM-Model comprises the highest number of attributes and characteristics describing digital maturity (Tab. 8). This also is driven by the fact that the 8 factors were broken down into 27 subfactors, which finally were described with 403 specific attributes across 5 maturity levels.

3.3 Digital Service Transformation Maturity Matrix

The DSTM-Model specifies each maturity level for each subfactor and therefore provides an orientation how to move up the maturity scale for each subfactor and what overall a more mature digital service organization and business means. Grouping of factors into Digital Capability and Digital Impact Indicators helps companies to pursue a balance between both dimensions. To achieve the highest level of digital maturity a balance between both indicators is required. Hence, achieving high level of maturity in just one dimension is not enough to achieve an overall high level of digital maturity. In this sense the model spans a matrix consisting of the two dimensions Digital Capability and Digital Impact (Fig. 3).

Within the matrix the different digital maturity areas defined by maturity levels and scoring range are depicted (Tab. 9). The key principle of the DSTM-Model is to always pursue a balance between Digital Capability and Digital Impact. Service companies just focusing on one dimension will not achieve higher level of DSTM. Particularly, if transformation efforts are mainly addressing the digital foundation, which starts with digital technology, and just aim to implement the latest technology trend to become digital, it will not drive digital maturity to a sufficient level. At the same time Digital Impact factors like Digital Culture, Leadership & Organization, Smart Services and Digital Service Business Model are needed to leverage digital technology to react to market demand and changes through improved service offerings. If a service company scores strong on Digital Capability factors and less on Digital Impact factors, the emphasis of actions needs to be placed on developing the weakest subfactors regarding Digital Impact first and vice versa.

Tab. 9: Maturity levels, scoring points assigned and arche-types of digital maturity

Maturity levels	**Level 1** "Testing & Learning"	**Level 2** "Formalized & Enabling"	**Level 3** "Strategic & Integrated"	**Level 4** "Converged & Managed"	**Level 5** "Innovative & Adaptive"
DC, DI-Score Range	0–10	10–25	25–45	45–70	70–100
Archetypes	Digital Explorer	Digital Promoter	Digital Player	Digital Transformer	Digital Innovator

In this way the DSTM-Matrix also supports the prioritization of actions to improve digital maturity. By positioning a service company in the DSTM-Matrix areas to improve digital maturity can be spotted depending on how far the "as-is-position" is off the ideal maturity evolution path and the future "to-be-position" of digital maturity can be envisioned. The ideal evolutionary path is to keep Digital Capability and Digital Impact always in balance. In that context the DSTM-Matrix also is a communication tool to facilitate discussion and understanding of the positioning, identifying potential focus areas and deciding a concrete improvement path and course of action addressing relevant subfactors and attributes.

3.4 DSTM-Assessment Model

The specific description of attributes for each maturity level per subfactor – 403 attributes for the model in total – forms the backbone of the assessment model. To quantify the level of maturity for a subfactor a simple scoring model was adopted. The scale of maturity is ranging from 0 to 100 points, whereby "Level 0" represents zero points, and "Level 5" represents 100 points. Higher maturity levels provide higher incremental points. This should reflect that lower maturity levels can be achieved faster and easier than higher levels of maturity. Therefore, higher levels of maturity are weighted stronger in the scoring model. During an assessment each subfactor will be rated between "Level 1" and "Level 5" depending on what level best describes the current state of DSTM of the service company. To qualify for a certain maturity level all attributes of this level and all previous levels must be fulfilled. Finally, the assessment scores of all subfactors are used to calculate an overall average Digital Capability (DC) and Digital Impact (DI) Score. Basing on the determined DC- and DI-Score the assessed service company can be positioned in the two-dimensional DSTM-Matrix (Fig. 3). The overall maturity level model and the proposed archetypes of digital maturity form the foundation for classifying service provider companies. The different typologies will be used to characterize companies related to their overall DSTM and to give a labelling and a description regarding their position (as-is position) in the DSTM-Matrix. Based on the defined maturity levels and scale of maturity ranging from 0 to 100 for each archetype a range of assessment scores for DC-Score and DI-Score was defined (Tab. 9).

4 TESTING THE MODEL

In the following the results obtained from testing the designed DSTM-Assessment Model are presented. Seven experts representing five service provider companies (Tab. 10) participating in the expert-panel of the Delphi-study, were testing the model based on a standardized easy-to-use assessment template which was provided per email.

The goal of the test was to proof firstly the understandability of assessment logic and attributes describing digital maturity, secondly the practicability and ease of use of the assessment templates itself, thirdly the evaluation of the assessment and fourthly the depiction in the DSTM-Matrix. The determination and evaluation of scores was facilitated by the

Tab. 10: Companies testing the DSTM-Model

	Company A	Company B	Company C	Company D	Company E
Industry	Elevator and Escalator products & services	High-end domestic appliances and commercial equipment & services	Print and digital document products & services	Automation technologies and services for commercial, industrial, public buildings and infrastructures	Ventilation, heating, air-conditioning, commercial refrigeration equipment & services
Participants	2	1	2	1	1
Roles of Participants	P1: Managing Director, P2: Senior Leader (Mgmt. Board)	P1: Senior Leader (Mgmt. Board)	P1: Managing Director, P2: Customer Service Expert	P1: Business Development Mgr.	P1: Senior Leader (Mgmt. Board)

Tab. 11: Digital Capability Scores per Company and Subfactor (max = 100)

Factors (critical levers)	Subfactor (critical enabler)	Company & Participant Assessment Scores A1	A2	B1	C1	C2	D1	E1	Score per subfactor
Digital Service Strategy	1.1 Digital Transformation Scenario for Service	45	10	25	70	70	100	70	56
	1.2 Market Analysis of Digitalization in Service	25	10	10	45	70	70	70	43
	1.3 Domains of Digitalization in Service	70	70	25	25	70	70	70	57
	1.4 Roadmap for Digitalization	45	10	0	45	45	100	70	45
Digital Competence	2.1 Profiles of Digital Competence	10	10	0	25	25	70	45	26
	2.2 Digital Talents	10	10	10	10	25	100	25	27
	2.3 HR-Development Agenda for Digitalization	10	10	10	10	25	70	45	26
Customer Experience	3.1 Personalization of Service	25	45	25	10	45	100	45	42
	3.2 Simplification of Interactions	25	10	25	0	45	70	25	29
	3.3 Management of Expectations	10	25	10	10	25	25	45	21
Digital Technology	4.1 Application of New Digital Technology	45	25	45	10	45	45	45	37
	4.2 Digital IT Architecture	25	45	25	25	45	100	45	44
	Average Digital Capability Score per Participant	29	23	18	24	45	77	50	
	Average Digital Capability Score per Company	26		18	34		77	50	

Tab. 12: Digital Impact Scores per Company and Subfactor (max = 100)

Factors (critical levers)	Subfactor (critical enabler)	Company & Participant Assessment Scores A1	A2	B1	C1	C2	D1	E1	Score per subfactor
Digital Service Business Model	5.1 Framework of Digital Service Business Model	10	10	10	10	45	100	45	33
	5.2 Service Engineering & Innovation	45	45	25	25	45	70	70	46
	5.3 Digital Service Ecosystem	10	10	10	10	25	25	45	19
Smart Services	6.1 Smart Product	45	25	100	25	45	100	45	55
	6.2 Smart Data	25	45	45	45	45	70	70	49
	6.3 Digital Service Platform	25	45	25	10	25	70	45	35
Digital Leadership and Organization	7.1 Creating the Organizational Frame	25	25	10	25	25	100	45	36
	7.2 Providing Orientation	25	10	25	10	45	100	45	37
	7.3 Managing Change	25	10	10	25	25	100	45	34
	7.4 Digital Savvy	10	10	10	25	25	100	25	29
Digital Culture	8.1 Digital First Mind-Set	45	45	10	10	25	70	25	33
	8.2 Innovation	25	10	10	25	25	70	45	30
	8.3 Agility	25	25	10	25	45	70	25	32
	8.4 Data-Driven Decisions	25	10	25	10	45	70	25	30
	8.5 Collaboration	10	10	10	10	45	70	45	29
	Average Digital Impact Score per Participant	25	22	22	19	36	79	43	
	Average Digital Impact Score per Company	24		22	28		79	43	

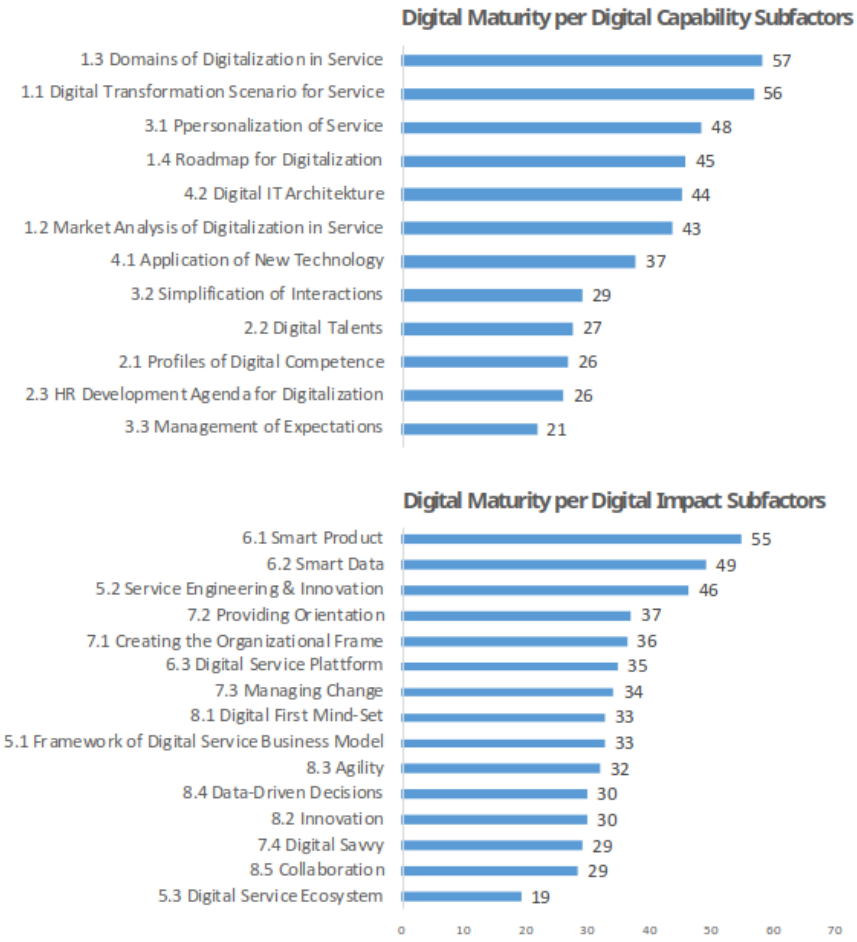

Fig. 4: Ranking of Digital Capability and Impact Subfactors by Digital Maturity Scores (max = 100)

applied assessment templates for each factor and average Digital Capability and Digital Impact scores per factor and finally for each service company could be evaluated quite easily (Tab. 11 and Tab. 12).

Furthermore, the overall scores of subfactors for all the service companies could be evaluated, which gives good insight into the overall maturity status for subfactors of the domain of service and provides guidance for service companies on which subfactors they should focus to drive digital transformation maturity further (Fig. 4).

Regarding Digital Capability it became evident that the subfactors related to "Customer Experience" (3.2 Simplification of Interactions, 3.3 Management of Expectations) and related to Digital Competence (2.1 Profiles of Digital Competence, 2.2 Digital Talents, 2.3 HR-Development Agenda for Digitalization) show lowest level of maturity. Subfactors related to "Digital Strategy" (1.1 Digital Transformation Scenario for Service, 1.3 Domain of Digitalization in Service) reflect highest level of maturity, which clearly underlines that service companies are working on their digital strategy but seem to lack the required digital competencies and talents. The ability to manage customer experience seems also to be underdeveloped, except the ability to personalize services. This clearly indicates that the factors "Customer Experience" and "Digital Competence" need to

Tab. 13: Distribution of Digital Capability and Impact subfactors across maturity levels

Maturity level (score)	Digital capability % of subfactors per maturity level (n = 12 subfactors)	Digital impact % of subfactors per maturity level (n = 15 subfactors)
Digital Innovator (>70)	0%	0%
Digital Transformer (46–70)	25.0% (16.7%)	20.0% (13.3%)
Digital Player (26–45)	66.7% (41.7%)	73.3% (33.3%)
Digital Promoter (11–25)	8.3% (41.7%)	6.7% (53.3%)
Digital Explorer (0–10)	0%	0%

Note: Figures in brackets reflect % distribution without scores of outliers (Company D)

be specifically addressed in the digital strategy of the service companies participating in this assessment.

Regarding Digital Impact most of the subfactors related to "Digital Culture" (8.2 Innovation, 8.3 Agility, 8.4 Data-Driven Decisions, 8.5 Collaboration) show lower levels of maturity. This assessment result clearly indicates that these service companies need a strong focus on "Digital Culture" to drive digital maturity. The subfactor "Digital Savvy", which reflects the digital competence of the leadership team, is also ranking very low. The lowest level of maturity of all Digital Impact subfactors is represented by the subfactor 5.3 Digital Service Ecosystem. The subfactors 6.1 Smart Products, 6.2 Smart Data and 5.2 Service Engineering & Innovation rank highest in this group, what underlines the main starting point of digital transformation in these service companies, namely making the product smart by adding sensors, capturing data in the cloud, analyzing data with algorithms to gain valuable insights and creating new services. Regarding the factor "Digital Service Business Model" it is quite interesting that the subfactor 5.2 Service Engineering & Innovation shows a higher level of maturity, but the other two subfactors which are 5.1 Framework of Digital Service Business Model and 5.3 Digital Service Ecosystem reflect clearly lower levels of maturity. This indicates that these service companies assess their ability to develop and engineer new services relatively high but are not able to translate this ability into developing digital service business models or a digital service ecosystem.

This ranking suggests that on average just a few subfactors are on a Digital Transformer level and most subfactors are still on a "Digital Promoter" or "Digital Player" level (Tab. 13). If you would take out the scores of the outlier service company positioned on Digital Innovator level (Company D) the average scores per subfactor would be even lower and just 16.7% of Digital Capability subfactors and 13.3% of Digital Impact factors would be on Digital Transformer level.

The transfer and depiction of the Digital Capability and Impact scores into the DSTM-Matrix was straight forward and worked out well. The matrix visualized clearly the "as-is" position of each assessed service company and lays a foundation for comparison and developing a path for the desired future state of digital maturity (Fig. 5).

The position of assessed service companies in the DSTM-Matrix depicts that most of the service companies – three out of five – are Digital Promoters or Digital Players. Overall, there is a big spread between the five assessed service companies ranging from Digital Promoter to Digital Innovator. All assessed service companies show a good balance between Digital Capability and Digital Impact factors, although three out of the five service companies close to Digital Player or Digital Transformer level need to improve their Digital Impact factors. Finally, the first test results suggest that most of the assessed service companies still reflect some digital immaturity and not have reached a Digital Transformer level yet. More attention on the factors highlighted above is needed to improve digital transformation maturity further.

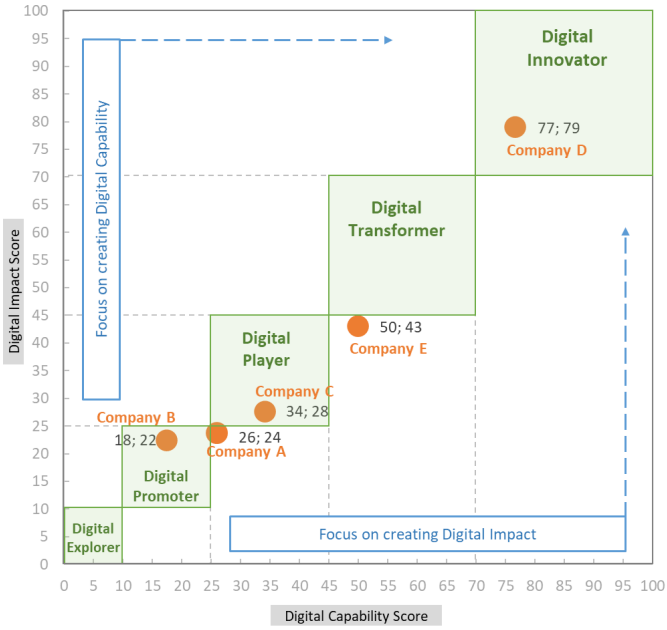

Fig. 5: Service companies positioned in the Digital Service Transformation Maturity Matrix (Source: pilot test)

5 DISCUSSION

5.1 Systematic Literature Review

A systematic literature review (Teichert, 2019) as part of this research took stock of research and contemporary development in the field of digital maturity and has identified 22 different digital maturity models. These models were examined in detail to better understand the contemporary development of digital maturity models and – building on the findings – a comprehensive Digital Service Transformation Maturity Assessment model for the domain of service was developed.

All reviewed digital maturity models are proposing different maturity dimensions, maturity stages and assessment items. Overall, 15 different maturity areas are identified in the included models: Digital Culture, Technology, Operations & Processes, Digital Strategy, Organization, Digital Skills, Innovation, Customer Insight & Experience, Governance, Vision, Digital Ecosystem, Leadership, Compliance & Security, Products & Services and Business Model. Maturity areas of relevance for transformational capabilities of an organization like vision, leadership, digital culture, innovation and governance are playing a more important role in general than in domain-specific contemporary digital maturity models. But to succeed in digital transformation efforts both transformational and digital capabilities are needed in organizations. When comparing the maturity areas addressed in different models, it also becomes evident that nearly all models place strong focus on the technological and process-side of digital transformation. In domain-specific digital maturity models, "technology" is the most addressed maturity area, followed by "digital skills" and "operations & processes". Analysis of maturity areas in general models clearly indicates that "digital culture" is the most addressed maturity area, followed by "technology" and "operations & processes". Hence, the culture aspect plays a significantly more important role in general digital maturity models than in domain-specific models. Other "soft" dimensions, more attached to transformational capabilities like leadership, vision, and

innovation culture are also more addressed in general than in domain-specific models. In addition, most of the contemporary digital maturity models – general and domain-specific – neglect and hardly reflect the capability to develop new and disruptive business models as an indicator for digital maturity. Just very few models address the aspect of the developing a new business model and to which extent digital is taken into consideration for it. This underlines that most companies rather focus on the exploitation of digital technology than on the exploration of digital innovation and development of new digital products and business models to generate new digital revenues. Another interesting finding is that maturity dimension "customer insight & experience" as characteristic of digital maturity plays a minor role in domain-specific models. General models also tend to show more external orientation and therefore take customer experience as criteria for digital maturity much stronger into account than domain-specific models.

A special light was shed in the analysis on the cultural aspect of digital transformation. Overall, more than half of the examined digital maturity models include "culture" as a maturity dimension. Especially general digital maturity models developed by practitioner (e.g. consultants) address "culture" as a critical enabler for digital transformation, because culture can be one of the barriers, which is often underestimated and usually not recognized by companies in the context of digital transformation. Especially attributes of a digital culture need to be well presented in a service-specific digital maturity model. When taking a closer look to the most frequently addressed cultural attributes in the examined digital maturity models, attributes like "collaboration", "agility & flexibility" and "organizational learning" could be found. The ability of an organization to change and continuously reinvent itself ("change ability"), along with "failure tolerance" and "risk tolerance" were identified as additional critical attributes of a digital culture. "Ideating new digitalized working methods", "open communication" and "customer centricity" were also addressed quite frequently in the culture dimension of the examined models. This is in line with a research study (Buvat et al., 2017), which was conducted to establish a definition of "digital culture".

