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Nudging Technique In Retail: Increasing Consumer Consumption

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ABSTRACT

Changes in consumer behaviour, coupled with shifting purchasing habits, have led to a new setting, one in which the retailers are seeking novel means of keeping potential consumers inside their stores for the maximum duration possible. This prolonged time span contributes to the increased frequency of impulsive actions, thus resulting in greater customer spending. Impulsive buyers are the most crucial target audience for retailers, for they are purely driven by emotion, making decisions without prior preparation or information gathering. Through the grasp of psychological science, behavioural and cognitive functioning, it is possible to discern the factors that make specific retailers and their stores more appealing than others. The main purpose of this paper is to point out a relatively new concept and a technique, called “nudging”, and to showcase the methods of gaining new customers through its utilisation within the Croatian retail market. The nudging technique is not a forceful one, opting to employ imperceptible and subtle means, such as playing certain music, utilising carefully selected scents, colours and lighting within the store, which all serve to improve consumer perception and satisfaction. The retailer can stand out from the competition, precisely by using nudging, which intertwines sensory perception and other psychological factors, incorporating them in the overall store design. For this particular purpose, a survey was conducted among Croatian customers, which examined the presence of specific nudging techniques in retail, as well as their effects on the consumer behaviour. The research results concluded that the Croatian retailers do indeed utilise some nudging techniques which, although perceived by their customers are ultimately left unaware of the impact they have on their respective decision-making process and behaviour.

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1. Introduction

The fact that human behaviour is quite interesting, unpredictable, highly individualistic, and at times seemingly mysterious and unfathomable represents a challenge for researchers; scientists, psychologists, anthropologists and others, motivating them to continuously study, analyse and discover new insights into the thought processes of people, consumers included (Milić, 2018, 64). It has been proven that behind every human action and decision there is an underlying impetus (Thaler and Sunstein, 2008, 84). The goal of retailers and the very purpose of their existence shows itself to be largely in attaining the highest possible income, and in order to achieve this, they, on a daily basis,

face a specific target audience and competition environment (Kovačević, 2003, 84). By introducing psychological incentives, i.e. nudging, into their business practices, the retailers manage to stand out from the competition, entering the struggle of gaining as many customers as possible. Consumers are unaware that specific information, concerning their environment, impacts their behaviour (Kopić, et al, 2013, 31), and if awareness does exist, they allow emotions to prevail and are thus guided by them (Milas, 2007, 11). In other words, consumers unknowingly reach a purchasing decision when nudged, encouraged by the retailers. The aim of this paper is to examine a relatively new concept and technique, called “nudging” and to present the examples of the most effective incentives, applicable within the global business environment, as well as to showcase the guidelines for their proper selection, in accordance with both the target audience’s needs and the characteristics endemic to a particular retail business branch. Therefore, the paper starts with the conceptual definition of nudging, as supported by the previous research findings (Kahneman, Slovic and Tversky, 1982, 48-68), as well as the introductions of relevant sections of behavioural and cognitive psychology, without which consumer behaviour would prove to be incomprehensible. Due to the constant shifts within the retail business, namely the changes originated by retailers and consumers alike, the emphasis is on the stores’ numerous characteristics - the colour, scent, music employed and lighting utilised within the store – all the factors gathered via a questionnaire, with the ultimate goal of determining the prevalence of nudging practices in Croatia, and thus establishing the level of both the retail market’s improvement and the current developmental stage. In conclusion, the thesis of the paper is presented, along with its limitations and future research suggestions.

1. Literature overview

Thaler and Sunstein (2008, 6) define the concept of 'nudging' as any aspect of the choice architecture system that modifies people's behaviour in a predictable way, without prohibiting any options (decisions) or resulting in significant changes of the economic incentives. The concept of nudging, behaviourism, and cognitive psychology are all closely intertwined. Behavioural economics, among other things, deals with the study of human economic behaviour and the means of their modification (Cartwright, 2011, 3-4), while cognitive psychology is a science that studies human mental processes, exploring learning strategies and perception (Sternberg, 2005, 2). Behavioural theory shows that emotions and various other factors influence the people’s decision making processes, causing them to behave in unpredictable and irrational ways (Lukavac and Zelić, 2018, 4). The central nervous system exhibits several distinct characteristics, preferring: a) novelties; b) straight, sharp lines and angles; c) patterns occurring in nature; as well as, d) it prioritises the sense of sight above all others (Pradeep, 2010). Moreover, there exists numerous scientific findings with regard to impulsive shopping, dealing with both its scope and importance (Mihic and Kursan, 2010; Kesić, 2006; Tendai and Chinpuza, 2009). An impulsive reaction is an uncontrolled, sudden, temperamental, customers’ response to a challenge or unexpected influx of information. Rook and Hock (1985, 23-27) identified five distinct characteristics that differentiate impulsive and non-impulsive purchasing, namely a) a feeling of sudden and spontaneous desire to act; b) temporary loss of control; c) psychological conflict and struggle; d) reduced ability of cognitive assessment; e) spending, regardless of the consequences. The research shows that women are more impulsive when buying symbolic goods and items with which they can express their own character, while men exhibit impulsive purchasing patterns when acquiring leisure products, thus showcasing their activities and independence (Mihic and Kursan, 2010, 7-28). Tendai and Chimpuza (2010, 102-108) point out the following characteristics of the sales premises - image, interior, lighting, music, colour, sales staff, furniture arrangement in the store, cleanliness, temperature – as the key factors influencing psychological motivation. The colour of the store represents an important marketing tool, one with a significant impact on the consumer purchasing behaviour, so much so that this sole factor is responsible for 85% of all the purchases done (Kumar,

2017, 2). According to Pavlek (2004, 82), through the effective use of fragrances, companies have the opportunity to connect with customers on an emotional level - to set the mood, promote the products, or position the brand. Research shows that the use of “strategic fragrances” results in consumers staying in stores longer, buying more, and leaving with a better impression of the quality of both the services and products (Bridges, Fowler, 2020, 151). Music affects the physiological functioning of an individual. It guides the rhythm of a person's breathing, affects muscle tension, blood pressure and motor functions. Stimulating music raises the excitation levels, while soothing and quiet music encourages relaxation (ZAMP, 2003, 2). Another study showed that slower and softer music has a positive effect on the trader's income, as consumers tend to stay longer and buy more (Ivanov, 2012) Lighting is an extremely important determinant within the shopping environment. It helps the potential consumer to spot the product and increases the customer's time spent within the store, with the intense, directional lighting strongly recommended for the sales area, for it facilitates impulsive shopping (Charles, David, 1994, 117-125). In addition to the aforementioned psychological incentives, other means of motivating purchasing behaviour in customers can be found in the literature, such as directing the customers to the product, utilising the arrows placed on the floor, positioning the products in the consumer's path, placing the small products next to the cash register, placing the shopping baskets in the middle of the store, featuring the last-minute sales, placing the items with a low rate of sales next to the store's entrance, or the selection of a more varied offer (Parmar, 2018; Mulholland, 2019; Thaler, Sunstein, 2008; Docrat, 2007, 64-67).

2. Factors of retail space design, as a means of creating psychological motivators

The influence of situational factors on consumer purchasing decision-making has been extensively investigated in the recent years, with the confirmation of existing situational and non-situational factors influencing the purchasing decision (Zhuang et al., 2005, 18). According to Belko (1975 in Kesić 2006, 11) there are 5 variable segments that can be regarded as situational factors: a) physical environment; b) social environment; c) time of purchase; d) a goal-driven consumer behaviour; e) current mental state. In the following chapters, the paper focuses on the store's physical environment, which encompasses the geographical area, decoration, sounds/music, lighting, scents, signs, design, product layout, colours, etc. (Kesić, 2006,13).

2.1. Colour

The colour red improves the viewer's mood, has a profound excitation effect and speeds up the heart rate (Cherry, 2020). That is precisely the reason why it is most often utilised during discounts and promotions; at a period when the retailers need to highlight promotions and attract consumers to the store (Khan, 2018). According to M. Reynolds (2019) both yellow and orange have a stimulating effect, engendering happiness and joy, and are, simultaneously - quite noticeable. The dominant yellow colour palette is suitable for stores selling toys, children's equipment, etc. Orange is an appetite-enhancing colour, so it is convenient in restaurants and food stores. The green colour relaxes people, soothes and engenders a sense of tranquillity. This colour is useful for shops that sell flowers, as well as the healthy food stores, pharmacies, or when environmental protection needs have to be accentuated (Burst, 2014). According to Ferreira (2019), blue is the colour of serenity, it has a calming effect on the human body, in essence, it is the red's opposite, it is passive and encourages concentration. It is recommended for it to be used in financial agencies, banks and insurance companies, for it binds the buyer and the trader with a sense of trust. White is the colour of purity, freshness and the new beginnings; as such, it is used in children's supplies stores, retro stores and galleries (Mouton-Brissé, 2018). When it comes to men, they most often prefer blue, green, and black, while women most often prefer blue, purple and green (Burst, 2014).

2.2. Scent

Ivory and spice scent notes may indicate prosperity, as well as luxury. Floral notes and vanilla scent work best in the women's clothing stores, while rustic, woody scents work well in men's clothing stores (Air Scent, 2019). Research has found that the lavender scent can reduce the symptoms of depression and anxiety and increase inspiration. For all its benefits, though, it also has a side-effect of reducing attention (Inside Retail, 2019). The clean, fresh and soft scent of cotton is coveted by the clothing retailers, for it enhances the natural scent of new clothes (Ambius, 2015). Earthy and vibrant, the scent of white pine and birch encapsulates the essence of winter and the joy of Christmas (Spangenberg, Grohmann, & Sprott, 2005, 3). Specialty food and kitchenware stores particularly utilise the scents of vanilla, nutmeg, honey, caramel, coffee, and chocolate, because of their powerful connection to food and the ability to create a pleasant environment (Peterson, 2014).

2.3. Music

Ramsey & Ramsey (2010) and Rubright (2016) advise that, when choosing music in retail, it is important to: a) play music that is legal; b) match the music with the brand; c) not to play the music according to one's own preferences and tastes; d) maintain a balance with a variety of songs; e) make the most of the sound system present (by reproducing the advertising messages, information regarding sales, promotions, etc.). Finding the best background music for a retail store isn't just about choosing the right songs; it's also about choosing music with the right tempo, volume, genre and messaging.

2.4. Lighting

Experimental research shows out that the cool lighting colours within stores are preferable to the warm ones (Soomro, Kaimkhani, Iqbal, 2017, 24). There exist three distinct types of lighting conditions, a uniform, ambient and accent lighting (Ufford, 2017). Levison (2020) points out that dim lighting encourages impulsive behaviour, making the customer more likely to exhibit creativeness. It is advisable to utilise it in the dessert sections, top restaurants, luxury stores, creative spaces and return counters. A bright lighting will contribute to the purchase of practical products, which are purchased carefully, under the influence of other customers. It can be used in health food stores or departments, restaurants, stores specializing in home and space decoration, offices, etc.

3. Research methodology

Due to the fact that the concept of nudging is still insufficiently researched within this particular geographic area, a survey was conducted, in the period ranging from the 3rd of September, 2020, to the 18th of September, 2020, with the aim of establishing the extent of technique utilisation by the retailers, as well as determining the overall familiarity level of Croatian customers with regard to it. The survey included 113 respondents/consumers. In order to reach the target segment of respondents, the survey was sent to various differing geographical locations, to people who varied in both age and gender, with the ultimate goal of assuring an unbiased sample, one capable of representing the entire population of Croatia.

The survey was created utilising Google Forms and included 12 questions, of which 4 dealt with the respondents' demographic characteristics, while the other 8 dealt with the nudging practices in retail. All the questions were multiple choice questions, with the respondents required to provide the answers to all of them. Indeed, the replies, obtained from all the subjects were full and complete. The survey was chosen as the most feasible means of conducting this particular research, because merely utilizing the observational methods could not yield the subject's responses and guarantee feedback on the store characteristics, such as volume, lighting, or the colors employed, particularly due to the fact that certain store elements would invariably result in people vacating the store area. The survey was

distributed via selected social networks (Facebook, Instagram, WhatsApp, Viber), utilising the snowball sampling technique.

Table 1. Demographic characteristics of the respondents

Sex	Male	33,6%
	Female	66,4 %
Age	0-20	4,4%
	21-40	72,6%
	41-60	20,4%
	61+	2,7%
Employment status	High schooler	4,4%
	College / university student	28,3%
	Employed	62,8%
	Unemployed	0,9%
	Retired	3,5%
Monthly income	Up to 3000 kn	15%
	3001 – 5000 kn	18,6%
	5001 – 8000 kn	33,6%
	More than 8000 kn	19,5%
	No income of their own	13,3%

Source: authors

Table 1 showcases the demographic characteristics of the 113 respondents, who participated in the survey. The respondents are predominately female (66.4%), between 21 and 40 years of age (72.6%), employed (62.8%) and with a monthly income ranging from 5001.00 to 8000.00 kn (33.6%).

4. Research results and discussion

Table 2 showcases the music which, while shopping, elicits the highest degree of enjoyment for the various age groups. There is a noticeable high percentage of preference for quieter music, of a slower rhythm, for all the age groups surveyed. 40% of the respondents within the age range of up to 20 years, preferred quieter music, of a slower rhythm. This type of music was also preferred by those within the age range between 21 to 40 years (42.68%), between 41 and 60 years it was 73.91% and for those older than 61, 67% preferred quieter music, of a slower rhythm. These results confirmed the previous findings, which concluded that customers stay longer and purchase more within a store utilising a slower, quieter music (Ivanov, 2012).

Table 2. Respondents' preferences regarding the rhythm and volume of music within the retail space, with regard to their age

	0-20	21-40	41-60	61+	Total
<i>Loud music, increased tempo</i>	40,00%	15,85%			13,27%
<i>Depending on my mood</i>		36,59%	17,39%	33,33%	30,97%
<i>Quieter music, lower tempo</i>	40,00%	42,68%	73,91%	66,67%	49,56%
<i>I prefer the silence within the store</i>	20,00%	4,88%	8,70%		6,19%
Total:	100,00%	100,00%	100,00%	100,00%	100,00%

Source: authors

Table 3 showcases the respondents' choices with regard to the visual characteristics of the retail spaces. The highest percentage of respondents, 41.59%, opted for decorating the store utilising warm

colours (shades of red, orange, yellow and light green). It is interesting to note that the results of this survey do not confirm the previous research results of females preferring blue, purple and green (cold colours), nor that the males prefer blue, black and green (Burst, 2014), since a percentage of 31.58% indicates that males also prefer warm colours. Additionally, the percentages between people preferring warm colours (41.59%) clashes with the reported 28.32% of people who espouse not caring / not paying attention to retail décor coloring. This essentially confirms the fact that consumers are unaware of the nudging effects. Nevertheless, the research has confirmed that warm colours encourage action and it is therefore desirable to use them in conventional stores, for the respondents tend to feel more comfortable in those particular settings.

Table 3. Retail decor as a respondent's preference, with regard to sex

	Male	Female	Total
<i>Utilising cold colours</i>	21,05%	28,00%	25,66%
<i>I don't care and I don't pay attention to that</i>	36,84%	24,00%	28,32%
<i>Colorful tones</i>	10,53%	1,33%	4,42%
<i>Utilising warm colours</i>	31,58%	46,67%	41,59%
Total	100,00%	100,00%	100,00%

Source: authors

Table 4 showcases the respondents' choices, with regard to the lighting characteristics. Most respondents, 46.9%, prefer uniform and strong lighting, followed by an option of dim lighting, with the products accentuated (38.9%), while 14.2% of the respondents report not paying attention to the lighting within the retail space. These results did not confirm previous research findings, which found that ambient lighting; dimmed lighting, with the products accentuated, has the greatest positive effect on the retailers' profits (Levison, 2020). Nevertheless, the majority of respondents (76.11%) expressed a willingness to remain in the store and browse, despite the unsatisfactory lighting conditions.

Table 4. Respondents' reactions to the intensity and characteristics of lighting within the retail space

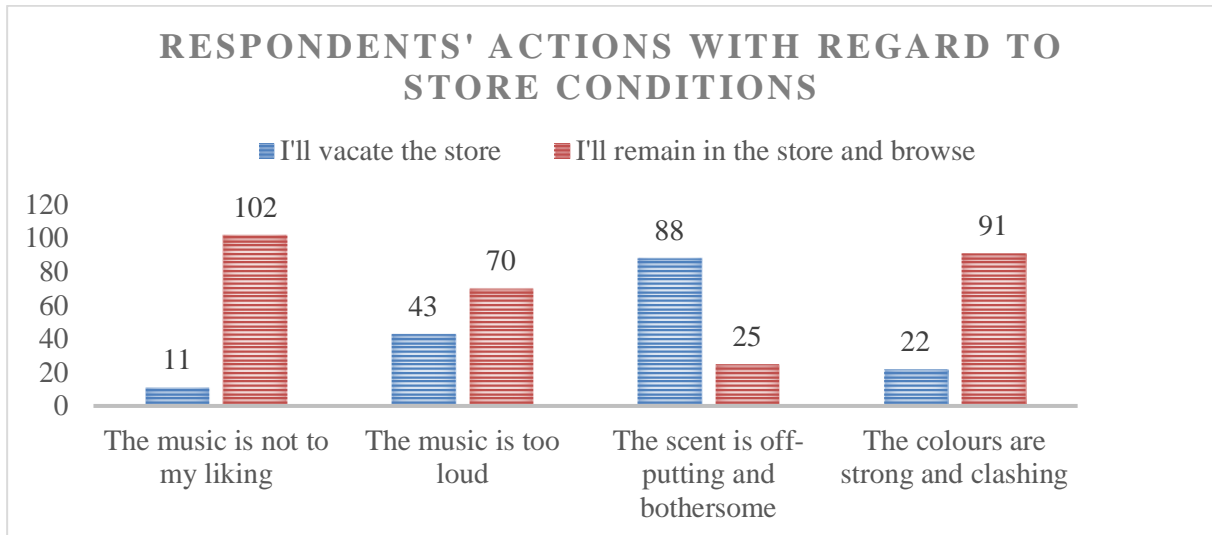
	The store lighting is too bright or too dark, what will I do?		
I feel more comfortable when the sales area is lit:	<i>I'll vacate the store</i>	<i>I'll remain in the store and browse</i>	Total
<i>Strong and uniform lighting</i>	14,16%	32,74%	46,90%
<i>I don't pay attention to the lighting inside the store</i>	0,0%	14,16%	14,16%
<i>Dim lighting, with the products accentuated</i>	9,73%	29,20%	38,94%
Total	23,89%	76,11%	100,00%

Source: authors

With the next survey question, the respondent decides between remaining in the store or vacating the premises, with regard to the specific circumstances. Graph 5 shows both the respondents' preference and behaviour, within the context of a particular situation. One notes that, while inadequate music can be ignored, with the customer continuing with the shopping experience, the situation regarding smell is quite the opposite (out of the 113 respondents, 88 will leave the store if the smell is repulsive). With regard to inadequate lighting and colours utilised, the customer will remain in the store and continue

browsing. However, this does not mean that purchasing behaviour will occur. The respondents' answers to all of the questions accentuate the dire need for careful retail space design, one with the aim of avoiding the unfavourable outcome of the customer vacating the store.

Graph 1. The survey results: the behaviour of respondents in a particular situation



Source: authors

5. Conclusion

Since the world and the people in it are continuously changing, this will impact both their shopping habits, as well as, the retailers they come in contact with. Marketers should utilise a variety of methods in order to bring the product as close to the consumers' focus as possible. All the methods discussed in this paper, from the carts used, the store characteristics employed, to the various promotional efforts, are aimed at accomplishing the goal of increasing the retailers' revenue. The aim of this study was to examine the utilisation level of the psychological incentives employed by the retailer, to determine the extent to which the consumers are aware of them, and establish the overall impact they have on the consumer. The survey, conducted among Croatian consumers, showed that consumers do notice the presence of nudging techniques employed, but remain unaware as how they influence their purchasing decisions and behaviour. Croatian consumers prefer warm colours utilised within a retail environment, a uniform lighting and quiet music, of slower rhythm, played (which proved to be effective regardless of the customer's age). An important factor is the use of fragrances, for it has been shown that the Croatian customers are extremely sensitive to them, unwilling to give a second chance to a retailer whose store has deemed to smell unpleasantly. A repulsive odour drives the consumers out of the store, thus leading to a reduced time spent inside the sales area, which is in stark contrast to the retailers' goals. Nudging techniques are extremely impactful for the Croatia's retail market, but the characteristics of this particular business still showcases great growth, development and research potential.

The paper further examines the relatively new methods of gaining customers and the means and strategies aimed at extending the duration consumers spend within a particular store. However, although the study gathered useful insights on Croatian consumers' preferences with regard to retail space characteristics, there also exist certain limitations that must be taken into account when attempting future research. Firstly, the sampling method used can be improved upon. The study was conducted with 113 respondents, with the percentage of male and female respondents being unequal,

75 women and 38 men, which may have affected the data collected. Also, using a sample larger than the 113 respondents surveyed could yield in different results. Secondly, the research was not conducted in a specific store environment and therefore, it might have been difficult for the respondents to imagine themselves within a specific retail space, characterised by certain music, colours, lighting and smell, thus indicating at the possibility of obtaining different data if the research was to be conducted within a laboratory or an on-site retail store.

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Does financial inclusion reduce non-performing loans and loan loss provisions?

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ABSTRACT

We examine whether countries that have high levels of financial inclusion have fewer non-performing loans and loan loss provisions in their banking sectors. The fixed effect panel regression methodology was used to analyse the effect of financial inclusion on bank non-performing loans and loan loss provisions. Using data from 48 countries, we find that greater formal account ownership is associated with high non-performing loans. Bank loan loss provisions are fewer in countries that have high levels of financial inclusion only when financial inclusion is achieved through the combined use of formal account ownership, bank branch supply and ATM supply. Also, non-performing loans are fewer in countries that experience economic boom and high levels of financial inclusion.

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1. INTRODUCTION

In this paper, we examine whether financial inclusion reduces the size of non-performing loans and loan loss provisions in the banking sector. We examine whether countries that have high levels of financial inclusion have fewer non-performing loans and fewer loan loss provisions in their banking sectors.

Financial inclusion involves bringing unbanked adults into the formal financial sector (Allen et al, 2016; Ozili, 2020). Financial inclusion is a strategy towards economic development especially for the excluded population. Many countries have taken deliberate steps to increase the level of financial inclusion. There is much research on the benefits of financial inclusion to individuals, firms and households (Subbarao, 2009; Allen 2016; Ozili, 2018).

Existing studies show that financial inclusion has some positive benefits for financial institutions (see, Han and Melecky, 2013; García and José, 2016; Ozili, 2018). Only few studies examine the effect of

financial inclusion on bank non-performing loans while existing studies have not examined the effect of financial inclusion on bank loan loss provisions.

In the literature, some studies suggest that financial inclusion can improve financial stability by increasing the deposit base of banks, the number of financial institutions and financial instruments (see, Hannig and Jansen, 2010; Han and Melecky, 2013; García and José, 2016). But these studies did not examine the effect of financial inclusion on crucial indicators of bank stability such as non-performing loans and loan loss provisions. This paper addresses this gap in the literature.

Non-performing loans are important indicators of bank soundness and stability (Nkusu, 2011). Loan loss provision is also an important indicator of bank safety from a prudential regulatory perspective (Ozili, 2021c). Bank supervisors require banks to reduce the size of non-performing loans (Boudriga et al, 2009), and to keep sufficient loan loss provisions to mitigate their credit risk exposure (Ozili, 2017). Understanding how financial inclusion affects bank stability is important because it can help bank regulators to understand the contribution of financial inclusion to the overall soundness of the banking sector.

This study contributes to the banking literature. It shows that financial inclusion is a determinant of bank stability. In the paper, we estimate the effect of several measures of financial inclusion on bank non-performing loans and loan loss provisions. We find some evidence that financial inclusion, together with some macroeconomic conditions, improves bank stability by reducing the size of non-performing loans and loan loss provisions in the banking sector.

This study also contributes to studies that examine the consequence of financial inclusion. It shows that greater formal account ownership is associated with high non-performing loans, but the use of formal accounts together with other financial indicators lowers the size of loan loss provisions.

The rest of the paper is structured as follows. Section 2 presents the literature review and hypotheses. Section 3 presents the research design, including the data, model and variable justification. Section 4 reports and discuss the results. Section 5 concludes.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Some studies examine how bank behavior or activities affect financial inclusion. For instance, León and Zins (2020) examine whether the development of regional foreign banks increase financial inclusion for firms and households. They use African bank data. They find that the presence of regional foreign banks increases firms' access to credit. Owen and Pereira (2018) examine the association between financial

inclusion and banking structure in a cross country analysis. They use several indicators of financial inclusion and banking structure. Their results show that greater banking industry concentration is associated with more access to deposit accounts and loans. They also find that financial inclusion is higher in countries in which regulations allow banks to engage in a broader scope of activities.

Other studies examine whether financial inclusion affects bank performance and stability. Kumar et al (2021) examine whether financial inclusion increases bank profitability. They analyse 122 Japanese banks from 2004 to 2018. They find that a reduction in the number of bank branches reduces the profitability of Japanese banks. However, increase in the number of loan accounts and automated teller machines (ATMs) did not have a significant effect on bank profitability. Musau et al (2018) analyse the effect of financial inclusion on credit risk in Kenya. Credit risk was measured using the non-performing loan ratio. They analyse 43 commercial banks in Kenya from 2007 to 2015. They find that bank availability, bank accessibility and bank usage had a significant effect on credit risk of commercial banks in Kenya. Ahamed and Mallick (2019) examine the association between financial inclusion and bank stability. They undertake a cross-country study of 2635 banks in 86 countries from 2004 to 2012. They find that higher levels of financial inclusion have a positive association with bank stability. The positive association is pronounced for (i) banks that have higher customer deposit funding share, (ii) banks that have lower marginal costs of providing banking services, and (iii) banks that operate in countries with stronger institutional quality.

In a separate study, Chauvet and Jacolin (2017) investigate the impact of financial inclusion on bank performance. They analyse 55,596 firms in 79 countries. They find that financial inclusion has a positive impact on firm growth. The positive impact is magnified when banking markets are less concentrated. Ozili (2021a), in a cross country analysis, examine whether high levels of financial inclusion are associated with greater financial risk in the banking sector. Financial risk was measured using the non-performing loan ratio and cost to income ratio. The results show that higher formal account ownership is associated with higher non-performing loan and high cost inefficiency in the financial sector of developed countries, advanced countries and transition economies. They also find that the combined use of credit cards with increased formal account ownership reduced insolvency risk and improved financial sector efficiency in developing countries.

Markose et al (2020) examine the economic viability of the Prime Minister Jan-Dhan Yojna (PMJDY) financial inclusion scheme introduced in India. They examine whether the scheme is economically viable in terms of the supply side funding gaps that threaten the efficacy and sustainability of the scheme. They analyse the PMDJY data for public sector banks, private sector banks and regional banks from 2014 to 2017. They found a lack of economic viability of PMJDY accounts in the majority of Indian public sector banks due to the rising cost which public sector banks have to bear to sustain the scheme.

Muthia et al (2019) examine the effect of financial inclusion on bank efficiency in Indonesia. They examine 26 banks in Indonesia from 2011 to 2016. They find that financial inclusion has a positive and significant effect on bank efficiency. Chen et al (2018) examine whether the promotion of financial inclusion affects the non-performing loans of commercial banks in China. They analyse data from 31 provinces from 2005 to 2016. The results reveal a negative impact of financial inclusion on non-performing loans.

To date, the literature has not examined the effect of financial inclusion on loan loss provisions, particularly how bank loan loss provisions are affected by supply-side financial inclusion instruments such as increase in bank branches and ATM supply. The present study fills this gap in the literature.

2.2. Hypothesis development

There are two main predictions for the effect of financial inclusion on non-performing loans and loan loss provisions. The first prediction is that greater financial inclusion may lead to high non-performing loans when loans are given to risky individuals, households and businesses (Musau et al, 2018). Loans granted to these risky segment of the population may not be repaid. When the loans are not repaid, it will increase the non-performing loans of banks and subsequently increase the size of loan loss provisions. When this is the case, we predict that greater financial inclusion will increase non-performing loans and loan loss provisions in the banking sector.

H1: greater financial inclusion is associated with higher non-performing loans and loan loss provisions in the banking sector.

On the other hand, greater financial inclusion can provide an opportunity for banks to diversify their loan portfolio to a diverse set of customers. Such loan diversification helps to reduce credit risk that arises from an undiversified loan portfolio. It will also reduce credit risk that arises from over-lending to a small group of customers which increases concentration risk in the loan portfolio of banks. When the loan portfolio is well diversified, it will not only prevent loans from being concentrated around a narrow group of borrowers, it will also increase the customer base of banks, and provide an opportunity for banks to diversify their loan portfolio thereby reducing concentration risk and credit risk in bank lending. The reduced credit risk will lead to fewer non-performing loans, and subsequently a reduction in the size of bank loan loss provisions. When this is the case, we predict that financial inclusion will reduce the size of non-performing loans and loan loss provisions. The findings of Morgan and Pontines (2014) supports this prediction. They find that an increase in lending to small and medium-sized enterprises reduces the non-performing loans of financial institutions.

H2: greater financial inclusion is associated with fewer bank non-performing loans and fewer loan loss provisions in the banking sector.

3. RESEARCH DESIGN

3.1. Data

The data used in this study was extracted from the global financial development indicators and the world development indicators available in the World Bank database. The dataset covers 48 countries. The countries are reported in table 1. The sample period covers only three years: 2011, 2014 and 2017. This narrow period was selected based on data availability as financial inclusion data was available mostly for the year 2011, 2014 and 2017. Countries that did not have reported data for financial inclusion, non-performing loans and loan loss provisions were removed from the sample, leaving only countries that have the required data in the sample.

3.2. The Model

The econometric model used to estimate the effect of financial inclusion on non-performing loans and loan loss provisions is specified below. The model is estimated using the fixed effect regression estimation procedure.

$$LLPi,t = c + \beta_1 ACCi,t + \beta_2 BRi,t + \beta_3 ATMi,t + \beta_4 NPLi,t + \beta_5 GDPi,t + ei,t \dots \text{equation 1}$$

$$NPLi,t = c + \beta_1 ACCi,t + \beta_2 BRi,t + \beta_3 ATMi,t + \beta_4 GDPi,t + ei,t \dots \text{equation 2}$$

where 'c' is the constant term, 'i' is country, and 't' is year. 'ACC' is the number of adults that own an account at a formal financial institution (% age 15+). 'ATM' is the number of automated teller machines (ATMs) per 100,000 adults. 'BR' is the number of bank branches per 100,000 adults. 'NPL' is the bank non-performing loans to gross loans ratio (%). 'LLP' is loan loss provisions divided by gross loans (%). This ratio is derived by multiplying the NPL ratio with the LLC¹ ratio. 'GDP' is real GDP growth rate.

3.3. Variable justification

The ACC, BR and ATM variables are the financial inclusion indicators used in this study. Formal account ownership (ACC), bank branches per 100,000 adults (BR) and ATMs per 100,000 adults (ATM)

¹ LLC is the loan loss coverage ratio. It is expressed as loan loss provisions divided by non-performing loans.

are widely used as indicators of financial inclusion in the financial inclusion literature (see, Naumenkova et al, 2019; Raza et al, 2019; Ozili, 2020; Neaime and Gaysset, 2018; Ozili, 2018; Emara and El Said, 2021, Kumar et al, 2021; and Ozili, 2021b).

A financial inclusion index (AFI) variable was also introduced into the model during our additional test. The AFI variable was derived as the average of the sum of three financial inclusion variables (i.e. ACC, BR and ATM). We do not have a definite prediction for the impact of financial inclusion on loan loss provisions and non-performing loan.

In the loan loss provisions model in equation 1, the NPL variable controls for the impact of non-performing loans on loan loss provisions. The literature show that non-performing loan is a major non-discretionary determinant of loan loss provisions in the banking sector (see Ozili and Outa, 2017; Caporale et al, 2018; Danisman et al, 2021). Many studies report a positive relationship between loan loss provisions and non-performing loans because banks will increase loan loss provisions when they expect high non-performing loans. This expectation is consistent with Bhat et al (2019) and Peterson and Arun (2018). Therefore, a positive relationship between loan loss provisions and non-performing loans is expected.

The GDP variable used in the study is real GDP growth rate. The GDP variable controls for the impact of macroeconomic changes on loan loss provisions. The literature shows that real GDP growth, which captures the state of the economy, affects the size of loan loss provisions (see, Floro, 2010; Pool et al, 2015). In times of economic prosperity, loan loss provisions are fewer in the banking sector because debtors can easily repay their debt as their incomes increase and business profit increase. This leads to fewer non-performing loans and fewer loan loss provisions. In recessionary times, loan loss provisions are higher in the banking sector due to tight financial conditions that make it difficult for debtors to repay their debt owed to banks. This leads to higher non-performing loans and higher loan loss provisions (see, Peterson and Arun, 2018; Ozili and Outa, 2017). Therefore, a negative relationship between GDP and LLP is expected.