Basing on the examined digital maturity models in this dissertation it can be argued that general digital maturity models more comprehensively address transformational capabilities, and the domain-specific models more strongly address digital-technological capabilities in the assessment of digital maturity of a company. There were some general models identified (Westerman and McAfee, 2012; Shahiduzzaman et al., 2017; Berghaus and Back, 2016), which already distinguish between two main areas encompassing digital assets, like digital capabilities, digital infrastructure and investments, and transformation enabler, like vision culture, leadership, governance, innovation or agility. These models cluster their dimensions into these main areas, which underlines the importance of the managerial and soft aspect of digital transformation efforts. They also propose a very comprehensive description of digital maturity and were used as guiding models in this dissertation. Following key findings of the systematic literature review are addressed by the developed Digital Service Transformation Maturity Model (DSTM) for service provider organizations:

- There is a lack of digital maturity models reflecting domains other than manufacturing, taking the context and challenges of other industries into account (e.g. service in technical industries). Major part of existing models addresses the domain of manufacturing (Industry 4.0). More specific and granular assessment approaches are required to give companies effective guidance towards digital maturity in different contexts.
- Inconsistency of dimensions, maturity levels and characteristics describing digital maturity across all existing digital maturity models. Underlaying definition of digital maturity demonstrate a significant heterogeneity in content and methodology.
- Most of the models provide an incomplete picture of digital maturity. Either transformational management capabilities (e.g.

vision, leadership, governance, innovation, agility) or an organization's digital foundation (e.g. technology, digital skills, organization, strategy, customer experience…) are not addressed sufficiently and systematically.

- Most of the examined digital maturity models are descriptive in their nature, just assessing the level of digital maturity, and do not give guidance and a clear roadmap how to achieve higher level of maturity (prescriptive).
- Cultural attributes enhancing digital transformation are not represented systematically in existing models. A consistent definition of "digital culture" has to be established.
- The aspect of digital business model is hardly addressed in any models.

5.2 Digital Service Transformation Maturity Model (DSTM)

Building on these findings a comprehensive Digital Service Transformation Maturity Model was developed by applying a development framework which was used for the development of other maturity models in other domains (de Bruin et al., 2005). By adopting the Delphi-Method 16 experts reflecting 10 different companies and two Universities of Applied Sciences were involved in the design of the model. The goal was to establish a very granular model consisting of factors, subfactors and five maturity levels including a default level zero which reflect business-as-usual and a state of inactivity trying to keep the status-quo and believing that it remains the solution to digital relevance. By breaking down the factors into subfactors a better granularity and guidance in striving for a desired future maturity state is provided. The subfactors were derived from clusters of themes generated by the experts. Finally, 8 factors and 27 subfactors were identified to describe digital transformation maturity for service provider organizations. When comparing the DSTM-Model with other relevant digital maturity models (Tab. 7) it becomes evident that the scope of the DSTM-Model is broader and the level of granularity significantly higher. None of the other models is using an additional layer of subfactors. In line with the guiding models (Westerman and McAfee, 2012; Shahiduzzaman et al., 2017; Berghaus and Back, 2016) a balance between digital capabilities and digital impact factors was pursued to ensure that digital maturity in the DSTM-Model is understood as a holistic concept addressing the managerial and soft aspect of digital transformation efforts, which is even more important in the service industry. The proposed model clearly addresses the identified lack of digital maturity models for the domain of service and the dissertation is enriching literature related to the topic of digital maturity models.

5.3 DSTM Assessment Model & Matrix

To make Digital Service Transformation Maturity assessable for each subfactor several specific attributes per maturity level were generated. Compared to other digital maturity models it is a very comprehensive model (Tab. 8). Eventually 403 specific attributes to assess the maturity of the subfactors were created in a way that each maturity level is building on the previous level. Building on these attributes each subfactor will be rated between "Level 1" and "Level 5" depending on what level best describes the current state of Digital Transformation Maturity of the service company. This detailed description of digital maturity per subfactor and per level provides also good guidance and orientation for moving to the next level of digital maturity. Even if actions to improve digital maturity are not fully prescribed in the model, the way attributes are formulated provides already a good informative basis for deriving possible actions from each attribute.

To visualize the assessment results of a service company (as-is-position) a two-dimensional Digital Transformation Maturity Matrix with a Digital Capability and Digital Impact Score was established. Within the matrix the different digital maturity areas are depicted. The key principle of the DSTM-Model is to always pursue a balance between Digital Capability

and Digital Impact factors. Service companies just focusing on one dimension will not achieve higher level of Digital Transformation Maturity. Particularly, if transformation efforts are mainly addressing the digital foundation, which starts with digital technology, and just aim to implement the latest technology trend to become "digital", it will not drive digital maturity to a sufficient level. At the same time Digital Impact factors like Digital Culture, Leadership & Organization, Smart Services and Digital Service Business Model are needed to leverage digital technology to respond to customer demand and changes in the environment through improved product and service offerings. By positioning a service company in the DSTM-Matrix areas to improve digital maturity can be spotted depending on how far the as-is-position is off the ideal maturity evolution path. If a service company scores strong on Digital Capability factors and less on Digital Impact factors, the emphasis of actions needs to be placed on developing the weakest subfactors regarding Digital Impact first and vice versa. In this way the DSTM-Matrix also supports the prioritization of actions to improve digital maturity. Overall, the designed DSTM-Matrix fulfils several important functions supporting the development and deployment of digital transformation efforts of a service company:

- Visualization-function: helping to visualize the as-is-position of the service company's digital transformation maturity in a two-dimensional continuum basing on Digital Capability and Impact Scores.
- Benchmarking-function: comparing the as-is-position with regards to maturity-zones in the matrix labelled with clear arche-types (Digital Resister, Digital Explorer, Digital Promoter, Digital Player, Digital Transformer, Digital Innovator). This maturity-zones reflect a position of balance between Digital Capability and Digital Impact factors.
- Alignment-function: supporting the discussion of results and review of detailed subfactor assessment to create common understanding of current state. Basing on the common understanding of current state the desired future state of digital transformation maturity can be developed.
- Roadmap-function: helping to decide the to-be-position of digital transformation maturity and to develop a path along the different maturity-zones. Underlaying subfactors and its specific attributes will help to develop a certain course of action fueling the transformation effort of a service company.
- Simulation-function: supporting to assess the impact of actions addressing different subfactors and make the progress visible. In this way the focus areas with biggest impact can be identified, prioritized and an effective course of action can be decided.

The DSTM-Matrix with its functions can effectively support the development process of the digital service strategy for a service provider company.

5.4 Test of the DSTM-Assessment Model

Finally, the designed DSTM-Assessment Model was tested by 7 experts participating in the expert panel of the Delphi-Study representing five service companies. The goal of the test was to proof firstly the understandability of assessment logic and attributes describing digital maturity, secondly the practicability and ease of use of the assessment templates itself, thirdly the evaluation of the assessment and fourthly the depiction in the DSTM-Matrix. Beyond that a first analysis and interpretation basing on the results was conducted. Basing on the feedback of experts the DSTM-Model is understandable, practicable and can be used in an easy way with the template provided for the test. Also, experts indicated that the assessment gives a clear picture of the as-is-situation and shows what could be possible regarding a potential desired state for different factors. This gives evidence that the attributes describing digital transformation maturity were clearly understandable for the assessors. At the same time some limitations and areas for improvement were pointed out. Especially it was highlighted that not all aspects can be assessed by one person, what proposes that

an interdisciplinary group of employees should be involved into the assessment. Beside interdisciplinarity it was mentioned that employees participating in the assessment should represent different levels of hierarchy, because perception of digital maturity might differ between various levels of hierarchy in a sense that employees from higher levels of hierarchy tend to assess digital maturity more optimistic than employees on lower levels. Regarding understandability one limitation was indicated. Although the assessment tool is clearly understandable for people who were involved in the development of the DSTM-Model like the experts testing it, it might be difficult for people not involved in the development and not being expert in the topic. In that context also the use of abbreviations should be reduced to a minimum because it could be misleading if assessors do not understand the concepts behind and are not familiar with it.

The determination and evaluation of scores was facilitated by the applied assessment templates for each factor and average Digital Capability and Impact Scores per factor and finally for each service company could be evaluated quite easily. Furthermore, the overall scores of subfactors for all the service companies could be evaluated, which gives good insight into the overall maturity-status for subfactors of the domain of service and provides overall guidance for service companies on which subfactors they should focus to drive digital transformation maturity further. The transfer and depiction of the Digital Capability and Impact Scores into the DSTM-Matrix is straight forward and worked out well. The Matrix visualized clearly the as-is-position of each assessed service company and lays a foundation for comparison and developing a path for the desired future state of digital transformation maturity.

The first results indicated that the subfactors related to Digital Capability Factors "Customer Experience" and "Digital Competence" show lowest levels of maturity in all assessed service provider companies. On the opposite the subfactors related to "Digital Service Strategy" reflect highest level of maturity compared to all other Digital Capability subfactors. This underlines that service companies feel quite comfortable with their digital service strategy. At the same time results also reveal that there is a lack of digital competence and talents in the service organization, which could be a roadblock for the development and execution of a digital service strategy. The ability to manage and design customer experience systematically also seems to be underdeveloped within the assessed service companies. Consequently, the factors "Digital Competence" and "Customer Experience" need to be addressed in the digital service strategy of service companies assessed in the test. Regarding Digital Impact Factors most of the subfactors related to "Digital Culture" indicate the lowest levels of maturity compared to all other subfactors. This is kind of alerting because research clearly shows that culture is the roadblock number one for digital transformation efforts. Creating a digital culture requires strong leadership and digital competence among the leaders and managers of an organization. However, the subfactor "Digital Savvy" also ranks very low compared to other subfactors. This clearly illustrates an overall risk for the assessed service companies in pursuing their transformation efforts successfully. Another finding in the test results is that out of the three subfactors related to "Digital Service Business Model" the subfactor "Framework of Digital Service Business Model" and "Digital Service Ecosystem" reflect quite low maturity levels compared to the third subfactor which is "Service Engineering & Innovation". This gives some evidence that service companies feel quite comfortable in developing and innovating their services but lacking a common framework for digital service business models they are not able to translate this ability into a new digital service ecosystem. To drive maturity of the factor "Digital Service Business Model" is a key requirement for becoming a Digital Innovator. The ranking of all the subfactors basing on their assessment scores suggests that Digital Capability and Digital Impact factors of assessed service companies are immature and assessed service companies have still to take some effort to become a Digital Transformer or Digital Innovator. Especially "Digital Culture",

"Digital Competence", "Customer Experience" and "Digital Service Business Model" are the clear areas of attention to positively impact Digital Service Transformation Maturity.

The position of assessed service companies in the DSTM-Matrix depicts that most of the service companies – three out of five – are Digital Promoters or Digital Players. Overall, there is a big spread between the five assessed service companies ranging from Digital Promoter to Digital Innovator. Overall, all assessed service companies show a good balance between Digital Capability and Digital Impact factors, although three out of the five service companies close to Digital Player or Digital Transformer level need to improve their Digital Impact factors. Finally, the first test results suggests that most of the assessed service companies still reflect some digital immaturity and not have reached a Digital Transformer level yet. More attention on the factors highlighted above is needed to improve digital transformation maturity further.

5.5 Practical Implication, Limitation and Recommendation

The practical implication of the developed DSTM-Model for service provider companies is that it gives a full picture of digital transformation, because it is a multidimensional maturity model which offers a better approach in approximating the digital transformation status than a one-dimensional model. Beyond a systematic and granular assessment of the status of digital transformation it also provides guidance on how to improve digital transformation maturity by making the areas of attention transparent. The systematic literature review identified just one digital maturity model in the domain of service. The DSTM-Model therefore offers an additional approach to management or other stakeholders for assessing digital maturity of a service company and supports internal strategy discussions to derive specific strategic initiatives like the initiation of company-wide digital projects and programs. Furthermore, the model enables systematic benchmarking and comparison related to digital transformation maturity between service companies.

The focus of the presented research work was placed on identifying the critical factors describing digital maturity, which provide insight how digital transformation success can be improved rather than just being measured.

The limitation of the model is that it is not fully prescriptive. The specific attributes used to describe digital transformation maturity give indeed some indication and idea of tangible measures, but they are not fully predefined. Furthermore, the model practicability and understandability just were tested by service companies participating in the Delphi-Study. They have special insight into the model, what will not be the case for other companies conducting an assessment.

As a next step it is recommended to apply the model in the companies, which were involved in the development of the model as a first step. In a second step it should be applied within service-provider entities that are independent of the model development. To establish generalizability of the DSTM-Model a higher volume of model applications is required (e.g. via web-interface). The evolution of the model will occur as the domain knowledge and model understanding broadens and deepens. This is required to ensure the continued relevance of the model. A further recommendation for future research is to investigate the link between digital maturity and transformation success and final business success. In this way the effectiveness of digital maturity models for the service industry can be proven.

6 CONCLUSION

This research work presented here is intended to complement the contemporary research and to close an identified gap related to digital maturity models in the domain of service. As a result, a domain-specific and holistic assessment model for the digital maturity of

service provider companies in a B2B-related context was developed. In comparison to other digital maturity models the model presented includes and specifies in more detail than other models the soft and managerial aspect of digital transformation, which can potentially be a critical hurdle for the transformation.

It serves a scientific and a practical purpose. The scientific purpose aims at addressing a white spot in the contemporary research related to digital maturity models for the domain of service in a B2B-related context. The developed model enables to collect data regarding the state of evolution of service provider companies related to digital maturity across different industries and will help researchers to further investigate and better understand potential interrelations between factors and digital transformation success for the domain of service in a B2B-related context, what further contributes to the digital maturity body of knowledge. The practical purpose of this research aims to gain systematic insights for management where a service provider company stands with regards to digital transformation, to identify digital maturity gaps and to develop a course of action for the relevant areas. Therefore, it provides a substantiated model for practitioners to apply within service provider companies to determine a solid reference point for further strategic initiatives to move effectively to the next level of digital maturity.

The presented DSTM-Model is not intended to fully prescribe the best and most easy route to the desired future state of digital maturity. Basing on its granularity and specific attributes describing current and potential target levels of digital maturity it indicates areas of attention, which might positively affect the effectiveness of digital transformation efforts, and therefore provides some guidance on how to move forward. As digital maturity is more a moving target than a static concept, the DSTM-Model needs to be continuously adapted to reflect new emerging technologies and new customer and market requirements.

Finally, the assessment model was tested successfully by five service companies. Practicability and understandability of the assessment model was confirmed. Basing on first comparisons related to the positioning of the companies in the DSTM-Matrix a clear variance related to digital transformation maturity became evident. Overall, the results suggest that just a few service provider companies reflect high levels of digital maturity and can be seen as Digital Transformers or Digital Innovators. A big portion of them still is on lower levels of digital maturity and are rated as Digital Promoter or Digital Player. They need to clearly define and drive their transformation efforts further to improve their level of digital transformation maturity.

A limitation of the research might be that the model just was tested by a small sample of service companies and experts participating in the development of the model and not by other service provider companies independent from the model development, what might not give a full picture regarding generalisability of the model. In addition, the relationship between the proposed factors and digital transformation success of service provider companies is not proven yet and needs further attention. Basing on the mentioned limitations and potential shortcomings following recommendations for future research are proposed:

- Identifying and linking best practices to successfully drive digital transformation maturity to each of the maturity levels per subfactor. This could be organized in a kind of knowledge-management database, in which service provider companies using the DSTM-tool provide input. In this way the DSTM-Model over time will become a more prescriptive model.
- Review and adoption of the content describing digital transformation maturity (factors, subfactors, specific attributes) to ensure a dynamic view of digital maturity reflecting new emerging trends and technologies and customer and market requirements.
- To establish generalisability of the digital maturity model successfully a high application and data collection volume is required (e.g. assessment via web-interface). The model will evolve as the domain-knowledge and model understanding broadens and

deepens. This phase is important to assure the relevance of the model over time and needs ongoing attention in future.

- Better understanding the relationship between the proposed factors, digital transformation success and business success.

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GENDER DIFFERENCES IN CAREER PLANNING AMONG YOUNG ADULTS

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ABSTRACT

Gender equality is the state where both men and women get equal opportunities, rights and status. Our exploratory research focuses on the situation in Armenia, the Czech Republic, Hungary and Slovakia. Unlike usual researches where traditionally countries from the West and East of Europe are investigated our exploratory research focuses on countries from the Eastern Block. These countries support gender equality in the labor market; however, they contribute in strengthening the traditional family model with the length of parental leave. Based on our exploratory research we can identify patterns showing that the opinion of society about the distribution of gender roles has undergone changes in these post-socialist countries. In general, there is a common understanding about equal rights of men and women. But still, in all investigated countries, there are "traditionally" thinking people, who tend to keep the strict role-distribution of gender in child upbringing, participation of women in political and managerial matters. The results of our exploratory research can guide the human resource departments and organizations who deal with labor market in their professional orientation activities among younger generation and be a base for a future large sample research to prove the identified patterns highlighted after analyzing the sample used by the authors.

KEY WORDS

career, education, gender equality, labor market, parental leave

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1 INTRODUCTION AND THEORETICAL FRAMEWORK

1.1 Gender in the Labor Market

Women's education increased significantly at the end of the 20th century. It has reached such a level that it has become possible to erase the difference between the level of education of men and women, both in Western and Eastern countries, not excluding China (Jiang, 2020). Nevertheless, many countries struggle with the so-called gender pay gap (Geisberger and Glaser, 2017; Fuchs, 2017) and the lack of women in leadership positions.

One of the reasons for these facts is that women choose different fields of study and career paths. Among the numerous reasons for gender-differentiated choice of study and professional direction, the link to considerations of future career and family life is often mentioned (Gabay-Egozi et al., 2015). The connection of career choice to future family life is significantly more often represented by women (Bass, 2015; Redman et al., 1994; Hägglund and Lörz, 2020). Bass (2015) notes that women in their research sample were more likely to be willing to change careers in order to take care of their family. Men were much less likely to consider parenthood in their career plans.