4. RESULTS

4.1 Descriptive statistics and correlation

The descriptive statistics result is reported in table 1. The mean values for each country is reported. Bank branch per 100,000 adults (BR) is highest in Spain and Bulgaria, and much lower in Peru and the Philippines. Formal account ownership (ACC) is highest in Denmark, Sweden and Australia, and much lower in Moldova and El Salvador. Automated Teller Machine (ATM) supply is highest in Australia and Austria and much lower in India. Loan loss provisions ratio (LLP) is highest in Brazil, and much lower in Canada. Non-performing loans ratio (NPL) is highest in Cyprus and Ukraine, and much lower in Canada. Real GDP growth rate (GDP) is highest in Turkey, and much lower in Ukraine.

Table 1: Country-specific descriptive statistics (mean values)

	ACC	ATM	BR	NPL	LLP	GDP	AFI
Albania	35	33	22	18	93	2	30
Argentina	43	41	13	1	154	2	32
Armenia	26	55	21	5	34	5	34
Australia	99	165	29	1	25	2	98.
Austria	97	154	14	2	67	2	88
Belarus	70	50	1	7	45	3	40
Belgium	97	90	39	3	48	1	75
Bosnia	55	46	32	12	91	1	44
Brazil	64	114	19	3	165	1	66
Bulgaria	62	93	56	14	74	2	71
Canada	98	219	22	0.6	21	2	113
Colombia	37	38	15	3	164	4	30
Costa Rica	60	65	22	1	123	3	49
Croatia	86	122	34	13	74	0.8	81
Cyprus	88	57	47	31	83	1	64
Czech	81	49	22	4	55	2	51
Denmark	99	55	29	3	51	1	61
Ecuador	44	30	11	3	123	4	28
El Salvador	25	33	12	2	122	2	23
Estonia	97	77	13	2	32	5	62
Georgia	44	65	29	3	66	5	46
Greece	83	65	30	31	97	-2	59
Guatemala	35	31	33	2	68	3	33
Hungary	73	58	15	11	76	3	49
India	55	16	12	5	51	6	28
Indonesia	34	40	16	2	59	5	30
Ireland	94	92	23	16	65	6	69
Latvia	91	64	23	7	91	4	59
Malaysia	77	50	10	1	31	5	46
Mexico	33	48	14	2	165	2	32
Moldova	26	33	38	13	79	5	32
North Macedonia	74	55	24	8	124	2	51
Panama	38	58	22	2	50	7	39
Paraguay	26	23	9	2	96	4	19
Peru	30	65	7	3	129	3	34
Philippines	28	22	8	2	72	5	20
Russia	63	155	34	7	85	2	84
Saudi Arabia	62	66	8	1	159	4	45
Singapore	97	62	9	1	38	4	56
Slovak	80	57	26	4	63	2	54
Slovenia	97	98	33	8	72	2	76
Spain	94	125	72	6	67	1	97

Sweden	99	39	19	1	28	2	52
Thailand	77	104	11	2	55	1	64
Turkey	60	71	18	2	82	7	50
Uganda	27	4	2	4	56	6	11
Ukraine	52	92	0.9	29	122	0.4	48
United Arab Emirate	76	61	12	6	82	4	49
Full sample average	65	69	21	6	81	3	52
Source: Authors' computation							

The correlation analysis is reported in table 2. In the correlation analysis, LLP is positive and significantly correlated with NPL as expected. Interestingly, LLP is negatively correlated with the three financial inclusion variables. The ACC, BR and ATM variables have a negative and significant correlation with LLP. This suggests that higher financial inclusion (i.e., higher formal account ownership, bank branch supply and ATM supply) is associated with fewer loan loss provisions. Meanwhile, NPL is positive and significantly correlated with BR. This suggest that increase in bank branches is associated with higher non-performing loans. Finally, the correlation between the three financial inclusion variables (ACC, BR and ATM) is low. Therefore, multi-collinearity is not a problem in our analysis.

4.2. Regression results

4.2.1. Effect of financial inclusion on loan loss provisions

First, we examine the effect of the individual financial inclusion variables on loan loss provisions using a step-wise panel regression procedure. The result is reported in table 3. The ACC, BR and ATM coefficients are statistically insignificant in column 1, 2 and 3. The result suggests that each of the financial inclusion variables do not have a significant effect on loan loss provisions when they are examined separately.

Next, we introduce the three financial inclusion variables into the model and re-estimate the model. The result is reported in column 4. The ACC, BR and ATM coefficients are statistically insignificant in column 4. This indicates that the number of formal account ownership, bank branches and automated teller machines do not significantly affect the size of loan loss provisions when they are examined together.

Next, we introduce the financial inclusion index variable (AFI) as a proxy for financial inclusion, and examine its effect on loan loss provisions. The result is reported in column 5. The AFI coefficient is statistically insignificant. This suggest that financial inclusion has no significant effect on loan loss provisions.

Further, we perform some interaction analysis to determine whether the individual financial inclusion variables may have some effect on loan loss provisions when they are combined. The result is reported in column 6 and 7. The ACC*ATM coefficient is positive and significant in column 6 and 7. This suggests that loan loss provisions are higher in countries that have greater formal account ownership and greater ATM supply. Similarly, BR*ATM coefficient is positive and significant in column 6 and 7. This suggest that loan loss provisions are higher in countries that have greater bank branch and greater ATM supply. Finally, the ACC*BR*ATM coefficient is negative and significant in column 7. This suggest that loan loss provisions are fewer in countries that have high levels of formal account ownership, bank branch supply and ATM supply.

Table 2: Pearson correlation of the variables

Variables	LLP	NPL	GDP	ACC	BR	ATM	AFI
LLP	1.000 ---- ----						
NPL	0.179** (2.16) ((0.03))	1.000 ---- ----					
GDP	-0.07 (-0.83) ((0.40))	-0.234** (-2.85) ((0.00))	1.000 ---- ----				
ACC	-0.383*** (-4.92) ((0.00))	0.102 (1.22) ((0.23))	-0.306*** (-3.82) ((0.00))	1.000 ---- ----			
BR	-0.165** (-1.99) ((0.04))	0.212** (2.58) ((0.01))	-0.271*** (-3.33) ((0.00))	0.272*** (3.36) ((0.00))	1.000 ---- ----		
ATM	-0.199** (-2.41) ((0.02))	-0.003 (-0.041) ((0.96))	-0.295*** (-3.67) (0.00))	0.559*** (8.02) ((0.00))	0.312*** (3.91) ((0.00))	1.000 ---- ----	
AFI	-0.310*** (-3.87) (0.00)	0.082 (0.98) ((0.32))	-0.363*** (-4.62) ((0.00))	0.801*** (15.91) ((0.00))	0.513*** (7.09) ((0.00))	0.916*** (27.23) ((0.00))	1.000 ---- ----

Source: Authors' computation. ***, **, * denote significance at 1%, 5% and 10% levels. Numbers in double parenthesis are p-values. Numbers in single parenthesis are t-values

Source: Authors' Compilation

Table 3: Effect of financial inclusion on bank loan loss provisions

Dependent variable: LLP							
	Stepwise analysis			4	AFI index	Interaction analysis	
	1	2	3			5	6
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
c	62.383*** (4.39)	68.242*** (8.25)	77.371*** (9.23)	68.429*** (4.45)	78.299*** (6.04)	78.112*** (3.73)	95.514*** (4.13)
ACC	0.049 (0.24)			0.137 (0.62)		0.197 (0.60)	-0.066 (-0.18)
BR		-0.101 (-0.31)		0.090 (0.25)		0.130 (0.18)	-1.156 (-1.13)
ATM			-0.155 (-1.44)	-0.187 (-1.52)		-0.811*** (-2.99)	-1287*** (-3.34)
AFI					-0.229 (-0.99)		
NPL	1.413*** (5.69)	1.419*** (5.88)	1.471*** (6.36)	1.382*** (5.50)	1.436*** (5.97)	1.305*** (5.25)	1.302*** (5.29)
GDP	1.627*** (2.77)	1.543*** (2.72)	1.386** (2.46)	1.504** (2.52)	1.392** (2.37)	1.687*** (2.84)	1.718*** (2.93)
ACC*ATM						0.006** (2.03)	0.012** (2.64)
ACC*BR						-0.011 (-1.15)	0.006 (0.43)
BR*ATM						0.008* (1.65)	0.035** (2.11)
ACC*BR*ATM							-0.0003* (-1.72)
R ²	94.51	94.52	94.63	94.66	94.57	95.08	95.25
Adjusted R ²	91.34	91.39	91.57	91.38	91.43	91.79	91.97
F-statistic	29.81	30.17	30.87	28.88	30.13	28.85	29.05

Source: Authors' computation. ***, **, * denote significance at 1%, 5% and 10% levels. Numbers in parenthesis are t-statistic values.

Source: Authors' Compilation

4.2.2. Transient effect of financial inclusion on loan loss provisions

In this section, we investigate the transient effect of each financial inclusion variable on loan loss provisions. To do this, we interact each financial inclusion variable on each control variable in order to determine their transient effect. The result is reported in table 4.

The ATM*NPL coefficient is positive and significant. This suggest that loan loss provisions are higher in countries that have high ATM supply and high non-performing loans. The result implies that higher ATM supply (or high financial inclusion) did not dampen the effect of non-performing loans on the size of loan loss provisions. Meanwhile, the ACC*NPL, ACC*GDP, BR*NPL, AFI*NPL, AFI*GDP, BR*GDP and ATM*GDP coefficients are insignificant.

Table 4: Effect of financial inclusion on loan loss provisions: transient effect

Dependent variable: LLP				
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
c	51.810*** (2.74)	70.499*** (4.57)	74.185*** (4.71)	78.880*** (4.97)
ACC	0.389 (1.42)	0.101 (0.46)	0.203 (0.95)	
BR		0.239 (0.63)	-0.048 (-0.13)	
ATM			-0.288** (-2.13)	
AFI				-0.244 (-0.87)
NPL	3.013** (2.23)	1.763*** (4.99)	-0.220 (-0.32)	0.629 (0.37)
GDP	3.442** (2.02)	1.614* (1.80)	2.743** (2.14)	2.569 (1.55)
ACC*NPL	-0.021 (-1.22)			
ACC*GDP	-0.029 (-1.14)			
BR*NPL		-0.019 (-1.48)		
BR*GDP		-0.007 (-0.19)		
ATM*NPL			0.022** (2.48)	
ATM*GDP			-0.017 (-1.03)	
AFI*NPL				0.015 (0.50)
AFI*GDP				-0.025 (-0.78)
R ²	94.81	94.91	95.10	94.64
Adjusted R ²	91.43	91.42	91.91	91.36
F-statistic	28.04	28.03	29.82	28.79
Source: Authors' computation. ***, **, * denote significance at 1%, 5% and 10% levels. Numbers in parenthesis are t-statistic values.				

Source: Authors' Compilation

4.2.3. Effect of financial inclusion on non-performing loans

In this section, we examine the effect of the individual financial inclusion variables on non-performing loans. The result in column 1 of table 5 show that the ACC coefficient is positive and significant. This suggest that greater formal account ownership is associated with higher non-performing loans. This implies that as more people own formal accounts, non-performing loans are likely to increase. The BR and ATM coefficients are statistically insignificant in column 1. This indicates that the number of bank branch and automated teller machines do not significantly affect the size of non-performing loans.

Further, we perform some interaction analysis to determine whether the individual financial inclusion variables have some joint effect, and transient effect, on non-performing loans. The result is reported in column 2 and 3. The ACC*ATM*GDP coefficient is positive and significant. The result suggests that greater formal account ownership, ATM supply and economic prosperity jointly increase non-performing loans rather than reduce it. Similarly, ACC*BR*GDP coefficient is positive and significant. The result suggests that greater formal account ownership, increase in branch supply and economic prosperity jointly increase non-performing loans rather than reduce it. The ACC*BR*ATM*GDP coefficient is negative and significant. This implies that non-performing loans are fewer in countries that experience economic boom and high levels of financial inclusion which is achieved through the combined use of greater formal account ownership, increase in bank branch supply and greater ATM supply.

Table 5: Effect of financial inclusion on non-performing loans

Dependent variable: NPL				
	1	2	3	4
	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)	Coefficient (t-statistic)
c	-4.246 (-0.66)	-4.974 (-0.63)	5.635 (0.73)	5.490 (0.95)
ACC	0.229** (2.57)	0.238** (2.11)	0.154 (1.55)	
BR	-0.193 (-1.26)	-0.188 (-1.20)	-0.454** (-2.56)	
ATM	-0.022 (-0.42)	-0.019 (-0.35)	-0.003 (-0.05)	
AFI				-0.004 (-0.04)
GDP	0.567** (2.32)	0.170 (0.23)	-0.755 (-1.29)	-0.418 (-0.62)
ACC*GDP		-0.004 (-0.26)		
BR*GDP	-	0.017 (1.01)		
ATM*GDP		0.005 (0.49)		
ACC*ATM*GDP			0.0002* (1.79)	
ACC*BR*GDP			0.001*** (2.72)	
BR*ATM*GDP			0.001 (1.14)	
ACC*BR*ATM*GDP			-0.0002** (-2.57)	
AFI*GDP				0.019 (1.51)
R ²	78.83	79.17	80.92	77.53

Adjusted R ²	66.22	65.60	68.12	64.56
F-statistic	6.25	5.84	6.32	5.97
Source: Authors' computation. ***, **, * denote significance at 1%, 5% and 10% levels. Numbers in parenthesis are t-statistic values.				

Source: Authors' Compilation

5. CONCLUSION

This paper examined the impact of financial inclusion on bank non-performing loans and loan loss provisions. The result showed that greater formal account ownership is associated with high non-performing loans. Also, loan loss provisions are lower in countries that have high levels of financial inclusion. Furthermore, non-performing loans are fewer in countries that experience economic boom and high levels of financial inclusion which is achieved through the combined use of greater formal account ownership, increase in bank branch supply and greater ATM supply.

The findings have policy implications. Policy makers should focus on further improvement in financial inclusion in good times because it has positive benefits for bank non-performing loans and loan loss provisions. Policy makers in several countries should strive to promote formal account ownership, availability of bank branches and ATM supply not only to reduce the level of financial exclusion but also to complement existing macro prudential policies towards enhancing bank stability. The main limitation of the study is that the sample period is narrow. This is because the World Bank's financial inclusion data often have a short time span. Future studies can examine the effect of financial inclusion on bank's risk-taking. Future studies can also explore the impact of financial inclusion on other indicators of bank stability other than non-performing loans and loan loss provisions such as capital adequacy ratio and insolvency risk.

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Appendix

A1: Variable description and sources

Variable description / definition	Symbol	Source
Account at a formal financial institution (% age 15+)	ACC	Global financial development indicators
ATMs per 100,000 adults	ATM	Global financial development indicators
Bank branches per 100,000 adults	BR	Global financial development indicators
Financial inclusion index (average of sum of ACC, BR and ATM)	AFI	Author's computation
Bank non-performing loans to gross loans ratio (%)	NPL	Global financial development indicators
Provisions to non-performing loans ratio (%)	LLC	Global financial development indicators
Loan loss Provisions to gross loans ratio (%) derived by multiplying NPL ratio with LLC ratio	LLP	Author's computation
Real GDP growth rate	GDP	World development indicators

Source: Authors' Compilation

The Effect of Public Debt on Private Consumption: The Case of Countries in Transition

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ABSTRACT

Developed countries have well-designed and developed economies in macroeconomic terms. However, not all countries benefit from the fruits of such an economy. Therefore, some countries are still faced with an economy that requires macroeconomic restructuring and development. People in these countries face high unemployment, evolving fiscal and monetary policies. The state is forced to borrow either internally or externally, where the latter is usually preferred. This paper aims to show the effects of government debt on private consumption with a particular focus on transition countries. Thereby explaining the factors that influence private consumption and the types of debt that governments take into account. The countries in regions, which are facing this problem, will be analysed in more detail. Kosovo is one such country, which will be analysed in detail, particularly the relationship between national debt and private consumption. This study is carried out using the statistical software STATA, whereby private consumption is a dependent variable, whilst national debt, gross fixed capital formation, foreign direct investment, consumer price index, export of goods and services and GDP growth are our independent variables. This paper is a compilation of information from multiple sources to describe the reality that transition countries are faced with when borrowing.

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1. INTRODUCTION

This paper attempts to review a range of material from various sources to put together a compact suite of information that should guide any individual who wants to find out more about public debt as an indicator of private consumption in countries in transition. The need for this emanates from the fact that governments face various challenges, particularly those related to debt settlement, focusing on external debt. Various analyses highlight the importance of each variable that influences private consumption so that the state can take into account the influencing indicators.

As the national debt, public debt is fundamentally different from private debt since public debt is not an individual debtor. Therefore, the state as a whole bears responsibility for making decisions about public debt. Through the national debt, the state wants to regulate the economic situation of the citizens. On the other hand, consumption is the main aspect based on which the individual regulates his/her economic situation. Transition countries have a harder time paying back their debts because they face an unenviable economic situation. Private consumption as one of the main indicators of the economic development of a country should be taken into account as it is the main driver of economic growth. In this study, we attempt to understand the importance and purpose of public debt as a tool and method for economic growth, measured in terms of stimulating consumption as a key alternative to achieving macroeconomic goals.

2. LITERATURE REVIEW

When a country's institutions are below a certain level of quality, higher public debt leads to slower growth (everything else being equal). However, when a country's institutions are relatively high quality, the national debt is neutral. Kourtellos et al., (2013) suggest that the government debt-to-growth ratio has been significantly reduced by the quality of a country's institutions. Therefore, if a country's institutions are relatively high quality, the national debt will grow neutrally (Kourtellos, et al., 2013).

Panizza (2008), on the other hand, suggests that the traditional dichotomy between external and domestic debt doesn't make much sense in a world dominated by open equity accounts. While the recent shift to domestic borrowing has had a significant positive impact on debt management, policymakers are not very complacent (Panizza, 2008).

Woo, (2010) suggests that given the surge in a country's national debt due to the global economic and financial crisis, there are serious concerns about its further economic and financial impact on the market. In particular, some observers have pointed to the potential risk that high debt could hamper capital accumulation and slow economic growth. This can happen through higher interest rates, future higher distortion of taxes, higher inflation, greater uncertainty and macroeconomic instability (Woo, 2010).

Several empirical studies have found a link between budget deficits, money supply growth and inflation in developed and developing countries. They highlight that it is often argued that in developing countries, high inflation occurs when governments face large and persistent deficits financed by spending. In addition, overall activity can positively impact enlargement, but different sectors can develop differently. This means it will get worse for some populations. This is likely greater with rising government spending than with tax cuts. This is because changes in government purchases are more likely to focus on specific sectors of the economy (Mustafi, 2018).

Developed countries are better able than developing countries to borrow and use domestic and foreign finance productively without bearing the costs of investment barriers, capital fluctuations, and political instability and displacement that normally accompany high debt levels. In contrast, in developing countries, the negative effects of debt overlap are likely to offset the potential benefits of the availability of additional resources. The main reason for this contrasting result is poor governance and poor institutions (Presbitero, 2012).

Local governments must take responsibility for their financial decisions at law and their taxpayers and those of other jurisdictions. Debt is the optimal solution for funding local investments as it restores stability between decision-makers, beneficiaries and taxpayers. However, this also requires a prudent and proactive fiscal policy that measures and compares the costs and benefits for each investment project and adjusts the investment volume to the current financial strength (Beer-Toth, 2009).

Overall capital accumulation represents household wealth, disposable income and government spending has a positive long-term and short-term impact on private consumption. However, the inflation rate and real interest rate only have a positive long-term effect on private consumption. This is because disposable income, capital accumulation, government spending, inflation and the real interest rate determine the variability of private consumption in the countries in the Asia-Pacific region. In most countries, the increasing national debt has no impact on private consumption, regardless of the financing policy. The main lesson to be drawn from this finding is that governments need to balance budgetary efforts between economic activities. Countries in the Asia-Pacific region should focus on microeconomic variables to increase private consumption and adopt conscious fiscal policies (Kusairi, et al., 2019).

A country with higher unpaid government debt will have a lower equilibrium growth rate. The deleveraging leads to a higher growth rate. Borrowing does not improve welfare in the determinant model (Aizenman, et al., 2007).

In particular, Ueshina (2018) examines the impact of public debt on an economy where the budget deficit fully funds public investment. Specifically, this model shows the impact of public debt on transition dynamics if the government follows the Golden Rule of Public Finances (GRPF) rather than the Balanced Budget Rule (BBR). The first can be referred to as a threshold rather than a stable state, as it provides the amount of public capital necessary for sustainable public debt.

Second, even when factoring-in debt-financed public investment and transition dynamics, the maximum rate of tax hike exceeds the level of the maximum welfare tax. Hence, these results also show how welfare effects can be modified depending on household characteristics and economic status when public investment is financed through a budget deficit (Ueshina, 2018).

Sutherland (1997) presented a model that shows how the influence of fiscal policy on consumption can vary depending on the level of the national debt. With moderate debt finance policies, there are traditional Keynesian effects. Current generations of consumers are deducting future taxes because they may no longer be alive at the time of the next debt stabilisation program (or, accordingly, a greater number of consumers will be available to pay taxes if a stabilisation program is in place). However, when debt levels hit the extremes, today's generation of consumers know that there is a high probability that they will stay alive if the next stabilisation program is implemented. A budget deficit can dampen consumer spending (Sutherland, 1997).

Public investment is the only type of government spending. Consequently, higher public debt, which increases the primary surplus, can only reduce productive public spending. In reality, however, other types of public spending, such as unproductive public consumption, can also be reduced. However, looking at the real-world economy, it seems that public investment is the type of expenditure that can be more easily reduced as public debt rises. This is because governments are not required to invest in public infrastructure, and there is no public investment lobby group. Hence, the decline in public investment due to growing public debt is not surprising (Greiner, 2007).

Uzun et al. (2012) noted that transition countries began to have market-oriented economies after 1991. Transition countries need external resources to change the economic structure into a market-based economy. Problems with the connection between production marketing and sales savings increased the need for external resources. In this study, Uzun et al. (2012) analysed the relationship between GDP (gross domestic product) per capita and debt growth to GDP (gross national product) between 1991 and 2009 in transition countries. Results showed positive long-term relationships between countries' debt and growth rates.

Moreover, in an economic open market policy, the authorities in the transition countries had to account for the costs of using foreign debt. The foreign debt initially had a positive effect on the growth rate of the transition countries. Still, they had to pursue a disciplined fiscal and monetary policy and also balance the current account (Uzun, et al., 2012).

A higher national debt drives private consumption more strongly, and the extent of the accumulation effects has worsened since the global financial crisis. This could be one of the reasons for fiscal consolidation in advanced economies suffering from high public debt after the global financial crisis (Cho & Rhee, 2013).

Based on the results of Fetai et al.'s (2020) study, we can deduce that the various sub-groups of countries in the European transformation process should design their fiscal initiative in such a way that they combat the highest levels of debt to support economic growth. Raising the highest tax level to offset debt is not a good strategy for the governments of all countries in the European transformation process, especially for low-income countries. They may need to take initiatives and other fiscal measures to stimulate the private sector as the engine of economic growth (Fetai, et al., 2020).

Jäger and Keuschnigg (2014) report some surprising results. First, increases in government debt in groups with reliable parameters can increase the well-being of future generations. Second, the admissibility of asymmetrical parameter collections makes all possible long-term welfare effects possible. The benefits of future generations can either decrease or increase in both countries or be influenced in the opposite direction. Furthermore, in small open economies, an increase in national debt can increase the human wealth of future generations if capital gains taxes are used to fund increased interest payments on the national debt (Jäger & Keuschnigg, 2014).

Chen et al. (2016) show that the positive effects of government investment on economic growth decrease with increasing government investment, especially if the ratio of public investment/GDP is more than 20.04%, after which the positive effect would be negative. Likewise, the effect of national debt on economic growth decreases when national debt increases, especially when the national debt / GDP ratio is higher than 59.72%, after which the positive effect would turn into a negative effect. The empirical results suggest that an optimal level of government investment in terms of economic growth or an increase in the production elasticity of private capital would lead

to a higher optimal level of public investment but a lower optimal level of public debt. Whereas an increase in the production elasticity of government investment leads to a lower optimal level of public investment but a higher optimal level of public debt (Chen, et al., 2016).

Karadam's (2018) evaluation results suggest that the non-linearity of the relationship between the debt level and growth depends mainly on the debt structure. Essentially, Karadam's (2018) results show that total public debt, short-term external debt, and long-term external public debt have the largest effects from raising the threshold. The growth effects of these debt components are very negative when debt levels are high. In addition, the public debt thresholds for developing countries are lower than for developed countries, which means that these economies need to be more careful with their public debt (Karadam, 2018).

Saungweme and Odhiambo's (2019) study shows that the impact of public debt on economic growth is not given and varies depending on some heterogeneous factors. These include the level of development of the countries studied, the institutional quality, the relative size of the public sector, the composition and the structure of government debt, the data sets and the research methodology used as well as the selected control variables, in the context of the other factors. Their study concludes that the impact of public debt on economic growth is not clear and that the notion of public debt is a negative phenomenon for economic growth as many scientific studies in recent years have provided such empirical evidence. (Saungweme & Odhiambo, 2019).

Kwon et al. (2009) emphasise the importance of institutional and structural factors in the relationship between debt and inflation, such as fiscal rules, inflation targets, and the depth and breadth of the financial sector. They also show that, despite the important role of monetary policy in steering inflation expectations, fiscal policy is likely to be the dominant driver of inflation in heavily indebted developing countries. This means that price stability, achieved mainly through the issuance of central bank open market instruments (i.e. the accumulation of sovereign debt) instead of monetising the deficit, can only be sustained if supported by fiscal consolidation and structural reforms to strengthen monetary independence (Kwon, et al., 2009).

A state can be solvent in the sense that it can generate enough income in the future to pay off the debt service, but it can become illiquid if it cannot enter the financial markets on reasonable terms when the old debts fall due. High-risk premiums drive up interest rates, a liquidity crisis can turn into a solvency crisis. Our analysis emphasises that the trend and the level of the debt ratio should be an important indicator. However, our analysis suggests that a government debt benchmark of 60% of GDP can be used flexibly to trigger the benchmark for debt limit analysis. The government should aim to cover the budget balance and national debt as much as possible, paying special attention to companies with significant tax risks, including state-owned companies and corporations, public-private partnerships, and pensions and health (Chitiga, 2014).

Sulejmani and Ademi (2019) empirically analyse the effects of public debt on economic growth and the policies that influence economic growth in the European transition countries from 1996 to 2017. Given the attention of many scholars and the importance of politics to national debt and economic growth, we have empirically investigated the relationship of these two variables in European transition countries and based on our knowledge. This is the first contribution that attempts to apply these techniques empirically for this group of countries to determine national debt ratios and economic growth. Public debt has a positive but insignificant impact on GDP per capita. Consumption has a positive and statistically significant effect on GDP per capita. The gross savings have a positive impact on GDP per capita. Fixed investment with a positive statistically significant coefficient positively affects GDP per capita. However, the positive government spending ratio claims a negligible effect on GDP per capita GDP (Sulejmani & Ademi, 2019).

The record increase in public debt as a percentage of GDP in the transition period is due to a strong increase in social spending without a simultaneous increase in tax revenue. To ensure the sustainability of public debt and the credibility of Romania's economy for the future, a better correlation is needed between some basic macroeconomic indicators and the inclusion of pressure from international financial institutions, as seems to be the trend in recent years (Albu & Pelinescu, 2000).

Empirical results by Časni et al. (2014) indicate a negative correlation between government debt and growth control for other growth determinants (opening of trade, value-added by industry and total investment). As the crisis unfolded in Central, Eastern and South-eastern Europe, the rapid

decline in production was followed by an increase in government spending and a decrease in government revenue, which led to an increase in the public deficit (Časni, et al., 2014).

There is a negative relationship between public debt and investment in the long run. Since there is a direct relationship between investment and economic growth and an inverse relationship between economic growth and public debt. However, public debt must be managed and kept under control, as high debt levels would have negative long-term effects, and the later phase of borrowing, which is characterised by high levels of debt, will lead to low growth (Thobeka & Marius, 2018).

The impact on the GDP growth rate is the most important factor in stabilising and reducing national debt in the new member states of Central and Eastern Europe. Active and direct management of national debt through budget consolidation and austerity measures can have a negative impact on GDP, especially in the short term, and thus increase the national debt, which has the opposite effect of the desired one (Pečarić, et al., 2018).

According to Matiti (2013), Kenya's domestic debt was stable. Contingent liabilities pose a potential risk and burden to the national budget and a risk to domestic debt sustainability. Therefore, the government should develop a framework for the recording and monitoring of all contingent liabilities and formulate and implement a guideline for contingent liability management. Regular reporting on outstanding debts will also ensure transparency for the public and donor countries in managing these debts (Matiti, 2013).

After reviewing the literature and the results of Kadia's (2020) empirical analysis, it can be noted that there is a statistically very non-linear relationship between national debt and economic growth and that corruption is strongly correlated with a country's economic growth. In addition, Kadia's (2020) analysis has shown that, on the one hand, public debt can be detrimental to economic growth due to its costs. On the other hand, when debt is used to increase a country's productivity to pay off previous debts with income, debt can positively impact the economy. Albania is a country in need of a reduction in its debt ratio / GDP. This can be done through an economic stimulus rather than a reduction in public debt (Kadia, 2020).

Ntshakala's (2015) preliminary aim of the study was to measure the impact of domestic debt on economic growth in Swaziland. The results showed that domestic debt is an important determinant of economic growth, so an increase in domestic debt will fuel the country's economic growth. This means that domestic debt positively impacts Swaziland's economic growth. Domestic government borrowing can be increased to fund investment growth, as this study has shown that an increase in changing domestic borrowing leads to an improvement in the country's economy. The country still has leeway for loans if those loans flow into growth-promoting projects (Ntshakala, 2015).

According to Cano (2020), Albania is a country in need of a reduction in its debt-to-GDP ratio. In Cano's (2020) view, this can be done through an economic incentive rather than a reduction in public debt. Empirical analysis showed that the increase in real government debt could have a negative impact on GDP, but observations showed no specific level at which the effects worsened. Instead, government debt rose, the cost of debt sometimes went down because governments replaced debt borrowed from commercial banks with debt from the IMF. Investing in sectors such as agriculture would prepare the country for more competitive products, while neighbouring countries have lost some of their competitive advantages due to the current economic crisis. So if the government were to borrow to invest in agriculture technology or education to increase human capital productivity, that debt would increase a country's overall productivity and wages and, later, positively affect consumption (Cano, 2020).

Šimović (2018) concluded that fiscal instability and the rise in public debt were similarly influenced by negative economic trends and a lack of financial regulation, as well as the deterioration in financing and the rise in interest rates during the recession. The empirical results confirmed the thesis that the level of national debt significantly influences and reduces the effectiveness of fiscal policy (Šimović, 2018).

3. RESEARCH METHODOLOGY

We collected our data from publications by the Central Banks of 22 transition countries, the World Bank, the International Monetary Fund, the European Central Bank. The analysis was carried out using Microsoft Office Excel and STATA software. Four empirical were used to measure the

empirical results; specifically, a) Linear Regression; b) Fixed Effect; c) Random Effect and d) GMM Model

Our sample consisted of European countries, which are in the process of transition. We made this selection based on official reports of the World Bank and the International Monetary Fund. The sample includes 22 European countries during six years between 2014 and 2019. In the sample chosen, we included 11 European countries that completed the transition phase in 2019. These are specifically: Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

The data collection was carried out in three phases. In the first phase, we have referred to studies by other authors who have analysed the impact of public debt on private consumption in different parts of the world. Through these reviews, we defined the study variables, which served for our economic measurement and the processing of the econometric results. In the second phase, after defining the variables of this study and selecting the sample, we started collecting the statistical data from the annual macroeconomic reports of the World Bank and the International Monetary Fund. In the final phase, we processed the data, coded it, and carried out the statistical data calculations using the Stata program. We then continued to extract the econometric results and analyse the findings of this study.

4. EMPIRICAL DATA ANALYSIS AND ECONOMETRIC RESULTS

The following table presents the data for descriptive statistics, including all the variables of this study. These descriptive statistics include the number of observations, the minimum and maximum values, the mean, the standard deviation and the variance.

Table 1: Statistics descriptive

Variables	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Final consumption costs	132	-1.404	107.138	78.34047	19.84033	393.6387
General government debt	111	-1.404	83.993	46.17059	22.11096	488.8946
Gross fixed capital formation	130	13.549	33.224	21.82301	3.516655	12.3669
Foreign direct investments	132	-41.508	54.649	3.893826	6.754075	45.6175
Consumer price index	131	-1.584	48.7	2.641275	5.271673	27.7905
Export of goods and services	132	21.937	96.216	55.2262	19.56827	382.9172
GDP growth	132	-9.773	7.6	3.097795	2.123581	4.5096

Based on the descriptive results presented in Table 1, we can conclude that the highest value of standard deviation belongs to the following variables: general government debt, final consumption costs and export of goods and services. The variables, which have the lowest standard deviation value, are gross fixed capital formation, foreign direct investment, consumer price index, and GDP growth. Therefore, the variables, which have a higher value of standard deviation, indicating that the data is more prevalent than the average value, while the variables, which have a lower value of standard deviation, are considered to be distributed closer to the average value.

Table 2: Correlation analysis

Variables	Final consumption Costs	General government debt	Gross fixed capital formation	Foreign direct investments	Consumer price inflation	Export of goods and services	GDP growth
Final consumption costs	1	0.3886	0.1714	0.1093	0.0528	-0.1869	-0.1669
General government debt	0.3886	1	-0.2109	0.0826	0.1626	0.1724	-0.2828
Gross fixed capital formation	0.1714	-0.2109	1	0.0003	-0.0799	-0.0216	0.1985
Foreign direct investments	0.1093	0.0826	0.0003	1	-0.0372	-0.1082	-0.0518
Consumer price inflation	0.0528	0.1626	-0.0799	-0.0372	1	-0.0724	-0.5888
Export of goods and services	-0.1869	0.1724	-0.0216	-0.1082	-0.0724	1	0.0213
GDP growth	-0.1669	-0.2828	0.1985	-0.0518	-0.5888	0.0213	1

According to the correlation results, there is a weak and positive correlation of 0.3886 between government debt and consumer spending. If the national debt increases by 38.86%, consumer spending increases and vice versa. There is a weak and positive correlation of 0.1714 between gross fixed capital formation and consumer spending. This means that if gross fixed capital formation increases by 17.14%, consumer-spending increases and vice versa. There is a weak and positive correlation of 0.1093 between FDI and consumer spending, which means that if FDI increases by 10.93%, consumer spending increases and vice versa. There is a weak and positive correlation of 0.0528 between the consumer price index and consumer spending. This means that if the consumer price index increases by 5.28%, consumer-spending increases and vice versa.

There is a weak and negative correlation of -0.1869 between exports of goods and services and consumer spending. This means that if the export of goods and services falls by -18.69%, consumer spending falls and vice versa. There is a weak and negative correlation of -0.1669 between GDP growth and consumer spending. This means that if GDP growth declines by -16.69%, consumer spending will decrease and vice versa.

The equation used in this paper is:

$$Y_t = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 \quad (1)$$

$$Y_t \text{ (Final consumption costs)} = b_1X_1 \text{ (General Government Debt)} + b_2X_2 \text{ (Gross Fixed Capital Formation)} + b_3X_3 \text{ (Foreign Direct Investment)} + b_4X_4 \text{ (Consumer Price Index)} + b_5X_5 \text{ (Export of Goods and Services)} + b_6X_6 \text{ (GDP growth)} + \varepsilon$$

Y_t - represents the dependent variable (the variable that is being explained). In our research case, the dependent variable is consumption costs.

$b_0, b_1, b_2, b_3, b_4, b_5$ and b_6 are defined as evaluation parameters or coefficients, where b_0 is the constant parameter while b_1, b_2, b_3, b_4, b_5 and b_6 are the independent variables evaluation parameters.

$X_1 - X_6$ - represents the independent variables. In our case, the independent variables are general government debt, gross fixed capital formation, foreign direct investment, consumer price index, exports of goods and services and GDP growth.

ε - is the term of the statistical variable or error. This contains all the factors or variables that are not predicted in the model and is a random and unprotected variable that captures positive and negative values. The statistical error indicates that other factors affect the dependent variable consumer spending. This indicates that the complete variable is not explained or does not give us information from the independent variables. Otherwise, the statistical component represents the unexplained part of the model.

Table 3: Econometric Results

Variables	Linear Regression	Fixed – Effects Regression	Random Effects – GLS Regression	GMM Model
Final consumption costs	-	-	-	0.2771462 (0.105)
General government debt	0.4470887 (0.000)	-0.0221073 (0.638)	-0.0006407 (0.989)	-0.046099 (0.309)
Gross fixed capital formation	1.698857 (0.001)	-0.5221767 (0.000)	-0.5005291 (0.000)	-0.4013045 (0.004)
Foreign direct investments	0.0895719 (0.712)	-0.0056275 (0.810)	-0.0054579 (0.817)	0.0076571 (0.698)
Consumer price index	-0.3865401 (0.313)	-0.0693754 (0.172)	-0.0720413 (0.155)	0.0764958 (0.162)
Export of goods and services	-0.2812974 (0.002)	-0.3747793 (0.000)	-0.3623835 (0.000)	-0.2944557 (0.002)
GDP growth	-1.350885 (0.173)	-0.0502668 (0.641)	-0.0502784 (0.641)	0.1558184 (0.178)
Const.	40.57312 (0.003)	111.0208 (0.000)	109.6636 (0.000)	81.94796 (0.000)
R Square	0.7015	0.7270	0.7353	-

H₁ - General government debt affects final consumption expenditures.

(Here, we can see that general government debt does not affect final consumption expenditures because general government debt is not intended for consumption but other investments. The hypothesis, in this case, is refuted).

H₂ - gross fixed capital formation affects consumer spending. Here we see that gross fixed capital formation has an impact on consumer spending since domestic investment is also intended for consumption. The hypothesis is accepted.

H₃ - Foreign direct investment affects consumer spending. Here we see that FDI has no impact on consumer spending, as the FDI does not serve to support final consumption but other investments. The hypothesis is rejected.

H₄ - consumer price index affects consumer spending. Here we see that the consumer price index does not affect consumer spending, which means that inflation has been kept at a constant level, which has not affected final consumption. The hypothesis is rejected.

H₅ - Exports of goods and services affect consumer spending. Here we can see that the export of goods and services affects consumer spending since exports are one of the indicators of the economic

development of countries and especially countries in transition and the growth of the trade balance. The hypothesis, in this case, is accepted.

H₆ - GDP growth affects consumer spending. Here we see that GDP growth does not affect consumer spending. Although GDP is an indicator showing the country's macroeconomic growth, in our case, it has no impact on consumer spending growth. The hypothesis is rejected.

5. DISCUSSION

Referring to the econometric results, it can be concluded that public debt has not affected private consumption in transition countries. This result is contrary to the economic theory that public debt affects private consumption. Given the fact that in low-debt economies, the level of public debt is not significant for private consumption, then the insignificant impact of public debt on private consumption in transition countries is acceptable and can be argued with empirical evidence.

Countries in transition (22 countries) for the period analysed (2014 - 2019) have an average value of public debt of 46.17%, a value which is not very high for these countries. Therefore, since these countries have a low level of public debt, the effect of this debt on private consumption is not significant. In countries with high debt levels, the level of public debt has a negative impact on private consumption since a fiscal expansion will be partially offset by private consumption.

The results of this study contradict the study of authors such as Cho and Rhee (2013), who analysed the non-linear effect of public debt on private consumption in OECD countries. This study shows that a higher level of government debt encourages more private consumption. Such a hypothesis applies to OECD countries, but our study highlights an insignificant impact of public debt on private consumption for transition countries. In addition, the results of this study contradict the findings of the study of the authors such as Berben and Brosens (2007). Therefore, this study shows that the correlation between government debt and private consumption in OECD countries is non-linear. Based on these results, it can be concluded that fiscal policies may be less effective in stabilising fluctuations in business cycles in countries with high government debt. Therefore, the empirical findings of our study are comparable to the results of the study by Kusairi et al. (2019), who note that the overall results of this study show that public debt does not affect private consumption in Asia – Pacific countries in the short and long term.

6. CONCLUSIONS AND RECOMMENDATIONS

One of the pillars of the state is to increase social welfare. It has to maintain this welfare and is obliged to ensure that these debts are thought through in detail and planned for the longer term.

This type of problem that every developed or under-developed state faces differs in the way that states deal with it. For example, the Maastricht Treaty predicts what the optimal level of debt will have to be to achieve stable economic growth. Based on our empirical findings, we can conclude that when the institutions of a state are weak, the national debt has a minimal effect on economic growth, whereas if the institutions of a state are developed, the national debt has a neutral effect on economic growth. As we note in the literature review, some authors concluded that developed countries are better able to manage public debt than developing countries because the latter suffers from poor management.

Public debt in the Western Balkans continues to be one of the main topics of discussion when focussing on EU integration. However, Western Balkans countries are characterised by stable budget levels despite their high national debt. High public spending and household borrowing have driven consumption growth.

Based on the results, we can see that only the variables gross fixed capital formation and exports of goods and services are significant and thus have an impact on consumer spending. Thus, the formation of gross fixed capital influenced the final consumption of consumers and other variables such as the export of goods and services influenced GDP growth and, at the same time, the growth of final consumption.

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EXAMINING SPILLOVER OF SUSTAINABLE BEHAVIOUR: AN INTERVENTION STUDY FROM THE PERSPECTIVE OF MALTESE PUBLIC OFFICERS.

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ABSTRACT

It has long been acknowledged that the various burgeoning problems inflicting the world are deeply rooted in human behaviour. Governance often entails policy formulation and strategies that initiate behavioural change to alleviate such problems and foster sustainability. However, this often appears as a strenuous endeavour, especially at the macro level. For this reason, implementing the behavioural spillover mechanism is deemed befitting. Few studies have directed their attention towards the relationship of individuals' sustainable behaviour across different settings, and such a perspective could indicate the way forward required within various future policy frameworks. Hence, the following intervention study attempts to examine behavioural spillover, which entails the transfer of attitudes from one domain to another, in this case, from a work-home perspective. This chapter builds upon such notion through a case study from the Maltese islands, the smallest EU member state, by providing insights from public officers. Such sampling population was selected as these individuals work closely within governmental structures and should act as agents of change in this regard. The methodological framework employs a positivist paradigm, based on a quasi-experimental design through an identical pretest and posttest Likert-scale questionnaire distributed to 14 public officers who undertook an educational module about sustainability at the University of Malta. These tests aimed to examine whether spillover of sustainable behaviour occurs within a spatio-temporal context - across the two different domains and during the entire intervention adopted. Quantitative findings are utilized to address two core research questions, from which various trends have been identified. Results show that positive spillover occurs for those behaviours which involve the least time, cost, and effort. It transpires that respondents are not willing to adopt drastic lifestyle changes. Such findings lay the foundation for the recommendations delineated in the current study, which might be helpful to other practitioners in public policy, management, and sustainable development.

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1. INTRODUCTION

In the wake of the ever-increasing issues inflicting the world, public administrations should adopt innovative measures to address and campaign for behavioural changes that would translate into fewer environmental impacts and eventually verge towards sustainability. Whitmarsh (2009) warns that changing behaviours, especially at the macro level, appear to be quite strenuous, and a myriad of resources are needed to accomplish such a task. Thøgersen and

Crompton (2009, p.142) assert that this necessitates 'far-reaching changes in individual behaviour, fundamental changes in business practice, and the implementation of ambitious new policies and regulations to drive interventions'. Being an underexplored area for many years, the notion of behavioural spillover seems to have gained ground recently within academic and policy contexts, as indicated by Austin et al. (2011), Truelove et al. (2014), and Nilsson et al. (2016) as cited in Galizzi and Whitmarsh (2019).

Besides shedding light on personal traits and pursuits through a psychological outlook, embodying the aforementioned in policy and governance is necessary. This can trigger a multiplier effect that might lead to a societal transformation. Capstick, Lorenzoni, Corner and Whitmarsh (2015) outline that such measures appear promising since they holistically address the shift towards sustainability rather than the small-scale and personal interventions carried out many a time in isolation.

Even though behavioural spillover often lends itself to the effects of the work domain on personal relationships, this chapter seeks to expose it across different domains, tackling it from a sustainable point of view. In this respect, the following section presents the objectives of this research in further detail.

1.1. Research Scope

The permeability between work-family relations has been the central motif of many studies such as Byron (2005); Eby et al. (2005), as cited in Sikora et al., (2007). However, as outlined in the introduction, the present research tries to fill the void concerning implementing sustainable behaviour across different settings as promulgated by Thøgersen (2012) and Tudor, Barr and Gilg (2007). Taking this into account, research is marshalled from the perspective of the Maltese islands, being the smallest EU member state and located in the middle of the Mediterranean, with a population marking half a million people (The Malta Independent, 2020) over an area of 316 square kilometres (NSO, 2014).

This study aims to examine the foregoing notion through a case study approach by expanding on research from previous studies. In addition, it shall scrutinize behavioural traits from the perspective of public officers who undertook an educational module at the University of Malta.

Thus, attention shall be directed towards the spatio-temporal spillover of sustainable behaviour between work and home by answering two core research questions:

- (i) Are there any similar or different behavioural trends between work and home?
- (ii) To what extent does the intervention utilized affect behaviour?

Answering these research questions will provide significant insights that contribute to existing knowledge in the field of human behaviour, sustainability and public administration. However, the results might also be applied to other spheres and may lay the foundation to further studies.

This chapter is divided into several sections. The first part examines the theoretical underpinnings of the research by exploring behavioural spillover and relevant theories. This is followed by the methodological framework employed, which is substantiated in the next section, where the findings are rolled out. Finally, the concluding part is reserved for answering the research questions and some relevant recommendations from the research outcomes.

2. THEORETICAL FOUNDATIONS

2.1. Behavioural Spillover – A definition

Spillover refers to the intra-individual transfer of knowledge, attitudes, or behaviour from a given domain to another (Geller, 2001; Poroli and Huang, 2018; Rodriguez-Muñoz et al., 2013; Littleford et al., 2014; Poortinga et al., 2013 as cited in Galizzi and Whitmarsh, 2019).

It has often been argued that pro-environmental behaviour (PEB) might initiate other positive behaviour in diverse areas (Gray, 1985; McKenzie-Mohr et al., 1995; Pickett et al., 1993 as cited in Thøgersen, 2012). Crompton (2008) also adds that individuals often perform inconsequential sustainable behaviour for their merit or refuse other behaviours that encourage substantial changes to their lifestyle. This is mainly attributed to factors such as inertia, denial and dislike of sacrifice (Oskamp, 2000) or values that do not align or directly affect one's 'interest, needs and existing attitudes' (Rogers, 2003, p.171).

Spillover can take place in three different manners: (i) The behavioural spillover occurs when one type of behaviour will affect another type of behaviour; (ii) The temporal spillover takes

place within a specific timeframe; (iii) Contextual spillover happens within established contexts or settings.

In this research, all spillover types mentioned above are fused and embodied in the work-home spillover. It focuses on the transfer of positive and negative behavioural traits between work and home. Their effects on one another are essential to 'generate similarities between the two domains' (Edwards and Rothbard, 2000, p.180). The authors mentioned above also add that the work-family domains, also referred to as work-family facilitation or work-family enrichment, can promote similar pro-environmental behaviours between them. However, Rashid and Wahid (2012) point out that behaviours might interfere positively or negatively.

After introducing the concept of behavioural spillover, the next section discusses in more detail the different types of positive and negative spillover, together with their archetypes – promoting, permitting, and purging spillovers.

2.2. Types of Positive Spillover

Positive spillover is when an initial PEB leads to a subsequent sustainable behaviour (Thøgersen and Crompton, 2009). It is multi-dimensional and often occurs through four bivariate dimensions – affect, values, skills, and behaviours (Hanson, Hammer, and Colton, 2006). A type of positive spillover is known as promoting spillover, which involves a type of impetus to further increase the desired behaviour in the future. Within 'promoting spillover', Dolan and Galizzi (2015) mention the following archetypes:

- (i) Cognitive dissonance refers to the self-awareness of unsynchronized actions and behaviour and their eventual conflict resolution by aligning them with one's worldviews.
- (ii) Similarly, in promoting consistency, is the notion of 'Foot-in-the-door' which relies on what Thøgersen and Crompton (2009) refer to as 'salesman tricks'. Futerra adds that it means to
get someone to do something small and then introduce another more significant action once the small one is completed. The move upwards will not just happen on its own: communications are needed to link each rung of the ladder (2006, p.10).

- (iii) The Intention-behaviour concept mainly postulates that the degree of intention can influence subsequent behaviour.
- (iv) Moreover, a Question/behaviour survey can serve as a reminder of certain behaviours that have been neglected.
- (v) Rationality crossover uses economic rationality in market-like behavioural settings to an eventual behaviour devoid of financial incentives (Cherry and Shogren, 2007). This same concept has also been applied to field-lab spillovers.

2.3. Types of negative spillovers

Negative spillover happens when a successful PEB is linked with a reduction in another type of behaviour (Thøgersen and Crompton, 2009). Negative spillovers are coined with permitting spillovers, which signifies a subsequent disengagement from the initial motive. These include, as highlighted by Dolan and Galizzi (2015):

- (i) Ego depletion occurs when high self-control in the first behaviour diminishes because of the subsequent behaviour.
- (ii) Moral licensing happens when moral entitlement to the subsequent behaviour has been attributed to the positive outlook towards the initial behaviour.
- (iii) The reverse foot-in-the-door effect occurs when an affirmative outlook towards the initial behaviour will lead to a negative response to a subsequent one (Guadagno, Asher, Demaine and Cialdini, 2001).
- (iv) The Resting on laurels effect occurs when progress towards a particular behaviour is seen as a sub-goal, and as a result, less effort is placed on the ultimate goal (Mazar, Amir and Ariely, 2008).
- (v) The single-action bias implies that no further action is needed for an initial purpose when in reality, further effort would be helpful (Weber, 1997).
- (vi) Coasting, where effort towards a particular motive diminishes since it is assumed that a previous action is sufficient (Carver, 2003).

Purging spillovers imply a conscious or unconscious desire stemming from the second behaviour to remediate some of the damage caused by the initial behaviour. Dolan and Galizzi (2015) point out that such spillovers include:

- (i) Moral cleansing is the opposite of moral licensing since, after a negative outcome on one's morality, an individual tries to restore his or her dignity. People tend to act morally when moral cleansing occurs, and their self-image is threatened.
- (ii) Conscience accounting is when individuals are more likely to donate due to illicit earnings than individuals who have earned income without deception.
- (iii) The transgression-compliance effect and the negative state relief focus on restoring personal values, which have been subject to negative influences, by acting more altruistically.

This section has confirmed that various requirements are needed for behavioural spillover to take place. According to Nash et al. (2017), the implementation of spillover is determined by two psychological approaches, which are: (i) self-perception, identity or consistency, and (ii) self-efficacy, knowledge, or self-motivation. The former emphasizes an individual's perception of oneself and the will to act consistently with that self-image. On the other hand, the latter involves the confidence attained in one behaviour which motivates the shift in another behaviour.

Furthermore, the climate within such different settings also determines the success of spillover. Rashid and Wahid (2012) postulate that any organizational structure should clearly define its goals and provide the necessary training to upskill employees. Family cohesion and support are essential within the other domain, where the focus is placed on the extent to which family members share common values and enjoy each other's company. Even though the factors above need to be considered in behavioural research, contextualizing them within regulatory frameworks should be deemed necessary for its successful implementation, as discussed in the next section.

2.4. Implications of Behavioural Spillover on policy and governance

Hale (2008, p.262) emphasizes that 'political mobilization is the most critical' regarding sustainable behaviour. He even seems to agree with Rogers's vision (2003, p. 29), who states that achieving accelerated results from mechanisms that promote behavioural change need to 'stem from authority decisions'. Envisaging 'behavioural silos', as postulated by Thøgersen (1999), where only one particular behaviour is observed, should be avoided since no

behavioural traits manifest themselves in a vacuum. Hence, as Hale warns, such situations call for a collaborative effort in order to be fruitful:

The impasse between government, business and individuals must, somehow, be broken... If we are to do so, we must understand the kind of public intervention that will make a difference... It is governments that determine the carbon intensity of the energy we use in our homes, the price and availability of different modes of transport and the relative price and carbon intensity of the goods and services that we buy... So the critical issue is not simply our behaviour, but the impact of our activism, behaviour and attitudes on political action (2008, p.12).

In response to this, The UK government's Department for Environment, Food and Rural Affairs (Defra) promotes the need 'to promote a range of behaviours as entry points in helping different groups to make their lifestyles more sustainable – including catalytic behaviours if identified through research' (Defra, 2008, p.22). Most sustainable policies aim to formulate a holistic vision, recently including behavioural studies. That is why behavioural spillover appears advantageous for policymakers since it can change a wide array of behaviours 'in a cost-effective manner with little regulation which might be politically unpopular' (Galizzi and Whitmarsh, 2019, p.1). Effective policies should create snapshots of 'all ripples of behaviour when a pebble of intervention is thrown in the pond' (Dolan and Galizzi, 2015, p.2).

Indeed, policy should be seen more as an intervention in the form of educational campaigns and tax incentives that serve as catalysts towards sustainable behaviour. This creates a chain reaction where the success of a PEB, through positive spillover, might warrant investment in additional policies. On the other hand, negative spillover indicates the requirement of more adequacy or redesign in policy formulation. Gillingham et al., (2013) and Jacobsen, Kotchen and Vandenbergh (2012) tend to disagree with the latter since the incidence of negative spillover does not translate into ineffective policy, but rather act as an indication of what underlying factors contributed to such results. Most importantly, the notion of spillover within such contexts should not be solely seen as a means to adhere to national or international legislation but more as a vehicle for stakeholders to be proactive. That is why the government, the general public and civil society should collaborate to search for solutions that initiate change.

Truelove, et al., (2014, p.128) assert that 'spillover research can better inform energy and environmental policy if it accounts for insights from relevant social science disciplines and examines spillover effects in realistic settings'. Thus, a better understanding of the

psychological underpinnings can improve policy design by foreseeing when positive or negative spillover might occur, which happens to be one of the main objectives of this study. As delineated in the following section, human behaviour within two realistic but distinctive settings is analyzed to provide valid contributions towards policy and governance.

3. METHODOLOGICAL FRAMEWORK

Since the central theme of this study is rooted in behavioural research, a positivist paradigm grounded in objectivism epistemology was adopted, focusing on the methods of natural sciences to discover the study of social science (Crotty, 1998, p.8). It tries to interpret findings linked to facts or measurable entities (Fadhel, 2002). Moreover, a quasi-experimental design, also referred to as 'field experiment' or 'in-situ experiment' Levy and Ellis (2011), was deemed befitting. The prefix 'quasi' signifies resembling experimental research, and it suggests that it mimics actual experiments, hence why quasi-experiments are considered a subtype of non-experiments. The quasi-experimental design relies on an empirical interventional study that highlights the influence of the independent variable on the dependent variable (Loewen and Plonsky, 2015) through varying degrees of change or variation. The former in this research refers to public officers' behaviour, whereas the latter refers to the intervention, which is the educational module.

A tool of quasi-experimental design and which is utilized in this research is a one-group pretest-posttest design. The dependent variable is measured before treatment commences, known as the control condition and once again after its completion, referred to as the treatment condition (Price et al., 2017). Stratton (2019) states that the pretest and posttest design involves the 'assessment of specific representatives of a population of interest, but not of the population as a whole' based on their 'attitudes or perceptions relative to an event, or to assess comfort in applying the information presented in a training session or with the introduction of a new concept'. Allen (2017) accentuates that an essential prerequisite for the pretest and posttest design is that the same type of treatment and opportunity is provided to a single group of participants.

Concerning this study, the population of interest involves 14 public officers who attended an educational module about sustainability at the University of Malta. The stages of pretest-posttest design include these three steps:

- (i) Administering the pretest: each student, based on confidentiality and anonymity, carried out a Likert-type questionnaire at the beginning of the educational module in October 2020.
- (ii) Providing the treatment: Up till January 2021, the 14 respondents all completed the education module.
- (iii) Completing the posttest: Upon the module's completion, a posttest Likert-type questionnaire, identical to the pretest, was carried out.

Such tools garnered quantitative data, which is essential to answer the research questions outlined in the research scope. This is carried out to evaluate how the information presented in the educational module has affected sustainable behaviours both at work and home.

While the pretest and posttest prove advantageous in offering directionality, only associations can be obtained since it is not a true experimental design (Stratton, 2019). More often than not, the effectiveness of the intervention rests on the improvement in results. However, the limitations of this methodological tool relate to internal validity. As explained below, the following threats were controlled as much as possible:

- (i) History focuses on external factors outside the research scope that influence the changes between the two tests. For example, even though all participants attended the same educational module, external factors influencing one's life might contribute to a behavioural change, which, alas, is an integral part of the study.
- (ii) The selection of participants guaranteed that all students were invited to participate and given the same treatment throughout.
- (iii) Experimental mortality emphasizes the right of respondents to drop out at any instance from this study. However, all students agreed to carry out both tests.
- (iv) Instrumentation implies that the same method and questions were used in both tests, as carried out in this study.
- (v) Instrument reactivity refers to the influence of the pretest on the posttest. Before each test, respondents were reminded to answer as truthfully as possible and that there was no correct or incorrect answer.

The understanding of this phenomena, based on behavioural and attitudinal change across time and domains, is in line with Baldwin’s line of thought (2018) who rightly states that it focuses on ‘how much of a change actually occurred or how much growth occurred between the pretest and the posttest’. Consequently, as the methodological framework has been delineated, the following section presents the findings of this study.

4. RESULTS AND FINDINGS

This section displays some stacked bar graphs revealing pertinent quantitative data obtained from Likert-scale questionnaires at the start and end of the intervention utilized. The main objective of the questionnaire is to delineate to what extent the respondents perform the selected behaviour to determine any common spatio-temporal trends.

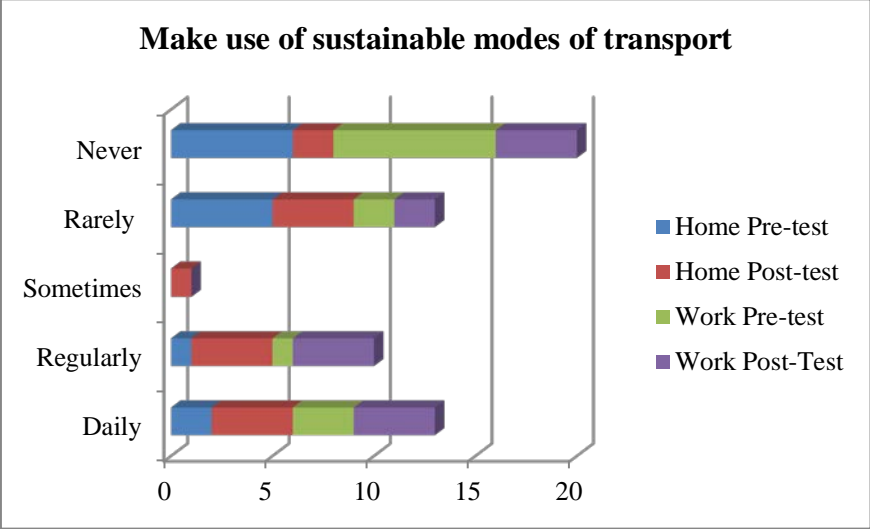


Figure 1: The use of sustainable means of transport

As seen in Figure 1, the pretest of attitudes at work and home share similar results since the never category scored the highest result, whereas the sometimes option scored the least. Furthermore, the daily and regularly categories shared similar behavioural results for the posttest in both domains. Interesting to note that the sometimes category scored no results, except in the posttest for behaviour at home.

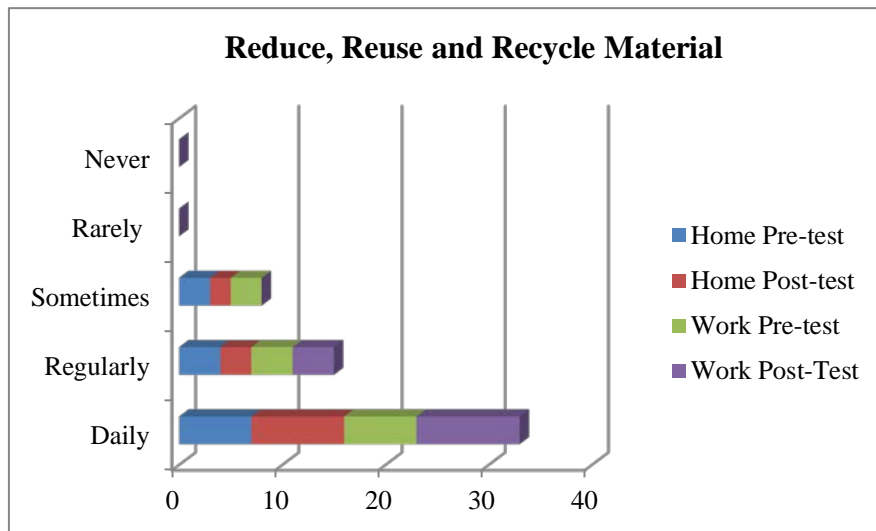


Figure 2: The practice of reducing, reusing and recycling

Figure 2 displays that the never and rarely categories scored no data, whereas the daily category garnered the highest amount of data in both pretest and posttest for both domains. It seems that respondents reduce, reuse and recycle consistently both at home and at work.

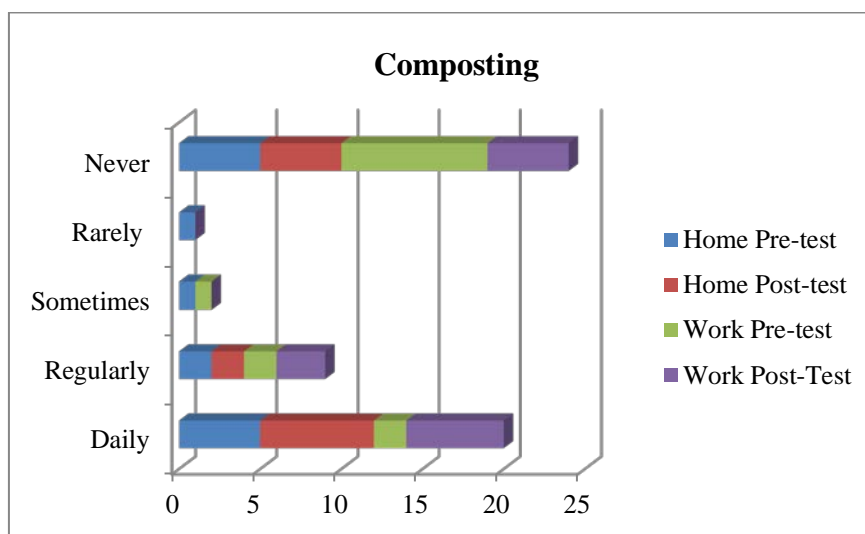


Figure 3: The practice of composting

As displayed in Figure 3, the never category scored the highest data altogether, with the work pretest scoring the highest in this category. On the other hand, the rarely category obtained no scores, except for one respondent in the home pretest. However, the daily category also shows that the data increased for both the home and work posttest when compared to the pretest.

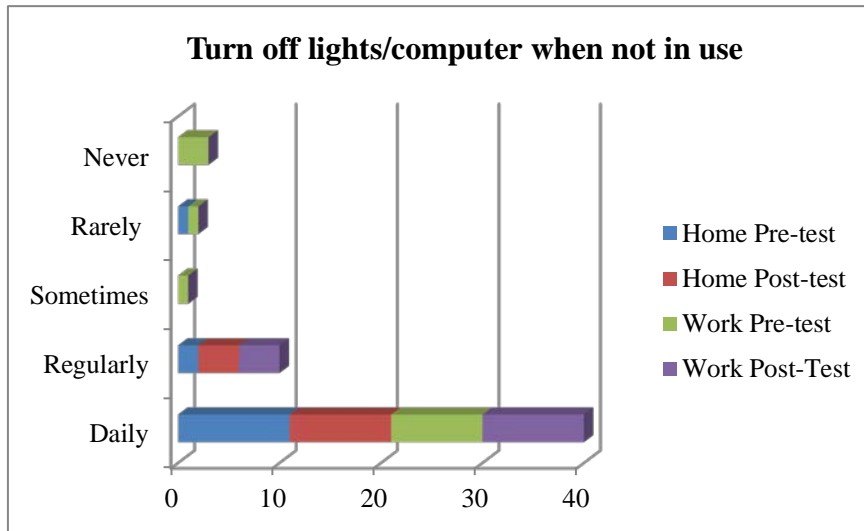


Figure 4: The practice of controlled electrical consumption

Figure 4 demonstrates that the daily category was strongest for both domains both in the pretest and posttest. The negative strands of the Likert scale scored low or no data.

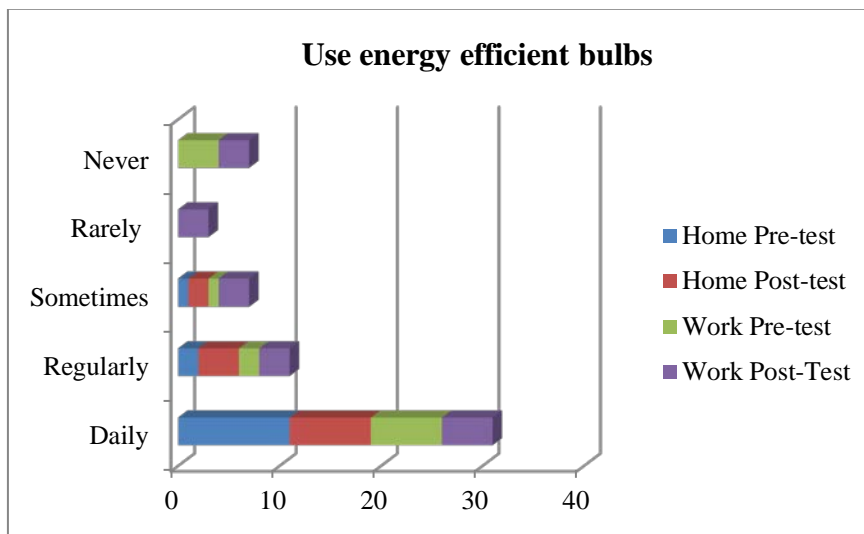


Figure 5: The use of energy-efficient bulbs

Interestingly, Figure 5 highlights that the rarely category scored data only in the work posttest. The work posttest scored the same results in nearly all categories, except the daily category, which scored the highest. However, unlike the sometimes and regularly category, the posttests for both domains decreased in the daily category compared to the pretest. The never and rarely category garnered data only from the work pretest and posttest.