In post-socialist states, before the transition to a market economy, women were led to full employment. In addition to the high rate of full-time employment of women in these countries, high demands were placed on women in the area of family and household care (Čermáková, 1995). In contrast, in Western countries, since the 1960s, there has been a push for a more balanced involvement of men and women in domestic and family duties and a strengthening of gender equality in the labor market in the form of the introduction of flexible working hours and the motivation of men to share parental leave (Newell and Reilly, 2001). In the course of the transformation of post-socialist countries since the 1990s, there has often been a shift away from egalitarianism, an extension of parental leave taken mostly by women, and a limitation of childcare services up to the age of three (Hašková and Saxonberg, 2016). The process of promoting gender equality in the countries of Western Europe, the USA and Australia on the one hand, and in post-socialist countries on the other hand, was therefore historically initiated at different times and under different socio-economic conditions. However, in both of these worlds, the traditional family model is considered to be a division of roles between men and women in the sense that the woman takes care of the household and the family, while the man is the breadwinner providing the family's financial resources (Larsen and Long, 1988; Dicke et al., 2019; Pospíšilová et al., 2020). Our research focuses on the situation in four post-socialist countries – Armenia, the Czech Republic, Hungary and Slovakia. Three of the selected countries are located in Central Europe and have a similar sociological, historical and political development, while one of the investigated countries (Armenia) is located on the border between Europe and Asia and has in common with the other countries, from a historical point of view, that it was significantly influenced the Soviet Union and that it is a Christian country. Currently, there is significant support for cooperation between the so-called Visegrad countries (Czech Republic, Hungary, Poland, Slovakia) and the countries of the so-called Eastern Partnership – these are Visegrad + grant programs. It is interesting and desirable to find out to what extent the given countries agree on gender issues through the prism of the career direction of young people. These are countries where government supports gender equality in the labor market, but at the same time contributes to strengthening the traditional family model with the length of parental leave, which is among the longest in the world. Parental leave in these countries is mostly taken by women, although it is also legally possible for men. According to the Raub et al. (2018) study, most women in OECD countries return to the labor market

only at the end of parental leave. In the same study, it is further stated that if parental leave lasts more than 6 months, there is a negative effect on the wage level and career seniority of women, especially among highly qualified employed women. However, the finding that longer parental leave has a positive effect on children's morbidity and the creation of a child's bond with the family is also important.

1.2 Parental Leave in the Surveyed Countries

In Armenia, parents have the opportunity to take parental leave until the child is three years old (Labour Code of the Republic of Armenia, 2004). Parents receive parental allowance up to two years and it is 28,600 AMD per month (about 60–70 EUR).

In the Czech Republic, parents can use parental leave until the child is three years old, while they can draw parental allowance until the child is four years old. In the first 28 weeks of parenthood, the caring parent receives a social insurance benefit, which depends on the amount of his/her income to date – it is about 70 percent of the income up to a maximum of 47,700 CZK per month (about 1,900 EUR). Regardless of participation in social insurance, parents receive parental allowance 300,000 CZK (about 12,205 EUR). From this amount of money, they draw a monthly parental allowance. The speed at which the specified amount of money is used up is chosen by the parents themselves – they can quickly use it up within at least 6 months or they can gradually use it up to a maximum of 4 years of the child's age (Act on State Social Support, 1995). Most often, parents use up the parental allowance within three years of the child's age (ČSÚ, 2019). It means parents get usually 9,700 CZK per month (about 395 EUR).

In Hungary, parental leave lasts up to three years of the child's age. Parents receive the parental allowance up to three years of the child's age. Up to two years it is called GYED which is 70 percent of previous earnings, up to a maximum of 225,288 HUF per month (about 567 EUR). GYED is only for insured parents. Up to three years of child's age it is called GYES. GYES is 28,500 HUF (about 72 EUR) per month (Act on the Labor Code, 2012).

In Slovakia, parental leave lasts up to three years of the child's age. Parents receive the parental allowance up to three years of the child's age, when the child is healthy. In the first 34 weeks of parenthood, the caring parent receives a social insurance benefit, which depends on the amount of his/her income to date – it is about 75 percent of the income up to a maximum of about 1,800 EUR. Regardless of participation in social insurance, parents receive parental allowance. The amount of this contribution is 270–370 EUR per month according to the definition of conditions in Act on Parental Benefits (2009).

1.3 Gender and Fields of Career

The long duration of parental leave, which is taken mainly by women, significantly contributes to gender inequality both in households and in the labor market. As mentioned above, another reason for gender inequality in the labor market is that women choose different fields of study and career paths. The lower representation of women is manifested in the fields of STEM (Science, Technology, Engineering, Mathematics). On the contrary, a higher representation of women can be observed in fields focused on language, art and culture. The fields of law, economics and sociology show a balanced representation of men and women (Hägglund and Lörz, 2020). Many scientific studies have investigated the reasons why the unequal involvement of women and men in different fields occur and several theories describing the way of field choice. These include the Rational Choice Model, Rational Choice Theory, Breen and Goldthrope's Model, Structural Factor of Becker, Habitus Theory, The Concept of Creative Society and many others (Baltrėnas et al., 2015; Barone et al., 2019; Breen and Goldthorpe, 1997; Charles and Bradley, 2002, 2009; Correll, 2001; Gabay-Egozi et al., 2010, 2015; Haller, 2001; Glaesser and Cooper, 2014; Johnson, 1999; Legewie and DiPrete, 2014; Lörz et al., 2011; Mann and DiPrete, 2013; Morgan et al., 2013; Ochsenfeld,

2016). As it becomes clear, there are several reasons for the different genders to choose the field of study and career direction. Among the numerous reasons for gender-differentiated choice of study and professional direction, the link to considerations of future career and family life is often mentioned (Gabay-Egozi et al., 2015).

As it was mentioned above, the connection of career choice to future family life is significantly more often represented by women (Bass, 2015; Redman et al., 1994; Hägglund and Lörz, 2020). Bass (2015) bases her claim on research conducted in the USA. Redman et al. (1994) investigated the choice of medical practice, medical field among men and women medical students. They found that women significantly more often choose general fields of medicine, which allow them to be more flexibile in their working life (shorter working hours, flexible working hours). Redman et al. (1994) conducted their research in Australia. In their research, Hägglund and Lörz (2020) confirmed that among students who chose to study social sciences and humanities, the justification for the choice of the importance of family is more evident in women, while this justification was not demonstrated in men. For students of other fields, the choice was not influenced by the relationship to the importance of the family. Likewise, Waaijer et al. (2016) when examining PhD students in the Netherlands they concluded that women and men choose different fields of study. Women are rarely found in engineering and science majors. On the contrary, a significantly larger number of PhD students among women, they want to work part-time. Hägglund and Lörz (2020) conducted their research in Germany. Professional studies from the USA confirm that women are disadvantaged in postgraduate studies and academic careers with regard to combining work and motherhood (Thébaud and Taylor, 2021). It is also often mentioned in the US literature that motherhood disadvantages women in employment, while fatherhood brings bonuses to men (Luhr, 2020). According to research conducted in Great Britain, women prefer jobs that allow them flexible working hours and good training during apprenticeships, while men prefer jobs with high pay and career advancement opportunities (Sutherland, 2012). Flexible working hours are important to balance parenthood and career. In the Spanish literature, it is stated that women and men have different goals that they want to achieve in their lives and careers (Fernández et al., 2006), by which it is understood that women more often than men consider the usefulness of work in the sense of improving the quality of life as their mission. The result of research conducted across 34 different countries is that the behavior of women and men in the division of employment and unpaid work is determined both by family policy and by the prevailing cultural practices of families and society (Çineli, 2022). Jung and Takeuchi (2016) even state that men and women create different mechanisms for the perception of career success, which implies a different approach in career planning. On the other hand, the latest studies (Ernst & Young, 2018; Arar and Öneren, 2018; Fodor and Jäckel, 2018; Hampton and Welsh, 2019; Bohdziewicz, 2016) focused on investigating behavior and planning among the young generation Z, ie. people born in the period 1995–2012, it is found that gender differences in the field of career choice are almost disappearing. Both women and men from generation Z expect excellent financial remuneration from their careers and demand flexible working hours and the possibility of working from home, which will allow them to pursue personal interests. Our research is focused on young adults (a large proportion of the interviewees belonged to generation Z), and therefore it will be interesting to observe whether the choice of career direction will also be similar for men and women. Although studies focused on generation Z show similar career expectations of young men and women, Grow and Yang (2018) state that there is a difference in career expectations between young men and women in many countries – women, unlike men, expect gender discrimination in the workplace.

As stated by the above-mentioned literary sources, the gender-differential choice of study field and career direction with regard to planned or existing parenthood is confirmed by research

from many countries. This gender difference is related to how the roles of men and women in families are perceived in individual countries. A comparison of how the choice of career is influenced by parenthood in the studied post-socialist countries Armenia, the Czech Republic, Hungary and Slovakia is not yet available in the professional literature. The first research question is: What is the opinion of the roles of men and women in families caring for young children in the countries studied? The second research question is: In the studied countries, is the choice of professional direction of young adults influenced by considerations about future parenthood more for women or for men?

By answering the research questions, feminine research in post-socialist countries will be expanded which is important for the global level of knowledge. Gender equality in the surveyed countries is one of the important topics that the government of all the surveyed countries is committed to achieve. The answers to the research questions will be essential both for understanding the ideas of young adults and the subsequent setting of the communication of gender issues. They will also help to understand the similarities/differences of the opinions of young adults in regions which have gone through very different historical developments. As for their economic systems in the past three decades: they have jointly governed the principles of the market economy and aim at establishing gender equality in the labor market.

2 METHODS AND DATA

In terms of legitimating methodological procedures, the following part of our study is dedicated to description of the research methodology carried out by the authors.

2.1 Research Design

In the framework of data collection, we used the design of quantitative research using one of the most common quantitative methods – questionnaire. Průcha (2014) explains that quantitative research has a well-defined subject matter of research, and it is important to identify hypotheses at the beginning of research. Quantitative research has well-formulated conclusions based on quantitative data.

Considering that the basic unit of our research is an individual, measurement of variables in a group of people and looking at the relationship between them become the main purpose (Punch, 2008). The standard procedure for such research is to determine the research problem; formulate hypotheses; test (verify) hypotheses; draw conclusions and present them (Chráska, 2007). We have used this procedure in carrying out our research.

In addition to the standard breakdown of research into quantitative and qualitative, we also recognize the categorization into basic, applied, experimental and evaluation (OECD, 1994). Based on the description of each category, we characterize our research as basic type, since such research represents experimental or theoretical work, which is primarily aimed at acquiring new knowledge about the nature of the phenomenon and new observable facts. Such detection will be provisionally free of specific application and immediate use. Basic research analyses characteristics, structures and relationships to formulate and test hypotheses, laws or theories (OECD, 1994).

In view of the above characteristics of quantitative and basic research, we proceeded in terms of formulating the research problem, objective and hypotheses.

2.2 Research Problem

The research problem was formulated, based on our theoretical analysis (face-to-face meetings, literature, internet articles) in Czech Republic, Hungary, Slovakia and Armenia. We also respected the principles of the formulation

of research problem: the problem should be formulated specifically, unambiguously and in the form of a question; the problem must imply the possibility of empirical authentication; the problem should reflect the relationship between two or more variables (Chráska, 2007, p. 17).

Based on the theoretical backgrounds described in the previous chapter and respect for the methodological principles of the research problem formulation, we have come to the establishment of a specific research problem: On the basis of which criteria do young adults prepare for a combination of future marriage, parenthood and career?

2.3 Research Objective and Hypotheses

In order to be able to obtain an answer to the research problem we identified and described the real situation, the next step was to set the goal of the research and, consequently, the hypotheses that we wanted to verify with research.

The main objective of our research is: to identify the current state and criteria for preparing young adults for the combination of future marriage and parenthood with careers in our selected countries – Czech Republic, Hungary, Slovakia and Armenia. As for the nations in the sample, unlike previous comparative research, we did not compare West to East, but rather four of the former socialist countries in the East. Therefore, the results are certainly novel, as no similar comparison has been done before in this topic.

Based on our research objective the following research hypothesis are generated:

- H_1: There is a significant difference in the family maintenance beliefs of families with young children related to gender and nationality of the surveyed countries.
- H_2: The choice of employment is influenced by the planning of future parenthood and marriage more for women than for men.

3 METHODOLOGY AND DATA

We used a questionnaire method for data collection as it is time-saving and adapted to collect data from several respondents in a short time.

After considering all methodological procedures, as well as topics of study and research, we confirmed the selection of the questionnaire to be suitable and effective for obtaining the required data. The designed questionnaire contains closed questions that are thematically focused precisely on obtaining information about preparing young adults for future marriage and parenthood and the combination of marriage and parenthood with their careers.

In total, the questionnaire contains 24 questions, divided into two groups: a) questions for finding basic demographic data (age, gender, educational attainment, residence, nationality and marital status); b) issues related to the preparation for future marriage and parenthood and the link to an individual's career. The questionnaire includes different types of questions: showing agreement or disagreement; multiple choice; indication of given responses.

The formulated questionnaire of our research contains carefully formulated questions that are logically ranked in terms of the objective of the research. Before launching the research, we validated the questionnaire among focus groups in all participating countries. Based on the pretested results we improved the questionnaire and developed the final version.

As part of the analysis of the obtained data from the questionnaires, we used statistical processing through the program SPSS version 26. We used various methods for data analysis. Descriptive analysis as crosstab was used for the presentation of composition of research sample and for the response analysis by gender and nationality. We used the variance analysis to determine significant differences in response analysis by gender, and Tukey's post hoc test was used for testing the significant differences for nationalities and education levels.

As can be seen from the above chapters, the questionnaire inquiry was carried out in several countries. Specifically, these were the Czech Republic, Slovakia, Hungary and Armenia. In each country, the questionnaire was distributed to a selected sample of respondents. The selection of the sample was intentional and the respondents were selected on the basis of predetermined criteria.

The respondents were primarily university students of the concerned countries. At the same time, the questionnaire was also distributed via social networks asking for the questionnaire to be shared between family members and friends of respondents who meet the above criteria.

We present the total composition of the research sample in Tab. 1.

Tab. 1: Composition of the research sample by country and gender after data cleansing

Country	Men	Women	Total
Armenia	45	114	159
Czech Republic	44	155	199
Hungary	55	128	183
Slovakia	38	153	191
Total	182	550	732

Our aim was to create a relatively homogeneous and equally distributed research sample, about 200 respondents from each country, so that we could also compare the data obtained among countries. The aim of this exploratory study, conducted on a relatively small sample size, was to use the results to establish the basis for a subsequent, larger-scale study on a similar topic.

The research was done taking into account the ethical norms, which are connected to the implementation of questionnaire surveys. The main aim of the research and the types of data to be collected were introduced to the respondents the during the research. All participants were informed, that the data were anonymous and the results will be summarized and published in the article.

4 RESULTS

Based on the results from the data collected in the exploratory research, the following patterns were observed.

H_1: There is a significant difference in the family maintenance beliefs of families with young children by gender and by the nationality of the surveyed countries.

To test the first hypothesis, we analyzed the six questions of the questionnaire, which are shown in Fig. 1. Taking into account the total number of respondents (732), it can be immediately seen that the agreement with the six questions ranges from 134 (18.3 percent) to 274 (37.4 percent): the lowest level of agreement was with the question "It is more important for a woman to help build her husband's career than her own", while the highest level of agreement was with the question "A child aged 0–3 suffers if their mother works part-time". Agreement with the six questions surveyed averaged 26.4 percent. The group of those who agreed was labelled Traditional, while the group of those who disagreed was labelled Modern.

The gender distribution of all respondents' answers in terms of agreement is shown in Fig. 2. The statement "It is more important for a woman to help build her husband's career than her own" was agreed by 25.27 percent of all men respondents and 16.00 percent of all women respondents, showing a 61:39 ratio of men to women in the Traditional Values group.

In response to the statement "Men are more suited to political positions than women", it is striking that 45.05 percent of all men and only 21.64 percent of women hold this view, so that the men side dominates over the women

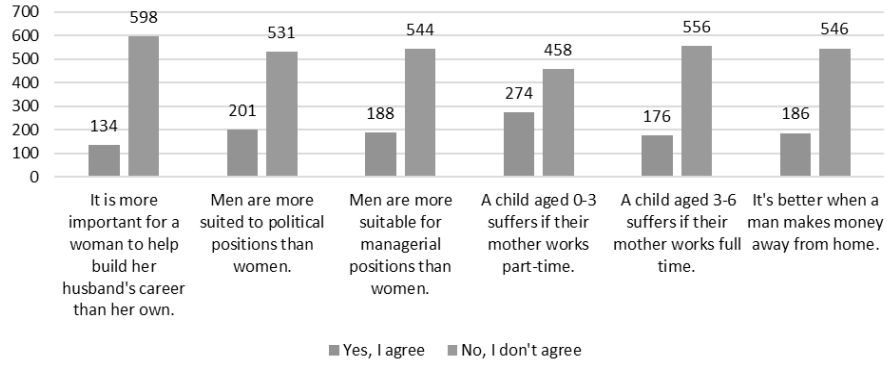

Fig. 1: Distribution of responses ($n = 732$)

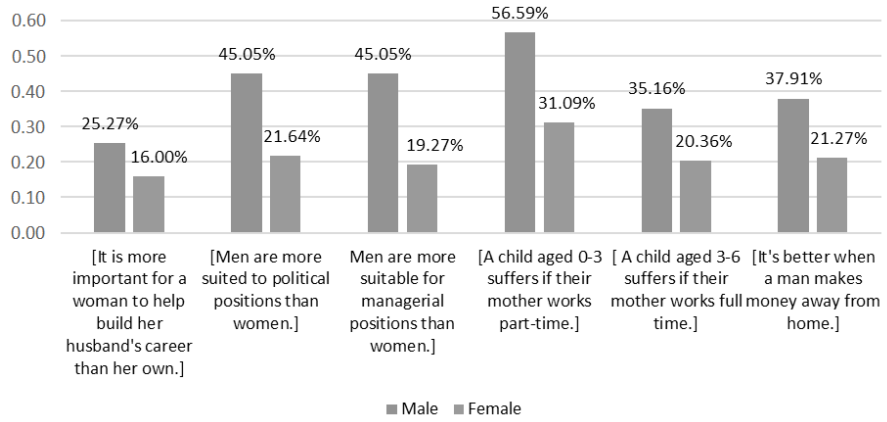

Fig. 2: Percentage agreeing with the statement by gender based on the total sample ($n = 732$)

side in the traditional persuasion by a ratio of 68:32. For the next question – "Men are more suitable for managerial positions than women" – the proportions (70:30): more men than women agree with this statement: 45.05 percent of all men respondents agree with this statement, compared to 19.27 percent of women. The statement "A child aged 0–3 suffers if their mother works part-time" was agreed by 56.59 percent of men and 31.09 percent of women. Both men and women agreement with this question was the highest of the six questions. Among those who agreed, men had a higher proportion of agreement, 65:35. (Note that only part-time, not full-time, was included in the question.) For the question on children as young as preschool age – "A child aged 3–6 suffers if their mother works full time" – 35.16 percent of men and 20.36 percent of women think the statement is true, a ratio of 63:37, again confirming the more traditional view of the men. The statement "It's better when a man makes money away from home" is held by 37.91 percent of men respondents, compared to only 21.27 percent of women respondents, giving a 64:36 ratio of traditionalists in favor of men.

Overall, taking into account the exploratory research sample ($n = 732$), the proportion of men who agree with the above mentioned six statements, i.e., those who hold Traditional values, is almost double that of the women.

In the following, we analyze the responses of the Traditional group for the four countries (Armenia, Czech Republic, Slovakia, Hungary) surveyed and their gender distribution, focusing on significance (Tab. 2).