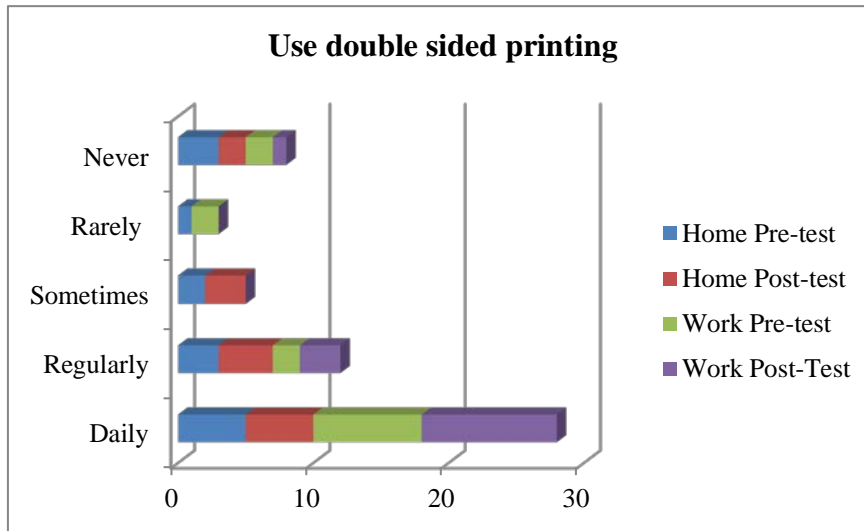


Figure 6: The practice of double-sided printing

While observing the results in Figure 6, one can notice that the daily category scored the same results for the home pretest and posttest. On the other hand, double-sided printing increased at work between the pretest and posttest. Furthermore, the rarely category scored the least data altogether while the sometimes category scored data only in the home domain.

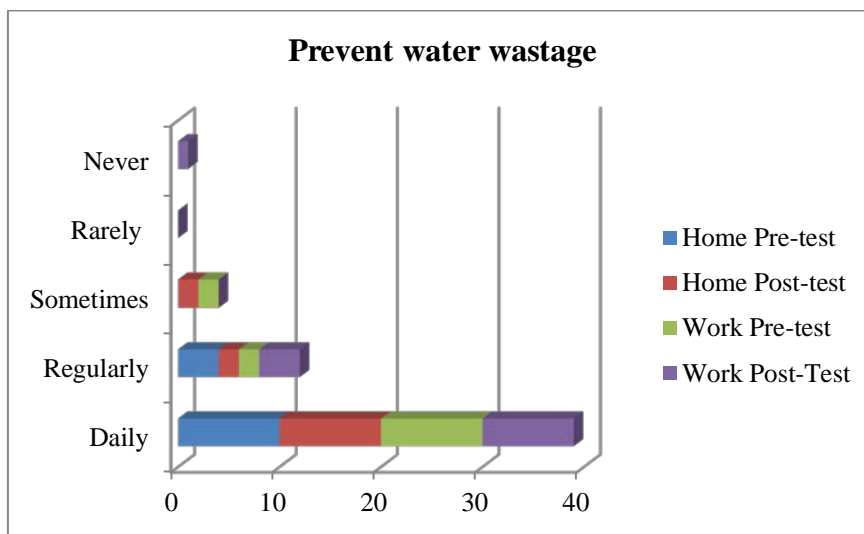


Figure 7: The practice of water wastage prevention

Figure 7 exhibits nearly no data for the negative strands of the Likert Scale since the daily category scored the majority of data.

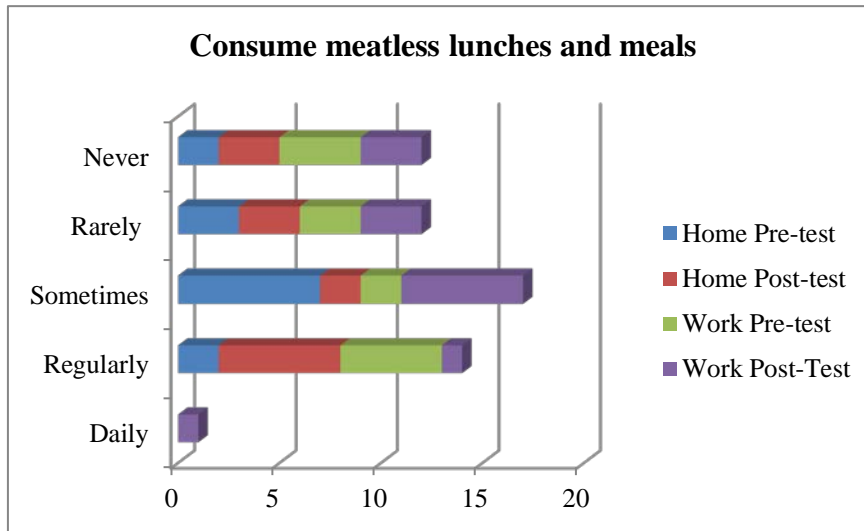


Figure 8: The consumption of meatless meals

Figure 8 reveals that the daily category scored the least amount of data, whereas the sometimes category scored the highest. Overall, the negative strands of the Likert Scale garnered the most results, implying that respondents are not willing to consume meatless lunches and meals both at work and home.

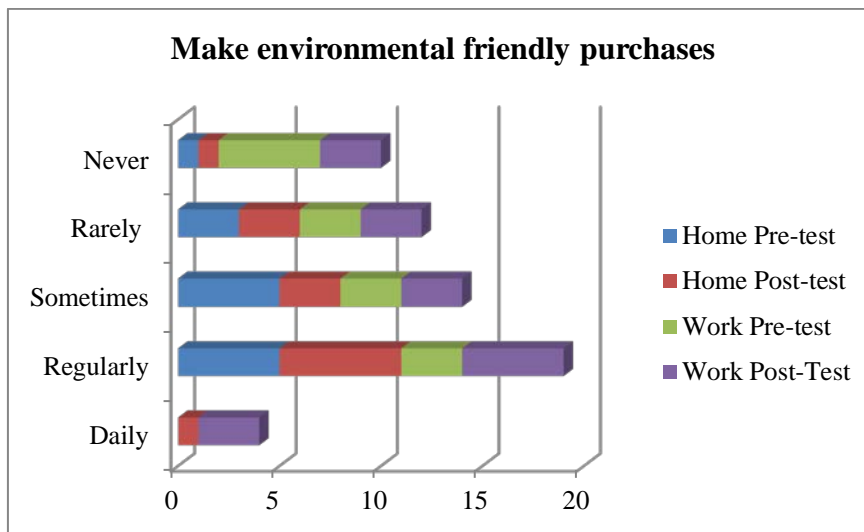


Figure 9: The practice of environmental friendly purchases

Figure 9 indicates that the daily category scored the least amount of data, both from the posttest at home and work. The regularly category scored the highest. However, the negative strands achieved a considerable amount of data as well.

Once the findings have been rolled out, the following section presents a discussion by answering the core research questions delineated in the research scope.

5. DISCUSSION

5.1 Answering Research Question 1

Research Question 1: Are there any similar or different behavioural trends between work and home?

The findings illustrate minimal differences between behaviours at home and work, echoing Edwards and Rothbard's (2000) words as mentioned in the theoretical component of this paper. Overall, respondents demonstrate consistency in behavioural traits irrespective of settings, fostering behavioural spillover. Interesting results reveal that recycling and water conservation behaviour obtained no or very low scores both for the work and home domains in the 'never' and 'rarely' category. This indicates that both behaviours are well-engrained in each setting, hinting at positive spillover. Surprisingly, composting displays different data since the 'never' data garnered high results. This is also experienced in the following categories: Sustainable transport methods, Purchasing environmentally friendly products and Consuming meatless meals. On the other hand, nearly all other options, the 'daily' category scored the highest.

These results conform with previous studies where respondents are willing to engage in sustainable behaviour that requires less effort, time, and cost since it is difficult to alter and maintain continuous behavioural changes, as McKenzie-Mohr (2000) puts forward. Verfuert, Jones, Gregory-Smith and Oates (2019) conclude that easy and small changes are considered a positive spillover in their study. The respondents believe that such minor shifts, which are feasible and more controllable, are a step towards a sustainable lifestyle.

Similarly, this study reveals that respondents are unwilling to consume meatless meals, as Truelove and Parks (2012) indicate. Respondents perceive this behaviour as a minimal contribution towards sustainability. Sanchez-Sabate and Joan Sabaté (2019) add that a minority are willing to adopt such a shift since meat consumption is strongly linked with social norms, preferences and cuisines. This is aligned with Rogers' (2003, p.171) ideology mentioned previously in the literature review. Reference to high costs has also surfaced in Diekmann and

Preisendörfer (1998), when using public transport instead of one's car, despite being a more sustainable option. In the case of both behaviours, this case study reveals similar results, indicating that these are more determined by habit rather than rationality (Verplanken et al., 1997; Bamberg et al., 2003; Lorenzoni et al., 2007 as cited in Blankenberg and Alhusen, 2019). Therefore, the most arduous task for the government is to find measures such as incentives to persuade people to change their habits gradually.

This constitutes more of 'practicality barriers' rather than 'individuality barriers'. The latter appears to be at a minimum in this study as it seems respondents do not lack laziness or disinterest. However, it transpires that even though individuals are aware of environmental issues, individuals are not willing to adopt drastic lifestyle changes and are not aware of the consequences their decision might imply.

5.2 Answering Research Question 2

Research Question 2: To what extent does the intervention utilized affect behaviour?

The intervention demonstrated effectiveness to increase awareness of sustainability. However, as indicated in previous studies such as Kollmuss and Agyeman (2002), awareness in itself does not automatically translate into sustainable behaviour. While the intervention has made participants reflect upon their behaviour, it seems that respondents generally retained their sustainable practices in most instances across both domains.

The results display that the intervention was effective, especially in 'composting' and 'make environmental friendly' purchases. Although the former scored highest in the 'never' category, an increase between pretest and posttest in the 'daily' category was experienced in both domains. The latter experienced this in the 'regularly' category and a consistent score or slight decrease in the 'never' and 'rarely' category. Similarly, 'sustainable transportation' experienced an increase for the 'daily' and 'regularly' option and a decrease in the 'never' option for both domains.

In addition, a slight increase was obtained in the 'daily' category for 'Reduce, reuse and recycle'. Consistent scores in both domains were obtained in 'Turn off the lights/switch off

computer' and 'Prevent water wastage' since low scores were obtained for the negative strands of the Likert Scale.

A decrease was experienced in the daily option for both domains in 'The use of energy-efficient bulbs'. However, the 'never' category was only experienced in the work domain and remained stable between the two tests.

Other interesting results between the two tests reveal that the daily use of double-sided printing is stable at home but increases at work, whereas all other strands of the Likert Scale remain stable. The 'regularly' option for 'consuming meatless meals' decreased at work but increased at home. While the 'never' and 'rarely' categories showed consistent results throughout, the 'daily' option garnered a very low score only for the work posttest. This denotes that a slight change might have happened throughout the intervention.

Once the findings have been discussed by answering the two research questions, the following section presents some concluding remarks and pertinent recommendations.

6. CONCLUDING REMARKS

This research has reviewed the theoretical foundations of behavioural spillover to apply them for the intervention study. Particular attention was paid to two crucial components of this study: the behavioural traits of public officers in different domains and the effectiveness of the intervention in promoting sustainable behaviour. The pretest and posttest questionnaires yielded some results:

- I. Similar behavioural trends are adopted irrespective of domain.
- II. Positive spillover occurs for behaviour that involves the least cost, effort and time.
- III. Respondents are not willing to make drastic lifestyle changes, and well-engrained practices become part of one's routine, possibly due to the influence of past environmental campaigns or marketing. For example, recycling exhibits robust positive results when compared to composting, which has been recently implemented on a national scale. Therefore, the latter's results still need to be reaped in the future.
- IV. An increase in awareness does not automatically translate into promoting sustainable behaviour.

Based on such findings, the following action points are being recommended, namely:

1. Given that this study focused on measuring public officers' behavioural traits, further studies might explore underlying motives or emotions behind spillover.
2. The findings stemming from this research can be transferable to not only realms of governance but can also aid in the formulation of sustainability programs and campaigns.
3. Greater engagement and alliances between stakeholders, such as the government, policymakers, the general public, and civil society are needed. Being proactive is key to further strengthening policy formulation. Moreover, cross-sector collaboration is critical in solidifying partnerships and base knowledge.
4. Identification of behavioural spillovers within governmental structures is essential, especially in the light of creating a more sustainable public service. Observing, acknowledging and reinforcing sustainable practices is deemed necessary to motivate the workforce to adopt such lifestyles even in their household.
5. The government should employ the use of measures that trigger positive spillover. 'The foot-in-the-door' technique should be an excellent way to help citizens to adopt more strenuous behaviour in the future.
6. The government should create more opportunities and revolutionize the notion of sustainable practices across public administration. Setting high standards is imperative to assist the workforce in focusing on all-inclusive behavioural targets rather than a single target. In addition, more opportunities for effort recognition should be initiated.

All in all, this study has laid the foundations for new pathways of good governance and policy, attested by the infusion of behavioural spillover for sustainability. This calls for a holistic and transformational vision that could improve organizational structures within the government to better society. Further research on these policy suggestions could map out the aforementioned for the well-being of the present and future generations, which is the crux of sustainable development.

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Impact of Organisational Commitment on Employee Productivity During Covid-19: Evidence from Afghanistan And India

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ABSTRACT

The paper examines the impact of COVID-19 on competitiveness and how organizational commitment and productivity have changed as a result of changes in processes, practices, or regulations. This paper analyses how employees fared during COVID in two countries, namely Afghanistan and India and the impact on organizational commitment and productivity. The research paper is based on secondary data and conceptual analysis of COVID-19 conditions or how this covetous environment affects their competitors, work environment, or fight for their rights. Moreover, the authors delved into how human capital management lead to organizational efficiency. Factors like (1) workplace safety, (2) targeted recruitment, (3) self-managed decision-making teams and decentralization, and (4) pay policy were all investigated. Employee engagement is widely assumed to influence organizational commitment, employee productivity, employee dedication, and, most importantly, it will generate comparative advantages for organizations. The primary goal of this research was to discover how people work efficiently and effectively with commitment and dedication during COVID-19.

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1. INTRODUCTION

1.1. A BRIEF EXPLANATION

COVID-19 is a worldwide tragedy where people experience unexpected disruptions in their society, family, and workplace, resulting in mental stress.

COVID-19 primarily affects workers' personal and professional lives, causing anxiety, frustration, and burnout. Unattended emotions can harm workers' morale and commitment, resulting in poor work quality, errors, and, ultimately, the organization's survival in difficult times.

Employee commitment to the organization is critical in an organization, and it has a direct impact on productivity. During the difficult times of the Covid pandemic, it was difficult for HR managers to keep their employees committed to the work to maintain the optimum level of productivity. Employees may become less committed to their work during this period due to salary reductions, work from home, mental stress, fewer engagement activities offered by the organization, a lack of a good working environment (office space), or a lack of resources (internet and other devices).

According to Brian Kropp, Gartner HR Chairman of Resources Practice, most companies focused on scenario preparedness and the organizational reactions required for business continuity. He states, "However, such plans frequently fail to address employees' ability to focus or influence their work."

HR should enable managers to implement six specific practices to ensure workers receive the necessary support to overcome the emotional response.

During the first phase of the COVID 19 crisis, most businesses worked hard to ensure their employees' basic needs' protection, stability, and security. These requirements, however, change and necessitate a more advanced approach as organizations progress to the next stage. Our research has yielded three overviews, each with actionable steps to assist employees in the next phase of the crisis.

Personnel managers have made significant changes in recent months to meet the most pressing needs of their workforce, and what is important in this situation is to be present, empathize, and be completely transparent.

In addition to basic needs like security and safety, employee well-being and productivity are heavily influenced by three other factors: trusting relations, social cohesion, and individual goals. Therefore, managers should facilitate the development of these areas through priority actions that meet a wide range of criteria for most people.

Changes among people are frequent (and sometimes unexpected). Some people fail, while others succeed. Employees are segmented so that customers adapt and are relevant to their specific needs, using a combination of science, technology, data, and analysis.

Employee motivation and actions must be met according to needs-based motivation theories. In the case of employee experience management, organizations must meet essential influential needs of the larger workforce while taking stock of the specific requirements of various segments. Our findings show a strong correlation between employees' reported needs and the factors that influence their loyalty, well-being, and work performance. The table below shows the highest personnel expectations and performance drivers, organized by key themes of staffing experience.

1.2. DATA

Between 3 January 2020 to 23 July 2021, 143,439 confirmed cases of COVID-19 were reported to the WHO in Afghanistan, with 6,357 deaths. On 18 July 2021, a total of 1,094,257 vaccine doses were administered. Afghanistan has a population of 31.6 million people, with rural areas accounting for 71.5 per cent of the population.

India has a population of 1.3 billion people. The country faces numerous challenges in its fight against COVID-19. The World Health Organization has stated that "the pandemic's fury depends on how Indians handle it." According to WHO reports in India, 31,257,720 confirmed cases of COVID-19 were reported between 3 January 2020 to 22 July 2021, 418,987 deaths were reported, and a total dose of 377,352,501 vaccine doses was administered at the beginning of 5 July 2021.

COVID-19 has impacted all organizations by causing mental, social and financial harm to their employees. As the company's most valuable asset, employees should be given undivided attention, and each organization should strive to meet its employees' basic needs. In order to keep employees working with commitment and efficiency, organizations must change their policies according to the needs of the time.

Most information and technology-based organizations have adopted a work-from-home policy for their employees. However, accepting this policy presents a significant challenge to the HR manager to keep employees engaged and committed to their work.

1. ORGANIZATIONAL COMMITMENT AND EMPLOYEE PRODUCTIVITY

Much research has been conducted on organizational commitment, but still, there are several issues that an organization faces due to a less committed workforce. According to Forbes, organizations face a dissatisfied and less committed workforce because of: poor supervisory support, lack of meaningfulness and purpose, unfair treatment, poor acknowledgement/recognition practices, job safety and security, and unequal rewards.

Organizational commitment is defined by Steers et al. (2001) as an employee's involvement in an organization based on his or her strong belief in the organization and its goals and values; it is the wishful behaviour and the strong desire to continue working for the organization. Meyer and Allen (1997) have defined commitment in the form of three different psychological states, which influence the desire of an employee to continue working in the organization. First, emotional involvement and belongingness are termed affective commitment. The behaviour of an employee related to the intention of leaving an organization is termed as continuance commitment; it is the feeling of an employee that they will lose more if they leave the organization than they will gain, it can be in the form of prestige, income, friendship or social loss. Finally, normative commitment is related to the obligation to remain in the organization ethically because it has provided the training and spent money on their development. Jaros et al. (1993) define affective commitment as the level of attachment of an employee in terms of loyalty, affection, belongingness and pleasure. Continuance commitment is explained as staying in the organization because he/she cannot afford the cost of leaving the organization. The third component is a moral commitment, which means that an employee stays because of the goals, values, and mission.

From the above definitions of the components of organizational commitment, it is clear that a committed employee is an asset to the organization. Therefore, every organization should keep its employee committed to the organization and their work to achieve the organization's optimum level of productivity and goals.

Organizational commitment and productivity are directly related, and it is universally accepted that a high level of commitment in employees contributes to achieving organizational goals. Committed employees work for primary organizational goals with efficiency and profitability. The following literature was reviewed to get an idea of research being conducted in this domain.

2. Literature Review

Many of the world's poorest and most vulnerable people live and work in the informal sector, and more than half of the population of industrialized countries lives and works in the informal economy. According to an ILO report, COVID-19 in India is likely to result in the expansion of over 400 million informal workers, as well as a significant decline in demand and a lack of income in sectors such as hospitality and accommodation, retail and wholesale, business services, construction, and

manufacturing facilities. Moreover, the average business in Afghanistan's central economic hub has indicated that the ongoing COVID-19 pandemic may only allow them to remain open for another two months. These findings were revealed in a COVID-19 Business Pulse Survey by the IFC and World Bank in collaboration with USAID. The survey included over 380 companies employing five or more people in the agricultural, manufacturing, and service sectors. It assisted policymakers in tracking the pandemic's effects. The information is based on 146 secondary sources. The findings highlight the most pressing issues and challenges confronting India and Afghanistan, primarily farm labourers, household workers, healthcare workers, daily wage workers, and so on (Mohammad Qais Rezvani et al., 2020).

The COVID-19 outbreak impacted nearly every sector, particularly Afghanistan's education system, including universities worldwide. To that end, the researcher investigated the impact of COVID-19 on the academic success and satisfaction of Afghan students with Online Teaching. It also investigated the significant differences in academic achievement and satisfaction among students enrolled in gender-specific online learning. There were 1231 participants from both public and private universities in Afghanistan, including 867 men and 364 women. Statistical analyses, both inferential and descriptive, have been performed. According to the findings of this study, COVID-19 harmed Afghan students' academic achievements, and students were extremely dissatisfied with online instruction during this critical period. In addition, the study found significant differences in academic performance and satisfaction with online teaching based on gender. Several implications and recommendations were made in light of the study's findings (Hashemi, 2021).

The purpose of this paper is to examine the practical behaviour of hotels in managing personnel during COVID-19 and to assess the impact of COVID-19 on the well-being of hotel employees using qualitative thematic analysis. This study demonstrates HRM practices that organizations can use to effectively manage their employees during times of uncertainty. HRM practices aimed at employees have a significant impact on their well-being. This paper incorporates insights from a good human resource management framework based on a job-demand model. The paper emphasizes themes that confirm and expand on existing wellness theories and models. The findings are significant for politicians because they provide guidance in times of difficulty for effective human management (Agarwal, 2021).

Many organizations are changing as the coronavirus (COVID-19) spreads rapidly worldwide. Many businesses have converted their entire workforce to temporary and remote communications. As a result, employee participation is expected to change. This study investigates and statistically evaluates factors that may influence employee participation levels. Data was collected from 208 people through an online questionnaire in India. US-14 was used to compute the engagement values (Utrecht Work Engagement Scale). The authors used multiple regression analysis to look at the impact of ten

different variables. Regression results show that the correct virtual instruments, contact between leaders, mental medical checks, and virtual training increase employee engagement. Female employees work from home at a higher rate than male employees. The number of children has a negative impact on employee engagement. When there are more children, employees' virtual involvement decreases. Finally, virtual teamwork, marital status, and entertainment tools have no significant impact on employee engagement. Based on the research findings, this study makes a few recommendations. First, businesses should make it possible to improve virtual tools such as internet speed and computer configuration. Second, wage workers should not have their hours reduced. Third, top management in organizations should communicate with employees regularly, increase virtual training, and encourage employees to undergo regular psychiatric examinations (Chaudhary et al., 2021).

This paper provides a comprehensive diagnosis of job satisfaction indexes in the Indian IT Sector during the COVID-19 period and factors that can be used to improve them. It focuses on the relative importance of employee satisfaction factors and their impact on employee satisfaction. The study also looks at the differences between factors that contribute to internal and external job satisfaction. It investigates the impact of age, gender, and management/non-management differences on work satisfaction attitudes. A quantitative (survey) method was used in the study, with a questionnaire sent to 355 IT staff (front and leaders) across India. There were 207 correct answers. The data was then analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.5, using descriptive statistics, the Mann Whitney test, and the Kruskal Wallis test. According to the findings, IT employees were somewhat satisfied with their work. The results show that the most critical factors contributing to work satisfaction during COVID-19 are working conditions, the opportunity to experiment with one's method, and the coordination of coworkers. In addition, job stability has been a source of concern and dissatisfaction. External satisfaction factors have also been significantly positive in the analysis. As a result, the findings urge IT company management to promote intrinsic satisfaction factors to increase overall employee satisfaction, increasing company productivity (Arora & Vyas, 2020).

A paper reviewed by senior hotel managers in Spain examines the number of interconnections between these variables. It demonstrates that organizational resilience and CSR practice increase managers' perceived job security and organizational involvement. COVID-19's organizational response influences workers' perception of protection and strength. As a result, hotels should increase operational flexibility and invest in CSR to assist management teams in the event of future catastrophic incidents (Filimonau et al., 2020).

Job and family positions have changed dramatically due to the worldwide COVID-19 pandemic. However, businesses can do little to improve working conditions and certain social concerns. By

introducing an individual-focused approach, Vaziri et al. (2020) investigate improvements in work-family interfaces before and after COVID-19 (Vaziri, H. et al., 2020).

This study also discovered a positive and significant impact on work-family relationships and employee performance on adaptability readiness. This new study proposed a model for increasing employee efficiency among Tangerang part-time packaging workers by improving work-life conflict management strategies and the ability to adapt. This research could aid worker preparation for the Fourth Industrial Revolution (Radita et al., 2021).

A COVID-19 crisis has had a long-term impact on nearly every aspect of human life worldwide. Moreover, the crisis has had an adverse effect. Therefore, the purpose of this study was to look into the impact of COVID-19 on employee insecurity, health complaints during isolation, risk-taking behaviour, and organizational change on job-related attitudes (work morale and job satisfaction), as well as staff turnover intentions in the hospitality industry (Demirovi et al., 2021).

This study aims to provide a critical understanding and synthesis of philosophical and empirical research into and the practice of corporate social responsibility (CSR), particularly in the aftermath of the COVID-19 pandemic. This research will show how it is valuable and significant. The authors explain why CSR can have positive and negative outcomes and potential feedback and policy recommendations (Ogden et al., 2020).

This article looks at five research areas that COVID's impact on employment: work loss, job shifts, job outcomes, management, and help. It also looks at COVID's impact on home life – home life changes, children's changes, child care (Venkatesh, 2020). Furthermore, to help the community during this pandemic, the article will discuss general research guidelines and concerns for researchers, editors, and reviewers (Venkatesh, 2020).

The COVID-19 time frame has positively impacted some aspects of an employee's life while harming others. The study concentrates on the relationships and dedication of employees who were influenced by COVID-19. An employee's success depends on happiness, and a happy employee paves the way for his or her company's success. A secure environment is an essential factor in this. Positive employee-employer relationships are essential for increasing employee and business morale and efficiency. On the other hand, employee dedication is related to efficiency and success in various ways. Employee presence demonstrates an employee's passion and dedication to a specific job (Kaushik, 2020).

3. Objectives of the study

- To Evaluate the effect of COVID-19 on employees' efficiency and organizational responsibilities.

- To evaluate the impact of COVID-19 on the Organisational Commitment of employees.
- To learn about the conditions faced during Covid-19 in Afghanistan and India.

4. Statement of the problem

During the difficult times of COVID-19, HR managers have found it challenging to keep their employees committed to their work to contribute to maximum productivity with efficacy and effectiveness. A dedicated employee is a valuable asset to the organization, and appropriate steps should be taken to engage and satisfy the employee. People in this field are more concerned with the impact of job satisfaction on organizational engagement, but in human resources, employee efficiency and organizational commitment are still unexplored territories.

5. Interpretation and analysis

Based on extensive literature reviews, existing studies have discovered the following techniques for increasing organizational productivity and commitment. HR should enable managers to implement six specific practices to ensure that workers receive the necessary support to overcome the emotional response.

5.1 The need for help for employees

Management must identify signs of distress in their employees through discussions and direct observation. To facilitate frequent conversations between managers and employees, HR should advise management on how to answer important questions arising from the COVID-19 pandemic, such as alternative working models, safety and employment prospects, the effect on employees, and workplace conflicts. This guidance may include discussion guides, instructions, or e-mail reminders of the most recent changes and general guidelines.

5.2 Encourage dialogue to create understanding

Managers must collaborate with employees in two-way interactions to ensure that communication actions benefit rather than harm them. Employees benefit from two-way communication between managers and staff because they have the information and points of view they need to interact and process negative feelings and improve their sense of strength. HR leaders must allow managers to participate in bilateral dialogues about the positive and negative effects of the recent COVID-19 outbreak.

5.3 Using clearness goals

In a competitive business climate, a direct correlation between individual success and the achievement of business goals will increase workers' trust in the importance of their work. Staff will remain

focused, optimistic, and objective if expectations are communicated and regularly provided updates on future developments. Managers can help re-establish the link between employee jobs and organizational success by scrutinizing their company's goals and translating the company's vision into employee meanings. Mr Kropp, one of the organization's leading engagement drivers, stated, their work contributes to our company goals, and effective employees are less concerned about their job safety because of the importance of their work to the organization's success. (Kropp, n.d.)

5.4 Reinforcement of organizational mismanagement concepts

The most important factor is psychological well-being, and adverse experiences by employees can have a negative psychological impact of up to 35%. To make matters worse, bullying increases by 33 per cent in times of insecurity. Administrators should allow whistleblowers to reveal dishonest behaviours, revoke networks to disclose misdemeanours, and emphasize punitive noncompliance in addition to modelling correct behaviour.

5.5 Acceptance of the efforts of workers

Managers must increase their appreciation efforts as COVID-19 disrupts and undermines employee engagement. A good recognition motivates not only the recipient to repeat his or her actions, but it can also serve as a warning to others. Recognition can take many forms other than currency benefits, such as public interest, signs of appreciation, growth potential, and low-cost benefits. Management should take advantage of the opportunity to help all employees. This demonstrates the company's commitment to long-term employee success.

5.6 Innovation Accelerate Interaction

The disruption and transformation in this period continue to necessitate creativity and risk-taking for employee engagement and organizational performance, even though managers and workers are more risk-averse in a competitive environment. The removal of HIPOs who are more interested in this type of opportunity is severe because of creativity and risk management limitations. Managers should set goals and provide radical innovation or process change opportunities while considering new investment constraints. This is especially important when a team or organization faces difficulties due to a process disruption or a market impact.

Employee involvement refers to an employee's emotional commitment to his employer and colleagues, as well as his mission and goals. It is NOT about job satisfaction, high pay, or expressing gratitude to an employee after a long day's work. Unfortunately, many businesses mistake viewing employee involvement as a matter of human resources. If you own a business, this article is for you as well.

6. Impact of Covid-19 on Employee Productivity and Organizational Commitment in Afghanistan

- The government has many options to explore to mitigate COVID-19 economic consequences. The country must depend on foreign partners and development agencies to assist the economy.
- Encouraging economic activity through country-wide development programmes requires a more significant development budget. Potential areas for investment may be potential infrastructure, health and education, particularly in rural areas.
- Government purchases at acceptable prices may reduce losses to deal with the uncertainty linked to exports of agricultural products, remarkably fresh fruit. However, the private sector, especially the hit industries, will require the tax relief to survive the losses and recover.
- The government could also have subsidized rates for services, including electricity. The financial strain on the government will undoubtedly increase in both steps. The government could allow certain industries, through strictly regulated steps, to start their production.
- There are two ways to regain public and business faith in order to fight the crisis, in addition to the policy choices.
- First, significant progress on the peace talks between the Afghan government and the Taliban.
- Second, the resolution of the dispute between President Ashraf Ghani and former CEO Abdullah Abdullah concerning the result of the 2019 presidential election. Funding is enabled when major donors are battling their financial problems and dealing with human victims due to the pandemic.
- On the other hand, a crisis will build both an atmosphere of stimulus and positive public sentiments for private sector investment.
- In Afghanistan and other affected countries, the pandemic is at its peak. Therefore, high priority should also definitely be added to humanitarian assistance, for which the media, government and private sectors have to collaborate. In the meantime, the administration must plan to deal with the future economic crisis.

The situation in Afghanistan is very different. Such incentives necessitate funding and strong institutions in Afghanistan, both of which are lacking. Almost half of the government spending was paid for, with the remainder funded through donations. Current revenue sources are expected to decline this year, reducing its ability to meet its budget. Unfortunately, during President Ashraf Ghani's first term, the main economic bodies, including the ministries of finance, economy, trade and industry, and the Da Afghanistan bank, were and continue to be dominated by acting ministers and governors (Central Bank). The country's largest financial entity, the Ministry of Finance, was divided into three autonomous bodies by presidential decree a month ago. This decision is currently being revised following the most recent reports, and rumours of its revocation have raised concerns about Afghanistan's financial institutions.

7. Impact of Covid-19 on Employee Productivity and Organisational Commitment in India

- Effective performance management provides a shared awareness of what people or teams must do while learning new skills to carry on business effectively.
- It is an all-year-long continuous mechanism of contact between employers and workers.
- Performance assessments help assess employee performance against targets and define various categories' expectations for positions, levels, and employment. In addition, performance control is a valuable way of distinguishing between low and high-performance workers.
- Remote working with almost 99% of workers at home has become normal. More important than ever is technology.
- Cost savings: In the following months, businesses will be handling cash flows through cost-saving measures:
- Responsible recruitment or freezing: companies recur to freezing, and vital and alternative recruitment will only occur once the economy is revived.
- Optimization of the workforce and pay-cuts: optimization to some degree can be necessary. The situation of Covid-19 will lead to a global workforce reduction as companies can save money through pay cuts.
- Travel & Expenses: Businesses should dramatically reduce travel and marketing expenses.
- Productivity for employees: In the coming months the productivity of employees will be closely monitored and followed more than ever before due to distant work
- Staff involvement: Lockdowns have resulted in employees' anxiety, anger, and burnout. It is indispensable to improve employee morale and to communicate frequently with every employee. Employee participation is crucial, and the HR teams need to make every effort to make sure that employees connect with each other.
- JLL has also taken significant initiatives such as one-on-one connections to workers, virtual education and growth, fun activities and team creation, such as WhatsApp competitions, motivational storytelling, wellness sessions.
- Commitment activities: the Covid-19 worsened the unfortunate situation that resulted in employee disengagement. In addition, the organizations initiated online team building activities, such as online family engagement, online courts, webinars, counselling sessions, team meetings, virtual learning and development.