"It is more important for a woman to help build her husband's career than her own"

Tab. 2: Respondents agreeing with the statement by gender and nationality

		Means, means differences and p-values of the two-samples t-tests					
Nationality		"It is more important for a woman to help build husband's career than her own."	"Men are more suited to political positions than women."	"Men are more suitable for managerial positions than women."	"A child aged 0–3 suffers if their mother works part-time."	"A child aged 3–6 suffers if their mother works full-time."	"It's better when a man makes money away from home."
Armenian	Men	0.49	0.58	0.56	0.71	0.69	0.53
	Women	0.37	0.38	0.32	0.43	0.48	0.24
	Difference	0.12	0.20	0.23	0.28	0.21	0.30
	Sig.	0.165	0.021	0.007	0.001	0.019	0.000
Czech	Men	0.11	0.30	0.32	0.50	0.09	0.32
	Women	0.11	0.14	0.15	0.23	0.05	0.27
	Difference	0.00	0.16	0.17	0.27	0.05	0.05
	Sig.	0.941	0.013	0.010	0.001	0.243	0.541
Hungarian	Men	0.24	0.53	0.56	0.62	0.45	0.49
	Women	0.13	0.26	0.18	0.36	0.29	0.25
	Difference	0.11	0.27	0.38	0.26	0.17	0.24
	Sig.	0.059	0.000	0.000	0.001	0.030	0.001
Slovakian	Men	0.16	0.37	0.32	0.39	0.11	0.11
	Women	0.08	0.14	0.15	0.26	0.08	0.10
	Difference	0.07	0.22	0.17	0.13	0.02	0.00
	Sig.	0.181	0.001	0.018	0.105	0.696	0.990

does not show a significant difference between men and women respondents in any of the countries studied, but when examining the actual difference found between the men and women values we can see that there is actually no difference in the Czech values and there is a tiny but not significant difference in the outer nations' values. The statement "Men are more suited to political positions than women" shows significant differences by gender for all four countries: Hungarian ($d = 0.27$, $p < 0.000$), Slovak ($d = 0.22$, $p = 0.001$), Czech ($d = 0.16$, $p = 0.013$) and Armenian ($d = 0.20$, $p = 0.021$) in order. Also significant differences are detected in all four countries for the statement "Men are more suitable for managerial positions than women", but the order is different: Hungarian ($d = 0.38$, $p < 0.000$), Armenian ($d = 0.23$, $p = 0.007$), Czech ($d = 0.17$, $p = 0.010$) and Slovak ($d = 0.17$, $p = 0.018$). There are significant differences in the values for the statement "A child aged 0–3 suffers if their mother works part-time" by genders in three countries (Armenia, Czech Republic, Hungary) and interestingly all three have nearly the same difference ($d_{\mathrm{Ar}} = 0.28$, $d_{\mathrm{Cz}} = 0.27$, $d_{\mathrm{Hu}} = 0.26$, $p = 0.001$), with no significant difference in Slovakia. The responses to the question "A child aged 3–6 suffers if their mother works full time" show that there is a significant difference between the opinions of Armenian ($d = 0.21$, $p = 0.019$) and Hungarian ($d = 0.17$, $p = 0.030$) men and women, while no significant difference is found for Czechs and Slovaks. Similar to the previous one, after aggregating the opinions on "It's better when a man makes money away from home", we see a significant difference for the Armenian ($d = 0.30$, $p < 0.000$) and Hungarian ($d = 0.24$, $p = 0.001$) responses.

When comparing countries, based on the exploratory research sample, it can be seen that for the six statements examined, Armenia and Hungary produced significant differences in the same five cases, while Czech respondents produced significant differences in three cases and Slovak respondents in two cases.

Tab. 3: Distribution of opinions by gender and nationality

		Percentage response											
		"It is more important for a woman to help build husband's career than her own."		"Men are more suited to political positions than women."		"Men are more suitable for managerial positions than women."		"A child aged 0–3 suffers if their mother works part-time."		"A child aged 3–6 suffers if their mother works full-time."		"It's better when a man makes money away from home."	
Nationality		No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Armenian	Men	51.1	48.9	42.2	57.8	44.4	55.6	28.9	71.1	31.1	68.9	46.7	53.3
	Women	63.2	36.8	62.3	37.7	67.5	32.5	57.0	43.0	51.8	48.2	76.3	23.7
Czech	Men	88.6	11.4	70.5	29.5	68.2	31.8	50.0	50.0	90.9	9.1	68.2	31.8
	Women	89.0	11.0	86.5	13.5	85.2	14.8	76.8	23.2	95.5	4.5	72.9	27.1
Hungarian	Men	76.4	23.6	47.3	52.7	43.6	56.4	38.2	61.8	54.5	45.5	50.9	49.1
	Women	87.5	12.5	74.2	25.8	82.0	18.0	64.1	35.9	71.1	28.9	75.0	25.0
Slovakian	Men	84.2	15.8	63.2	36.8	68.4	31.6	60.5	39.5	89.5	10.5	89.5	10.5
	Women	91.5	8.5	85.6	14.4	85.0	15.0	73.9	26.1	91.5	8.5	89.5	10.5

To further examine the responses to confirm the hypothesis, we also wanted to see how agreement and disagreement with each statement varied by country and gender (Tab. 3).

Those agreeing with the statement "It is more important for a woman to help build her husband's career than her own", i.e., those with traditional values, are Armenian men (48.9 percent), Armenian women (36.8 percent), Hungarian men (23.6 percent) and Slovak men (15.8 percent). The least likely to be considered as having traditional values are Slovak women respondents (8.5 percent). The statement "Men are more suited to political positions than women" is represented by Armenian (57.8 percent) and Hungarian (52.7 percent) men, Armenian women (37.7 percent), Slovak (36.8 percent) and Czech (29.5 percent). Czech (13.5 percent) and Slovak (14.4 percent) women agree the least. The statement "Men are more suitable for managerial positions than women" is most strongly agreed by Hungarian (56.4 percent) and Armenian (55.6 percent) men, while Armenian women respondents (32.5 percent) and Czech and Slovak men agree at 31.8 percent and 31.6 percent respectively. Czech and Slovak women are the least sympathetic to this statement, with 14.8 percent and 15.00 percent respectively. The statement "A child aged 0–3 suffers if their mother works part-time", as mentioned above, was agreed with most by Armenian (71.0 percent), Hungarian (61.8 percent) and Czech (50.00 percent) men and Armenian women (43.00 percent), while the figures for Czech (23.2 percent) and Slovak (26.1 percent) women were much lower. Responses to the statement "A child aged 3–6 suffers if their mother works full time" show the most extreme results: while the scores of Czechs (women: 4.5 percent, men: 9.1 percent) and Slovaks (women: 8.5 percent, men: 10.5 percent) show a tendency to disagree, the scores of Armenians (men: 68.9 percent women: 48.2 percent, and Hungarians (men: 45.5 percent, women: 28.9 percent) are more in agreement. In the "It's better when a man makes money away from home" agreement, Armenian and Hungarian men have high scores (53.3 percent and 49.1 percent respectively), followed by Czech men at 31.8 percent. Both Slovak men and women show a 10.5 percent agreement.

The set of Traditional values was further tested and the Tukey's post hoc test for analysis of variance revealed the following (Fig. 3):

Significant differences were found between the groups marked with different letters. "It is more important for a woman to help build her husband's career than her own" statement resulted in two main groups: there is a significant difference between the Slovak-Czech-Hungarian (letter a) and the Armenian (b) values. Two groups also emerged for "Men are more suited

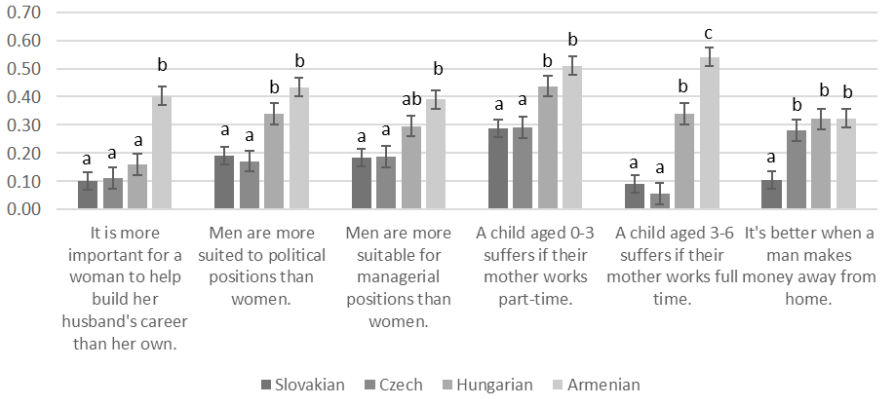

Fig. 3: Tukey's post hoc test for analysis of variance

to political positions than women": one with similarities between the Slovak and Czech scores and the other with similarities between the Hungarian and Armenian scores, with a significant difference between the two groups. The group structure of the statement "Men are more suitable for managerial positions than women" shows an interesting picture: there is a significant difference between the Slovak-Czech and Armenian scores, while the Hungarian scores are similar to both groups. The analysis of the question "A child aged 0–3 suffers if their mother works part-time" separates two main groups for significant differences: one with Slovak and Czech respondents and the other with Hungarian and Armenian respondents. The statement "A child aged 3–6 suffers if their mother works full time" was divisive, with three groups emerging: the Slovak-Czech group (a) showed significant differences with both the Hungarian (b) and Armenian (c) groups. Furthermore, the Hungarian (b) and Armenian (c) opinions also differ significantly. In the case of the statement "It's better when a man makes money away from home", significance is found between the Czech-Hungarian-Armenian values and the Slovakian values.

Based on the exploratory research data results, it can be stated that the first hypothesis was confirmed following the variance analysis tests for the four countries studied and the gender differences in opinion.

H_2: The choice of employment is influenced by the planning of future parenthood and marriage more for women than for men.

Our hypothesis focuses on conscious career choice, i.e., that young people choose a profession and a job with the concept of family with children as a priority. 45 percent of respondents did not consider family at all when deciding on a career and were only influenced by the need to achieve their dreams. However, it can also be seen that the rest of the respondents (except for 1 percent who could not answer the question) were more or less concerned with the idea of starting or maintaining their own family.

Now let's see to what extent the 54 percent of the total sample had the idea of their own family in mind: 8 percent said they would completely subordinate their career to starting their own family and parenthood. Twice as many people, 16 percent, think that being a parent or about to be a parent has only a small effect on their choice of job or career. A relatively high number of people, 30 percent of the sample, think they can balance work and parenthood without damaging either side.

In fact, the results of the exploratory research sample confirm that having a career and a good job is incredibly important for this generation. And having a family of their own, including parenthood, seems to come after a career.

Looking further at the sample by gender, there is no significant relationship between men and women responses (Tab. 4). Tested using variance analysis, Independent Sample T-test.

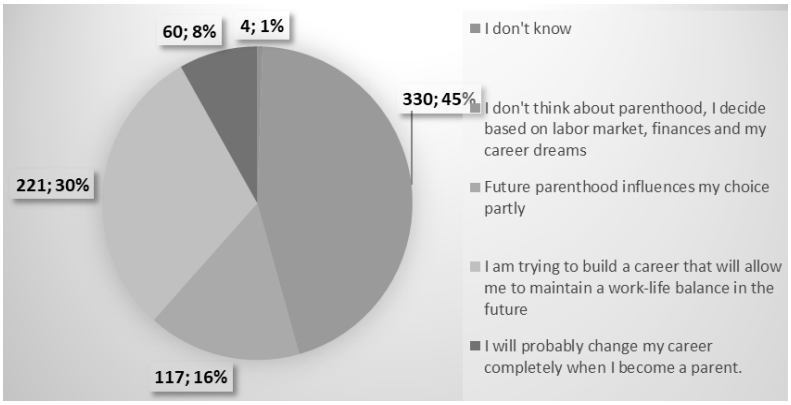

Fig. 4: To what extent was your choice of field of study influenced by considerations about future parenthood? ($n = 732$)

Tab. 4: To what extent is your current career choice influenced by future parenthood?

Gender	**Means, means differences and p-values of the two-samples t-tests**
Men	1.91
Women	2.04
Difference	−0.13
p-value	0.149

When tested the men/women responses by each country separately, there was a significant difference between the values in the Czech responses, the women indicated that their career choice was more influenced by their future adulthood than the men ($d = 0.41$, $p = 0.018$). However, in the other three countries, the difference between men and women responses is subtle.

Tab. 5: To what extent is your current career choice influenced by future parenthood?

	Means, means differences and p-values of the two-samples t-tests			
Gender	**Armenia**	**Czech Republic**	**Hungary**	**Slovakia**
Men	2.44	1.55	1.84	1.79
Women	2.28	1.95	2.09	1.89
Difference	0.16	−0.41	−0.26	−0.10
Sig.	0.397	0.018	0.110	0.603

It can be seen that of the four countries surveyed, Czech women respondents are the most conscious of preparing for parenthood compared to Czech men.

Four categories were created by educational attainment: high school, college/bachelor's degree, university/master's degree, and doctoral degree/PhD (Tab. 6). When the sample was examined by these categories, the following results were obtained: looking at the sample, there is no significant difference in education between prospective parenting roles as we would assume (e.g. the higher the education the bigger the difference).

Tab. 6: To what extent is your current career choice influenced by future parenthood?

		Means for groups and p-values of the Tukey HSD test in homogeneous subsets	
Education	n	**1**	**2**
Secondary school	337	1.87	×
BA/BSc	187	2.08	2.08
MA/MSc	162	2.10	2.10
PhD	46	×	2.43
Sig.		0.317	0.053

Notes: Subset for $\alpha = 0.05$; uses Harmonic Mean Sample Size = 110.415; the group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

However, a Tukey's post hoc test was performed, which shows that there is a significant difference between high school education and PhD education on the perception of parenthood: namely, PhD holders take more into account prospective parenthood when choosing their career.

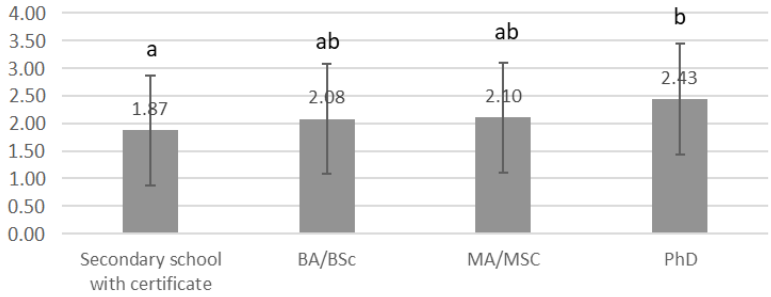

Fig. 5: Tukey's post hoc test, Perception of parenthood by education level, ($n = 732$)

We looked further with cross tabulation analysis: we also looked at educational attainment by gender. Tab. 7 and Fig. 6 show us the results. When looking at men and women with a secondary school education, it can be seen that women are more attentive and more conscious about choosing a career that puts their future family first than men, with a small difference ($d = 0.11$).

There is no difference among the scores of respondents with bachelor's degree, they are the same for both women and men. In case of master degree students, it can be seen that the values of women are higher than those of men, and as a result, it can be concluded that women with master's degree keep in mind future parenthood and the performance of related tasks when they choose a career or workplace. The difference between the values of the master's men and women answers is 0.21.

The biggest difference is clearly noticeable among those with the higher degree of education: the difference between the opinion values of men and women with PhD degree is 0.38. It follows that the parental involvement of women with PhD degree is much stronger than that of men with a similar degree.

Overall, the higher the educational attainment of women, the more consciously they prepare for the role of their own family and parenthood, and consequently the more these options influence their career and job choices.

Tab. 7: To what extent is your current career choice influenced by future parenthood?

Education		**Means and means differences**
Secondary school	Men	1.79
	Women	1.90
	Difference	0.11
BA/BSc	Men	2.08
	Women	2.08
	Difference	0.00
MA/MSc	Men	1.95
	Women	2.15
	Difference	0.21
PhD	Men	2.19
	Women	2.57
	Difference	0.38

5 DISCUSSION AND CONCLUSIONS

5.1 Hypothesis 1

Ensuring equal rights and equal opportunities for men and women is one of the most important challenges of modern developed and developing countries. In political, social, economic, cultural, and social life and other areas, guarantees of equal rights and equal opportunities for women and men are regulated in different ways, up to the existence of relevant laws.

Ensuring gender equality in all areas of public life, the legal protection of women and men from gender discrimination, support for the formation of civil society, and the establishment of democratic relations in society are among the

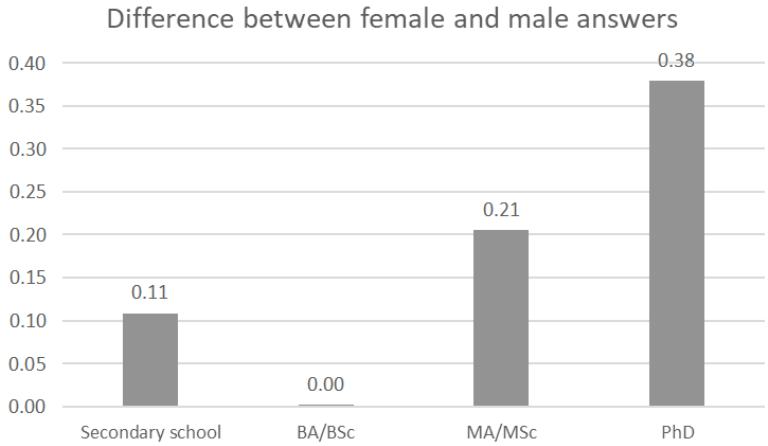

Fig. 6: To what extent is your current career choice influenced by future parenthood?

priorities of any country. The equal right to education became one of the dramatic changes in men-women rights' equality.

In the post socialist countries, men-women equality and real-life distribution of duties underwent significant changes after the collapse of the socialist order. Although they had equal rights to education in the USSR, Czechoslovakia and Hungary, the real employment opportunities varied greatly, and national customs and strict parental role-playing were among the main factors.

Our research shows that the biggest difference between "traditional" and "modern" groups is about the role of women to help their husband's career. 81.7 percent of the survey's participants agree, that women career is as important as men's.

The most part of participants (72–73 percent) disagree that men are more suited for managerial and political positions. This approved the idea, there is a big positive change in the society's opinion about the women's role in the abovementioned positions. Despite this, it is worrying that one-quarter of men in "traditional" group still thinks that women have an obligation to help their husband in building a career rather than thinking about their careers.

In the same group compared to women number, the number of men who believe that men are more suitable for managerial and political positions, is doubled. Our research indicates, that more men agree with "traditional" statements ("It is more important for a woman to help build her husband's career than her own"; "Men are more suited to political positions than women"; "Men are more suitable for managerial positions than women"; "A child aged 0–3 suffers if their mother works part-time"; "A child aged 3–6 suffers if their mother works full-time"; "It's better when a man makes money away from home"), than women. In some cases, the number of men is doubled then women's numbers. So, in spite of prevalence of modern thinking in general, there is still big difference in the traditional value group based on gender.

In the traditional group there is a significant difference by gender for all four countries regarding the questions about role of women in managerial and political positions: more men agree with the opinion, that men are more suitable for the abovementioned positions. Also, in Armenia and Hungary, the number of men, who think, that the child aged 0–6 suffers, if mother is involved in part-time or full-time work, is significantly higher compared to women number. We notice the same significant difference between men and women for the situation of making money away from home among Armenian and Hungarian participants.