Technology: HR is revisiting its processes as the digital approach grows, ranging from talent acquisition, onboarding, interaction, learning and growth to outsourcing. With the help of platforms such as WebEx and WhatsApp, talent management teams at JLL have switched to virtual recruiting, ensuring applicant protection and sustained business support. They also provide continuous learning by creating online learning sessions and courses. The dependencies on HR staff for daily requests and

policies have been minimized on the Heres Intranet websites. They provide continuous support to new hires through Webex, WhatsApp, Microsoft teams while working from home without face-to-face interactions via a remote onboarding programme.

8. Recommendation for organizational commitment during this era

8.1 Counselling and coordination

HR managers must maintain a two-way dialogue with their employees to ensure employee participation in communication efforts. For example, provide effective therapy for workers to alleviate their loneliness anxiety, release their fears, or relieve tension.

8.2 Workers require assistance

Employees do not want to be viewed as faceless cogs in a giant machine; they want to understand the unique value each brings to the organization. Employers have begun to accept this utility as well. Human resource practitioners must understand, embrace, and communicate this factor. In order to allow frequent conversations between line managers and employees, HR should provide management with appropriate guidance on the best response to sensitive issues of a post-COVID-19 pandemic, such as work safety, alternative modules of work, effect on personnel, and stress in the work environment.

8.3 Reinforcing organizational principles

The most significant influence on emotional safety is job well-being — an inexperienced employee can reduce psychological concerns re job safety by up to 35%. To make matters worse, employee bullying increases by 33% during times of insecurity. HR managers should enable, recall the networks of misconduct reporting, and highlight disciplinary action for post – Covid-19 non-conformity, in addition to modelled correct actions.

8.4 Appreciate employee efforts

Because COVID-19 causes significant disruption and undermines employee participation, HR managers must strengthen their appreciation programs and efforts. Effective recognition inspires the recipient and frequently serves as a clear indicator of behaviour to other employees. Appreciation can take many forms, including public recognition, gratitude tokens, opportunities for advancement, and low-cost benefits in exchange for monetary rewards. This increases the company's commitment to the employee's long-term success.

8.5. Innovation Engagement

Disruptive and risk-taking demands are becoming increasingly crucial for employee engagement and organizational performance in this unprecedented period of change and disruption. The disengaging effect of restrictions on the growth and risk-taking method is especially severe for high potential employees (HIPO) who are demotivated. Even if the company's new investment budget is limited, HR managers must emphasize the importance of process changes or incremental innovation and provide opportunities for them.

8.6. Educating and equipping employees

Employees must be educated and informed on COVID-19, safety tips, and wellness information. In this case, HR must communicate the company's actions. HR can create exciting articles on the activity feed about the growing events and topics in this area.

8.7. Employee Well-being

After acknowledging the distress and tension caused by the COVID-19 pandemic, HR must place a greater emphasis on the mental health and general well-being of its employees. Holistic benefits are popular for an organization's well-being. These advantages provide financial security and mental well-being. Although the packages for these services vary, the goal is to provide employees with benefits that go above and beyond traditional healthcare.

8.8. Employee upscale

Staff want to be treated as individuals, as evidenced by the trend toward personalization. Employees are shown support through the improvement, development, and learning systems. This allows employees to feel respected while also filling knowledge gaps in the business. According to a Deloitte survey, employees are the primary reason for their "inability to learn and grow."

Developing New Age Policies - In light of the business continuity plan for these needs following COVID-19, organizations must have processes, procedures, and policies in place. For example, if an office or plant is closed or affected, organizations must review their policies on flexibility, remote work, and contract staffing and review and explain their pay and benefits policies.

8.9. Looking forward

While these measures have become the new job of an HR professional, they may not be suitable for every business. However, in the post-COVID-19 world, all HR should shift toward a more humanistic approach, where employees improve their working conditions.

HR professionals can work together to increase employee confidence and impressions by reacting or responding to crises and uncertainties. In addition, HR professionals can aid these initiatives.

10. Conclusion

Most organizations have begun to prepare scenarios and respond to the business continuity required to ensure post-COVID-19 business continuity. In order to re-establish competitiveness and provide staff experience, organizations must foster trust and openness.

Following COVID-19, organizations must revise their business strategies and operating procedures. They need dedicated employees now more than ever to get them through this challenging period. Workers can cope with feelings of fear, loneliness, and apprehension, among other things. In this scenario, the role that HR professionals play becomes critical. However, when social distancing is introduced and practised, it is not easy for HR practitioners to provide consistent processes, strategies, and commitments.

According to McKinney's research, leaders should change their policies and make their workforce believe that the instinct for organizational changes is correct and in their favour. First, the manager should focus on being action-oriented and empathetic to build trust and affiliation. Second, in addition to the employees' basic needs, there should be a trusting relationship and social cohesion, which affects the employees' emotional well-being and work effectiveness.

Given all of these challenges, human resources will be an organization's lifeline, and they must take care of and faithfully manage the post-COVID-19 situation. These issues, in particular, are primarily concerned with the human aspects of the global pandemic, and the HR position post-COVID-19 can be transformed.

As a result, some activities can be included in HR's new role, and the effects of the global pandemic can be investigated in various ways.

Furthermore, the findings indicated that management could improve its commitment to pay, policies, and working conditions in the organization during COVID-19. This can be addressed by enhancing online and offline worker experiences and intensifying direct debate on issues. In order to improve organizational involvement, organizational variables such as salary scales, workers' feedback on policy development, and the work environment should be improved.

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Experimental Study on Effects of Concrete Properties by Partially Replacement of Industrial Waste: A Green Concrete

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ABSTRACT

Green concrete is concrete produced using waste materials obtained from various sources to develop an eco-friendly construction and reduce carbon emissions. The present experimental study is carried out to produce concrete using waste material from different industries to partially replace traditional concrete. Many research studies have been made using different waste materials which are available and useful as a replacement. The present study deals with industrial waste such as foundry sand (FS) and ground granulated blast furnace slag (GGBS) in the concrete so that the emission can be reduced and contribute to the environment. This study prepared two mixes for M35 Grade by replacing industrial wastes partially in the concrete mix. The first mix was prepared by partially replacing foundry sand with fine aggregates in proportions of 15%, 20%, 25% and 30%. The second mix was prepared by partially replacing the ground granulated blast furnace slag with cement in proportions of 30%, 40% and 50%. Test results were conducted to check the workability and compressive strength of the mixes prepared. These were then compared with the properties of conventional concrete at the end of 7 and 28 days. Test results indicate that 25% of FS and 30% of GGBS are the optimum percentages of industrial waste to use compared to conventional concrete properties at the end of 7 and 28 days. The present study also indicates the economic benefits of partially replacing the waste materials by reducing carbon emissions, and the study is beneficial to produce eco-friendly green concrete.

ARTICLE INFO

Keywords:

Fresh Properties, Compressive strength, Ground Granulated Blast Furnace Slag (GGBS), Waste Foundry Sand (FS).

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1. INTRODUCTION

1.1. General

Concrete is an integral part of the construction industry, and the mixture is composed of materials like cement, fine aggregates, coarse aggregates and water. Concrete is an important material in construction as it fulfils the requirements of workability, durability, strength and ability to resist fire. Concrete is also prepared by adding some admixtures into the mix to enhance the properties of concrete. In the present day, the increasing demand for industrialization is also increasing the production of industrial waste, and its secure disposal is a matter of concern. This study also focuses on the economic benefits of using waste materials obtained from industries and agriculture activities. Production of eco-friendly concrete is a prime duty of every researcher leading to industrial benefits obtained from any construction works. Therefore, many researchers have placed minimizing waste

obtained from industries and agricultural fields on their priority list, together with the utilization of waste material as a partial replacement with the concrete mix components. This study indicates that the utilization of industrial and agricultural waste as a substitute in concrete mix leads to waste minimization and contributes to environmental protection by reducing carbon emissions produced in concrete production.

In this research, an experimental study was carried out to check the optimum percentage of utilizing industrial waste and investigate the concrete mix's workability and compressive strength. In the present study, the first mix was prepared by partially replacing foundry sand with fine aggregates in different proportions of 15%, 20%, 25% and 30% and test results were conducted to check the workability and compressive strength of the prepared concrete. The result indicates that the optimum percentage for concrete utilization is 25% of foundry sand replacement with fine aggregates. In the second concrete mix, the optimum percentage of foundry sand, i.e. 25%, along with partial replacement of GGBS with cement in different proportions of 30%, 40% and 50%, is prepared. Test results were conducted to check the workability and compressive strength of the mix at the end of 7 and 28 days. Results obtained from the second mix indicate that 25% of foundry sand and 30% of ground granulated blast furnace slag are the optimum percentages for utilizing industrial waste. This composition also indicates higher workability and compressive strength compared to conventional concrete properties at the end of 7 and 28 days (Sheikibrahim et al., 2018)

The investigation carried out for this study also indicates that using these industrial wastes as substituents for preparing concrete mix helps develop an eco-friendly and green construction material and leads to cost-effective construction for the industry.

2. METHODOLOGY

This experimental study was carried out to investigate the performance of concrete mixtures prepared using different industrial wastes without compromising the performance and characteristic performance of the concrete, including workability, durability, and strength of the concrete. Concrete is prepared for M35 Grade mix, and a total of 72 cube specimens were cast to check the fresh and mechanical properties of the concrete after curing for 7 and 28 days—the nominal mix proportion of M35 grade mix as per recommendations given in IS Code 456. Concrete cubes were cast for Mix 1 concrete and Mix 2 concrete and conventional concrete using 150*150*150 mm size moulds (Kumbhar and Sangar, 2011)

2.1 Material Used

2.1.1 Cement

Cement plays a binding role in concrete mixtures, which holds all the concrete mix materials together. The cement used for this study to prepare concrete mixture is Portland Pozzolana Cement sieved

through a 90 μ sieve. The various tests were performed on cement to investigate the properties of the cement as per regulations given by IS Code: 1489 (Part-1). The initial setting time recorded for PPC was 90 minutes, and the final setting time recorded was 8 hours when performing lab tests (IS: 10262-2009, 2009).

2.1.2 Fine Aggregates

Fine aggregates are particles that pass through 4.75 μ and are retained on a 75 μ sieve as per standard recommendations given by IS: 456. In this study, the fine aggregates used are obtained from river sand made up of crushed aggregates. Initial testing is done in laboratories to investigate the properties of fine aggregates to check the suitability of the material for preparing the concrete mix.

2.1.3 Coarse Aggregates

Coarse aggregates are defined as aggregates retained on a 4.75 mm sieve, and tests were performed to investigate the initial conditions as per recommendations given by IS Code 383: 1970. This study uses coarse aggregates ranging from 10mm to 20 mm to prepare the concrete mix. The coarse aggregates were properly washed to remove the unwanted dust and impurities attached to the aggregates and dried properly using dry surface conditions.

2.1.4 Foundry Sand

Foundry Sand is a waste material obtained from casting industries obtained from the casting of ferrous and non-ferrous metals. Foundry Sand is used as a partial replacement with fine aggregates to investigate the optimum utilization percentage in the concrete mix. The utilization of FS is not only helpful to reduce the carbon emissions in the production of concrete but also helpful for minimizing waste and preparation of greener concrete. In the present study, FS is used from Bhoparai Metals Pvt. Punjab-Mohali-India (Bhimani, et al. 2013).



Figure1 Foundry Sand

Source: Author's Own Photo

2.1.5 Ground Granulated Blast Furnace Slag

Ground Granulated Blast Furnace Slag is used as waste material as a partial replacement with cement to find the optimum percentage for utilizing industrial waste. For the present study, the GGBS used is obtained from ECOGEN industry private Limited Dehradun HP. The utilization of

GGBS in the concrete mix is helpful to reduce the heat of hydration effect. In addition, the study indicates that usage of GGBS in optimum percentages is responsible for increased strength and is beneficial for enhancing other properties of concrete, like workability and durability (Karri et.al, 2015).



Figure 2 Ground Granulated Blast Furnace Slag

Source: Author's Own Photo

2.1.6 Super Plasticizer

In the present study, a superplasticizer is used to prepare the concrete mix so that the properties of the concrete mix can be enhanced. RHEOPLAST-SP-450 superplasticizer is used in this experimental investigation, a water-retardant admixture, and the dosage used for mixing is 20%-30%. The superplasticizer used for the study is responsible for improving the workability of fresh concrete and gaining the concrete's ultimate strength.

2.1.7 Water

In this experimental investigation, locally available tap water is used to prepare the mix of concrete, and for curing purposes, casted cubes are used. The laboratory testing is done to check the quality standards of water used for preparing the mix. The water used for mixing was clean, free from impurities like salts, oil and acid.

3. TEST PROCEDURE

3.1 Mix Proportion

M35 grade concrete is considered, and the mix was prepared as per regulations given by IS Code 10262-2009 and IS: 456. Two concrete mixes were prepared by utilizing industrial waste. Mix 1 is prepared by partially replacing foundry sand with a volume of fine aggregates in different proportions of 15%, 20%, 25% and 30%. Test results were conducted to investigate the workability and compressive strength of the concrete. Mix 2 is prepared by partially replacing the GGBS with a volume of cement in different proportions of 30%, 40% and 50%. Test results were conducted to check the optimum percentage of utilizing FS and GGBS in the concrete mix, and results obtained for workability and compressive strength were compared with the properties of conventional concrete.

Table 1 Values for Mix proportion of M35 Concrete Grade

Batch Units	Water	Cement	Fine Aggregates (Kg)	Coarse Aggregates (Kg)
Volume in Cubic meter	190	420	685	1170
Ratio of materials	0.45	1	1.63	2.8

Source: Author's Compilation

Table 2 Values of Mix proportion for FS and GGBS

S No.	GGBS	FS	Cement	Fine Aggregates	Coarse Aggregates	Water
1.	30%	25%	336	513	1170	151
2.	40%	25%	294	513	1170	132
3.	50%	25%	252	513	1170	113

Source: Author's Compilation

4. TEST RESULTS

4.1 Test results for workability

This study test is conducted to check the workability for concrete Mix 1, concrete Mix 2 and conventional concrete. Test results shown in Table 3 indicate that the test values obtained for concrete Mix 2 in which 25% replacement of FS with fine aggregates and 30% replacement of GGBS with cement shows higher workability of 110 mm when compared to other trials mixes and slump for conventional concrete.



Figure 3 Figure for slump test

Source: Author's Own Photo

Table 3 Values of Slump for concrete mix with FS and GGBS

Sr. No.	Mixture	Slump Value (mm)
1.	Conventional Concrete	105
2.	FS 25% + GGBS 30%	110
3.	FS 25% + GGBS 40%	65
4.	FS 25% + GGBS 50%	25

Source: Author's Compilation

4.2 Test Results for Compressive strength

Tests were performed to check the compressive strength of the concrete specimen as per regulations provided by IS: 516-1959 at the end of 7 days and 28 days from curing. Mix 1 is prepared by replacing FS in different proportions with fine aggregates, and a minimum of 3 cubes were cast for each proportion to check the test results for compressive strength. Mix 2 is prepared by taking the optimum percentage of FS, which is 25%, and trial mixes were prepared by replacing GGBS with Cement in different proportions. The number of cubes cast for each trial is three, and the strength is checked for every trial specimen at the end of 7 days and 28 days. Test results shown in Table 4 indicate that 25% of FS and 30% of GGBS is the optimum percentages for utilizing industrial waste into the concrete mix and shows higher values for compressive strength when compared to the test results of conventional concrete.

Table 4 Test Results for Compressive strength

Sr. No.	Mix Proportions	7 Days	28 Days
1.	Conventional concrete	19.6	33.86
2.	Trial 1 with 15% FS	20.56	30.36
2.	Trial 2 with 20% FS	21.35	33.65
3.	Trial 3 with 25% FS	24.04	36.79

4.	Trial 4 with 30% FS	18.59	32.61
5.	Trial 5 with (25% + 30%)	25.78	37.93
6.	Trial 6 with (25% + 40%)	21.03	34.73
7.	Trial 7 with (25% + 50%)	19.79	31.55

Source: Author's Compilation

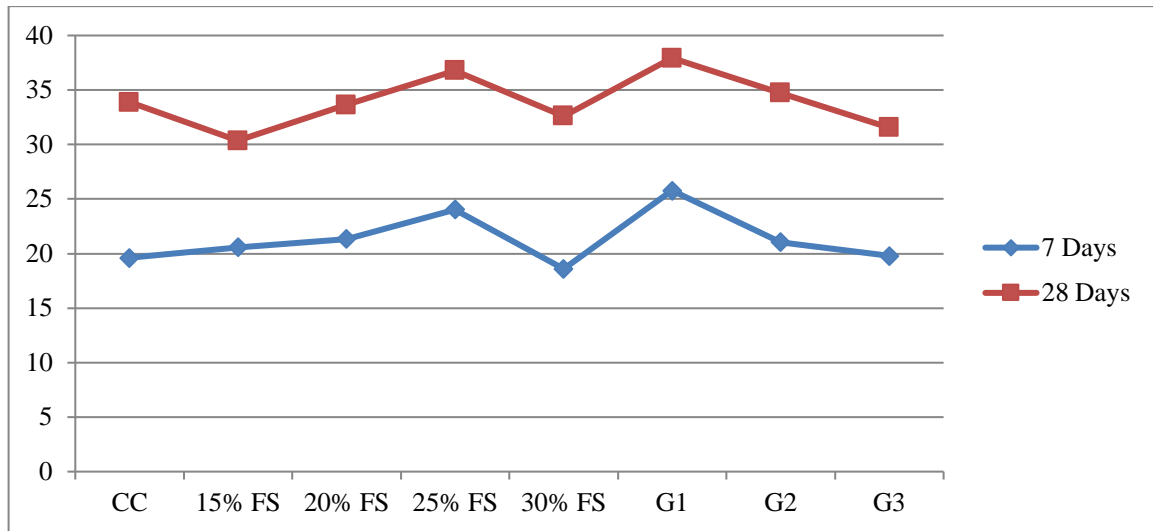


Figure 4 Test Results for Compressive strength
Source: Author's Compilation

5. CONCLUSION

1. The study conducted to assess the workability of the concrete indicated that the presence of foundry sand and ground granulated blast furnace slag helps increase the workability of the fresh concrete and shows a higher slump value when compared to the slump value of conventional concrete.
2. Our study indicates that a 25% replacement of foundry sand with fine aggregates shows a higher value for compressive strength and is the optimum percentage to partially replace the concrete mix.
3. The study concluded that the specimen prepared with 30% replacement of GGBS with cement and 25% replacement of FS with fine aggregates showed higher compressive strength at 25.78 kN/mm² and 37.93 kN/mm² for 7 and 28 days, respectively when compared with the test results for compressive strength of conventional concrete.
4. The study concludes that replacing 25% of FS and 30% of GGBS in concrete preparation can lead to eco-friendly green construction, and carbon emissions can be reduced by partially replacing the natural waste in the production of concrete.

5. The study concludes that utilizing industrial waste for the production of concrete is beneficial for minimizing waste properly and contributing towards a healthier environment by producing greener concrete.

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Analyzing the Impact of COVID-19 on the Financial Failure Risk in Borsa İstanbul Manufacturing Companies

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ABSTRACT

There is no agreed and precise definition of the concept of financial failure. This situation causes the studies of the concept to be associated with bankruptcies. Although not every company experiencing financial failure goes bankrupt, it can be noted that economic fluctuations that happen on a global scale cause many companies to face the risk of financial failure and even bankruptcy. Furthermore, the COVID-19 pandemic has also affected the economic policies of countries and thus affected the operations of companies. This study aims to analyze the financial failure risk of Borsa İstanbul (BIST) manufacturing companies before and after COVID-19. In the research, financial statements of BIST manufacturing industry companies published quarterly between the years 2019-2020 were used. Within the scope of the research, the quarterly financial statements of 146 BIST companies listed in the manufacturing industry for the years 2019-2020 were analyzed with the financial failure models of Altman (1968), Springate (1978), Taffler (1983) and Zmijewski (1984).

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Keywords:

Borsa İstanbul, COVID-19, Financial Failure, Manufacturing, Risk

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1. INTRODUCTION

In recent years, the deepening of global trade and currency wars and the increase in protectionist concerns in international trade has adversely affected the economies of many developed and developing countries and businesses operating in these economies. In this context, states and businesses may experience fluctuations in the economic and financial context. While the results of these adverse effects can often be measured within specific methods, they are sometimes insufficient due to excessive uncertainty, which may increase risk. The global impact of the COVID-19 pandemic, which emerged in Wuhan, China, in December 2019 and spread worldwide in a short time, presents much uncertainty and, therefore, risk.

Pandemics have been occurring naturally since ancient times. A highly pathogenic and antigenically exceptional novel type A virus has spread easily to and from humans. Although the virus was not recognized until 1933, historical records describe pandemics dating back to Hippocrates. The first severe pandemic with vital historical records occurred in 1580 and was determined to have destroyed some Spanish cities. Ten pandemic outbreaks have been documented in the last 300 years (Kelley &

Osterholm, 2008). However, it is controversial that the recent COVID-19 pandemic will cause radical changes in the current order. These changes also constitute a source of risk.

From a financial point of view, it is of great importance for businesses to keep their costs and expenses related to production, activities and financing under control, to closely monitor current and potential interest, exchange rate and liquidity risks, and to make their cash flows and profitability sustainable in order to avoid financial failure. It can be said that almost all sectors have been adversely affected by the COVID-19 process. Prominent sectors can be listed as follows: Airlines, hotels, restaurants, hospitality services, retail, especially manufacturers with complex supply chains, exporters heavily dependent on the Asian market first affected by the global pandemic, tourism-related businesses, transportation, cruises, ports, and the shipping sector, due to the decline in demand and commodity prices for oil, gas, mining, and metal industries. The problems companies faced during the COVID-19 period can be listed as follows: Consumer demand has decreased, and it is uncertain when it will increase and return to its former level. Companies' supply chain has been disrupted, and cash and working capital problems have emerged. Suppliers have had difficulty delivering critical components to manufacturers, and the production process has been delayed or stopped. The decline in consumer demand has caused a backlog in the stocks of companies, and it has become more and more challenging to clean their inventories. As a result, companies had difficulties collecting their receivables from their cash-strapped customers on time. There were also delays in supplier payments due to short-term cash flow constraints. Posted checks, which play a critical role in commercial life and are used as a method of financing receivables, caused serious collection problems due to the cash flow problems in this period. In addition, since companies guarantee post-dated checks, financing problems and their legal consequences arise due to the inability to pay post-dated checks (Deloitte, 2020). Therefore, the risk of financial failure increases due to these problems faced by companies during the COVID-19 process.

This study aims to analyze the financial failure risk of companies listed in the Borsa İstanbul (BIST) manufacturing industry in 2019 and 2020 comparatively. The financial data of the companies for the years 2019 and 2020 was analyzed quarterly. Within the scope of the research, the quarterly financial statements of 146 BIST companies listed in the manufacturing industry sector for the years 2019-2020 were evaluated using Altman (1968), Springate (1978), Taffler (1983) and Zmijewski (1984) financial failure models. The study consists of five main parts. In the introduction part of the study, the relationship between the risk of financial failure and the COVID-19 pandemic and the purpose of the study is explained. In the second part, the literature review on financial failure is presented, and in the third part, the scope and method of the study are given. In the fourth part, the analysis findings made according to the financial failure models of BIST manufacturing industry companies are presented. Finally, in the fifth part, the analysis findings are explained by comparing them with the literature and sharing suggestions for future studies.

2. LITERATURE REVIEW

Winakor & Smith (1935), one of the first financial failure modelling studies, examined 183 companies that went bankrupt between 1923 and 1931. Merwin (1942), on the other hand, examined the financial ratios of firms before bankruptcy to their financial failures over the data of a total of 900 firms that went bankrupt and continued their activities in the period 1926-1936. In both studies, net working capital ratio (net working capital/total assets) and current ratio were important variables in estimating financial failure.

Beaver (1966) conducted one of the most widely known studies among univariate financial failure models, including 79 successful and 79 unsuccessful companies listed in the USA between 1954 and 1964. Weibel (1973) studied 36 successful and 79 unsuccessful firms listed in Switzerland during the 1960-1971 period. They identified the most successful variables in estimating financial failure by using the financial data of 36 unsuccessful small-scale firms. Beaver (1966) found that the working capital ratio (working capital/total assets) and current ratio are among the most influential variables in predicting financial failure, while Weibel (1973) found that the current ratio is among the most influential variables in predicting financial failure.

The first multivariate financial failure model experiments were carried out by Tamari (1966) using the financial data for the period 1956-1960 and included 16 firms that filed for bankruptcy and 12 Israeli firms that went bankrupt. As a result of the study, it has been determined that the current ratio of the companies is one of the six variables that affect their financial failures. Among the financial failure models, the most widely known studies are Altman's (1968; 1983; 1993) studies. Among these, Altman's (1968) study has the feature of being the first financial failure study that does not contain personal judgments and is based entirely on statistical methods. In his study, Altman (1968) developed an estimation model based on the main variables affecting financial failure by using the data of 33 successful and 33 unsuccessful publicly traded manufacturing firms listed in the USA with multiple discriminant analyses. At the end of the study, five financial ratios, including the net working capital ratio, were selected among 22 financial ratios for the model called Z score. Altman (1983) developed the Z score model, which is a model that can also be used in non-public companies, and Altman (1993) altered the Z score model, which can be used in both publicly traded companies and companies listed in industries other than manufacturing.

Springate (1978) studied 40 manufacturing companies listed in Canada; Ohlson (1980) used 105 unsuccessful and 2058 successful companies listed in the USA; and Taffler (1982) examined 25 unsuccessful and 45 successful companies trading on the London Stock Exchange. They aimed to determine the financial ratios that affect financial failure by creating a model that could be used to predict financial failure. All three models have determined that the working capital ratio affects financial failure, which is included in the estimation models. In another study to develop a financial failure model, Zmijewski (1984) developed 12 models using data between 1972 and 1978 of 40

successful and 40 unsuccessful manufacturing companies whose shares were traded on the New York Stock Exchange (NYSE). It was determined that the current ratio is one of the determinants of financial failure in all models. Frydman et al. (1985) carried out financial failure modelling by using the data of 58 unsuccessful and 142 successful manufacturing companies listed in the USA during the 1971-1981 period, and 20 ratios including working capital ratio, current ratio and liquid assets ratio (cash stocks/total assets) were used. They determined that the financial ratio affects financial failure. Odom & Sharda (1990) included 64 bankrupt and 65 non-bankrupt companies listed in the USA during the 1975-1982 periods in their study. Tirapat & Nittayagasetwat (1999) studied 55 unsuccessful, and 341 successful companies listed in Thailand in 1997; Jones & Hensher (2004) studied 24 unsuccessful and 62 successful IT and service companies listed in Australia in the period 1999-2003, whilst Salehi & Abedini (2009) used data from 30 successful and 30 unsuccessful companies listed in Iran between 1995-2007. As a result of all four studies, it has been found that the working capital ratio is one of the determinants of financial failure.

Ganesalingam & Kumar (2001) used the data of 42 successful and 29 unsuccessful companies listed in Australia between 1986 and 1998 to make financial failure predictions. As a result of the study, it has been determined that ten financial ratios, including the current ratio, acid-test ratio and cash ratio, can be used in estimating financial failure. In addition, Gruszczynski (2004), in his study on 200 companies listed in Poland between 1995-1997, and Keener (2013) in his study on 1203 retail companies listed in the USA between 2005 and 2013, found that the cash ratio had statistically significant effects on the financial failures of firms.

Chen et al. (2006) analyzed 89 unsuccessful and 940 successful companies listed in China between December 1999 and June 2003, and Ijaz et al. (2013) investigated the financial ratios affecting financial failure by using the financial data of 35 sugar companies in Pakistan between 2009 and 2010. As a result of both studies, it was determined that the current ratio has statistically significant effects on financial failure and can be used in financial failure predictions. Almansour (2015), on the other hand, examined the internal determinants of financial failure by using data from 11 successful and 11 unsuccessful companies listed in Jordan during the 2000-2003 period and found that the working capital ratio and current ratio had statistically significant effects on financial failure.

Tian & Yu (2017) used 29 financial ratios of 108 Japanese and 112 European companies listed in Japan and European countries in the 1998-2012 period. Different financial failure models for Japanese and European companies were developed, and the results of their models were compared to the results of Altman's (1968) Z score model. As a result of the study, it was stated that retained earnings/total assets, leverage ratio and short-term liabilities/sales ratios were chosen for all models created for Japan, and equity/total debt ratio for European countries. In addition, it was noted that their model performed better than the Altman (1968) Z score model.

Fejér-Király et al. (2019) analyzed the determinants of financial failure by using data from 65 unsuccessful and 95 successful companies traded in the Bucharest Stock Exchange. As a result of the

study, it was determined that the variable of net working capital was selected for the model, which was developed to predict financial failure 1 and 2 years before, and it had significant effects on financial failure. Li & Faff (2019) developed a model using the data of 421 unsuccessful and 441 successful companies between 1988 and 2011, and it was noted that the working capital ratio is one of the 11 variables that affect financial failure.

One of the first financial failure modelling studies in Turkey was carried out by Göktan in 1981. Göktan (1981) predicted the financial failures of the companies 1, 2, 3 and 4 years before the failure, based on the data of 25 successful and 14 unsuccessful companies between 1976 and 1980. As a result of the study, nine financial ratios, including the current ratio, were included in the developed model. One of the first studies to make financial failure predictions with multidimensional statistical models in Turkey was carried out by Aktaş in 1993. Aktaş (1993) developed a financial failure prediction model based on data from 25 successful and 35 unsuccessful companies between 1980 and 1989. As a result of the study, it was determined that the current ratio, acid-test ratio and liquid assets ratio, and working capital management were among the determinants of financial failure. Ünsal (2001) examined the financial ratios that can predict financial failure using data from 16 unsuccessful and 55 successful companies and stated that cash ratio, acid-test ratio and current ratio are among the variables that are determinants of financial failure. Aktaş et al. (2003) developed a financial failure prediction model using the data from 53 successful and 53 unsuccessful industrial, commercial and service companies between 1983 and 1997. As a result of the study, five financial ratios, including the acid-test ratio, were determined. It has also been determined that some influential variables can be used to predict financial failure. In the study of İçerli & Akkaya (2006), 40 unsuccessful and 40 successful companies operating in the 1990-2003 period were examined with financial ratios and the Z test. The cash, acid-test, and current ratios were significant predictors of financial failure. Terzi (2011), on the other hand, aimed to develop a model to predict the financial failure risks of companies based on the data of 10 unsuccessful and 12 successful companies between 2009 and 2010. As a result of the study, six among nineteen financial ratios, including the net working capital ratio, were determined to predict failure effectively. Zeytinoğlu & Akarim (2013) developed a year-specific financial failure model for 2009, 2010 and 2011 with 115 companies. They found that the current ratio was dominant only in the 2009 model, and the net working capital ratio was the main factor of financial failure in all three models.

Ural et al. (2015) analyzed the financial failure risks of companies for one, two and three years before the failure, using the data of 24 food, beverage and tobacco companies in the 2005-2012 period. They used five financial ratios without any working capital variables for one year before failure, seven financial ratios including current ratio and acid-test ratio for two years before financial failure, and eight financial ratios including cash ratio and inventory ratio for three years before financial failure. They determined the current ratio as the significant variable of the financial failure prediction models. Toraman & Karaca (2016) used the data of 17 chemical companies between 2010 and 2013 and

examined the effects of various financial ratios with the Altman (1968) Z score values. They found that the working capital ratio has a significant effect on the Z-score values of the companies. Akyüz et al. (2017) examined sixteen paper and paper products companies operating in 2015. Ertan & Ersan (2018) investigated financial failure using ratios of 175 successful and 33 unsuccessful manufacturing companies between 2000 and 2004. Karadeniz & Öcek (2019) examined the financial ratios affecting financial failure by using the financial data of 12 tourism companies operating in the period between 2012 and 2017. As a result of all three studies, it has been determined that cash ratio, acid-test ratio, and current ratio had statistically significant effects on financial failure and can be used in financial failure predictions. Karaca and Özen (2017) investigated financial failures in the tourism sector companies in Borsa İstanbul using the Altman model.

Arslantürk Çöllü et al. (2020) determined the financial ratios affecting financial failure by using 2016-2018 data of textile, clothing and leather companies whose shares are listed in the BIST. They found that the current ratio, trade receivables ratio and inventory turnover are among the financial ratios that affect financial failure. In the study by Temelli & Tekin (2020), 241 companies in Borsa İstanbul between 2011 and 2019 were analyzed with the Springate model. It was found that 77.6% of the companies were financially successful in the analyzed period.

3. SCOPE, DATA AND METHODOLOGY

Manufacturing industry companies listed on BIST between 2019 and 2020 are within the scope of this research. Data and information of BIST manufacturing industry companies were obtained from the Public Disclosure Platform (KAP). As of July 2021, there are 180 companies operating in the BIST manufacturing industry (KAP, 2021). The 146 manufacturing industry companies analyzed in this study are given in Table 1.