It is visible, that Armenia and Hungary produced significant differences in the same five cases, while Czech respondents produced

significant differences in three cases and Slovak respondents in two cases. "It is more important for a woman to help build her husband's career than her own" does not show a significant difference between men and women respondents in any of the countries studied.

It is very visible that in traditional groups, that is who gave positive responses to the questions, the number of men in all positive responses is greater than women in all participating countries. The only exception applies to the question "It's better when a man makes money away from home", where the number of men and women who answered positively is equal in Slovakia.

Based on our research results we can notice, that in many cases the Armenian opinion is much closer to the traditional way of thinking and attitude, rather than Slovak and Czech ones. Hungarian responses mostly are situated between Armenian and Slovak-Czech responses, in some cases being closer to Armenian ("Men are more suited to political positions than women"; "A child aged 0–3 suffers if their mother works part-time").

5.2 Hypothesis 2

It was very interesting for us to study the impact of different factors on determination of future choice of employment. The exploratory research identified patterns, that in the most cases the need to achieve their dreams is the most important factor to choose the future job. And only 16 percent of responses prove, that the future parenthood influence on their choice partly. Only a small group (8 percent) think, that they will completely change their job after becoming a parent. This indicates the privilege role of career and job in family and parenthood. What is interesting in this case – there is no significant difference between men and women responses in general. But when we analyze it by countries, only in Czech responses we indicate difference: the women indicated that their career choice was more influenced by their future adulthood than the men.

We cannot show a significant difference in education (in our case – high school; college/bachelor's degree; university/master's degree; and doctoral degree/PhD) between prospective parenting roles as well. But PhD holders take more into account prospective parenthood when choosing their career.

In Master's and PhD levels, the higher the education, the more we notice the increasing difference between men and women responses regarding career choice influenced by future parenthood. It is visible, that women are more likely influenced by future parenthood than the men.

Based on our exploratory research we can testify, that the opinion of society about the distribution of roles of men and women in family has undergone big positive changes in post-socialist countries. In general, there is a common understanding about men and women equal rights and their implementation. But still, in all investigated countries, there are "traditional" thinking people, who tend to keep the strict role-distribution of men and women in the upbringing of the child, in terms of financial security, participation of women in political and managerial matters.

The results of our exploratory research can guide governmental and non-governmental organizations dealing with studying and management of labor market, as well as educational organizations (high schools, vocational and higher educational institutions etc.) in their professional orientation activities among younger generation.

In the same way, the results of the research can help the management of companies in setting up flexible forms of work and managing parental leave. It should be stressed that our research is exploratory in nature and the results will be used as a basis for repeating the survey on a larger, appropriate sample.

Taking into account the aforementioned data, we can state that the correct approaches of the given country and the leadership and the improvement of the existing legislative regulations are invaluable in the matter of equality of men and women rights. A striking example of such improvement can be the fact that men are also allowed to take childcare leave. It has a two-way effect. On the one hand,

it can be more favourable in those families where the woman is overloaded with work and earns more money than the man. On the other hand, this circumstance significantly increases the awareness and self-awareness of the equality of rights in male-female relationships.

From the point of view of legislative regulations, the role of the government and authorities of the given country is irreplaceable, but it would be desirable to increase the participation and involvement of women in the management bodies of various spheres of public life in real life.

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MODERATING EFFECT OF M-BANKING APPS USERS' DEMOGRAPHIC VARIABLES ON THE RELATIONSHIP BETWEEN THE EASE OF USE AND BRAND TRUST

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ABSTRACT

The study aimed to determine the impact of m-banking apps' ease of use on brand trust, including the moderating effect of users' demographic factors on that relationship. The research was quantitative, where 400 samples were selected based on simple random sampling. The participants were m-banking app users based on their availability and popularity and concentrated on the Dhaka division. The collected data were processed through the SPSS V23 and SmartPLS. Structural equation modeling (SEM) was run to test the hypothesis. The study revealed a positive significant impact of m-banking apps' ease of use on brand trust. In addition, gender and age had a moderating effect on the relationship between ease of use and brand trust, especially the male and older class groups who had strong brand trust at the high level of m-banking apps' ease of use.

KEY WORDS

m-banking apps, ease of use, brand trust, moderation effect, demographic factors, Bangladesh

JEL CODES

M1, M3, C12

1 INTRODUCTION

The modern electronic paradigm we see influences every part of our lives (Khan and Arif, 2023). Computers have almost always determined which things to sell in stores. They are doing functions that humans previously performed, and they will undoubtedly drive automobiles in the future (Khan et al., 2015). The advancement of mobile marketing is even more remarkable because marketers must deal with the critical tasks of product development, promotion and advertising, distribution channel selection, and customer relations, all of which have been reinvented by the various online systems, social media, business manage-

KHAN, Md. Rahat, and ROY, Sanjoy Kumar. 2023. Moderating Effect of M-Banking Apps Users' Demographic Variables on the Relationship between the Ease of Use and Brand Trust. *European Journal of Business Science and Technology*, 9 (2): 249–265. ISSN 2694-7161, DOI 10.11118/ejobsat.2023.015.

ment apps, and mobile devices (Roy et al., 2016). Regardless of function, every company sector has been touched, either directly or indirectly, by technological advances in the external environment (Khan et al., 2022b). For instance, the financial institutions industry has had to embrace technology, as seen by online (electronic) banking, ATM and credit cards, mobile banking, money transfers, and other services that cater to the specific demands of various clients (Khan, 2020). Mobile banking, in particular, has piqued the market's attention and is regarded as the business's future, particularly with the convergence of communications, technology, electronics, and media (Khan et al., 2019). The mobile device has risen primarily due to the requirement for mobility, driven by both the customer experience and the convergence angle. As a result, organizations are embracing mobility solutions from both corporate and individual users (Khan et al., 2015). Mobile devices have become an integral component of most people's everyday life.

Innovation and mobile technology advancements can revolutionize how customers conduct financial transactions by providing new options that match their lives. Mobile money transactions have been adopted more widely in underdeveloped nations than industrialized countries (Khan and Hossain, 2021). For example, consumers in the United States are suspicious of the benefits of mobile financial services. They are concerned about the degree of security and susceptibility of hackers gaining access to their financial records via mobile, hence the lower acceptance rate (Williams, 2012). Mobile banking is the supply and use of banking and financial services through mobile communications devices (Ngatia, 2013). Services may comprise the ability to execute bank and stock market deals, manage accounts, and obtain mainly designed information. They also claim that many clients are prepared to pay a fee to use the mobile banking facility. Mobile device absorption, new generations enticed by technology, enhancing consumer movement, and the swift convenience of mobile apps have all contributed to the rapid growth and adaptation of mobile banking, providing enormous business possibilities for organizations seeking to satisfy their consumers more conveniently (Shankar and Rishi, 2020). Technical advancements heavily impact consumer behavior.

Several studies were explored in m-banking literature. For example, the adoption and acceptance of m-banking (Tan et al., 2010; Shaikh and Karjaluoto, 2015; Baabdullah et al., 2019), the technology acceptance model, and m-banking (Tiwari and Tiwari, 2020; Paramaeswari and Sarno, 2021), service quality of m-banking (Arcand et al., 2017; Shankar et al., 2020), trust in m-banking (Ramos et al., 2018; Tiwari et al., 2021), ease of use in m-banking (Olasina, 2015), m-banking satisfaction (Hamidi and Safareeyeh, 2019; Kamboj et al., 2021), transaction and using convenience, (Sulistyowati et al., 2021; Shahid et al., 2022), m-banking apps (Khan et al., 2022a; Saprikis et al., 2022), m-banking and demographic factors, (Haider et al., 2018; Vasudeva and Chawla, 2019; Windasari and Albashrawi, 2021). However, there is a gap in the existing literature on users' demographic characteristics' role in the relationship between m-banking apps' ease of use and brand trust. Hence, based on the above discussions, the following research questions can be searched to answer from a new study:

- RQ_1: How does the ease of use in m-banking apps influence brand trust?
- RQ_2: What kinds of demographic factors influence the relationship between m-banking apps' ease of use and brand trust?

A study should be a top priority to look into in order to answer the research questions above and fill in the gaps in the current literature. Thus, the study aimed to measure the role of users' demographic characteristics on the relationship between m-banking apps' ease of use and brand trust. The upcoming sections of the research were designed as follows. The second section highlighted the closely related literature to the research context. Then, the third section pointed out the methodology of that research. After that, the fourth section explains the analysis and discussion of the research findings. Finally, the study concluded with limitations, implications, and future research direction.

2 LITERATURE REVIEW

2.1 Mobile Banking (M-Banking)

Mobile banking or m-banking, according to most academic definitions, is an extension of m-commerce that allows users to connect bank accounts using mobile devices to carry out operations, including checking account balances, moving funds, online payment, or trying to sell stocks (Alafeef et al., 2011; Shaikh and Karjaluoto, 2015). Banking markets in developing and/or least developed countries might become more affordable and accessible through mobile banking and other digital financial technology (Lee et al., 2022). Even though ATMs (automated teller machines), cell phones, and Internet banking provide efficient distribution pathways for conventional banking product offerings, mobile banking is expected to have a considerable impact on the economy as the most recent distribution hub created by the banks' retail as well as micro-financing in several developing and developed nations (Hossain et al., 2018; Kamboj et al., 2021; Naeem et al., 2022; Lee et al., 2022).

Remarkably, the enhanced use of smartphones has expanded the market for mobile banking services, leading a large number of banks, microfinance organizations, software companies, and network operators to offer this cutting-edge service alongside new clusters of apps and services intended to boost the share of the market, enhance customer retention, attain unbanked communities, and create employment opportunities (Shaikh, 2013; Shaikh and Karjaluoto, 2015; Tiwari et al., 2021) even though retail m-banking offers several advantages. Nevertheless, it is not widely adopted or used (due to the concern for trustworthiness, transaction safety, ease of use, convenience, technology acceptance, demographic factors, and service quality) by consumers, particularly in developing nations (Baabdullah et al., 2019; Shankar et al., 2020; Khan et al., 2022a; Windasari and Albashrawi, 2021; Shahid et al., 2022). Therefore, the study considered m-banking apps' ease of use, brand trust, and demographic factors of m-banking users to measure the impacts on the banking industry.

2.2 Brant Trust

Brand trust is essential for fostering brand loyalty among consumers (Tiep Le et al., 2021). The concept has been recognized in the extant literature because the vital element concerns the improvement and upkeep of the connection between two alternate partners in diverse contexts (Sirdeshmukh et al., 2002; Amani, 2015). There were several conceptualizations of brand trust considered in the branding literature. For instance, (Delgado-Ballester et al., 2003) Operationalize brand trust considers a state of feeling at ease while interacting with a brand based totally on the belief that the brand will continue to be dependable and responsible for satisfying the consumer. Different scholars also view brand trust as clients' willingness to rely upon a brand (Tran et al., 2022). Brand trust is highlighted as perceptions and expectancies based on beliefs that a brand has precise features and traits that can be regular, capable, and credible (El Naggar and Bendary, 2017).

Furthermore, consumers prefer to feel confident in a brand before purchasing, mainly when there is uncertainty over several identical items to pick from and when significant risks are involved. In these circumstances, brand trust is a gateway to purchasing decisions (Sanny et al., 2020). These corporate traits are directly connected to consumer and brand interaction. As a result, enterprises publish research to attract consumers' perspectives on the brand, establish it in their thoughts, create a favorable brand reputation, and enhance brand trust by interacting with their entire brand communication channels (Bilgin, 2018). Wallace et al. (2021) suggested that Brand trust is a final result of previous experiences and interactions, and it mirrors the method of mastering over the years. This idea rationalizes that brand experience is the most relevant and essential source of brand trust (Kang et al., 2017).

2.3 Ease of Use in M-Banking Apps Toward Brand Trust

In order to foresee and simplify the consumers' psychosocial intention, the TAM (technology acceptance model) emphasizes the roles that anticipated benefit, anticipated ease of use, and mindset toward the action play (Hansen et al., 2018). The notion of ease of use in marketing has sought to identify, explore, and incorporate viewpoints on the origin of convenience and a related theory of convenience direction into more contemporary advances in marketing (Kotler and Zaltman, 1971). Initial use of the concept of comfort may be seen in the term 'convenience products,' where ease of use refers to clients' financial savings in time and effort in buying an item (Malureanu et al., 2021). Ease of use has constantly emphasized effort and time as aspects of convenience, and increasing this attention on these consumer inputs, which are focused on acquiring products and services, led to the notion of convenience as a product or item feature that decreases its non-monetary value (Kotler and Zaltman, 1971; Akdim et al., 2022).

Customers' comfort has long been examined, particularly in retailing and consumer behavior studies (Eger et al., 2021; Anderson et al., 2021). In addition, rising customer demand for ease of use is recognized due to socio-economic change, technical advancement, and increased competitiveness in corporate contexts, whether online or offline (Seiders et al., 2007; Alaimo et al., 2022). The perception of customers' ease of use in purchasing can enhance the trust in a particular online platform and the likelihood to continue engaging in future buy transactions (Saoula et al., 2023). Customers tend to refrain from utilizing a technology-enabled system that presents challenges in terms of comprehension (Silitonga et al., 2020). On the contrary, they would search for alternative options that offer comparable activities but include a more simplified and trusted process (Khan and Sharma, 2020; Wilson et al., 2021). Recent research findings have revealed that the perceived ease of use of e-commerce platforms significantly impacts customers' trust in the e-commerce sector (Botha et al., 2020; Albayrak et al., 2023; Marthanti et al., 2022). Moreover, the ease-of-use elements positively and statistically significantly impact consumer brand trust. Likewise, the extent to which customers regard a system or technology as easy to use significantly impacts their trust levels (Maryanto and Kaihatu, 2021; Khan et al., 2022a). Hence, the following hypothesis can be drawn:

H_1: The mobile banking apps' ease of use significantly impacts brand trust.

2.4 Moderating Effect of Demographic Characteristics

The existing body of literature unequivocally demonstrates that customers exhibit distinct attitudes and actions when analyzed through demographic variables. Several studies within the marketing literature have employed demographic characteristics as moderators in their research endeavors (Mihić and Kursan Milaković, 2017; Akbarov, 2022; Higueras-Castillo et al., 2022; Alwan and Alshurideh, 2022), and these factors distinguish how customers decide in respect to their purchase intentions and/or habits (Gilal et al., 2020; Riva et al., 2022; Sharma et al., 2022). The relationship between ease of use and brand trust may vary based on various factors (Khan et al., 2022a). This study aimed to check the moderation impact of gender, occupation, residence, and income on the relationship between ease of use and brand trust. For this purpose, researchers consider gender (male and female), occupation (student and other), residence (urban and non-urban), income (below 20000 taka and above 20000 taka), and age (less than equal to 25 years and more than 25 years) as a categorical variable to assess the moderation impacts (See Tab. 2).

Attempting or transitioning to a novel product or service entails a certain level of risk. Moreover, empirical evidence suggests that individuals of the male gender have a higher propensity for risky decision-making and display a lower inclination toward brand trust than their female counterparts (Lu et al., 2021). Gender differences influence e-commerce transactions to particular businesses and consumers'

Tab. 1: The demographic variables of the two groups

Demographic Variables	Group 1	Group 2
Gender	Male (0)	Female (1)
Occupation	Student (0)	Others (1)
Residence	Urban (0)	Rural and Sub Urban (1)
Income	$\leq$ 20000 Taka (0)	$>$ 20000 Taka (1)
Age	$\leq$ 25 years (0)	$>$ 25 years (1)

trust in their brand (Murphy and Tocher, 2011; Effendi et al., 2020). Earlier studies found that female consumers were more influential on brand trust than male consumers (Ratnasari et al., 2020; Xue et al., 2020). On the other hand, another study found the reverse outcome of gender moderation on brand trust (Khan and Rahman, 2016). Therefore, the following hypothesis can be proposed:

H_2: Gender moderates the relationship between Mobile banking apps' ease of use and brand trust.

Previous research has indicated differences in consumption patterns between employed and those who are not (Stamper and Van Dyne, 2001). Reports indicate that individuals' attitudes toward employment can influence consumer behavior, leading to a distinct market segment (Schaninger and Allen, 1981; Pervin and Khan, 2022). Individuals often seek insights from an informative group of experts by conducting information searches or witnessing the behavior of influential individuals (Huaman-Ramirez and Merunka, 2019; Srivastava et al., 2016). Based on this information, it can be inferred that time constraints may significantly impact brand trust for working consumers as they prioritize ease of use. In contrast, non-working consumers prioritize the development of brand trust. Thus, the following hypothesis can also be proposed:

H_3: Occupation moderates the relationship between Mobile banking apps' ease of use and brand trust.

Given that various geographical areas have distinctive cultures, consumers will likewise differ based on where they are from one another. One of the qualities touched by culture seems to be the level of trust consumers have in a brand (Munaier et al., 2022). Consequently, a study found that residential areas can play a moderating role in consumers' brand trust. Hence, the study proposed the following hypothesis:

H_4: Residence moderates the relationship between Mobile banking apps' ease of use and brand trust.

Income is a parameter that has garnered significant research interest in mobile banking, as it has the potential to either facilitate or hinder the adoption of e-commerce (Hernández et al., 2011; Paul, 2019). The connection between higher income and the perception of fewer hidden risks in engaging with online platforms impacts the interest among online-based consumers. The limited financial resources of individuals can act as a barrier to engaging in e-commerce. The perception of ease of use and trust will likely enhance as income levels increase (Huaman-Ramirez and Merunka, 2019; Atulkar, 2020; Akbarov, 2022; Alam et al., 2022). Thus, the following hypothesis can be proposed:

H_5: Income moderates the relationship between Mobile banking apps' ease of use and brand trust.

Age is a significant determinant in shaping consumer behavior, influencing individuals' views and behaviors toward products or services (Thaichon et al., 2016). When examining banking services, it is observed that elderly clients exhibit a restricted capacity for information processing compared to their younger counterparts. The discrepancy above resulted in variances in their attitudes towards ease of use in offerings and their levels of trust (Homburg and Giering, 2001; Lu et al., 2021). Therefore,

the age group can also be considered to play a moderating role in ease of use and brand trust (Herrando et al., 2019). More studies found that younger consumers have more positive trust in the brand trust than older consumers (Huaman-Ramirez and Merunka, 2019; Alam et al., 2022). Therefore, the study proposed the following hypothesis:

H_6: Age moderates the relationship between Mobile banking apps' ease of use and brand trust.

3 METHODOLOGY

3.1 Research Model

The proposed research model is depicted in Fig. 1 to investigate the assumed hypotheses. It was projected that ease of use would have a beneficial impact on brand trust.

In addition, the demographic factors were predicted to moderate the relationship between ease of use and brand trust while using their respective m-banking apps.