Table 1: BIST Manufacturing Companies Analyzed Within the Scope of the Research

No.	Company	Code
1	Acıselsan Acıpayam Selüloz Sanayi Tic. A.Ş.	ACSEL
2	Adel Kalemçilik Tic.ve San. A.Ş.	ADEL
3	Afyon Çimento Sanayi T.A.Ş.	AFYON
4	Akçansa Çimento Sanayi ve Tic. A.Ş.	AKCNS
5	Akın Tekstil A.Ş.	ATEKS
6	Aksa Akrilik Kimya Sanayi A.Ş.	AKSA
7	Alarko Carrier Sanayi ve Tic. A.Ş.	ALCAR
8	Alcatel Lucent Teletaş Telekomünikasyon A.Ş.	ALKA
9	Alkim Kağıt Sanayi ve Tic.A.Ş.	ALKIM
10	Anadolu Efes Biracılık ve Malt Sanayii A.Ş.	AEFES
11	Arçelik A.Ş.	ARCLK
12	Arsan Tekstil Ticaret ve Sanayi A.Ş.	ARSAN
13	Anadolu Isuzu Otomotiv Sanayi ve Ticaret A.Ş.	ASUZU
14	A.V.O.D.Kurutulmuş Gıda ve Tarım Ürünleri San. Tic. A.Ş.	AVOD
15	Aygaz A.Ş.	AYGAZ
16	Bağfaş Bandırma Gübre Fabrikaları A.Ş.	BAGFS
17	Bak Ambalaj San.ve Tic. A.Ş.	BAKAB
18	Banvit Bandırma Vitaminli Yem San. A.Ş.	BANVT
19	Berkosan Yalıtım ve Tecrit Mad. Üretim ve Tic. A.Ş.	BRKSN
20	Bilici Yatırım Sanayi ve Tic. A.Ş.	BLCYT
21	Bantaş Bandırma Ambalaj San. Tic. A.Ş.	BNTAS
22	Batı Söke Söke Çimento San. T.A.Ş.	BSOKE
23	Batçım Batı Anadolu Çimento San. A.Ş.	BTCIM
24	Birko Birleşik Koyunlular Mensucat Tic.ve San. A.Ş.	BRKO
25	Birlik Mensucat Tic.ve San. İşletmesi A.Ş.	BRMEN
26	Borusan Mannesmann Boru San.ve Tic. A.Ş.	BRSAN
27	Bossa Tic. Ve San İşletmeleri T.A.Ş.	BOSSA
28	Bosch Fren Sistemleri San.ve Tic. A.Ş.	BFREN
29	Brisa Bridgestone Sabancı Lastik San.ve Tic. A.Ş.	BRISA
30	Burçelik Bursa Çelik Döküm Sanayi A.Ş.	BURCE
31	Burçelik Vana San.ve Tic. A.Ş.	BURVA

32	Bursa Çimento Fabrikası A.Ş.	BUCİM
33	Coca-Cola İçecek A.Ş.	CCOLA
34	Çelik Halat ve Tel San. A.Ş.	CELHA
35	Çemaş Döküm Sanayi A.Ş.	CEMAS
36	Çemtaş Çelik Makine Sanayi ve Tic. A.Ş.	CEMETS
37	Çimbeton Hazır beton ve Prefabrik Yapı Elemanları San. Ve Tic. A.Ş.	CMBTN
38	Çimentaş İzmir Çimento Fabrikası T.A.Ş.	CMENT
39	Çimsa Çimento Sanayi Tic. A.Ş.	CIMSA
40	Çuhadaroğlu Metal San. Ve Paz. A.Ş.	CUSAN
41	Dağı Giyim Sanayi ve Tic. A.Ş.	DAGI
42	Dardanel Önemtaş Gıda Sanayi A.Ş.	DARDL
43	Demisaş Döküm Emaye Mamulleri San. A.Ş.	DMSAS
44	Derimod Konf. Ayakkabı Deri San ve Tic. A.Ş.	DERİM
45	Desa Deri San.ve Tic. A.Ş.	DESA
46	Deva Holding A.Ş.	DEVA
47	Diriteks Diriliş Tekstil San.ve Tic. A.Ş.	DIRIT
48	Ditas Doğan Yedek Parça İmalat ve Teknik A.Ş.	DİTAS
49	Doğan Burda Dergi Yayıncılık ve Paz. A.Ş.	DOBUR
50	Doğtaş Kelebek Mobilya San ve Tic. A.Ş.	DGKLB
51	Doğuşan Boru san ve Tic. A.Ş.	DOGUB
52	Döktaş Dökümcülük Tc.ve San. A.Ş.	DOKTA
53	Duran Doğan Basın ve Ambalaj San. A.Ş.	DURDO
54	DYO Boya Fabrikaları San.ve Tic. A.Ş.	DYOBY
55	Ege Endüstri ve Tic. A.Ş.	EGEEN
56	Ege Gübre Sanayi A.Ş.	EGGUB
57	Ege Profil Ticaret ve San. A.Ş.	EGPRO
58	Ege Seramik San.ve Tic. A.Ş.	EGESER
59	Ege Plast Ege Plastik Tic.ve San A.Ş.	EPLAS
60	Ekiz Kimya San.ve Tic. A.Ş.	EKİZ
61	Emek Elektrik End. A.Ş.	EMKEL
62	Eminiş Ambalaj San.ve Tic. A.Ş.	EMNIS
63	Erbosan Erciyes Boru Sanayii Tic. A.Ş.	ERBOS
64	Ereğli Demir Çelik Fabrikaları T.A.Ş.	EREGL
65	Ersu Meyve ve Gıda San. A.Ş.	ERSU
66	Federal -Mogul Izmit Piston ve Pim Üretim Tesisleri A.Ş.	FMZIP
67	Ford Otomotiv San. A.Ş.	PROTO
68	Formet Çelik Kapı San. Ve Tic. A.Ş.	FORMT
69	Frigo-Pak Gıda Maddeleri San. ve Tic. A.Ş.	FRIGO
70	Gediz Ambalaj San.ve Tic. A.Ş.	GEDZA
71	Gentaş Dekoratif Yüzeyler San.ve Tic. A.Ş.	GENTS
72	Gersan Elektrik Tic. Ve San. A.Ş.	GEREL
73	Goodyear Lastikleri T.A.Ş.	GOODY
74	Göлтаş Göller Bölgesi Çimento Sanayi Tic. A.Ş.	GOLTS
75	Gübre Fabrikaları T.A.Ş.	GUBRF
76	Hateks Hatay Tekstil İşletmeleri A.Ş.	HATEK
77	Hektaş Tic. T.A.Ş.	HEKTS
78	Hürriyet Gazetecilik ve Matbaacılık A.Ş.	HURGZ
79	İhlas Ev Aletleri İmalat Sanayi ve Tic. A.Ş.	IHEVA
80	İhlas Gazetecilik A.Ş.	IHGZT
81	İskenderun Demir Çelik A.Ş.	ISDMR
82	İzmir Demir Çelik San. A.Ş.	IZDMC
83	Jantsa Jant Sanayi ve Tic. A.Ş.	JANTS
84	Kaplamin Ambalaj Sanayi ve Tic. A.Ş.	KAPLM
85	Kardemir Karabük Demir Çelik Sanayi Tic. A.Ş.	KARDMD
86	Karsan Otomotiv Sanayii ve Tic. A.Ş.	KARSN
87	Karsu Tekstil Sanayii ve Tic. A.Ş.	KRTEK
88	Kartonsan Karton San. Ve Tic. A.Ş.	KARTN
89	Katmerciler Araç Üstü Ekipman San. Ve Tic. A.Ş.	KATMR
90	Kent Gıda Maddeleri San. Ve Tic. A.Ş.	KENT
91	Kereviş Gıda San. Ve Tic.A.Ş.	KERVY
92	Klimasan Klima San. Ve Tic.A.Ş.	KLMSN
93	Konfrut Gıda San. Ve Tic.A.Ş.	KONFRT
94	Konya Çimento Sanayii A.Ş.	KONYA
95	Kordsa Teknik Tekstil A.Ş.	KORDS
96	Kristal Kola ve Meşrubat Sanayi Ticaret A.Ş.	KRSTL
97	Kütahya Porselen Sanayi A.Ş.	KUTPO
98	Lüks Kadife Ticaret ve Sanayii A.Ş.	LUKSK
99	Makina Takım Endüstrisi A.Ş.	MAKTK
100	Marshall Boya ve Vernik Sanayi A.Ş.	MRSHL
101	Menderes Tekstil Sanayi ve Ticaret A.Ş.	MNDRS
102	Mondi Olmuksan Kağıt ve Ambalaj Sanayi A.Ş.	OLMK
103	Mondi Tire Kutsan Kağıt ve Ambalaj Sanayi A.Ş.	TİRE
104	Niğbaş Niğde Beton Sanayi ve Ticaret A.Ş.	NİBAS
105	Nuh Çimento Sanayi A.Ş.	NUHCM
106	Otokar Otomotiv ve Savunma Sanayi A.Ş.	OTKAR
107	Oylum Sınai Yatırımlar A.Ş.	OYLUM
108	Özbal Çelik Boru Sanayi Tic. Ve Taahhüt A.Ş.	OZBAL
109	Parsan Makine Parçaları Sanayii A.Ş.	PARSN
110	Penguen Gıda Sanayi A.Ş.	PENGD
111	Petkim Petrokimya Holding A.Ş.	PETKM
112	Pınar Entegre Et ve Un Sanayii A.Ş.	PETUN
113	Pınar Su ve İçecek Sanayi ve Ticaret A.Ş.	PINSU
114	Pınar Süt Mamulleri Sanayii A.Ş.	PNSÜT
115	Prizma Pres Matbaacılık Yayıncılık Sanayi ve Tic. A.Ş.	PRZMA
116	Royal Halı İplik Tekstil Mobilya Sanayi ve Tic. A.Ş.	ROYAL
117	RTA Laboratuvarları Biyolojik Ürünler İlaç ve Makine San. Tic. A.Ş.	RTLAB
118	Sanifoam Sünger Sanayi ve Ticaret A.Ş.	SANFM
119	Saray Matbaacılık Kağıtçılık Kırtasiyecilik Tic. Ve San. A.Ş.	SAMAT
120	Sarkuysan Elektrolitik Bakır Sanayi ve Tic.A.Ş.	SARKY
121	Say Yenilenebilir Enerji Ekipmanları Sanayi ve Tic. A.Ş.	SAYAS
122	Sasa Polyester Sanayi A.Ş.	SASA
123	Sekuro Plastik Ambalaj Sanayi A.Ş.	SEKUR
124	Seçuk Gıda Endüstri İhracat ve İthalat A.Ş.	SELGD
125	Silverline Endüstri ve Ticaret A.Ş.	SILVR

126	Söktaş Tekstil Sanayi ve Tic.A.Ş.	SKTAS
127	Sönmez Pamuklu Sanayii A.Ş.	SNPAM
128	Tat Gıda Sanayi A.Ş.	TATGD
129	Temapol Polimer Plastik ve İnşaat Sanayi Ticaret A.Ş.	TMPOL
130	Tofaş Türk Otomobil Fabrikası A.Ş.	TOASO
131	Tuççelik Alüminyum ve Metal Mamulleri Sanayi ve Tic.A.Ş.	TUCLK
132	Tuğuş Gıda Sanayi ve Tic.A.Ş.	TUKAS
133	Tümosan Motor ve Traktör Sanayi A.Ş.	TMSN
134	Tüpraş-Türkiye Petrol Rafinerileri A.Ş.	TUPRS
135	Türk Prysmian Kablo Sistemleri A.Ş.	PRKAB
136	Türk Traktör ve Ziraat Makineleri A.Ş.	TTRAK
137	Türk Tuborg Bira ve Malt Sanayii A.Ş.	TBORG
138	Ulusoy Elektrik İmalat Taahhüt ve Tic.A.Ş.	ULUSE
139	Ulusoy Un Sanayi ve Ticaret A.Ş.	ULUUN
140	Uşak Seramik Sanayi A.Ş.	USAK
141	Ülker Bisküvi Sanayi A.Ş.	ULKER
142	Vestel Beyaz Eşya Sanayi ve Tic. A.Ş.	VESBE
143	Vestel Elektronik Sanayi ve Ticaret A.Ş.	VESTL
144	Viking Kağıt ve Selüloz A.Ş.	VKING
145	Yataş Yatak ve Yorgan Sanayi ve Ticaret A.Ş.	YATAS
146	Yünsa Yünlü Sanayi ve Ticaret A.Ş.	YUNSA

Source: Authors' Compilation

While Mondi Olmuksan Kağıt ve Ambalaj Sanayi A.Ş was traded on the BIST with the OLMIP code, it started to be traded with the OLMK code on 01.07.2021 due to the company name change and was included in the analysis with the same code. Of the 34 manufacturing industry companies not included in the research, 11 were offered to the public (IPOs) in 2021, 3 in 2020 and 1 in 2019 and started to be traded on the BIST. They were not included in the analysis due to the lack of financial statements for the periods studied. Merko Gıda Sanayi ve Tic. A.Ş. (MERKO) was excluded from the analysis. Oyak Çimento (OYAKC) was excluded from the scope of the analysis since Oyak Cement group companies were merged under Mardin Çimento in 2019, and the name of Mardin Çimento was changed to Oyak Çimento since it does not have financial statements for the relevant year. Seventeen manufacturing companies that publish their financial reports every six months are also excluded from the analysis. The companies not included in the study are given in Table 2.

The research used financial statement data of BIST manufacturing companies published in quarterly periods between 2019 and 2020. The companies' financial statement data within the research scope for the relevant periods were taken from the KAP and Fintables databases. In addition, the closing prices of stocks are taken from investing.com.

Within the scope of the research, the quarterly financial statements of 146 BIST companies operating in the manufacturing industry sector for the years 2019-2020 were evaluated using Altman (1968), Springate (1978), Taffler (1983) and Zmijewski (1984) financial failure models. The financial failure models and calculations used in the study are given in Table 3.

Table 2: BIST Manufacturing Companies Excluded from the Scope of the Research

No.	Company	Code
IPOs in 2021		
1	BMS Çelik Hasır Sanayi ve Ticaret A.Ş.	BMS
2	Kalekim Kimyevi Maddeler San. ve Tic.A.Ş.	KALKIM
3	Işık Plastik Sanayi ve Dış Ticaret Pazarlama A.Ş.	ISKPL
4	Kervan Gıda Sanayi ve Ticaret A.Ş.	KRVGD
5	Kütahya Şeker Fabrikası A.Ş.	KTSKR
6	Meditera Tıbbi Malzeme Sanayi ve Ticaret A.Ş.	MEDTR
7	Mercan Kimya Sanayi ve Ticaret A.Ş.	MERCN
8	Qua Granite Hayal Yapı ve Ürünleri Sanayi Ticaret A.Ş.	QUAGR
9	Selva Gıda Sanayi A.Ş.	SELVA
10	Türk İlaç ve Serum Sanayi A.Ş.	TRILC
11	Boğaziçi Beton Sanayi Tic.A.Ş.	BOBET
IPOs in 2020		
1	Fade Gıda Yatırım ve Sanayi Ticaret A.Ş.	FADE
2	Bayrak EBT Taban Sanayi ve Ticaret A.Ş.	BAYRK
3	Dinamik Isı Makine Yalıtım Malzemeleri Sanayi ve Ticaret A.Ş.	DNISI

IPOs in 2019		
1	Yükselen Çelik A.Ş.	YKSLN
Companies that publish Financial Reports on a 6-monthly basis		
1	Ayes Çelik Hasır ve Çit Sanayi A.Ş.	AYES
2	Balatacılar Balatacılık Sanayi ve Ticaret A.Ş.	BALAT
3	Baştas Başkent Çimento Sanayi ve Ticaret A.Ş.	BASCM
4	İzmir Firça Sanayi ve Ticaret A.Ş.	IZFAS
5	Mega Polietilen Köpük Sanayi ve Ticaret A.Ş.	MEGAP
6	Orma Orman Mahsulleri İntegre Sanayi ve Ticaret A.Ş.	ORMA
7	Özerden Plastik ve Sanayi Ticaret A.Ş.	OZRDN
8	Rodrigo Tekstil ve Sanayi Ticaret A.Ş.	RODRG
9	Politeknik Metal Sanayi ve Ticaret A.Ş.	POLTEK
10	Sodaş Sodyum Sanayii A.Ş.	SODSN
11	Taze Kuru Gıda Sanayi ve Ticaret A.Ş.	TKURU
12	Sumas Suni Tahta ve Mobilya Sanayi A.Ş.	SUMAS
13	Vanet Gıda Sanayi İç ve Dış Ticaret A.Ş.	VANGD
14	Yibitaş Yozgat İşçi Birliği İnşaat Malzemeleri Ticaret ve San. A.Ş.	YIBITAŞ
15	Yonga Mobilya Sanayi ve Ticaret A.Ş.	YONGA
16	Safkar Ege Soğutmacılık Klima Soğuk Hva Tes. İhracat İthalat San. A.Ş.	SAFKAR
17	Seyitler Kimya Sanayi A.Ş.	SEYKM

Source: Authors' Compilation

Table 3: Financial Failure Models in the Research

Financial Failure Model	Formula	Result
Altman (1968)	$\text{Altman } Z = 0.012 \cdot X_1 + 0.014 \cdot X_2 + 0.033 \cdot X_3 + 0.006 \cdot X_4 + 0.999 \cdot X_5$ <p> $X_1 = \text{Working Capital} / \text{Total Assets}$ $X_2 = \text{Retained Earnings} / \text{Total Assets}$ $X_3 = \text{Net Profit Before Interest and Taxes (NPBIT)} / \text{Total Assets}$ $X_4 = \text{Market Value} / \text{Total Liabilities}$ $X_5 = \text{Sales} / \text{Total Assets}$ </p>	<p>$Z < 1,81$ then the company is classified as “not at risk of financial failure”</p> <p>$1,81 \leq Z \leq 2,99$ then the company is classified as “uncertain”</p> <p>$Z > 2,99$ then the company is classified as “not at risk of financial failure”</p>
Springate (1978)	$\text{Springate}_z = 1.03 \cdot X_1 + 3.07 \cdot X_2 + 0.66 \cdot X_3 + 0.4 \cdot X_4$ <p> $X_1 = \text{Working Capital} / \text{Total Assets}$ $X_2 = \text{Net Profit Before Interest and Taxes (NPBIT)} / \text{Total Assets}$ $X_3 = \text{Net Profit Before Taxes (NPAT)} / \text{Current Liabilities}$ $X_4 = \text{Sales} / \text{Total Assets}$ </p>	<p>$Z < 0.862$; then the company is classified as “at risk of financial failure”</p> <p>$Z > 0.862$; then the company is classified as “not at risk of financial failure”</p>
Taffler (1983)	$\text{Taffler}_z = 3.20 + 12.18 \cdot X_1 + 2.50 \cdot X_2 - 10.68 \cdot X_3 + 0.03 \cdot X_4$ <p> $X_1 = \text{Net Profit Before Taxes (NPAT)} / \text{Average Short Term Liabilities}$ $X_2 = \text{Current Assets} / \text{Total Liabilities}$ $X_3 = \text{Short Term Liabilities} / \text{Total Assets}$ $X_4 = (\text{Current Assets} - \text{Stoklar} - \text{Short Term Liabilities}) / (\text{Sales} - \text{Net Profit Before Taxes} + \text{Amortization})$ </p>	<p>$Z < 0,3$ then the company is classified as “at risk of financial failure”,</p> <p>$Z > 0,3$ then the company is classified as “not at risk of financial failure”</p>
Zmijewski (1984)	$\text{Zmijewski} = -4.336 - 4.513 \cdot X_1 + 5.769 \cdot X_2 + 0.004 \cdot X_3$ <p> $X_1 = \text{Net Income} / \text{Total Assets} = \text{ROA}$ $X_2 = \text{Total Liabilities} / \text{Total Assets} = \text{Leverage}$ $X_3 = \text{Current Assets} / \text{Current Liabilities} = \text{Current Ratio} = \text{Liquidity}$ </p>	<p>$Z > 0$ then the company is classified as “at risk of financial failure”,</p> <p>$Z < 0$ then the company is classified as “not at risk of financial failure”</p>

Source: Authors' Compilation

Abbreviations are used in the tables while giving the financial status of the companies. RoFF (Risk of Financial Failure) was used for companies with a risk of financial failure, NRoFF (No Risk of Financial Failure) for companies with no risk of financial failure, and UN (Uncertain) for companies with an uncertain risk of financial failure.

4. FINDINGS

The Altman Z values of the BIST manufacturing companies within the scope of the research, calculated between 2019 and 2020, are given in Table 4.

Table 4: Altman Z Values of Manufacturing Companies for 2019-2020

No.	Code	Altman Z							
		2019/3	2020/3	2019/6	2020/6	2019/9	2020/9	2019/12	2020/12
1	ACSEL	4,83	5,52	4,50	9,03	5,63	20,10	6,46	13,08
2	ADEL	1,40	1,02	1,03	1,07	1,09	1,15	1,72	1,49
3	AFYON	0,13	-0,07	0,09	4,15	0,18	5,48	0,15	5,89
4	AKCNS	0,92	0,96	1,00	1,75	1,16	1,92	1,61	2,04
5	ATEKS	1,25	1,13	1,28	1,41	1,27	1,88	1,46	2,76
6	AKSA	0,84	1,01	0,74	0,83	0,74	1,14	0,75	1,71
7	ALCAR	3,42	2,90	2,78	3,55	3,37	5,08	3,96	10,51
8	ALKA	1,64	3,01	2,48	6,46	2,39	6,48	3,49	6,30
9	ALKİM	1,90	2,54	2,03	6,71	1,95	6,30	2,25	7,28
10	AEFES	0,52	0,56	0,66	0,69	0,74	0,72	0,67	0,67
11	ARCLK	1,06	1,01	1,09	1,12	1,10	1,09	1,09	1,15
12	ARSAN	0,84	1,25	0,96	1,35	1,04	1,84	0,93	2,17
13	ASUZU	0,50	0,61	0,45	0,82	0,50	0,83	1,00	1,16
14	AVOD	1,08	0,99	1,13	1,43	0,97	2,06	0,81	2,37
15	AYGAZ	1,46	1,53	1,68	1,70	1,80	1,74	1,94	1,96
16	BAGFS	0,65	0,76	0,57	0,78	0,75	0,78	0,71	0,87
17	BAKAB	1,19	1,42	1,15	1,44	1,26	1,75	1,39	2,21
18	BANVT	1,58	1,68	2,21	2,02	1,97	1,96	2,01	2,67
19	BRKSN	0,86	0,94	0,74	1,35	0,84	2,06	1,06	2,64
20	BLCYT	1,09	3,49	1,13	3,30	1,63	6,27	2,66	6,39
21	BNTAS	2,99	5,08	2,81	6,00	3,30	5,86	4,73	6,21
22	BSOKE	0,12	-0,20	0,01	-0,11	0,06	-0,11	0,01	-0,09
23	BTCİM	0,30	0,12	0,23	0,15	0,24	0,18	0,26	0,15
24	BRKO	-0,98	-1,14	-0,89	-1,17	-1,04	-0,06	-1,11	0,30
25	BRMEN	-1,13	-3,86	-1,19	0,50	-1,22	-1,86	-1,10	-9,77
26	BRSAN	0,52	0,39	0,55	0,40	0,50	0,44	0,51	0,77
27	BOSSA	0,71	0,95	0,81	0,97	0,81	1,35	1,10	1,70
28	BFREN	7,84	9,51	7,13	10,39	9,64	27,45	11,54	27,83
29	BRİSA	0,64	0,52	0,61	0,68	0,69	0,84	0,66	1,38
30	BURCE	0,15	0,23	0,14	0,41	0,22	1,55	0,43	1,29
31	BURVA	0,89	4,14	0,92	4,78	2,27	11,30	4,20	16,52
32	BUCİM	1,73	1,92	1,76	1,89	1,71	2,13	1,81	3,21
33	CCOLA	0,98	1,08	1,08	1,29	1,21	1,40	1,10	1,48
34	CELHA	0,49	0,38	0,57	0,24	0,44	0,54	0,32	0,75
35	CEMAS	0,75	2,16	0,72	4,49	0,87	4,50	0,38	3,98
36	CEMTS	4,54	5,37	5,47	8,42	5,87	7,82	7,86	11,10
37	CMBTN	1,04	0,32	0,86	0,64	0,92	1,16	0,95	2,31
38	CMEN	2,76	1,45	2,65	2,46	2,05	3,34	2,33	3,70
39	CİMSA	0,64	0,54	0,59	0,82	0,71	0,92	0,75	0,75
40	CUSAN	1,05	1,60	1,27	1,87	1,47	2,18	1,73	2,46
41	DAGİ	0,34	0,38	0,49	0,85	0,53	0,56	1,37	0,84
42	DARDL	-5,66	-0,68	-5,64	0,66	-5,03	0,92	-2,46	1,48
43	DMSAS	1,36	1,25	1,14	1,49	1,07	1,82	1,39	1,94
44	DERİM	0,89	1,06	0,80	1,09	0,83	1,23	1,36	1,31
45	DESA	0,52	0,72	0,70	0,43	0,66	1,36	0,96	1,72
46	DEVA	1,36	2,13	1,46	2,77	1,57	2,81	1,84	2,98
47	DIRIT	-1,19	-1,30	-1,91	-1,00	-2,30	-1,37	-2,34	-1,12
48	DITAS	0,80	0,74	0,82	0,89	0,75	1,70	0,90	1,62
49	DOBUR	1,73	1,79	1,86	5,06	1,78	7,11	2,79	9,06
50	DGKLB	0,03	-0,04	0,13	0,21	-0,03	0,39	0,07	0,40
51	DOGUB	-1,00	2,87	3,61	5,31	5,84	6,91	5,98	6,69
52	DOKTA	0,46	0,89	0,56	1,46	1,04	1,44	1,46	1,64
53	DURDO	0,46	0,80	0,46	0,68	0,73	0,77	0,81	1,07
54	DYOBY	0,27	0,28	0,31	0,54	0,32	0,84	0,49	1,18
55	EĞEEN	5,07	4,38	4,68	5,11	4,84	5,43	5,61	10,92
56	EĞGUB	1,63	1,13	1,51	1,71	2,02	2,69	1,16	2,94
57	EĞPRO	1,24	1,28	1,17	1,40	1,31	1,73	1,44	2,76
58	EĞESER	2,19	1,75	2,00	2,00	1,86	2,31	2,10	3,04
59	EPLAS	1,14	2,99	1,28	3,41	1,62	3,47	2,27	4,38
60	EKİZ	-1,27	-0,65	-1,08	0,06	-0,78	0,08	-0,61	0,25
61	EMKEL	-0,11	0,00	0,05	0,21	-0,03	0,06	0,05	0,32
62	EMNIS	-1,90	-1,82	-0,72	-1,40	-1,45	0,68	-1,29	2,37
63	ERBOS	2,90	2,55	2,49	3,24	2,81	4,06	2,36	4,49
64	EREGL	1,42	1,50	1,74	1,54	1,55	1,57	1,67	2,68
65	ERSU	0,88	5,76	0,64	8,24	1,40	9,31	2,44	7,08
66	FMZİP	13,46	30,43	17,89	59,38	16,78	78,11	41,59	77,56
67	FROTO	1,76	1,90	2,01	1,83	2,20	2,22	2,36	3,07
68	FORMT	2,10	0,78	1,67	0,96	2,43	1,22	0,98	1,30
69	FRİGO	0,77	1,20	0,89	1,98	0,83	4,84	1,05	2,09
70	GEDZA	2,41	2,95	2,39	3,99	2,70	4,00	2,60	4,83
71	GENTS	2,01	2,69	1,94	3,15	2,12	3,60	2,71	5,26

72	GEREL	1,24	1,25	1,28	2,44	1,36	2,42	1,52	2,17
73	GOODY	1,41	1,51	1,42	2,48	1,41	2,70	2,69	3,02
74	GOLTS	0,88	0,87	0,77	0,93	0,75	0,99	0,83	1,13
75	GUBRF	0,49	1,31	0,35	2,04	0,53	2,14	0,58	5,56
76	HATEK	0,65	0,89	0,51	1,10	0,63	1,36	1,14	1,62
77	HEKTS	1,29	1,72	1,08	1,20	0,86	1,11	1,28	1,14
78	HURGZ	0,92	0,82	0,73	1,22	0,75	2,12	1,41	1,71
79	IHEVA	1,96	5,53	2,06	5,16	4,96	6,99	9,11	6,41
80	IHGZT	1,16	3,26	1,53	2,49	1,86	6,68	4,58	4,68
81	ISDMR	1,53	2,33	2,72	2,36	2,60	2,15	2,85	3,31
82	IZDMC	-0,48	-0,45	-0,41	-0,52	-0,37	-0,29	-0,33	-0,18
83	JANTS	1,63	1,51	1,69	1,75	1,26	2,37	1,67	3,03
84	KAPLM	0,41	0,63	0,32	0,82	0,35	1,57	0,53	2,77
85	KARDMD	0,82	0,53	0,84	0,66	0,73	0,70	0,68	1,12
86	KARSN	0,05	0,36	0,22	0,89	0,06	1,15	0,54	1,19
87	KRTEK	0,64	0,64	0,63	0,55	0,77	0,87	0,60	0,89
88	KARTN	1,35	1,23	1,31	1,33	1,19	1,59	1,24	35,36
89	KATMR	0,56	0,97	0,92	1,01	0,93	1,29	1,10	1,32
90	KENT	1,71	1,86	1,67	2,98	1,60	102,88	1,99	100,83
91	KERVT	1,17	1,85	1,31	1,97	1,40	2,07	1,68	2,00
92	KLMSN	1,31	1,13	1,37	1,38	1,22	1,28	1,52	1,43
93	KONFRT	1,59	1,80	1,93	2,39	3,21	2,69	1,64	2,08
94	KONYA	8,21	7,02	8,06	8,66	10,05	16,36	11,03	27,95
95	KORDS	1,07	0,74	1,05	0,53	0,88	0,66	0,82	0,91
96	KRSTL	3,30	5,73	3,98	10,49	5,06	10,94	6,57	17,56
97	KUTPO	2,18	2,62	2,15	7,79	2,45	6,08	2,72	9,51
98	LUKSK	1,24	1,45	1,20	1,77	1,29	2,57	1,66	2,82
99	MAKTK	1,72	1,72	2,46	2,77	3,12	3,10	3,40	5,28
100	MRSHL	0,85	1,10	0,79	1,32	0,97	4,94	1,92	5,12
101	MNDRS	0,32	0,21	0,28	0,53	0,46	0,77	0,40	0,58
102	OLMK	0,81	1,83	0,60	1,79	0,75	3,07	0,56	3,63
103	TIRE	0,90	1,82	0,73	1,84	0,84	1,79	1,37	1,88
104	NIBAS	13,70	7,73	12,15	11,71	15,04	26,53	9,38	64,49
105	NUHCM	1,41	2,22	1,21	2,77	1,43	3,25	2,23	6,93
106	OTKAR	1,15	1,21	1,68	1,57	1,80	1,32	1,82	2,20
107	OYLUM	0,24	2,68	0,82	2,43	0,97	3,17	1,44	3,00
108	OZBAL	-1,68	-0,07	-1,72	0,64	-1,78	1,13	-0,75	0,78
109	PARSN	0,50	0,58	0,74	0,74	0,56	0,75	0,75	0,92
110	PENGD	-0,20	0,11	-0,17	-0,02	0,09	3,16	0,01	3,96
111	PETKM	1,03	0,94	1,18	1,05	1,07	1,00	1,00	1,29
112	PETUN	1,35	1,63	1,52	2,18	1,69	2,43	1,86	2,46
113	PINSU	-0,43	-0,39	-0,37	-0,17	-0,21	0,15	-0,25	-0,12
114	PNSUT	0,92	1,14	0,88	1,18	1,01	1,24	1,18	1,28
115	PRZMA	4,15	12,33	4,49	9,65	8,29	3,29	8,93	5,56
116	ROYAL	-0,04	0,23	0,23	0,18	0,25	0,47	0,22	0,51
117	RTLAB	4,35	6,13	3,66	18,64	6,95	18,88	5,12	9,54
118	SANFM	0,31	0,80	0,28	0,82	0,40	1,19	0,81	1,53
119	SAMAT	0,33	0,07	0,51	1,32	0,80	1,51	0,23	3,61
120	SARKY	1,39	1,54	1,23	1,56	1,15	1,89	1,32	1,96
121	SAYAS	0,34	1,76	0,61	4,16	0,95	2,97	1,50	2,21
122	SASA	0,89	0,60	0,74	0,77	0,42	0,78	0,41	1,24
123	SEKUR	0,79	0,59	0,49	0,68	0,53	0,94	0,71	0,98
124	SELGD	3,10	4,39	2,88	5,71	3,25	18,12	5,27	32,95
125	SILVR	0,57	0,79	0,81	1,09	0,85	1,17	1,02	1,74
126	SKTAS	-0,08	-0,59	-0,44	-0,55	-0,53	-0,14	-0,37	-0,04
127	SNPAM	2,81	4,42	3,23	6,90	3,64	10,73	4,56	13,80
128	TATGD	2,25	2,68	1,99	2,87	1,95	2,45	2,35	2,42
129	TMPOL	1,07	1,09	0,89	1,34	0,95	1,39	1,23	1,57
130	TOASO	1,19	1,29	1,31	1,43	1,46	1,34	1,23	1,58
131	TUCLK	0,64	0,73	0,58	0,79	0,64	1,07	0,73	1,02
132	TUKAS	1,72	3,53	2,15	3,39	1,78	2,63	4,15	2,72
133	TMSN	1,36	0,84	1,19	1,18	1,23	1,44	1,23	2,28
134	TUPRS	1,07	0,62	1,11	0,66	1,14	0,84	0,98	0,88
135	PRKAB	1,14	1,66	1,12	2,21	1,32	2,88	1,67	3,38
136	TTRAK	1,12	1,46	1,07	2,15	1,47	2,32	1,82	3,17
137	TBORG	1,42	2,38	1,42	2,47	2,10	3,22	2,66	3,13
138	ULUSE	17,72	10,26	13,40	12,17	13,08	16,44	11,62	10,96
139	ULUUN	1,29	1,19	1,23	1,34	1,23	1,15	1,13	1,21
140	USAK	0,33	0,48	0,37	0,86	0,37	0,99	0,52	1,08
141	ULKER	1,59	1,18	1,25	1,62	1,23	1,67	1,27	1,56
142	VESBE	1,19	1,20	1,21	1,69	1,13	1,70	1,33	1,89
143	VESTL	0,12	0,14	0,20	0,28	0,15	0,28	0,20	0,55
144	VKING	-0,72	-0,57	-0,81	-0,49	-0,86	-0,58	-0,70	-0,31
145	YATAS	1,53	1,68	1,65	1,85	1,83	2,06	1,94	2,52
146	YUNSA	0,70	1,27	0,77	1,36	0,62	1,72	1,31	1,58

Source: Authors' Compilation

The companies' determination within the research scope according to the Altman Z values in Table 4 for the years 2019-2020 according to the threshold values (Table 3) is given in Table 5. Again, RoFF (Risk of Financial Failure) was used for companies with a risk of financial failure, NRoFF (No Risk of Financial Failure) for companies with no risk of financial failure, and UN (Uncertain) for companies with an uncertain risk of financial failure.