3.2 Measurement Design

A structured questionnaire was developed based on literature analysis. The mobile banking brand trust scale was picked by (Hansen et al., 2018; Moon et al., 2022), and the ease of use scale was developed by (Shankar and Rishi, 2020; Khan et al., 2019) from the literature survey. The questionnaire was split into two sections (Khan and Rammal, 2022; Khan et al., 2022c). The first section comprised demographic information, while the second section contained model measurement elements. A 7-point Likert metric was devised, with '1' indicating strongly disagree and '7' indicating strongly agree (Khan et al., 2018; Khan and Roy, 2023). The study picked 13 factors for the model: 5 under brand trust and 8 under ease of use. Only 8 factors were retained from EFA and CFA analysis. Tab. 2 of the following states the measurement items of the research.

3.3 Sampling, Data Collection, Analyzing Tools, and Procedures

The empirical study is based on the primary data type (Jayarathne et al., 2022; Roy et al., 2023). In Bangladesh, only 16 banks serve millions of private bank users and commercial enterprises under mobile finance services (Khan et al., 2022a). In Bangladesh, there are 114.051 million mobile banking service users, and only 33 million are active under this service (Khan et al., 2022a; The Business Standard, 2022). However, there is no specific statistic about total m-banking app users in Bangladesh. According to Gefen et al. (2011), it is recommended to have a minimum sample size of 77. A recent study by Tabachnick and

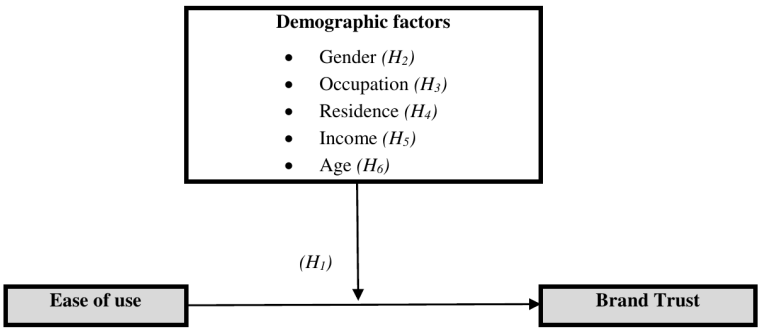

Fig. 1: Proposed model

Tab. 2: Measurement Items

Item code	Items
Ease of use	
EU1	I am really adept at utilizing my m-banking apps.
EU2	I am considerably more familiar with utilizing my m-banking apps than other individuals.
EU3	I feel comfortable working on financial transactions by using my m-banking apps.
EU4	I am comfortable comprehending the words and contexts used in m-banking apps.
EU5	Easy to use mobile banking apps for me.
EU6	Utilizing mobile banking apps is not particularly complicated.
EU7	My bank offers relatively simple applications.
EU8	I have no trouble using my m-banking apps.
Brand trust	
BT1	I fully trust my bank.
BT2	My bank aspires to have a reputation for being reliable.
BT3	My m-banking apps are very reliable.
BT4	Both my bank and m-banking apps are trustworthy.
BT5	I believe my bank does have the tech ability to prevent being supplanted on m-banking apps by another bank.

Source: Hansen et al. (2018), Shankar and Rishi (2020), Khan et al. (2019), Moon et al. (2022)

Fidell (2007) has introduced new test statistics that enable estimating models with a minimum of 60 participants. The minimum sample for SEM analysis through SmartPLS should be 200 (Kaur et al., 2022; Belwal et al., 2023). This study calculated the sampling amount using the Raosoft sample measurement calculator (`http://www.raosoft.com/samplesize.html`). According to the calculator, it is recommended to obtain a sample size of 377 in order to achieve a 95% confidence level for a population size greater than 20,000.

Hence, a simple random sampling technique was used to reach 400 respondents (Roy and Ahmed, 2016; Al Ahad et al., 2020). The respondents were given questionnaires. The questionnaire was classified into two parts. One part had demographic questions, and another contained questions related to the latent construct of mobile banking adoption. Only 230 responses were utilized for the study based on the data suitability. The response rate was found to be 57.5%. MS Excel (V2007), SPSS (V22), and SmartPLS (V3.3.5) software (Ringle et al., 2015) were used to evaluate the data. Measurement and structural modeling were used to execute and evaluate the suggested model (Al Ahad and Khan, 2020).

4 ANALYSIS AND DISCUSSION

4.1 Demographic Analysis

The demographic characteristics of the respondents are presented in Tab. 3, which shows diversity in gender, occupation, monthly income, and residential area. Male respondents accounted for 66% of the total sample, whereas females were 34%. In total, 49% of the respondents were students; the service sector and business represent 47.4% and 4.1% of the total respondents, respectively. The monthly Income level of almost 49% of the respondents was below 10,000. Besides this, the respondents' 26% monthly income level was above 30,000. In total, 63.5% of the respondents were residing in urban areas.

Tab. 3: Descriptive Statistics of the Collected Data ($n = 268$)

Variables	Category	Frequency	Percentage	Cumulative (%)
Gender	Male	178	66.4	66.4
	Female	90	33.6	100.0
Occupation	Service	127	47.4	47.4
	Business	11	4.1	51.5
	Students	130	48.5	100.0
Monthly Income (BDT)	Below 10,000	129	48.1	48.1
	10,001–20,000	35	13.1	62.2
	20,001–30,000	35	13.1	74.3
	Above 30,000	69	25.7	100.0
Residence	Rural	43	16.0	16.0
	Sub-Urban	55	20.5	36.5
	Urban	170	63.5	100.0

Note: BDT = Bangladeshi Taka

4.2 Measurement Model Assessment

To assess the measurement model, researchers check the factor loadings (λ), Cronbach's alpha (α), composite reliability (CR), average variance extracted (AVE), and discriminant validity (Hair et al., 2010; Roy, 2022). From the result, it was found that (see Tab. 4) the factor loadings for all variables were substantial and surpassed the indicated cutoff threshold of 0.60 (Chin et al., 1997). Furthermore, the findings of construct consistency using Cronbach's values varied from 0.852 to 0.882, more significant than the 0.70 indicated by (Nunnally and Bernstein, 1994). All latent constructs' composite dependability (CR) values varied from 0.910 to 0.919, much higher than the tolerable limit of 0.70 (Hair et al., 2010). Based on the high relevance of items in assessing their respective constructs and all latent variables having composite reliability of at least 0.70, it is possible to infer that the assessment model has appropriate convergent validity.

Furthermore, the AVE value exceeded the recommended 0.50 (Hair et al., 2010). Again, to assess the discriminant validity of the measurement model, Fornell and Larcker's (1981) conditions and Heterotrait-Monotrait ratio (HTMT) criteria were applied. The entire HTMT ratio value is less than the threshold of 0.85 (Kline, 2015), as shown in Tab. 4.

Tab. 4: Convergent and discriminant validity

Factor	Items	λ	α	CR	AVE
Brand trust (BT)	BT1	0.892	0.856	0.912	0.776
	BT2	0.908			
	BT3	0.842			
Ease of Use (EU)	EU1	0.868	0.893	0.926	0.757
	EU2	0.882			
	EU3	0.881			
	EU4	0.850			

	Brand Trust (BT)	Easy of Use (EU)
Fornell and Larcker's criteria		
Brand Trust (BT)	0.881*	
Ease of Use (EU)	0.691	0.870*
HTMT ratio		
Brand Trust (BT)		
Ease of Use (EU)	0.816	

Note: Diagonal elements (*) represent the square root of AVE values.

4.3 Structural Equation Model (SEM) and Discussion

The study then examines the path coefficients of the structural model, illustrated in Tab. 5 and Fig. 2. As for H_1, the Mobile banking app's ease of use significantly impacted its brand trust ($\beta = 0.606$, t-value $= 5.373$, p-value < 0.001). The hypothesis was supported, which firmly

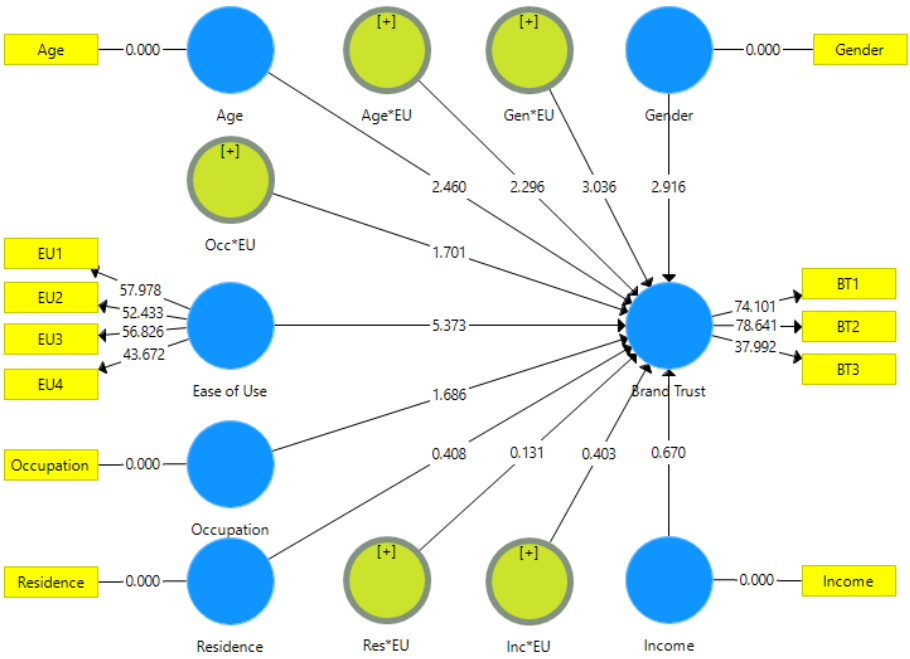

Fig. 2: Results of the structural model

confirms that the Mobile banking app's ease of use positively impacts its brand trust. The study outcomes were supported by earlier research (Botha et al., 2020; Albayrak et al., 2023; Marthanti et al., 2022). However, so far, our knowledge and according to the mobile banking literature analysis, this is possibly the first research by any researcher (both global and Bangladeshi perspectives) to test ease of use as brand trust's measurement variable. The research outlined that business firms like banks whose services may be connected with apps may consider ease of use as a platform for users' brand trust.

Again, the results of moderation analysis revealed that only gender ($\beta = 0.282$, t-value $= 3.036$, p-value < 0.01) and age ($\beta = -0.337$, t-value $= 2.296$, p-value < 0.05) significantly moderate the relationship between ease of use and brand trust, supporting the hypothesis H_2 and H_6. That means the ease of use of mobile apps differs for male and female consumers, which in turn moderates the association between ease of use and brand trust of the users. Fig. 3 shows that women's curve is much steeper than men's.

At the low level of ease of use, male users have a high level of brand trust compared to female users. Nevertheless, female users have more vital brand trust than men at the high ease of use. The outcomes supported the earlier studies (Khan and Rahman, 2016) and did not support the findings (Ratnasari et al., 2020; Xue et al., 2020). Hence, the moderation result can infer that the male users are more worried about ease of use and brand trust for any financial transaction services than the female users. Similarly, the age group moderates the relationship between ease of use and brand trust. It was found from Fig. 3 that curves for the age group above 25 years were much steeper. With a high level of ease of use, the older group has much more trust in the brand than the young group. The adverse outcomes were found in the earlier research (Huaman-Ramirez and Merunka, 2019; Alam et al., 2022). That means in the case of fanatical service, older users are much more concerned than the younger group.

Tab. 5: Structural Equation Model (SEM) with Results

H	Relationships	β	t-values	p-values	Supported
Direct effect					
H_1	Ease of Use → Brand Trust	0.606	5.373	0.000	Yes
Moderation effect					
H_2	Gender* Ease of Use → Brand Trust	0.282	3.036	0.004	Yes
H_3	Income* Ease of Use → Brand Trust	0.043	0.403	0.689	No
H_4	Occupation* Ease of Use → Brand Trust	0.222	1.701	0.095	No
H_5	Residence* Ease of Use → Brand Trust	0.014	0.131	0.897	No
H_6	Age* Ease of Use → Brand Trust	−0.337	2.296	0.026	Yes

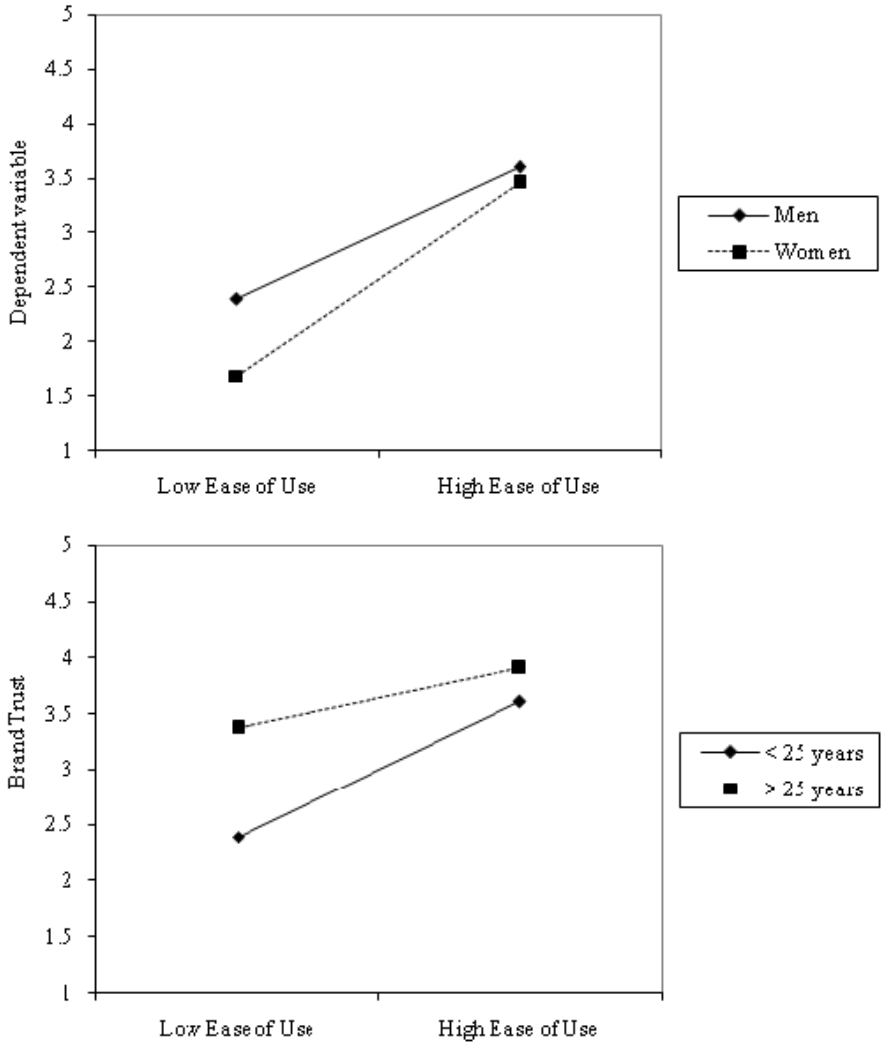

Fig. 3: Moderation effect by gender and age

The other moderation effects were found insignificant, so hypotheses (H_3, H_4, and H_5) are not supported. This study revealed that occupation, residence, and income do not moderate the relationship between ease of use and brand trust.

4.4 Predictive Power (R^2) and Predictive Relevance (Q^2)

The quality of the structural model was evaluated by the coefficient of determination (R^2) and predictive relevance (Q^2). The model has substantial explanatory power as ease of use explains 57.3% of the variance in brand trust. Again, the predictive relevance value was 0.356, greater than 0, indicating good predictive relevance (Chin et al., 2020). The researchers also checked the goodness of fit (GoF) index. The approximate fit of the structural model was assessed by standardized root mean square residuals (SRMR). For the excellent fit of a model, the SRMR value should be less than 0.08 (Henseler, 2012). The SRMR value of the study was 0.046, which indicates considerable goodness of fit.

5 CONCLUSION, IMPLICATIONS, AND FUTURE DIRECTION OF THE RESEARCH

5.1 Implication in Practice

The current study demonstrates how banks may generally foster brand trust in mobile banking services and mobile banking apps. Firstly, bank officials might benefit from knowing the significance of demographic factors, such as gender, occupation, residence, personal income, and age, in connection to brand trust when developing strategies for specific demographic groups, especially ease of use in m-banking apps. Based on such findings, they may develop their m-banking apps' features, which could assist the m-banking users using them for banking purposes. Additionally, the study explains how bank regulators and analysts gain from m-banking apps' ease of use on brand trust in light of the various business and individual class groups. This study's outcome demonstrates that gender and age factors are significant in m-banking apps' ease of use and brand trust. Additionally, this research has the potential to serve as a blueprint for how the ease of use factors can assist in creating brand trust in the marketplace.

5.2 Implication in Theory

The current work may serve as a blueprint for future research. One research cannot possibly cover everything. Hence, the current study, which is focused on the moderation effect of m-banking consumers' demographic factors on the relationship between apps' ease of use and brand trust, restricts the inclusion of many related but potentially significant characteristics. As a result, researchers are offering the existing study's constraints as a potential area for further investigation on mobile banking apps. Future research can be developed with more variables such as service quality, trustworthiness, brand performance, loyalty, convenience, etc. The abovementioned variables will test the relationship between apps' ease of use and brand trust. Few demographic variables, such as education, experience, etc., can be applied to the proposed and validated new research model as a mediating and/or moderation effect. Finally, a comparative study on the same topic among similar patterns of m-banking markets would be another appreciable investigation in the existing literature.

5.3 Ending Remarks

Outcomes embrace the idea that conceptual foundations and empirical relationships cannot be separated. As a result, the research has been carried out in such ways: firstly, the study proved the necessity of the research by explaining why learning more about mobile banking apps is crucial for Bangladesh, which is growing

in technology-based banking services. Secondly, the issues of m-banking apps' ease of use affect brand trust through empirical testing. Lastly, the role of app users' demographic factors affects the relationship between ease of use and brand trust. The fundamental limitations of the study were data collection challenges. The pandemic and post-pandemic situations were challenging, including less technology-oriented knowledge of the mobile banking app users. Another critical issue was research funding. Due to such constraints, the study could not collect mass data across the country. However, owing to such limitations, the research has some implications that were explained clearly. Based on the findings of the study, there are some recommendations for the policymakers of mobile banking service providers. The marketing manager should focus more on convenience features for the upgraded brand trust to grab the market share. Besides, they should also concentrate on developing effective marketing mixes such as proper cost features and availability.

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LEARNING OUTCOMES ACHIEVEMENT OF MANAGEMENT ACCOUNTING COURSE

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ABSTRACT

This study aims to prove the factors that affect learning outcomes achievement of management accounting courses. The sample is accounting students at four major universities in East Java, Indonesia. The questionnaire was filled out using a Google form, and the number of samples was 417 respondents. Hypothesis testing using partial least squares. Nine hypotheses were tested with gender as a moderating variable. Performance expectations and effort affect student intensity and subsequently affect active participation. Changes in facilitation conditions and the level of participation affect the achievement of learning outcomes. Different from prediction, gender was not shown to be a moderating variable.

KEY WORDS

active participation, effort expectancy, learning outcomes achievement, performance expectancy, social influence

JEL CODES

A22, M41, M53, O33

1 INTRODUCTION

The management accounting function ensures the reliability and relevance of accounting information used in decision-making, especially economic decisions. Students are expected to have mastered the basic concepts, techniques, methods, and procedures of management accounting. After students have mastered theoretical knowledge, teaching is conducted in laboratories to deepen technical and practical understanding. The learning method for the financial management accounting course is generally the offline direct synchronous: learning, discussions, and laboratories so lecturers can transfer knowledge and monitor student performance more carefully.

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During the Covid-19 pandemic, the learning process in the classroom turned into online learning. Online learning has become a preferred learning system (Kustono et al., 2021; Grynyuk et al., 2022). It is considered an alternative learning process that is more flexible and safer from the spread of the virus because it uses online applications or social media networks. Online learning has a positive impact, saving money and flexible time and place.

Contrary to its positive effect, online learning shows implementation constraints, so it is not optimal to achieve the target. Baker and Unni (2019) found that during online learning, students' average grade point (GPA) is higher than in offline learning. The GPA obtained by the online learning process increases, but the ability to master the material for each subject is low. It can happen because the lecturer gives more assignments than lecture material, so students are unhappy with the online learning process (Hilmiatussadiah, 2020). Detailed testing regarding the suitability of the GPA with the competencies possessed has not been widely carried out. GPA scores do not necessarily describe the quality of understanding knowledge.

This study analyses the factors determining the achievement of the management accounting course learning method with the Unified Theory of Acceptance and Use of Technology (UTAUT) approach. The management accounting course is a prescribed course that requires students to understand theory and practice comprehensively. Learning outcomes achievement (LOA) analysis provides much understanding because of its completeness.

The UTAUT perspective identifies user reactions that affect technology acceptance (Venkatesh et al., 2003; Alam et al., 2020; Yacob et al., 2022). UTAUT modification model was carried out to achieve the research objectives. From a learning perspective, technology is defined as a learning method. Technology acceptance is analogous to achieving learning outcomes (LO). Additional analysis was conducted by comparing the effectiveness of offline and online learning in management accounting courses.

In 2022, the spread of Covid-19 in Indonesia began to decline. Universities are starting to implement hybrid learning, a combination of face-to-face and online. Face-to-face learning is attended by a maximum of 40 percent of students in one class. Some students study in class in one course, and others stick with the online system. This condition allows for head-to-head comparisons because online and offline methods are parallel in the same class and semester. However, learning success is evaluated with expectations, ease of use of learning media, the influence of other students, and facilitation conditions that support the learning method.

This research provides novelty by using the UTAUT model to analyze the LOA. The UTAUT model is modified by analogy with some constructs. The construct of intention to use technology was modified into an intention to follow a learning method. The behavioural use is converted into an active participation construct. The actual usage is realized in the LO achievement. Students' understanding is measured by a comprehensive ability to analyze management accounting cases and determine the appropriate opinion.

From the model modification, the research problem relates to the role of individual expectations and social influences on intentions that impact behaviour and LO achievement. Understanding the effectiveness of online and offline learning conducted additional testing.

2 THEORETICAL FRAMEWORK

The UTAUT model is a new model developed by Venkatesh et al. (2003) by examining theories about the acceptance and behaviour of using technology. UTAUT brings together the best characteristics derived from eight other technology acceptance theories, so it is named the Unified Theory of Acceptance and Use of Technology. This model has four fundamental constructs: performance expectancy, effort expectancy, social influences, and facilitating

conditions that influence behavioural intentions to use technology (Chan et al., 2015).

The UTAUT model emphasizes the effect of expectations and social influence on intentions to use technology. This study uses the model as a reference for testing aspects of the behaviour in offline and online accounting management learning. Intentions and FC determine user behaviour and ultimately impact actual use. Actual usage is reflected in the achievement of target results.

2.1 Factors of Learning Outcomes Achievement

Learning is a process of interaction between students and lecturers in knowledge transfer, mastery of skills, and attitude formation. As a process, learning requires an evaluation of the achievement of goals. The learning objective is expected to be known, understood and can be done by students who have completed the course. Thus, LO is a cumulative ability obtained through internalizing knowledge, attitudes, skills, and competencies (Lin et al., 2017; Pablico et al., 2017).

LO must be accompanied by appropriate assessment criteria so that LO can be assessed. These achievements are to be formulated in the competencies. Students' competencies are measured and evaluated at the end of the period to assess their abilities and learning effectiveness. The course score is a reflection of the level of competence. Therefore, the score should be parallel with competence.

Learning methods can be grouped as classroom learning (offline) and electronic learning (e-learning). Online learning methods can be categorized as e-learning. In contrast to e-learning which includes using computers, the internet, cell phones, intranets, radio, TV, and others, online learning only uses online media or the internet (Kustono and Nanggala, 2020). Because the difference between the two terms is not very wide, sometimes the two terms can replace each other.

The evaluation carried out shows that online learning has several obstacles. Student learning motivation decreased. The obligation to study independently causes students with low motivation to tend to fail. Lack of interaction between teachers and students or between other students can slow down understanding in the teaching and learning process. Likewise, the evaluation process cannot be carried out as well as during the offline learning process.

Performance expectancy (PE) is the extent to which an individual believes using the system will help him achieve an advantage in a particular job or activity (Gunasinghe et al., 2020; Sultana, 2020). PE is a combination of perceived usefulness, extrinsic motivation, job fit, relative advantage, and outcome expectations.

PE relates to how an individual believes using a system helps them achieve an advantage in a particular job or activity. PE arises primarily because of the belief that the individual can perform a behaviour and that the perceived factors will facilitate or hinder performing a behaviour.

PE reflects experience, understanding, abilities, and expectations of future success. PE affects behaviour directly and indirectly through intentions because have motivational implications (El-Masri and Tarhini, 2017). The more positive one's attitude towards behaviour, the stronger one's will to reach it.

Students who understand the benefits and conveniences obtained compared to the obstacles are expected to form an intention to use the method. The greater the resources owned and the fewer obstacles faced, it is assumed that the greater a person's intention to behave following that intention. Students who feel that specific learning methods facilitate the learning process have the intention to utilize and use them continuously.

PE positively and significantly affects behavioural intentions (Rahmaningtyas et al., 2020; Maphosa et al., 2020). PE on learning methods can improve the mastery of management accounting knowledge and increase students' intentions. Based on the description above, it is concluded that the hypothesis formula is as follows:

H_1: Performance expectations positively affect intentions to take management accounting courses.

Effort expectancy (EE) is the level of comfort associated with using a system or technology. EE is also defined as the level of ease of use of the system that reduces individuals' effort, energy, and time in doing their work (Gursoy et al., 2019; Ramllah and Nurkhin, 2020). Information technology users believe that information technology that is more flexible, easy to understand, and easy to operate will encourage intention to use information technology and will continue to use it.

EE is the level of convenience of a learning method to reduce the effort of both energy and time to carry out its duties. Ease of use of the system creates a belief that using the system will be helpful to and develop a sense of comfort. By following a specific learning system, learning can be done better. This advantage will affect students in completing each task. EE is the dominant factor influencing the intention to use a system (Sun et al., 2013; El-Masri and Tarhini, 2017). It shows that students have high intentions if they feel the method is useful and easy to apply.

H_2: Effort expectancy positively affects the intention to take part in learning the management accounting course.

Social influences (SI) are the degree to which an individual trust other people's opinion to use the new system. SI impacts individual behaviour through three mechanisms: compliance, internalization, and identification (Tan et al., 2014; Oliveira et al., 2016). The stronger the environment, lecturers, peers, or other students give influence students, the greater the intention to follow their chosen learning methods.

SI reflects the influence of environmental factors, such as suggestions or opinions from family, friends, or relatives to use a particular system. Individual beliefs about people's expectations are important to display certain behaviours (Magano et al., 2020). Positive or negative attitudes utilizing a learning method are formed from the knowledge and experiences of others so, influencing the intention to participate using the same method. People's expectations that are considered necessary to individuals regarding certain behaviours lead to a desire to fulfill these expectations or perform the desired behaviour. The greater the social influence, the greater the desire to meet these expectations, so the more significant the intention to carry out the expected behaviour (Gao and Bai, 2014; Peek et al., 2014; Alam et al., 2020). In learning management accounting courses, the response of classmates can be a stimulus for forming student perceptions of the learning method used.

H_3: Social influences have a positive effect on the intention to take part in learning the management accounting course.

Learning facilities are facilities that facilitate the teaching and learning process. Complete facilities support teaching and learning activities to run smoothly so that the objectives can be adequately achieved. Utilization of learning facilities includes all the use of tools that support student learning activities.

A method can be run by requiring specific supporting facilities. The offline method has different facility characteristics from distance learning. The online model requires internet technology capabilities, hardware capabilities, materials, and various teaching materials. Facilities are also related to solutions when a process is not running well. These problems must be resolved quickly.

Completeness of supporting facilities increases user confidence in using technology. Individuals do not behave when objective environmental conditions get in the way. Learning facilities also include lesson plans, infrastructure, and learning methods to support teaching and learning activities.

Facilitating conditions (FC) are the extent to which an individual believes that the technical and organizational infrastructure is in place to support the use of the method (Rahmaningtyas et al., 2020; Purohit et al., 2022). FC dimensions include resources, knowledge, and compatibility. Resources are resources outside the individual that affect the success of a system.

FC includes support from universities in technology. Support facilities for applying learning methods and technologies provide optimism for students and lecturers to obtain exemplary achievements. FC supports students' success in following the specified learning method.

Afshan and Sharif (2016), Alam et al. (2020), and Rahmaningtyas et al. (2020) mention that support from universities and lecturers is a critical aspect of supporting learning success.

H_4: The facilitating conditions have a positive effect on the intention to take part in learning the management accounting course.

The intention is an internal component within the individual that influences their actions (Kustono, 2021). The intention is the full involvement of students in certain subjects and likes to learn new material and skills. Students who take a course will study it seriously because there is a unique attraction for them. Intentions can affect the level of achievement of students' LO. The suitability of students' intentions with the following learning system encourages someone to be actively involved in these activities.

Student behaviour depends on evaluating the learning system that is followed. Perception of a method depends on how interested students are after following it. The intensity of the learning method shows the desire or intention of students.

Learning activities not carried out according to students' intentions can negatively impact LO. On the other hand, the intention and the availability of positive stimuli will make students feel satisfied. Intention reflects the tendency to obtain learning achievement (Dwivedi et al., 2019; Batu and Hadining, 2020; Aziz, 2022). Based on the previous, the intention is suspected to affect active participation in the learning method.

H_5: Intention has a positive effect on active participation in learning management accounting courses.

A crucial aspect of achieving the targets in the learning process is the active interaction between lecturers and students. Participation is required in the learning process. Active participation of students in learning can be seen in student activities to do something to understand the lecture material seriously.

Active participation of students can be realized through assignments, discussions, and activities that support the success of the learning process (Sawatsky et al., 2015; O'Connor et al., 2017; Rubio et al., 2018; Winarto et al., 2019). A management accounting course requires understanding the concepts and competencies to use in business performance decision-making. The participatory process encourages a deep and comprehensive understanding of what theory and practice should be. Activity has an impact on LOA in management accounting courses.

H_6: Active participation positively affects the learning outcomes achievement of the management accounting course.

Previous research has shown that gender stereotypes significantly influence the educational behaviour of students. Females outperform males in learning outcomes due to stronger perseverance, commitment, self-regulation, and significantly more positive online learning outcomes (Alghamdi et al., 2020). Another study found that females may be more likely to self-regulate their learning than males (Liu et al., 2021). Nevertheless, Tang et al. (2021) found the opposite result, where hands-on learning and the coronavirus outbreak may be a reason to encourage male students to participate in online learning more actively. Male students showed stronger perceptions of an interactive classroom communication system than female students, significantly enhancing their learning experience (Rafique et al., 2021).

Female students have advantages in aesthetics and practical problems, while males are more interested in the abstract aspect. It will undoubtedly impact students' management accounting learning achievement (Zhang et al., 2020). Female students tend to have low motivation in counting and solving cases. Meanwhile, male students have more potent abilities in numeric and logic.

The management accounting course relates to numbers because it is a management accounting activity for financial statements. Completion of assignments often requires professional judgment. Gender can be a variable that affects the variables being tested because it is inherently attached to the student's personality (Padilla-Meléndez et al., 2013; Zhang et al., 2020).

The UTAUT model places gender as a moderating variable in the PE, EE, and SI

relationship. Following Venkatesh et al. (2003), the proposed hypotheses are:

H_{7a}: Gender moderates the association between performance expectations and intention to take management accounting courses.

H_{7b}: Gender moderates the association between effort expectations and intention to take management accounting courses

H_{7c}: Gender moderates the association of social influence on intention to take management accounting courses.

3 METHODOLOGY AND DATA

The sample used is students majoring in accounting who have taken management accounting courses in 2021/2022. The sample selection is based on considering the homogeneity of the characteristics of the class, previous abilities, age, and experience so that other factors can be controlled. Students who take part in this semester's management accounting experience learning using the mixed learning method, namely online and offline. It makes it easy to compare the effectiveness of this learning directly.

This study uses the UTAUT approach, adapted to the research objectives. Exogenous constructs are independent variables that are not predicted by other variables in the model. The exogenous constructs are PE, EE, SI, and FC. An endogenous construct is a factor expected by one or more constructs: intentions and LOA.

3.1 Data Collection Techniques

The data collection method uses primary data by distributing online questionnaires to students of the Accounting Department in four leading universities in East Java, Indonesia. The selected universities were based on consideration of the researcher's understanding of the similarity of facilities, infrastructure, curricula, and learning outcomes for management accounting courses. Researchers teach at the university either as permanent or as guest lecturers. The collected data were analyzed and tested to conclude the hypothesis.

The measurement uses a Likert scale to measure students' attitudes, opinions, and perceptions regarding the tested variables. The Likert scale uses a range of values: (1) Strongly Disagree, (2) Disagree, (3) Simply Agree, (4) Agree, and (5) Strongly Agree.

The variables PE, EE, SI, FC, INT, and AP were measured using a questionnaire UTAUT with modifications to the research objectives. For the LOA variable, the questionnaire is divided into two, namely the theoretical knowledge section and the practical section. Practical ability is measured by case studies comprehensively covering management accountants' competence. The raw material for the questionnaire statement is taken from the certified public accountant exam questions with the necessary adjustments. The most straightforward approach in technology acceptance research is to proxy gender as male and female. While not entirely true, stereotypes and gender matches are very close. According to the following opinion, gender is represented by males and females.

The questionnaire feasibility test was conducted to ensure that the results of the questionnaire data collection were worthy of analysis. One way to measure convergent validity is if the loading factor value > 0.6, then the research instrument is said to be valid (Lambie et al., 2022).

A reliability test determines variables' consistency, accuracy, and predictability and uses Cronbach's alpha to test (Shahmohammadi, 2017). A variable is reliable if the Composite Reliability value is above 0.7 and can be strengthened by a Cronbach's Alpha value above 0.6.

The data analysis method used is Structural Equation Modelling (SEM). SEM is a multivariate technique to estimate a series of dependent relationships simultaneously. This research uses variation-based SEM with the bootstrapping method, known as partial least

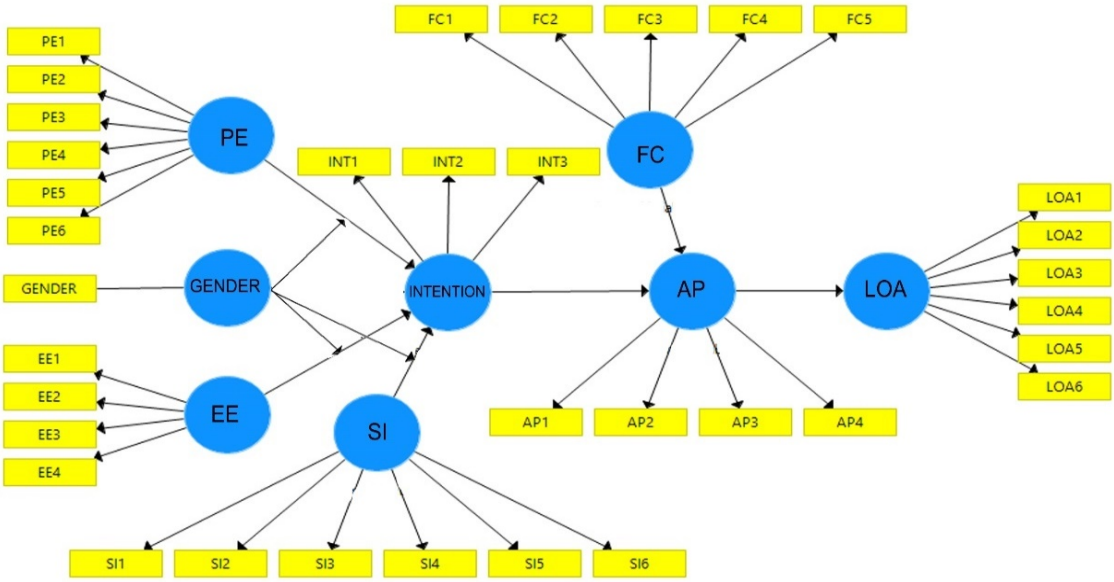

Fig. 1: Modified model to examine the learning outcome achievement

square (PLS). The SmartPLS version 3.2.3 use statistical testing for the inner and outer model.

The steps in the PLS test depicted are designing the inner model, outer model, and path diagram construction. The design of the inner model is to develop the relationship between latent variables in PLS. In this case, the acceptance behaviour of learning methods is influenced by three variables: PE, EE, and IS. Designing the outer model is developing the relationship between latent variables and their indicators. The path diagram's construction compiles the causal relationship obtained from the design of the inner and outer models. Fig. 1 presents the structure of the behavioural path diagram.

Hypothesis testing is done by looking at the inner weight coefficient of the structural model, which is said to be significant with the requirement that the t-count value > 1.96. If t-count > 1.96, there is a significant effect between one and another variable.

4 RESULTS

Respondents are undergraduate students majoring in accounting at four leading universities in East Java. The questionnaires were distributed from March to June 2022 because even semester lectures were finished. Respondents filled out the online questionnaire via the questionnaire link on the Google form. The number of samples is 417 respondents consisting of 136 samples of offline and 281 online students.

The outer model Evaluation is done with convergent validity and composite reliability. Convergent validity can be seen from the value of outer loadings on latent variables and indicators. This study uses a limit value > 0.60 to be said to be a valid statement. Tab. 1 presents the results of the correlation indicators and their variables.

Invalid items are not used for further analysis. Indicators of SI-6 (0.344), SI-7 (0.268), and AP-2 (0.532) are deleted. Further analysis does not include these items in the outer model calculation.