Table 5: Financial Status According to Altman Z Values of Manufacturing Companies for 2019-2020

No.	Code	Altman Z-Financial Status							
		2019/3	2020/3	2019/6	2020/6	2019/9	2020/9	2019/12	2020/12
1	ACSEL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
2	ADEL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
3	AFYON	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
4	AKCNS	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
5	ATEKS	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
6	AKSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
7	ALCAR	NRoFF	UC	UC	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
8	ALKA	RoFF	NRoFF	UC	NRoFF	UC	NRoFF	NRoFF	NRoFF
9	ALKIM	UC	UC	UC	NRoFF	UC	NRoFF	UC	NRoFF
10	AEFES	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
11	ARCLK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
12	ARSAN	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
13	ASUZU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
14	AVOD	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
15	AYGAZ	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF
16	BAGFS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
17	BAKAB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
18	BANVT	RoFF	RoFF	UC	UC	UC	UC	UC	UC
19	BRKSN	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
20	BLCYT	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	UC	NRoFF
21	BNTAS	NRoFF	NRoFF	UC	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
22	BSOKE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
23	BTCIM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
24	BRKO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
25	BRMEN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
26	BRSAN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
27	BOSSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
28	BFREN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
29	BRISA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
30	BURCE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
31	BURVA	RoFF	NRoFF	RoFF	NRoFF	UC	NRoFF	NRoFF	NRoFF
32	BUCIM	RoFF	UC	RoFF	UC	RoFF	UC	UC	NRoFF
33	CCOLA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
34	CELHA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
35	CEMAS	RoFF	UC	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
36	CEMTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
37	CMBTN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
38	CMENT	UC	RoFF	UC	UC	UC	NRoFF	UC	NRoFF
39	CIMSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
40	CUSAN	RoFF	RoFF	RoFF	UC	RoFF	UC	RoFF	UC
41	DAGI	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
42	DARDL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
43	DMSAS	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
44	DERIM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
45	DESA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
46	DEVA	RoFF	UC	RoFF	UC	RoFF	UC	UC	UC
47	DIRIT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
48	DITAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
49	DOBUR	RoFF	RoFF	UC	NRoFF	RoFF	NRoFF	UC	NRoFF
50	DGKLB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
51	DOGUB	RoFF	UC	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
52	DOKTA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
53	DURDO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
54	DYOBY	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
55	EGEEN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
56	EGGUB	RoFF	RoFF	RoFF	RoFF	RoFF	UC	UC	UC
57	EGPRO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
58	EGESER	UC	RoFF	UC	UC	UC	UC	UC	NRoFF
59	EPLAS	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	UC	NRoFF
60	EKIZ	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
61	EMKEL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
62	EMNIS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
63	ERBOS	UC	UC	UC	NRoFF	UC	NRoFF	UC	NRoFF
64	EREGL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
65	ERSU	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	UC	NRoFF
66	FMZIP	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
67	FROTO	UC	UC	UC	UC	UC	UC	UC	NRoFF
68	FORMT	UC	RoFF	UC	RoFF	RoFF	RoFF	RoFF	RoFF
69	FRIGO	RoFF	RoFF	RoFF	UC	RoFF	NRoFF	RoFF	UC
70	GEDZA	UC	UC	UC	NRoFF	UC	NRoFF	UC	NRoFF
71	GENTS	UC	UC	UC	NRoFF	UC	NRoFF	UC	NRoFF
72	GEREL	RoFF	RoFF	RoFF	UC	RoFF	UC	RoFF	UC
73	GOODY	RoFF	RoFF	RoFF	UC	RoFF	UC	UC	NRoFF
74	GOLTS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
75	GUBRF	RoFF	RoFF	RoFF	UC	RoFF	UC	RoFF	NRoFF
76	HATEK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
77	HEKTS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
78	HURGZ	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	RoFF
79	IHEVA	UC	NRoFF	UC	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
80	IHGZT	RoFF	NRoFF	RoFF	UC	UC	NRoFF	NRoFF	NRoFF
81	ISDMR	RoFF	UC	UC	UC	UC	UC	UC	NRoFF
82	IZDMC	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
83	JANTS	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	NRoFF
84	KAPLM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
85	KARDMD	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
86	KARSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
87	KRTEK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
88	KARTN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
89	KATMR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
90	KENT	RoFF	UC	RoFF	UC	RoFF	NRoFF	UC	NRoFF

91	KERVT	RoFF	UC	RoFF	UC	RoFF	UC	RoFF	UC
92	KLMSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
93	KONFRT	RoFF	RoFF	UC	UC	NRoFF	UC	RoFF	UC
94	KONYA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
95	KORDS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
96	KRSTL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
97	KUTPO	UC	UC	UC	NRoFF	UC	NRoFF	UC	NRoFF
98	LUKSK	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
99	MAKTK	RoFF	RoFF	UC	UC	NRoFF	NRoFF	NRoFF	NRoFF
100	MRSHL	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	UC	NRoFF
101	MNDRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
102	OLMK	RoFF	UC	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
103	TIRE	RoFF	UC	RoFF	UC	RoFF	RoFF	RoFF	UC
104	NIBAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
105	NUHCM	RoFF	UC	RoFF	UC	RoFF	NRoFF	UC	NRoFF
106	OTKAR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC	UC
107	OYLUM	RoFF	UC	RoFF	UC	RoFF	NRoFF	RoFF	NRoFF
108	OZBAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
109	PARSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
110	PENGD	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
111	PETKM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
112	PETUN	RoFF	RoFF	RoFF	UC	RoFF	UC	UC	UC
113	PINSU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
114	PNSUT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
115	PRZMA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
116	ROYAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
117	RTLAB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
118	SANFM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
119	SAMAT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
120	SARKY	RoFF	RoFF	RoFF	RoFF	RoFF	UC	RoFF	UC
121	SAYAS	RoFF	RoFF	RoFF	NRoFF	RoFF	UC	RoFF	UC
122	SASA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
123	SEKUR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
124	SELGD	NRoFF	NRoFF	UC	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
125	SILVR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
126	SKTAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
127	SNPAM	UC	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
128	TATGD	UC	UC	UC	UC	UC	UC	UC	UC
129	TMPOL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
130	TOASO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
131	TUCLK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
132	TUKAS	RoFF	NRoFF	UC	NRoFF	RoFF	UC	NRoFF	UC
133	TMSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
134	TUPRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
135	PRKAB	RoFF	RoFF	RoFF	UC	RoFF	UC	RoFF	NRoFF
136	TIRAK	RoFF	RoFF	RoFF	UC	RoFF	UC	UC	NRoFF
137	TBORG	RoFF	UC	RoFF	UC	UC	NRoFF	UC	NRoFF
138	ULUSE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
139	ULUUN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
140	USAK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
141	ULKER	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
142	VESBE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	UC
143	VESTL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
144	VKING	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
145	YATAS	RoFF	RoFF	RoFF	UC	UC	UC	UC	UC
146	YUNSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
TOTAL	NO RISK OF FAILURE	14	22	13	32	19	41	22	51
	RISK OF FINANCIAL FAILURE	120	104	112	88	111	75	96	64
	UNCERTAIN	12	20	21	26	16	30	28	31

Source: Authors' Compilation

When Table 5 is examined, it is seen that in the period of 2019/3, when the number of financially unsuccessful firms was the highest, 120 of 146 firms failed Altman Z scores. According to the Altman Z-score, it is seen that the period with the highest success belongs to 2020/12 where 51 out of 146 companies are successful. The companies that have been successful in each quarter with the Altman Z Score calculated for the period 2019-2020 are: ACSEL, BFREN, CEMTS, EGEEN, FMZIP, KONYA, KRSTL, NIBAS, PRZMA, RTLAB, ULUSE. Companies that failed in terms of Altman Z Score in all periods are: ADEL, AKSA, AEFES, ARCLK, BAGFS, BSOKE, BTCIM, BRKO, BRMEN, BRSAN, BOSSA, BRISA, BURCE, COLA, CELHA, CIMSA, DAGI, DARDNL, DERİM, DESA, DIRIT, DITAS, DGKLB, DOKTA, DURDO, DYOBY, EKİZ, EMKEL, GOLTS, HATEK, HEKTS, IZDMC, KARDMD, KARSN, KRTEK, KATMR, KLMSN, KORDS, MNDRS, PETKM, PINSU, PNSUT, ROYAL, SANFM, SASA, SEKUR, SILVR, SKTAS, TMPOL, TOASO, TUCLK, TUPRS, ULUUN, USAK, ULKER, VESTL, VKING, YUNSA.

86	KARSN	0,06	0,16	0,17	0,24	0,14	0,41	0,23	0,61
87	KRTEK	0,50	0,42	0,53	0,32	0,57	0,41	0,30	0,43
88	KARTN	1,16	1,03	1,12	1,13	0,93	1,32	0,97	1,35
89	KATMR	0,43	0,74	0,78	0,75	0,84	0,91	0,84	0,86
90	KENT	0,65	0,70	0,72	0,68	0,57	0,67	0,63	0,53
91	KERVY	0,73	0,79	0,83	0,76	0,83	0,78	0,75	1,02
92	KLMSN	0,81	0,60	0,84	0,72	0,67	0,70	0,73	0,79
93	KONFRT	0,79	0,53	1,00	0,63	0,61	0,45	0,32	0,46
94	KONYA	0,56	0,40	0,56	0,59	0,77	0,90	0,71	0,70
95	KORDS	0,46	0,31	0,46	0,07	0,37	0,21	0,33	0,36
96	KRSTL	0,79	0,79	0,66	0,78	0,74	0,78	0,67	0,51
97	KUTPO	0,99	0,89	0,95	0,90	0,90	0,93	1,12	1,33
98	LUKSK	0,44	0,37	0,57	0,36	0,45	0,54	0,52	0,83
99	MAKTK	0,86	0,73	0,89	0,49	0,94	0,68	0,64	0,71
100	MRSHL	0,65	0,59	0,63	0,52	0,60	0,49	0,84	0,51
101	MNDRS	0,15	0,04	0,12	0,19	0,28	0,36	0,13	0,39
102	OLMK	0,49	0,57	0,38	0,58	0,47	0,56	0,32	0,77
103	TIRE	0,41	0,43	0,35	0,47	0,41	0,41	0,37	0,54
104	NIBAS	0,15	0,24	0,16	0,17	0,27	0,10	0,46	-0,15
105	NUHCM	0,38	0,75	0,37	0,80	0,42	0,80	0,56	0,70
106	OTKAR	0,58	0,68	1,16	0,81	1,08	0,67	0,89	0,99
107	OYLUM	0,33	0,62	0,36	0,68	0,33	0,66	0,44	0,62
108	OZBAL	-0,64	0,06	-0,76	0,19	-0,72	0,16	-0,27	-0,01
109	PARSN	0,13	0,13	0,07	0,04	0,02	0,05	0,03	0,27
110	PENGD	0,01	0,04	0,13	-0,07	0,25	0,45	0,03	0,56
111	PEIKM	0,59	0,51	0,62	0,56	0,56	0,57	0,51	0,62
112	PETUN	0,36	0,46	0,47	0,42	0,55	0,42	0,47	0,47
113	PINSU	0,10	0,09	0,19	0,10	0,35	0,27	0,14	-0,03
114	PNSUT	0,38	0,47	0,35	0,37	0,34	0,34	0,43	0,37
115	PRZMA	0,32	0,71	0,41	0,41	0,54	0,46	0,60	0,64
116	ROYAL	0,20	0,44	0,46	0,27	0,28	0,47	0,25	0,58
117	RTLAB	0,78	0,96	1,15	1,64	0,09	1,05	0,34	1,32
118	SANFM	0,24	0,33	0,25	0,32	0,32	0,38	0,37	0,46
119	SAMAT	0,19	0,18	0,29	0,50	0,44	0,41	-0,02	0,60
120	SARKY	0,70	0,73	0,62	0,69	0,58	0,84	0,58	0,82
121	SAYAS	0,42	0,87	0,66	1,35	0,70	0,79	0,69	1,19
122	SASA	0,13	-0,16	0,03	-0,04	-0,11	-0,10	-0,15	0,15
123	SEKUR	0,57	0,37	0,40	0,40	0,36	0,31	0,42	0,26
124	SELGD	0,67	0,47	0,67	0,45	0,68	0,69	1,04	0,85
125	SILVR	0,16	0,40	0,33	0,27	0,33	0,46	0,42	0,50
126	SKTAS	0,22	-0,08	0,07	-0,16	-0,01	-0,02	0,06	0,05
127	SNPAM	0,33	0,39	0,32	0,09	0,25	0,21	0,77	0,59
128	TATGD	1,01	1,22	1,00	1,06	0,88	0,87	1,04	0,58
129	TMPOL	0,60	0,38	0,47	0,44	0,46	0,52	0,46	0,62
130	TOASO	0,44	0,49	0,47	0,42	0,48	0,52	0,55	0,61
131	TUCLK	0,26	0,22	0,23	0,17	0,29	0,26	0,17	0,41
132	TUKAS	0,40	0,57	0,41	0,49	0,38	0,56	0,50	0,50
133	TMSN	0,34	0,23	0,30	0,38	0,24	0,46	0,24	0,70
134	TUPRS	0,29	0,01	0,36	0,16	0,29	0,28	0,24	0,23
135	PRKAB	0,65	0,69	0,65	0,76	0,75	0,71	0,78	0,77
136	TTRAK	0,51	0,71	0,47	0,78	0,60	0,96	0,80	1,21
137	TBORG	0,53	0,61	0,70	0,77	1,16	1,14	1,04	1,00
138	ULUSE	1,61	0,87	1,17	0,94	1,31	0,98	1,20	0,92
139	ULUUN	0,67	0,62	0,72	0,63	0,61	0,56	0,61	0,66
140	USAK	0,16	0,30	0,22	0,38	0,20	0,41	0,32	0,37
141	ULKER	0,91	0,46	0,54	0,71	0,58	0,68	0,47	0,98
142	VESBE	0,36	0,40	0,45	0,53	0,41	0,60	0,43	0,73
143	VESTL	0,09	0,16	0,15	0,18	0,13	0,25	0,17	0,38
144	VKING	-0,06	-0,05	-0,20	-0,07	-0,23	-0,20	-0,17	-0,20
145	YATAS	0,88	1,08	1,15	0,83	1,06	1,34	1,22	1,41
146	YUNSA	0,51	0,75	0,53	0,46	0,41	0,68	0,61	0,57

Source: Authors' Compilation

The determination of the companies within the scope of the research according to the Springate values in Table 6 for the years 2019-2020 according to the threshold values (Table 3) is given in Table 7. RoFF (Risk of Financial Failure) was used for companies with a risk of financial failure and NRoFF (No Risk of Financial Failure) for companies with no risk of financial failure.

Table 7: Financial Status According to Springate Values of Manufacturing Companies for 2019-2020

No.	Code	Springate-Financial Status							
		2019/3	2020/3	2019/6	2020/6	2019/9	2020/9	2019/12	2020/12
1	ACSEL	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
2	ADEL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
3	AFYON	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
4	AKCNS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
5	ATEKS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
6	AKSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
7	ALCAR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
8	ALKA	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
9	ALKIM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
10	AEFES	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
11	ARCLK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
12	ARSAN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
13	ASUZU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
14	AVOD	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
15	AYGAZ	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF

16	BAGFS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
17	BAKAB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
18	BANVT	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF
19	BRKSN	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
20	BLCYT	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF
21	BNTAS	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	RoFF
22	BSOKE	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
23	BTCIM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
24	BRKO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
25	BRMEN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
26	BRSAN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
27	BOSSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
28	BFREN	NRoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF
29	BRISA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
30	BURCE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
31	BURVA	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF
32	BUCIM	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
33	CCOLA	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF
34	CELHA	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF
35	CEMAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
36	CEMTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
37	CMBTN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
38	CMENT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
39	CIMSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
40	CUSAN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
41	DAGI	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
42	DARDL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
43	DMSAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
44	DERIM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
45	DESA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
46	DEVA	RoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
47	DIRIT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
48	DITAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
49	DOBUR	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
50	DGKLB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
51	DOGUB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
52	DOKTA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
53	DURDO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
54	DYOBY	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
55	EGEEN	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
56	EGGUB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
57	EGPRO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
58	EGESER	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
59	EPLAS	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
60	EKIZ	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
61	EMKEL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
62	EMNIS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
63	ERBOS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF
64	EREGL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
65	ERSU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
66	FMZIP	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
67	PROTO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
68	FORMT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
69	FRIGO	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
70	GEDZA	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
71	GENTS	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF
72	GEREL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
73	GOODY	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF
74	GOLTS	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
75	GUBRF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
76	HATEK	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
77	HEKTS	NRoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
78	HURGZ	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
79	IHEVA	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
80	IHGZI	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
81	ISDMR	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
82	IZDMC	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
83	JANTS	NRoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
84	KAPLM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
85	KARDMD	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
86	KARSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
87	KRIEK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
88	KARTN	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
89	KATMR	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF
90	KENT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
91	KERVY	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
92	KLMSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
93	KONFRT	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF
94	KONYA	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF
95	KORDS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
96	KRSTL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
97	KUIPO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
98	LUKSK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
99	MAKTK	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	RoFF	RoFF
100	MRSHL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
101	MNDRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
102	OLMK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
103	TIRE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
104	NIBAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
105	NUHCM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
106	OTKAR	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
107	OYLUM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
108	OZBAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
109	PARSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF

110	PENG	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
111	PETKM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
112	PETUN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
113	PINSU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
114	PNSUT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
115	PRZMA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
116	ROYAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
117	RTLAB	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
118	SANFM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
119	SAMAT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
120	SARKY	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
121	SAYAS	RoFF	NRoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF
122	SASA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
123	SEKUR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
124	SELGD	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
125	SILVR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
126	SKTAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
127	SNPAM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
128	TATGD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF
129	TMPOL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
130	TOASO	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
131	TUCLK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
132	TUKAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
133	TMSN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
134	TUPRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
135	PRKAB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
136	TTRAK	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
137	TBORG	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
138	ULUSE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
139	ULUUN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
140	USAK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
141	ULKER	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
142	VESBE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
143	VESTL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
144	VKING	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
145	YATAS	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
146	YUNSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
TOTAL	NO RISK OF FAILURE	20	20	25	23	21	36	27	38
	RISK OF FINANCIAL FAILURE	126	126	121	123	125	110	119	108

Source: Authors' Compilation

When Table 7 is examined, the period of 2020/12 is seen as the period with the highest success, and the Springate scores show a total of 38 companies being successful. The least successful periods were experienced in 2019/3 and 2019/6. Only 20 companies scored successfully within those periods. In Table 7, companies that are financially successful in all quarters in terms of Springate scores as of 2019-2020 and quarterly periods are as follows: ALCAR, ALKIM, CEMTS, KUTPO, ULUSE. The companies that failed in all periods are ADEL, AFYON, AKCNS, ATEKS, AKSA, AEFES, ARSAN, ASUZU, AVOD, AYGAZ, BAGFS, BAKAB, BTCIM, BRKO, BRMEN BRSAN, BOSSA, BRISA, BURCE, CEMAS, CMBTN, CMENT, CIMSA, CUSAN, DAGI, DARDL, DERİM, DIRIT, DGKLB, DOGUB, DOKTA, DURDO, DYOBY, EGGUB, EGPRO, EKİZ, EMKEL, EREGL, ERSU, FORMT, GEREL, GUBRF, IZDMC, KAPLM, KARDMD, KARSN, KENT, KLMSN, KORDS, KRSTL, LUKSK, MRSHL, MNDRS, OLMK, TIRE, NIBAS, NUHCM, OYLUM, OZBAL, PARSN, PENG, PETKM, PETUN, PINSU, PNSUT, PRZMA, ROYAL, SANFM, SAMAT, SARKY, TOASO, TUCLK, TUKAS, TMSN, TUPRS, PRKAB, ULUUN, USAK, VESBE, VESTL, VKING and YUNSA.

According to the formula in Table 3, the Taffler model's values of the BIST manufacturing companies within the scope of the research for the years 2019-2020 are given in Table 8.

Table 8: Taffler Model's Values of BIST Manufacturing Companies for 2019-2020

No.	Code	Taffler							
		2019/3	2020/3	2019/6	2020/6	2019/9	2020/9	2019/12	2020/12
1	ACSEL	9.41	13.79	12.59	18.67	9.47	18.67	10.22	23.28
2	ADEL	0.76	-0.24	-0.67	-0.64	-0.62	-0.80	0.46	-1.28
3	AFYON	-1.77	-2.50	-1.82	2.05	-1.59	2.56	-2.23	2.50
4	AKCNS	0.23	0.35	0.41	1.96	1.07	3.00	2.18	2.47
5	ATEKS	3.35	2.47	3.24	2.36	2.86	2.63	2.93	7.16
6	AKSA	0.97	0.52	0.57	0.22	0.71	2.11	0.29	3.18

101	MNDRS	-1,44	-2,81	-1,85	-1,39	-0,45	-2,19	-1,82	2,17
102	OLMK	-1,20	-0,07	-2,59	0,07	-1,30	0,03	-2,72	0,41
103	TIRE	-1,54	-1,37	-2,00	-1,30	-1,43	-1,26	-1,39	-0,70
104	NIBAS	3,68	6,21	3,05	4,56	3,78	2,91	10,49	-3,13
105	NUHCM	2,91	6,35	3,09	9,06	3,34	8,06	5,13	7,32
106	OTKAR	-0,44	1,10	2,88	2,09	3,98	1,33	2,12	2,59
107	OYLUM	1,23	3,81	2,00	4,57	2,02	5,23	1,99	3,92
108	OZBAL	-8,01	-0,97	-8,34	-0,47	-8,33	1,40	-4,50	-1,74
109	PARSN	1,61	2,31	1,05	0,88	0,51	2,32	0,96	3,52
110	PENGD	-3,00	-0,90	-3,34	-1,42	-2,71	3,31	-0,48	4,65
111	PETKM	3,24	2,41	3,17	3,01	2,73	2,82	2,27	4,00
112	PETUN	3,67	5,09	4,99	4,73	5,85	5,07	6,02	6,16
113	PINSU	-3,78	-3,61	-3,99	-3,65	-2,88	-3,34	-2,67	-3,68
114	PNSUT	2,00	2,53	1,48	1,84	1,53	1,60	2,29	1,47
115	PRZMA	7,65	20,13	10,31	10,38	10,53	3,77	11,24	14,72
116	ROYAL	-3,66	-0,62	-1,69	-1,29	-1,88	-0,41	-2,47	0,34
117	RTLAB	19,13	16,33	20,10	23,52	13,09	12,23	9,70	9,71
118	SANFM	2,59	3,66	3,88	4,02	3,21	5,26	16,58	6,14
119	SAMAT	-1,22	-2,06	-1,53	0,17	-1,35	0,36	-4,01	0,74
120	SARKY	0,50	1,12	-0,37	1,46	-0,25	1,71	-0,13	1,11
121	SAYAS	0,75	0,74	1,28	4,38	1,64	0,74	-0,29	3,51
122	SASA	1,30	-1,60	0,34	0,09	0,07	-2,17	-1,41	0,89
123	SEKUR	0,51	0,97	1,02	0,54	1,30	0,66	1,32	0,38
124	SELGD	7,37	7,60	7,48	7,07	7,63	10,40	14,97	15,64
125	SILVR	-2,56	-1,80	-1,01	-1,94	-1,76	-2,37	-1,44	-1,65
126	SKTAS	0,29	-2,76	-1,18	-3,07	-0,77	-0,97	-1,52	-0,44
127	SNPAM	4,72	5,51	5,73	1,70	3,90	2,69	14,48	8,90
128	TATGD	5,45	7,19	5,66	5,72	3,99	3,28	5,45	4,71
129	TMPOL	2,18	0,07	0,65	0,25	0,77	0,31	1,34	0,57
130	TOASO	0,23	0,69	0,12	0,69	0,75	0,43	1,04	0,30
131	TUCLK	0,86	0,92	0,40	0,56	1,50	0,42	-0,59	0,51
132	TUKAS	-0,01	1,84	0,51	1,64	0,00	1,82	1,39	2,51
133	TMSN	1,27	1,93	0,79	2,67	1,57	3,14	2,19	4,69
134	TUPRS	-0,30	-1,93	0,09	-0,53	-0,43	-0,01	-0,82	-0,26
135	PRKAB	0,10	0,84	-0,17	0,98	0,61	0,47	1,35	0,43
136	TTRAK	0,23	1,00	-0,43	2,26	0,65	3,03	2,18	5,00
137	TBORG	-0,12	1,08	0,04	1,74	3,50	4,99	3,79	3,13
138	ULUSE	23,87	7,39	14,81	8,81	14,54	8,61	11,81	3,50
139	ULUUN	-0,32	-0,79	-0,11	-0,50	-0,64	-0,71	-0,68	-0,50
140	USAK	-0,61	-0,13	-0,68	0,86	-0,97	1,39	-0,11	0,85
141	ULKER	6,82	-0,17	2,56	4,30	3,19	3,65	1,00	5,87
142	VESBE	0,18	0,01	-0,28	0,82	-0,31	0,65	-0,20	2,35
143	VESTL	-3,58	-2,55	-3,39	-2,39	-3,39	-2,27	-3,24	-1,12
144	VKING	-4,04	-3,95	-4,92	-4,20	-5,23	-5,11	-4,40	-5,55
145	YATAS	1,57	2,16	2,56	2,01	2,52	3,98	1,99	3,60
146	YUNSA	-1,76	0,09	-1,59	0,07	-2,25	1,14	-1,11	0,78

Source: Authors' Compilation

The companies' determination within the research scope according to the Taffler values in Table 8 for the years 2019-2020 according to the threshold values (Table 3) is given in Table 9. RoFF (Risk of Financial Failure) was used for companies with a risk of financial failure and NRoFF (No Risk of Financial Failure) for companies with no risk of financial failure.

Table 9: Financial Status According to Taffler Model's Values of Manufacturing Companies for 2019-2020

No.	Code	Taffler-Financial Status							
		2019/3	2020/3	2019/6	2020/6	2019/9	2020/9	2019/12	2020/12
1	ACSEL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
2	ADEL	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
3	AFYON	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
4	AKCNS	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
5	ATEKS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
6	AKSA	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF
7	ALCAR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
8	ALKA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
9	ALKIM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
10	AEPES	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
11	ARCLK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
12	ARSAN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
13	ASUZU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
14	AVOD	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	RoFF	RoFF
15	AYGAZ	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
16	BAGFS	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF
17	BAKAB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
18	BANVT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF
19	BRKSN	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF
20	BLCYT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
21	BNTAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
22	BSOKE	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF
23	BTCIM	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF
24	BRKO	NRoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
25	BRMEN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
26	BRSAN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
27	BOSSA	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
28	BFREN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
29	BRISA	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF
30	BURCE	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF

31	BURVA	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF
32	BUCIM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
33	COLLA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
34	CELHA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
35	CEMAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
36	CEMTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
37	CMBTN	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
38	CMENT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
39	CIMSA	RoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	RoFF
40	CUSAN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
41	DAGI	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
42	DARDL	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
43	DMSAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
44	DERIM	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
45	DESA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
46	DEVA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
47	DIRIT	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
48	DITAS	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF
49	DOBUR	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
50	DGKLB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
51	DOGUB	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
52	DOKTA	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
53	DURDO	RoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
54	DYOBY	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
55	EGEEN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
56	EGGUB	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF
57	EGPRO	RoFF	NRoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
58	EGESER	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
59	EPLAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
60	EKIZ	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
61	EMKEL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
62	EMNIS	RoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
63	ERBOS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
64	EREGL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
65	ERSU	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
66	FMZIP	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
67	FROTO	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF
68	FORMT	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF
69	FRIGO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
70	GEDZA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
71	GENTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
72	GEREL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF
73	GOODY	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
74	GOLTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
75	GUBRF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
76	HATEK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
77	HEKTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
78	HURGZ	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
79	IHEVA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
80	IHGZT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
81	ISDMR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
82	IZDMC	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
83	JANTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
84	KAPLM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
85	KARDMD	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
86	KARSN	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
87	KRIEK	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF
88	KARTN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
89	KATMR	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
90	KENT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
91	KERVY	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
92	KLMSN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
93	KONFRT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	RoFF
94	KONYA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
95	KORDS	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
96	KRSTL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
97	KUTPO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
98	LUKSK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
99	MAKTK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
100	MRSHL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
101	MNDRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
102	OLMK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
103	TIRE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
104	NIBAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF
105	NUHCM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
106	OTKAR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
107	OYLUM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
108	OZBAL	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF
109	PARSN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
110	PENGD	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
111	PETKM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
112	PETUN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
113	PINSU	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF
114	PNSUT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
115	PRZMA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
116	ROYAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
117	RTLAB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
118	SANFM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
119	SAMAT	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
120	SARKY	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
121	SAYAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF
122	SASA	NRoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
123	SEKUR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
124	SELGD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF

125	SILVR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
126	SKTAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
127	SNPAM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
128	TATGD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
129	TMPOL	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
130	TOASO	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF
131	TUCLK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF
132	TUKAS	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF
133	TMSN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
134	TUPRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
135	PRKAB	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
136	TTRAK	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
137	TBORG	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
138	ULUSE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
139	ULUUN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
140	USAK	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
141	ULKER	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
142	VESBE	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
143	VESTL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
144	VKING	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
145	YATAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
146	YUNSA	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF
TOTAL	NO RISK OF FAILURE	93	93	97	93	103	107	92	112
	RISK OF FINANCIAL FAILURE	53	53	49	53	43	39	54	34

Source: Authors' Compilation

When Table 9 is examined, a total of 112 companies showed success in the period of 2020/12, when the number of companies with the highest Taffler score was successful. It is seen that the Taffler score shows a total of 54 companies that failed in the 2019/12 period when the success was the lowest. Companies with financially successful Taffler score in all periods include: ACSEL, ATEKS, ALCAR, ALKA, ALKİM, AEFES, ARCLK, ARSAN, AYGAZ, BAKAB, BLCYT, BNTAS, BRSAN, BFREN, BUCİM, COLA, CEMTS, CMENT, CUSAN, DAGI , DMSAS, DEVA, EGEEN, EGESER, EPLAS, ERBOS, EREGL, ERSU, FMZIP, FRIG, GEDZA, GENTS, HATEK, HEKTS, HURGZ, IHEVA, IHGZT, ISDMR, JANTS, KARTN, KENT, KERVTYA, KLMSN, RSTLKON , KUTPO, LUKSK, MAKTK, NUHCM, OTKAR, OYLUM, PARSN, PETKM, PETUN, PNSUT, PRZMA, RTLAB, SANFM, SEKUR, SELGD, SNPAM, TATGD, ULUSE, YATAS. Companies with unsuccessful Taffler scores in all periods include: ASUZU, BRMEN, CELHA, DGKLB, DYOBY, EKİZ, EMKEL, GUBRF, IZDMC, KAPLM, MRSHL, TIRE, SILVR, SKTAS, TUPRS, ULUUN, VESTL, VKING.

According to the formula in Table 3, the Zmijewski model's values of the BIST manufacturing companies within the scope of the research for the years 2019-2020 are given in Table 10.