In addition to testing validity, construct reliability tests were carried out by composite reliability and Cronbach's alpha. Composite reliability is used to see whether indicators are

Tab. 1: Result of convergent validity test

Variables		Indicator items	Outer loading	Conclusion
PE	PE-1	Following the entire lecture process will improve my learning outcomes.	0.764	Valid
	PE-2	The learning method allows me to access more information about the content of the course.	0.800	Valid
	PE-3	Understanding and following the learning methods presented by the lecturer increases my chances of getting a high GPA	0.636	Valid
	PE-4	I can use some information technology to improve my competence.	0.681	Valid
	PE-5	I am sure I will get good grades because I have no difficulty with the course.	0.714	Valid
	PE-6	Using information technology devices increases motivation to learn management accounting material.	0.673	Valid
EE	EE-1	The lecturer's explanations are conveyed well and clearly.	0.734	Valid
	EE-2	Management accounting courses are easy to understand and implement in everyday life.	0.791	Valid
	EE-3	Technological devices for learning this subject do not require much effort.	0.675	Valid
	EE-4	The learning plan makes it easier for me to study contemporary management accounting.	0.727	Valid
SI	SI-1	My friends gave directions to take management accounting courses.	0.748	Valid
	SI-2	My friends encourage me to study hard in the management accounting lecture process.	0.695	Valid
	SI-3	Knowing that my classmates study management accounting seriously and get good grades motivates me to do the same.	0.688	Valid
	SI-4	I get readings about the subject outside of class from friends who have passed this course.	0.683	Valid
	SI-5	The management accounting course is interesting because of the supervisor's advice.	0.344	Invalid
	SI-6	My friends gave directions to take management accounting courses.	0.168	Invalid
FC	FC-1	Lecture materials can be obtained or borrowed from the university.	0.840	Valid
	FC-2	The learning technology used is in accordance with the needs of the classes.	0.734	Valid
	FC-3	The university provides adequate technological facilities for offline/online* learning accounting management classes.	0.850	Valid
	FC-4	The university helps with communication channels to understand management accounting material.	0.768	Valid
	FC-5	Management accounting practice can be performed well when classes are held offline/online*.	0.810	Valid
INT	INT-1	Contemporary management accounting developments are exciting, thus encouraging to enrich the latest references.	0.767	Valid
	INT-2	The offline/online* learning motivates me to always be diligent in attending class when I do not miss the discussed material.	0.736	Valid
	INT-3	Offline/online* courses encourage me to have enough reading material and not be lazy.	0.694	Valid
AP	AP-1	Class discussion on management accounting material is fascinating and open-minded, so I want to participate.	0.686	Valid
	AP-2	In my class, most of the students are actively involved.	0.532	Invalid
	AP-3	The offline/online* class model encourages me to contribute meaningfully to class discussions.	0.725	Valid
	AP-4	I want to always do and submit assignments on time.	0.722	Valid
LOA	LOA-1	It is relatively easy to explain the similarities and differences between Management Accounting and Financial Accounting.	0.985	Valid
	LOA-2	I can easily distinguish the full costing concept from other accounting concepts.	0.736	Valid
	LOA-3	I can quickly explain production costs based on cost behaviour.	0.824	Valid
	LOA-4	I can easily decide to accept/reject an order or buy or make a semi-finished product.	0.850	Valid
	LOA-5	I can prepare segmented reporting based on product lines, divisions, and sales areas.	0.784	Valid
	LOA-6	Students can calculate production costs using the activity-based costing method very well.	0.737	Valid

Note: *) Choose according to the method you are experiencing

consistent in representing variables. Data with a composite reliability value and Cronbach's alpha > 0.7 is reliable. Tab. 2 shows composite reliability and Cronbach's alpha.

Tab. 2: Construct reliability test

Variable	Composite reliability	Cronbach's alpha
PE	0.861	0.806
EE	0.822	0.713
SI	0.817	0.716
FC	0.900	0.860
INT	0.877	0.847
AP	0.861	0.784
LOA	0.873	0.816

Based on Tab. 2, it can be seen as a reliability value. All variables, composite reliability, and Cronbach's alpha have values greater than 0.7 and 0.6. It can be concluded that all indicator variables have good reliability.

Inner model testing is carried out to ensure that the construction model is robust and accurate. The inner model is evaluated through an adjusted R-square (R^2). The higher the R^2 value, the better the proposed research model's prediction model.

Tab. 3: Inner model test

Variable	R-square	Adjusted R-square
INT	0.661	0.650
AP	0.699	0.692
LOA	0.457	0.452

Tab. 3 shows that PE, EE, and FC variables were able to explain 65% of the INT changes. The INT variable can explain differences in AP by 69.2%, and AP and FC explain 45.2% of LOA changes. The contribution indicates that the goodness of fit meets the requirements.

4.1 Hypothesis Testing

Hypothesis testing is done by looking at the value of the internal weight coefficient of the structural model. The output results of hypothesis testing are shown in Tab. 4.

Tab. 4: Path coefficients

	Original sample	Standard deviation	t-stat.	p-values
PE → INT	0.675	0.068	9.988	0.000**
EE → INT	0.221	0.079	2.812	0.005**
SI → INT	0.032	0.076	0.425	0.671
FC → AP	0.501	0.093	5.367	0.000**
INT → AP	0.400	0.097	4.116	0.000**
AP → LOA	0.676	0.056	11.990	0.000**

Note: ** significant at 1%, * significant at 5%

Tab. 4 indicate INT was affected by PE (0.675; p-values 0.000) and INT (0.221; p-values 0.005). SI does not affect INT because it has a p-value of 0.671 > 0.05. AP is affected by FC (0.501; p-value 5.367) and INT (0.40; p-value 0.000). The effect of FC has a positive coefficient of 0.676 and a t-statistic value of 5.367 > t-table 1.96. INT affects AP with a coefficient of 0.40 and a p-value of 0.00. The AP variable positively affects LOA. Five hypotheses were successfully accepted, and one hypothesis was rejected.

5 DISCUSSION AND CONCLUSION

PE is a construct that measures the extent to which system users believe that using the system will help them obtain increased performance in their work. Students believe that the lecture system can help facilitate the LOA. The curriculum and teaching methods have gone through a process of selecting the best alternatives.

A management accounting course requires theoretical knowledge and technical skills. After following the lesson, students are expected to understand the concept of management accounting and the steps involved in conducting management accounting to improve decision-making of a company's performance.

The belief that the lecture system implemented is following the needs of the LO, increasing student interest in participating in learning. It is consistent with the prediction that PE positively affects intention.

EE is the expectation of whether the implemented system does not burden the user. Students who know the importance of management accounting courses feel that the curriculum used in the lecture process clarifies methods, tasks, and ways to achieve LO. This perception forms the willingness to follow every instruction in the curriculum. The belief that the lecture system is a guideline and procedure for achieving goals makes it easier to follow them. Students who find it easy to make the intention to obey it. EE has a positive impact on INT. The finding strengthens the conclusions made by previous system research (Sun et al., 2013; El-Masri and Tarhini, 2017).

SI is the belief that an individual must follow those around him to use a particular system. The curriculum is mandatory. Students follow the conditions that have been determined. In learning, there is no process to influence each other because the choice is mandatory after obtaining the agreement of the university, lecturers, and students. SI was not shown to have an impact on student intentions.

FC measures an individual's belief that the university's technology and infrastructure have supported a system. The lecture system can work if it gets support from the individuals involved. In offline learning, lecturers need infrastructures such as classes, whiteboards, viewers, and other facilities. Remote audio-visual technology is required for online learning. This result aligns with previous findings (Afshan and Sharif, 2016; Rahmaningtyas et al., 2020).

Availability of supporting facilities is needed so that learning runs smoothly. Universities that want an effective teaching and learning process should prepare it all. The availability of facilities affects the seriousness of students in learning. Lecturer and student interaction activities increased so that active participation was also improved.

Active participation shows that the lecture process is knowledge-sharing among class members. Lecturers function more as facilitators. Students must seek sources of knowledge to be discussed in class actively. This active participation broadens the discourse of student knowledge so that they can achieve learning objectives. AP is proven to affect the ALO. These findings support the conclusions of previous research (Sawatsky et al., 2015; O'Connor et al., 2017; Rubio et al., 2018).

The moderating test examines the effect of gender on the relationship between exogenous variables on INT. Tab. 5 shows the test results by including the gender variable as a moderator.

Tab. 5: Path coefficient of gender effect

	Original sample	**Stand. dev.**	***t*-stat.**	***p*-values**
PE → INT	0.780	0.248	3.147	0.002**
EE → INT	0.861	0.390	2.209	0.028*
SI → INT	0.141	0.143	0.988	0.324
FC → AP	0.493	0.090	5.488	0.000**
GEN*EE → INT	−0.556	0.499	1.115	0.265
GEN*PE → INT	−0.361	0.547	0.660	0.509
GEN*SI → INT	−0.222	0.233	0.955	0.340
GENDER → INT	0.478	0.260	1.843	0.066
INT → AP	0.408	0.093	4.384	0.000**
AP → LOA	0.688	0.059	11.717	0.000**

Note: ** significant at 1%, * significant at 5%

Moderating variables are variables that strengthen the relationship between exogenous and endogenous variables. The test is done by interacting with gender on the relationship between the two variables. Tab. 5 shows that the presence of gender eliminates the relationship between EE, PE, and SI. It is because gender does not have a direct relationship with INT. Gender is not a moderating variable, so hypotheses 7*a*, 7*b*, and 7*c*, which state that gender moderates the relationship between PE, EE, and SI, are rejected.

5.1 Online and Offline Learning Methods

The learning system is discussed by analyzing the effect of expectations and social interactions on the intention and achievement of learning objectives.

Tab. 6: Outcomes of achievement of different learning methods

	Online		Offline	
	Original sample	***p*-values**	**Original sample**	***p*-values**
PE → INT	0.628	0.000**	0.710	0.000**
EE → INT	0.317	0.001**	0.104	0.371
SI → INT	0.049	0.617	0.087	0.428
INT → AP	0.487	0.000**	0.396	0.038*
FC → AP	0.438	0.000**	0.492	0.033*
AP → LOA	0.674	0.000**	0.660	0.000**

Note: ** significant at 1%, * significant at 5%

LO achievement of different learning methods showed in Tab. 6. Separation analysis of the effect of exogenous variables on endogenous variables gives different results. In the online lecture system, the variables that have no impact on INT are EE (0.317; 0.371) and SI (0.049; 0.428). The default lecture system before the pandemic was an offline system. Students and lecturers interact in the classroom. When the research was conducted at the end of the pandemic, the offline model did not change its application. Students come to class, interact, and attend lectures. Management accounting students are final-year students who have followed the offline learning system in the previous period. It causes offline students not to feel that EE affects their learning intention. In contrast to online, which requires additional efforts such as telecommunication signals, hardware with certain specifications, and new learning systems.

Tab. 7: The difference in the mean of each variable with different learning methods

	Mean			
	Online	**Offline**	***t*-stat.**	**Sig.**
PE	4.12	3.77	3.07	0.003**
EE	3.49	3.18	2.58	0.011*
SI	3.76	3.78	0.13	0.202
FC	3.69	4.02	2.34	0.021*
INT	3.80	4.08	2.36	0.020*
AP	3.65	3.93	2.26	0.009**
LOA	3.31	4.19	5.12	0.000**
LOA1 (theoretical)	4.08	4.13	0.58	0.558
LOA2 (technical)	2.92	4.22	3.00	0.000**

Note: ** significant at 1%, * significant at 5%

Additional testing was conducted to see the difference between each variable in online and offline learning conditions. The table shows the results of the independent sample test for each variable based on online or offline learning.

Tab. 7 shows the mean of each variable with different learning methods. The mean PE obtained is 4.12 (online) and 3.77 (offline). This value is above the median, indicating that the respondent believes the learning method adopted can help him complete the learning objectives. Respondents are optimistic that they can achieve the targeted results with the method.

Statistical testing shows that PE is different between online and offline. Online students are more optimistic than offline and believe that learning goals can be better achieved. Online learning provides several conveniences, such as reduced class interaction, depth of material, and difficulties for lecturers to monitor student activities. These students had higher perceptions of usefulness and outcome expectations. The online system is considered a more effective way to achieve higher performance.

EE is the level of comfort in the learning system expected by students. Most of the respondents feel that the learning system requires extra effort. It is indicated by the proximity of the scores obtained with the median. In the score range of 1–5, the respondents' mean was 3.49 (online) and 3.18 (offline). Statistically, the EE mean between online and offline is different. Online students believe that learning goals can be achieved more easily.

The indicator score for students with online systems is above the median. They argue that the course curriculum in management accounting is comprehensive enough that students believe that all the curriculum demands methods and is more easily met than students who follow face-to-face learning. The classroom method provides opportunities for direct interaction between lecturers and students. This interaction allows lecturers to conduct in-depth evaluations of management accounting courses. Students cannot depend on discussion groups and must have independent abilities. Students feel that offline class makes learning targets more challenging to achieve.

SI is an individual's perception that society gives more value to him when he uses the system. The average score is 3.76 (online) and 3.78 (offline). Respondents believe that when other people use the system, they must follow it. The more influence an environment gives, the higher the desire to participate in the system. Statistically, the SI on online or offline management accounting learning selection is no different. The t-statistic value shows the number 0.25 and the p-value 0.85. The implementation of a certain education system requires obedience. If the system is mandatory, then students have no choice. The system can be chosen if the university allows students to choose online or offline. Students often act on the invitation of friends. The high score of SI indicates whether to choose online or offline, mostly due to SI.

FC is driven by the individual's belief that the technical and organizational infrastructure is in place to support the use of a system. The average score shows that 3.69 (online) and 4.02 are far from the median. FC is perceived differently between online and offline system students. Students who do face-to-face have high confidence in the availability of technical and organizational infrastructure to support the learning system. Respondents consider the available infrastructure sufficient to ensure the learning process runs. It is possible because the university's infrastructure and curriculum are prepared for offline study. This need is different from online systems, which require new properties such as communication technology, hardware, signals, and a modified curriculum.

The intention score shows that the respondent has the intention to follow the management accounting lecture system. The assessment results of the intention score show 3.80 for online and 4.08 for offline. The management accounting course is a prescribed course, so it is mandatory to be able to pass with good grades. Students who take offline learning have higher intentions. This high number indicates that accounting students feel that management accounting is a subject that must be mastered. Mastery of management accounting is absolute because the career choice after graduation is to become a management accountant. Offline learning makes it easier to understand and have technical management accounting skills.

Students are required to participate in the lecture process actively. The involvement includes attendance, independent study, class participation, task completion, willingness to enrich literacy, and participation in case simulations. The score for this construct statement is 3.65 (online) and 3.93 for offline students. Students actively participate so that every lecture activity is appropriately followed.

Face-to-face class requires students to prepare themselves before, during, and after the lecture. Case study or project-based assignments require students' active involvement at every stage. Lecturers can give assignments, and students must also respond directly. At the end of the lecture, students will be evaluated and assessed to determine student achievement on the specified LO. Management accounting courses generally expect students to master theoretical and practical abilities. Theoretical knowledge is related to knowledge of standards, methods, criteria, causes, and effects. Practical knowledge is associated with the ability of students to complete management accounting assignments. To further clarify the differences between theoretical and practical competencies, the LOA is presented as a diagram in Fig. 2.

Tab. 7 and Fig. 2 show measurement results show that the student's score for theoretical ability (LOA 1) is relatively high. Respondents scored 4.08 (online) and 4.12 (offline). The Independent t-samples test resulted in a score of 0.212 with a p-value of 0.714. Students who take online learning have a lower average theoretical outcome but are not statistically different. The online and offline method does not affect theoretical knowledge achievement in management accounting courses.

Comparison of LOA on practical knowledge shows different results. The mean of LO obtained is relatively low, namely 2.92. Its score below the median indicates that online students' ability is technically inadequate. Offline students have better management accounting technical knowledge. The score obtained is 4.22. This score is well above the median.

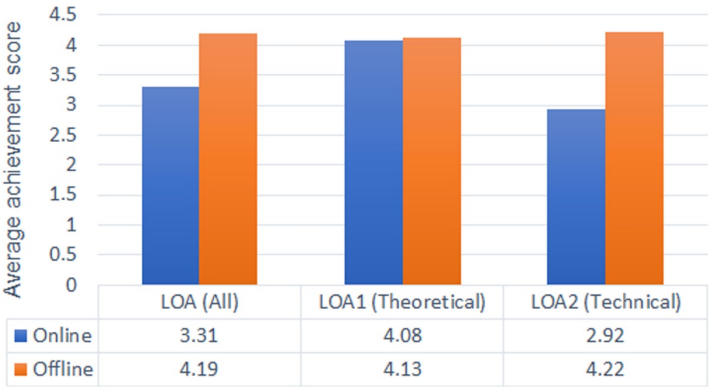

Fig. 2: The comparison of LOA on different learning methods

Practical knowledge is the knowledge that must be practiced. It relates to the mastery of knowledge, abilities, and skills. Students are required to be able to synthesize problems, analyze them, and choose alternative solutions. Offline students can take advantage of interactions with lecturers to discuss and deepen their knowledge.

The LO, PE, and EE scores indicate differences in individual learning targets when linked. Online students have higher PE and EE scores but lower LOA assessments than offline. They believe that the performance is higher and the process easier. LOA measurement uses theoretical and practical cases, so a high score indicates the comprehensive ability of the management accounting course. Following the findings, it is likely that individual learning objectives are GPA scores, not competencies. Previous research shows that online learning methods make GPA scores easier to obtain. The PE and EE data support the Hilmiatussadiah (2020) conclusions. The interaction process is not as smooth as in face-to-face learning. A minimal understanding of the practical ability shows an insufficient knowledge of management accounting subjects taught and can impact learning effectiveness.

5.2 Conclusion

The research examines the effect of performance expectations, effort expectations, and social influences on the intention of following specific learning methods. Nine hypotheses were tested, with five accepted and four rejected. The results showed that performance and effort expectancy were antecedents of student intentions, while social influence had no effect. The first and second Hypotheses are accepted, while the third hypothesis is rejected. Intentions are proven to affect the level of student participation. The fourth hypothesis is accepted. Learning outcomes are positively influenced by the availability of facilitating conditions and the level of participation. The fifth and sixth hypotheses are accepted. Additional testing was carried out by separating online and offline learning students. As a result, in learning practical technical aspects, offline students outperformed the scores obtained by online students. Practical competence cannot be achieved by students having to study independently but by interacting directly with lecturers. Gender does not prove a mediating role in the relationship of exogenous variables to students' intentions. Seventh hypotheses (a, b, c) are rejected.

For practitioners, this research shows practical competence is difficult to achieve using online learning methods. Deepening this ability requires teaching, monitoring, and direct supervision from the lecturer. On theoretical knowledge, the use of online learning methods can be done. The curriculum should be grouped into a syllabus of theoretical and practical knowledge. On material related to practical competence, intensive monitoring must be carried out. It is necessary to pay attention

to students' intentions. Continuous efforts by preparing attractive learning designs can affect the quality of learning outcomes. It is not only for management accounting courses but also for other courses.

The implication for the institutions is related to facilitating conditions. Complete and adequate supporting facilities determine learning success; different courses require different properties. The university must prepare to meet the student's competency goals.

Successive tests prove that a group of samples can have different sub-characteristics. Individual learning objectives are indicated to be different from the achievement of learning outcomes. Personal goals are more about GPA scores rather than competence. Future research could refine these findings by examining the focus on individual goals that have not been explored much.

The sample selected was students who took a management accounting course at the end of the pandemic. The time factor may lead to limited generalizability. When the pandemic ends and the situation returns to normal, the academic atmosphere may also be different. Another factor is that the sample only consists of students at four universities in East Java. Every university has a different culture, especially if the country is different. This study has limited generalizations due to time, the small group tested, and socio-cultural. Future research can consider university culture as a moderating variable to make broad conclusions.

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