Table 10: Zmijewski Values of BIST Manufacturing Companies for 2019-2020

No.	Code	Zmijewski							
		2019/3	2020/3	2019/6	2020/6	2019/9	2020/9	2019/12	2020/12
1	ACSEL	-3,49	-3,56	-4,07	-3,78	-4,14	-4,00	-4,29	-4,20
2	ADEL	-0,94	-0,42	-0,46	-0,29	-0,44	-0,03	-0,81	0,10
3	AFYON	-0,34	0,11	-0,11	-2,53	0,10	-2,68	0,33	-2,68
4	AKCNS	-1,21	-1,08	-1,34	-1,30	-1,55	-1,61	-1,72	-1,64
5	ATEKS	-2,57	-2,30	-2,57	-2,33	-2,42	-2,19	-2,36	-2,71
6	AKSA	-0,73	-0,80	-0,73	-0,47	-0,95	-0,63	-0,98	-1,15
7	ALCAR	-2,62	-2,30	-2,27	-2,18	-2,66	-2,34	-2,63	-2,55
8	ALKA	-1,26	-2,28	-2,27	-3,47	-2,46	-3,80	-3,29	-3,98
9	ALKİM	-2,58	-3,00	-3,00	-2,91	-3,30	-3,24	-4,03	-3,88
10	AEFES	-1,55	-1,41	-1,48	-1,46	-1,60	-1,43	-1,70	-1,49
11	ARCLK	-0,19	-0,19	-0,20	-0,32	-0,26	-0,38	-0,31	-0,58
12	ARSAN	-2,19	-2,41	-2,62	-2,58	-2,83	-2,98	-2,50	-3,62
13	ASUZU	-0,39	-0,35	-0,32	-0,28	-0,49	-0,17	-0,69	-0,31
14	AVOD	-0,95	-0,44	-1,07	-0,34	-0,92	-0,03	-0,76	-0,21
15	AYGAZ	-1,00	-0,99	-1,36	-0,72	-1,47	-0,67	-1,70	-1,02
16	BAGFS	-0,08	0,08	-0,13	0,27	-0,58	0,73	-0,35	0,34
17	BAKAB	-0,95	-0,95	-0,84	-0,76	-1,09	-0,86	-1,11	-1,13
18	BANVT	-1,08	-1,22	-1,57	-1,03	-1,62	-0,93	-1,89	-0,39
19	BRKSN	-0,98	-0,76	-0,81	-0,72	-0,72	-1,01	-0,69	-1,34
20	BLCYT	-2,27	-3,71	-2,61	-3,57	-3,37	-3,92	-4,25	-3,97
21	BNTAS	-3,50	-3,63	-3,61	-3,65	-3,69	-3,72	-3,95	-3,84
22	BSOKE	-0,17	0,94	0,14	1,51	0,12	2,89	0,85	2,83
23	BTCİM	-0,57	0,13	-0,43	0,49	-0,46	1,33	-0,01	1,26
24	BRKO	-2,13	-1,99	-2,18	-1,80	-1,87	-1,96	-1,67	-2,32

25	BRMEN	-0,50	1,56	-0,11	2,25	0,28	2,55	0,43	-2,58
26	BRSAN	-1,05	-1,06	-1,23	-1,15	-1,15	-1,00	-1,01	-1,10
27	BOSSA	0,34	0,08	0,28	0,26	-0,10	0,31	-0,33	-0,28
28	BFREN	-2,94	-2,73	-2,89	-1,96	-3,24	-2,50	-3,26	-2,17
29	BRISA	0,35	0,39	0,42	0,38	0,37	0,02	0,36	-0,33
30	BURCE	-0,59	-1,37	-0,56	-1,03	-0,48	-1,37	-1,42	-1,35
31	BURVA	-0,30	-0,16	-0,34	0,32	-0,29	0,13	-0,57	-0,46
32	BUCIM	-3,03	-3,00	-3,12	-2,80	-3,11	-2,74	-2,99	-3,13
33	CCOLA	1,44	1,41	1,32	1,30	1,17	1,14	1,17	1,15
34	CELHA	0,41	0,82	0,49	1,10	0,48	1,26	0,83	1,04
35	CEMAS	-0,97	-3,02	-1,18	-3,75	-1,38	-4,00	-0,45	-3,51
36	CEMTS	-3,26	-3,46	-3,76	-3,85	-3,79	-3,65	-3,91	-4,33
37	CMBTN	-1,31	0,00	-1,07	0,21	-0,86	0,67	-0,46	0,69
38	CMENY	-2,81	-2,27	-2,64	-2,02	-2,51	-1,88	-2,42	-2,16
39	CIMSA	-0,88	-0,45	-0,82	-0,95	-0,88	-1,04	-0,85	-0,79
40	CUSAN	-1,25	-1,66	-1,48	-1,59	-1,79	-1,54	-1,79	-1,66
41	DAGI	-1,20	-1,07	-1,52	-1,20	-1,63	-1,48	-1,49	-1,86
42	DARDL	18,74	4,92	18,98	0,19	16,44	-0,06	10,55	-0,20
43	DMSAS	-0,93	-0,71	-0,85	-0,54	-1,02	-0,59	-1,17	-0,90
44	DERIM	0,58	0,13	0,75	0,13	0,81	0,18	0,78	0,22
45	DESA	0,15	0,03	0,09	0,17	-0,10	-0,03	-0,25	-0,12
46	DEVA	-1,35	-1,72	-1,60	-1,91	-1,79	-2,43	-1,97	-2,56
47	DIRIT	0,42	0,21	-0,73	-0,19	2,39	0,11	4,12	1,85
48	DITAS	-0,33	0,06	-0,48	0,13	-0,59	-0,08	-0,41	-0,32
49	DOBUR	-0,80	-0,56	-0,83	-0,26	-0,60	-0,38	-0,50	-0,21
50	DGKLB	1,08	1,51	1,25	1,69	1,21	1,59	1,73	1,15
51	DOGUB	-0,51	-2,66	-2,82	-2,36	-2,80	-2,32	-2,66	-2,01
52	DOKTA	0,71	1,13	0,51	1,15	0,45	1,04	0,79	0,65
53	DURDO	-0,06	0,30	-0,12	0,52	-0,25	0,90	-0,23	0,39
54	DYOBV	0,83	0,80	0,72	0,53	0,69	0,22	0,35	-0,47
55	EGBEN	-3,32	-3,08	-3,46	-2,85	-3,83	-3,32	-4,02	-3,59
56	EGGUB	-1,55	-0,79	-1,70	-1,16	-2,25	-1,78	-1,22	-1,94
57	EGPRO	-0,37	-0,58	-0,46	-0,49	-0,71	-0,39	-0,69	-1,25
58	EGESER	-2,79	-2,20	-2,61	-2,11	-2,50	-2,37	-2,68	-2,85
59	EPLAS	-0,62	-1,93	-0,77	-2,07	-1,20	-2,24	-0,90	-2,76
60	EKIZ	0,89	0,33	1,19	0,22	1,08	0,81	-0,02	0,16
61	EMKEL	0,67	0,18	0,33	0,26	0,36	0,48	0,27	0,41
62	EMNIS	3,25	5,09	3,46	4,79	4,29	4,46	5,10	-0,11
63	ERBOS	-2,57	-2,38	-2,55	-2,72	-2,85	-2,97	-2,28	-3,40
64	EREGL	-2,15	-2,46	-2,69	-2,45	-2,78	-2,56	-2,74	-2,90
65	ERSU	-2,85	-2,95	-2,62	-3,07	-2,82	-3,00	-2,82	-2,85
66	FMZIP	-4,34	-4,31	-5,08	-4,68	-5,41	-5,19	-5,83	-5,59
67	FROTO	-0,05	-0,13	-0,32	-0,12	-0,73	-0,22	-0,74	-1,01
68	FORMT	-1,32	-0,48	-1,23	-0,14	-1,35	-0,45	-0,26	-0,55
69	FRIGO	-0,56	-0,82	-1,14	-1,57	-1,70	-1,76	-1,19	-1,11
70	GEDZA	-2,76	-2,72	-2,76	-3,12	-3,14	-2,92	-3,05	-3,08
71	GENTS	-2,68	-2,82	-2,58	-2,72	-2,73	-2,80	-2,87	-2,81
72	GEREL	-1,62	-0,83	-1,03	-0,97	-0,70	-0,83	-0,34	-0,77
73	GOODY	-0,59	-1,01	-0,78	-1,88	-0,87	-1,94	-2,60	-2,08
74	GOLTS	-0,73	-0,70	-0,74	-0,63	-0,84	-0,42	-0,91	-0,51
75	GUBRF	0,00	0,20	0,14	0,06	0,16	0,14	0,46	-0,76
76	HATEK	-2,38	-2,61	-1,96	-2,47	-2,06	-2,34	-3,02	-2,60
77	HEKTS	-0,70	-1,32	-0,82	-0,88	-0,80	-0,92	-1,48	-0,96
78	HURGZ	-2,70	-2,59	-2,58	-2,34	-2,33	-2,16	-2,52	-2,01
79	IHEVA	-2,77	-3,20	-2,65	-3,12	-3,59	-3,55	-3,76	-3,79
80	IHGZT	-3,22	-3,06	-3,07	-2,73	-3,08	-2,62	-3,58	-2,79
81	ISDMR	-2,13	-2,91	-3,15	-2,92	-3,35	-2,98	-3,32	-3,41
82	IZDMC	1,49	1,49	1,09	2,17	1,16	2,67	1,55	1,33
83	JANTS	-2,25	-1,92	-2,70	-2,44	-3,01	-3,00	-3,32	-3,63
84	KAPLM	-0,49	-0,52	-0,35	-0,38	-0,07	-0,32	-0,17	-0,26
85	KARDMD	-1,28	-0,83	-1,39	-0,53	-1,34	-0,39	-1,08	-0,67
86	KARSN	0,77	-0,04	0,63	0,01	0,17	0,11	-0,10	-0,14
87	KRTEK	0,30	0,56	0,41	0,56	0,15	0,38	0,41	-0,27
88	KARTN	-3,56	-3,41	-3,70	-3,55	-3,83	-3,92	-4,01	-4,18
89	KATMR	0,94	0,90	0,93	1,01	0,56	1,04	0,78	0,34
90	KENT	-1,50	-1,48	-1,43	-1,62	-1,47	-2,68	-1,75	-2,77
91	KERVT	-0,13	-0,69	-0,16	-0,62	-0,25	-0,67	-0,83	-1,46
92	KLMSN	-0,08	0,18	-0,49	0,18	-0,77	0,22	-0,52	-0,04
93	KONFRT	-2,02	-1,15	-2,77	-1,64	-2,82	-1,29	-1,41	-1,04
94	KONYA	-3,43	-3,31	-3,35	-3,06	-3,47	-3,34	-3,47	-3,27
95	KORDS	-2,20	-2,32	-2,14	-1,39	-2,58	-2,33	-2,44	-2,50
96	KRSTL	-2,89	-2,67	-2,60	-2,70	-2,55	-2,57	-2,75	-3,15
97	KUTPO	-2,62	-2,66	-2,60	-2,83	-2,96	-2,75	-3,10	-2,94
98	LUKSK	-1,57	-1,49	-1,58	-1,14	-1,86	-0,79	-1,85	-1,59
99	MAKTK	-2,27	-2,55	-2,58	-2,14	-2,83	-2,29	-2,88	-2,47
100	MRSBL	0,44	0,31	0,42	0,42	0,30	0,38	-0,45	-5,22
101	MNDRS	0,55	1,27	0,76	1,52	0,45	1,90	0,79	0,04
102	OLMK	-0,40	-0,97	0,13	-0,72	0,04	-0,73	0,32	-0,71
103	TIRE	-0,45	-0,50	-0,21	-0,43	-0,27	-0,59	-0,34	-0,61
104	NIBAS	-2,88	-3,26	-2,44	-3,21	-2,57	-3,01	-3,42	-2,75
105	NUHCM	-2,07	-2,65	-1,99	-3,09	-2,32	-3,40	-2,71	-3,70
106	OTKAR	0,81	0,60	0,19	0,26	-0,26	-0,02	-0,53	-0,55
107	OYLUM	-1,08	-1,83	-1,43	-1,70	-1,45	-1,86	-1,20	-1,92
108	OZBAL	2,08	-0,06	2,47	-0,37	2,71	-0,95	1,98	-0,63
109	PARSN	-0,73	-1,11	-0,83	-0,97	-0,71	-1,01	-0,97	-1,34
110	PENGD	0,61	-1,11	0,89	-0,72	0,70	-1,99	-1,12	-2,42
111	PETKM	-0,45	-0,41	-0,49	-0,36	-0,55	-0,24	-0,45	-0,74
112	PETUN	-2,65	-2,85	-2,96	-3,25	-2,76	-2,78	-2,70	-3,02
113	PINSU	0,56	1,02	0,86	1,29	0,91	1,24	0,97	0,72
114	PNSUT	-1,80	-1,77	-1,81	-1,82	-1,86	-1,82	-2,01	-1,85
115	PRZMA	-3,48	-3,72	-3,36	-3,60	-3,34	-2,35	-3,56	-3,53
116	ROYAL	1,83	1,30	1,91	1,40	2,05	1,40	2,35	1,21
117	RTLAB	-3,93	-3,36	-4,16	-3,61	-4,22	-3,61	-3,85	-3,41
118	SANFM	0,30	0,19	0,34	0,30	0,32	0,24	0,04	-0,02

119	SAMAT	0,09	0,62	0,19	-0,37	0,39	-0,39	1,50	-0,78
120	SARKY	-0,48	-0,20	-0,33	-0,21	-0,42	-0,30	-0,31	-0,54
121	SAYAS	-0,57	-0,43	-0,63	-1,36	-0,83	-0,36	-0,53	-0,51
122	SASA	-1,10	-0,42	-1,09	-0,40	-1,28	0,05	-1,11	-0,24
123	SEKUR	0,01	-0,79	-0,73	-0,65	-1,13	-0,72	-0,87	-0,70
124	SELGD	-2,66	-2,94	-2,65	-3,00	-2,70	-3,23	-3,37	-3,64
125	SILVR	-0,07	0,32	-0,11	0,37	-0,02	0,48	0,33	0,21
126	SKTAS	0,56	1,32	0,74	1,51	0,78	0,77	0,93	0,39
127	SNPAM	-2,27	-2,75	-2,98	-2,64	-3,13	-2,42	-3,44	-2,85
128	TATGD	-2,00	-1,78	-1,75	-1,74	-1,69	-1,43	-2,00	-2,24
129	TMPOL	-0,47	-0,43	-0,57	-0,44	-0,90	-0,34	-1,10	-0,44
130	TOASO	-0,09	-0,15	-0,33	-0,24	-0,85	-0,03	-1,03	-0,30
131	TUCLK	-0,82	-0,62	-0,77	-0,47	-0,91	-0,39	-0,78	-0,52
132	TUKAS	-0,39	-0,96	-0,70	-1,09	-0,85	-0,86	-1,17	-1,56
133	TMSN	-1,62	-1,86	-1,46	-1,58	-1,68	-1,70	-1,89	-2,02
134	TUPRS	0,20	0,42	0,06	0,56	0,06	0,62	0,03	0,52
135	PRKAB	-0,69	-0,91	-0,65	-1,04	-0,97	-0,86	-1,15	-0,93
136	TTRAK	0,30	0,09	0,27	-0,16	0,02	-0,15	-0,09	-0,38
137	TBORG	-0,73	-1,32	-0,91	-1,33	-1,76	-2,06	-2,31	-2,30
138	ULUSE	-3,83	-2,61	-3,65	-2,74	-3,68	-2,87	-3,67	-2,11
139	ULUUN	0,15	0,22	-0,11	0,14	0,04	0,19	0,11	0,00
140	USAK	-0,60	-0,29	-0,59	-0,73	-0,46	-1,02	-0,40	-1,04
141	ULKER	-0,74	-0,66	-0,86	-0,90	-0,97	-0,91	-1,11	-0,89
142	VESBE	-0,91	-0,79	-0,72	-1,17	-1,05	-1,04	-1,17	-1,65
143	VESTL	0,46	0,24	0,34	0,06	0,30	0,03	0,24	-0,44
144	VKING	1,05	1,54	1,42	1,72	1,74	2,15	1,87	2,25
145	YATAS	-0,81	-0,99	-1,12	-0,85	-1,37	-1,04	-1,38	-1,26
146	YUNSA	0,01	-0,21	-0,06	-0,22	0,13	-0,45	-0,19	-0,46

Source: Authors' Compilation

The companies' determination within the research scope according to the Zmijewski values in Table 10 for the years 2019-2020 according to the threshold values (Table 3) is given in Table 11. RoFF (Risk of Financial Failure) was used for companies with a risk of financial failure and NRoFF (No Risk of Financial Failure) for companies with no risk of financial failure.

Table 11: Financial Status According to Zmijewski Model's Values of Manufacturing Companies for 2019-2020

No.	Code	Zmijewski-Financial Status							
		2019/3	2020/3	2019/6	2020/6	2019/9	2020/9	2019/12	2020/12
1	ACSEL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
2	ADEL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF
3	AFYON	NRoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
4	AKCNS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
5	ATEKS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
6	AKSA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
7	ALCAR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
8	ALKA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
9	ALKIM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
10	AEFES	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
11	ARCLK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
12	ARSAN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
13	ASUZU	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
14	AVOD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
15	AYGAZ	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
16	BAGFS	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF
17	BAKAB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
18	BANVT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
19	BRKSN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
20	BLCYT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
21	BNTAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
22	BSOKE	NRoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
23	BTCIM	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF
24	BRKO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
25	BRMEN	NRoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
26	BRSAN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
27	BOSSA	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
28	BFREN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
29	BRISA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
30	BURCE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
31	BURVA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
32	BUCIM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
33	CCOLA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
34	CELHA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
35	CEMAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
36	CEMTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
37	CMBTN	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF
38	CMENT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
39	CIMSA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
40	CUSAN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
41	DAGI	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
42	DARDL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
43	DMSAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
44	DERIM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
45	DESA	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
46	DEVA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF

47	DIRIT	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
48	DITAS	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
49	DOBUR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
50	DGKLB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
51	DOGUB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
52	DOKTA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
53	DURDO	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF
54	DYOBY	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
55	EGEEN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
56	EGGUB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
57	EGPRO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
58	EGESER	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
59	EPLAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
60	EKIZ	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
61	EMKEL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
62	EMNIS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
63	ERBOS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
64	EREGL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
65	ERSU	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
66	FMZIP	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
67	FROTO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
68	FORMT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
69	FRIGO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
70	GEDZA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
71	GENTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
72	GEREL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
73	GOODY	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
74	GOLTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
75	GUBRF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
76	HATEK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
77	HEKTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
78	HURGZ	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
79	IHEVA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
80	IHGZT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
81	ISDMR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
82	IZDMC	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
83	JANTS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
84	KAPLM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
85	KARDMD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
86	KARSN	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF
87	KRIEK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
88	KARTN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
89	KATMR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
90	KENT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
91	KERVN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
92	KLMSN	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
93	KONFRT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
94	KONYA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
95	KORDS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
96	KRSTL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
97	KUITPO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
98	LUSK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
99	MAKTK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
100	MRSHL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF
101	MNDRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
102	OLMK	NRoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
103	TIRE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
104	NIBAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
105	NUHCM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
106	OTKAR	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF
107	OYLUM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
108	OZBAL	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
109	PARSN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
110	PENG	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF
111	PETKM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
112	PETUN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
113	PINSU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
114	PNSUT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
115	PRZMA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
116	ROYAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
117	RTLAB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
118	SANFM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
119	SAMAT	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF
120	SARKY	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
121	SAYAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
122	SASA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
123	SEKUR	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
124	SELGD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
125	SILVR	NRoFF	RoFF	NRoFF	RoFF	NRoFF	RoFF	RoFF	RoFF
126	SKTAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
127	SNPAM	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
128	TAIGD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
129	TPPOL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
130	TOASO	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
131	TUCLK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
132	TUKAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
133	TMSN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
134	TUPRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
135	PRKAB	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
136	TTRAK	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF
137	TBORG	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
138	ULUSE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
139	ULUUN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
140	USAK	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF

141	ULKER	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
142	VESBE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
143	VESTL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
144	VKING	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
145	YATAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
146	YUNSA	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
TOTAL	NO RISK OF FAILURE	110	105	112	108	111	110	116	123
	RISK OF FINANCIAL FAILURE	36	41	34	38	35	36	30	23

Source: Authors' Compilation

According to Table 11, the period with the highest number of successful companies with a Zmijewski score is 2020/12 with a total of 123 companies. The period with the highest number of unsuccessful companies is 2020/3. The manufacturing companies that failed in all periods are: COLLA, CELHA, DERİM, DGKLB, DOKTA, IZDMC, KATMR, MNDRS, PINSU, ROYAL, SKTAS, TUPRS, VKING.

Those with successful financial scores in all periods include: ACSEL, AKCNS, ATEKS, AKSA, ALCAR, ALKA, ALKİM, AEFES, ARCLK, ARSAN, ASUZU, AVOD, AYGAZ, BAKAB, BANVT, BRKSN, BLCYT, BNTAS, BRKO, BRSAN, BFREN, BURCE, BURVA, BUCİM, CEMAS, CEMTS, CMENT, CIMSAS, CUSAN, DAGI, DMSAS, DEVA, DOBUR, DOGUB, EGEEN, EGGUB, EGPRO, EGESER, EPLAS, ERBOS, EREGL, ERSU, FMZIP, FROTO, FORMT, FRIG, GED, GENTS, GEREL, GOODY, GOLTS, HATEK, HEKTS, HURGZ, IHEVA, IHGZT, ISDMR, JANTS, KAPLM, KARDMD, KARTN, KENT, KERVT, KONFRT, KONYA, KORDS, KRSTL, KUTPO, LUKSK, MAKTK, TIRE, NIBAS, NUHCM, OYLUM, PARSN, PETKM, YATAS PETUN, PNSUT, PRZMA, RTLAB, SARKY, SAYDAS, SARKY, SAYDAS, TATGD, TMPOL, TOASO, TUCLK, TUKAS, TMSN, PRKAB, TBORG, ULUSE, USAK, ULKER, VESBE.

Comparative information on the financial status of the BIST manufacturing companies for the periods 2019/12 and 2020/12 for financial failure models within the scope of the research is given in Table 12.

Table 12: Evaluation of Financial Failure Models Used in the Research for the Periods of 2019/12 and 2020/12

No.	Code	2019/12				2020/12			
		Altman	Springate	Taffler	Zmijewski	Altman	Springate	Taffler	Zmijewski
1	ACSEL	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
2	ADEL	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
3	AFYON	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF
4	AKCNS	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
5	ATEKS	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
6	AKSA	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
7	ALCAR	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
8	ALKA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
9	ALKİM	UN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
10	AEFES	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
11	ARCLK	RoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF
12	ARSAN	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
13	ASUZU	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF
14	AVOD	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	RoFF	NRoFF
15	AYGAZ	UN	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
16	BAGFS	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	RoFF
17	BAKAB	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
18	BANVT	UN	RoFF	NRoFF	NRoFF	UN	RoFF	RoFF	NRoFF
19	BRKSN	RoFF	RoFF	NRoFF	NRoFF	UN	NRoFF	NRoFF	NRoFF
20	BLCYT	UN	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
21	BNTAS	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
22	BSORE	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
23	BTCİM	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
24	BRKO	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
25	BRMEN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
26	BRSAN	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
27	BOSSA	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF
28	BFREN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
29	BRİSA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF
30	BURCE	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
31	BURVA	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
32	BUCİM	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
33	COLLA	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
34	CELHA	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
35	CEMAS	RoFF	RoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF

36	CEMTS	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
37	CMBTN	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	RoFF	RoFF
38	CMENT	UN	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
39	CIMSA	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF
40	CUSAN	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
41	DAGI	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
42	DARDL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
43	DMSAS	RoFF	RoFF	NRoFF	NRoFF	UN	NRoFF	NRoFF	NRoFF
44	DERIM	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
45	DESA	RoFF	NRoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
46	DEVA	UN	RoFF	NRoFF	NRoFF	UN	NRoFF	NRoFF	NRoFF
47	DIRIT	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
48	DITAS	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF
49	DOBUR	UN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
50	DGKLB	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
51	DOGUB	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
52	DOKTA	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
53	DURDO	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	RoFF
54	DYOBY	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
55	EGEEN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
56	EGGUB	UN	RoFF	RoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
57	EGPRO	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
58	EGESER	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
59	EPLAS	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
60	EKIZ	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	RoFF	RoFF
61	EMKEL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
62	EMNIS	RoFF	RoFF	NRoFF	RoFF	UN	NRoFF	NRoFF	NRoFF
63	ERBOS	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
64	EREGL	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
65	ERSU	UN	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
66	FMZIP	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
67	FROTO	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
68	FORMT	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
69	FRIGO	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
70	GEDZA	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
71	GENTS	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
72	GEREL	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
73	GOODY	UN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
74	GOLTS	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
75	GUBRF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF
76	HATEK	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
77	HEKTS	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
78	HURGZ	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
79	IHEVA	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
80	IHGZT	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
81	ISDMR	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
82	IZDMC	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
83	JANTS	RoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
84	KAPLM	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	RoFF	NRoFF
85	KARDMD	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
86	KARSN	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
87	KRTEK	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	NRoFF
88	KARTIN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
89	KATMR	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF
90	KENT	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
91	KERVT	RoFF	RoFF	NRoFF	NRoFF	UN	NRoFF	NRoFF	NRoFF
92	KLMSN	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
93	KONFKT	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	RoFF	NRoFF
94	KONYA	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
95	KORDS	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
96	KRSTL	NRoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF	NRoFF
97	KUTPO	UN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
98	LUKSK	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
99	MAKTK	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
100	MRSHL	UN	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF
101	MNDRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
102	OLMK	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
103	TIRE	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	RoFF	NRoFF
104	NIBAS	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF
105	NUHCM	UN	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
106	OTKAR	UN	NRoFF	NRoFF	NRoFF	UN	NRoFF	NRoFF	NRoFF
107	OYLUM	RoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
108	OZBAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
109	PARSN	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
110	PENGD	RoFF	RoFF	RoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
111	PETKM	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
112	PETUN	UN	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
113	PINSU	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
114	PNSUT	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
115	PRZMA	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
116	ROYAL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF
117	RTLAB	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
118	SANFM	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
119	SAMAT	RoFF	RoFF	RoFF	RoFF	NRoFF	RoFF	NRoFF	NRoFF
120	SARKY	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
121	SAYAS	RoFF	RoFF	RoFF	NRoFF	UN	NRoFF	NRoFF	NRoFF
122	SASA	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
123	SEKUR	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
124	SELGD	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
125	SILVR	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
126	SKTAS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
127	SNPAM	NRoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
128	TATGD	UN	NRoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
129	TMPOL	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF

130	TOASO	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	RoFF	NRoFF
131	TUCLK	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
132	TUKAS	NRoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
133	TMSN	RoFF	RoFF	NRoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
134	TUPRS	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
135	PRKAB	RoFF	RoFF	NRoFF	NRoFF	NRoFF	RoFF	NRoFF	NRoFF
136	TTRAK	UN	RoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
137	TBORG	UN	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
138	ULUSE	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF	NRoFF
139	ULUUN	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
140	USAK	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
141	ULKER	RoFF	RoFF	NRoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
142	VESBE	RoFF	RoFF	RoFF	NRoFF	UN	RoFF	NRoFF	NRoFF
143	VESTL	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	NRoFF
144	VKING	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF	RoFF
145	YATAS	UN	NRoFF	NRoFF	NRoFF	UN	NRoFF	NRoFF	NRoFF
146	YUNSA	RoFF	RoFF	RoFF	NRoFF	RoFF	RoFF	NRoFF	NRoFF
	NO RISK OF FAILURE	23	24	92	114	50	37	110	124
TOTAL	RISK OF FINANCIAL FAILURE	96	122	54	32	65	109	36	22
	UNCERTAIN	27	-	-	-	31	-	-	-

Source: Authors' Compilation

According to the data in Table 12, it is seen that the BIST manufacturing companies with successful Altman Z, Springate, Taffler, Zmijewski scores in the quarterly periods of 2019 and 2020 are: ACSEL, ALCAR, ALKA, BFREN, EGEEN, FMZIP, IHEVA, ULUSE. BIST companies with unsuccessful scores were: BSOKE, CELHA, DERİM, DIRIT, DGKLB, EMKEL, IZDMC, PINSU, SILVR, SKTAS, TUPRS, VKING.

5. CONCLUSION

This study aimed to analyze the financial failure risk of BIST manufacturing companies in the COVID-19 period by comparing 2019 and 2020 with four different financial failure models. Analysis was carried out with the most used Altman (1968), Springate (1978), Taffler (1983) and Zmijewski (1984) financial failure models in the literature, with quarterly data from 146 companies.

The analysis results show that while the risk of financial failure decreased in all four models, the number of financially successful companies increased when the 2019 and 2020 quarterly data were compared. This can be interpreted as meaning that the BIST manufacturing industry companies are less affected by the COVID-19 process when comparing 2019 and 2020. While the risk of financial failure decreased in the quarter of 2019, the number of financially successful companies increased. This increase is also valid for the quarters of 2020. While the number of financially failed companies in the first quarter of 2019 and 2020 decreased in Altman and Zmijewski models, there was no change in the number of financially successful or unsuccessful companies in Springate and Taffler models. The difference between these models in the first quarter is not found in the following quarters. In the Zmijewski and Taffler models, financially successful companies by quarter are higher than in the Altman and Springate models.

On the other hand, in Altman and Springate models, the number of companies at risk of financial failure is considerably higher than in Zmijewski and Taffler models. This may be due to the fact that the variables in the models are similar to each other. According to the Springate model, the number of

companies at risk of financial failure is higher than the number of companies calculated according to the Altman model. It can be explained by the Altman model using market value, total debt, and retained earnings as variables. As a result of the calculations made according to the four financial failure models, some companies are at risk of financial failure in all quarters. Companies at risk of financial failure in all quarters in both the Altman and Springate models are; ADEL, AKSA, AEFES, BAGFS, BTCIM, BRKO, BRMEN, BRSAN, BOSSA, BRISA, BURCE, CELHA, CIMSA, DAGI, DARDNL, DERİM, DIRIT, DGKLB, DOKTA, DURDO, DYOBYS, EKİZ, EMKEL, IZDMC, KAR KARSN, KLMSN, KORDS, MNDRS, PINSU, PNSUT, ROYAL, SANFM, TOASO, TUCLK, TUPRS, ULUUN, USAK, VESTL, VKING, YUNSA. Companies at risk of financial failure in all quarters in the Altman, Springate, and Taffler models include CELHA, DERİM, DGKLB, DOKTA, IZDMC, MNDRS, PINSU, TUPRS, VKING.

As a result of these two (Altman and Springate) or three models (Altman, Springate and Taffler), a detailed study can be made about the financial ratios of companies with financial failure risk in all quarters. Therefore, a more robust model can be proposed for the risk of financial failure. While this will benefit companies in shaping their financial policies, it will enable them to reach more reliable results in their decision making. In the literature, financially unsuccessful and financially successful companies are examined, while financially unsuccessful companies are bankrupt. In this study, one notes that companies that have not gone bankrupt may also risk financial failure. For this reason, companies with and without the risk of financial failure can be identified with sector-specific financial ratios, and even different thresholds can be found.

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Literature survey on DEA in the insurance industry with a focus on identification of research hotspots with text mining

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ABSTRACT

DEA is a frequently used non-parametric methodology for measuring the relative efficiency of Decision-Making Units (DMUs) that use the same inputs to produce the same outputs. Emrouznejad and Yang (2018) provided a literature survey on DEA with 10,300 peer-reviewed journal articles from 1978 to the end of 2016. Our article focuses on DEA applications in the insurance industry in convergence with the existing relevant literature as Kaffash et al (2020), who have surveyed 132 DEA articles in the insurance industry for the period from 1993 to 2018. We include particular keyword analyses necessary to identify research hotspots in different periods. This article aims to conduct a bibliometric analysis of DEA-published documents (articles in journals and book chapters) in the insurance industry from 1993 to 2021, focusing on identifying research hotspots based on keyword co-occurrence analysis. We have analyzed published documents from relevant databases, such as Scopus, Web of Science, Ebsco and ProQuest. We use descriptive analytics and text mining as the main methods in our analysis. We provide descriptive statistics for articles per year and category of the insurance industry, geographical distribution, top five journals and authors by citations, and citation analysis. An additional qualitative factor of our article is in-depth keyword co-occurrence analysis by using text mining to identify research hotspots in the insurance industry. Our analysis aims to contribute to researchers and insurance practitioners as an empirical and applicative point for initiating and developing research.

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1. INTRODUCTION

In the financial landscape of one country, of crucial importance is the stability of its key sectors and stakeholders (banks, insurance companies, pension and health funds and investment funds, among others) to maintain the stability of the financial system. Moreover, the financial system's stability is of key importance for economic growth. Therefore, measuring its efficiency as one of the leading indicators for the successful operation of financial and non-financial institutions attracts the research interest of many academics, researchers and practitioners worldwide.

Data Envelopment Analysis (DEA) is a non-parametric methodology that measures the relative efficiency of Decision Making Units (DMUs) that use the same inputs and produce the same outputs. Despite this, it does not require a production correspondence between the used inputs and the produced outputs. Instead, DEA provides information on the efficiency of each DMU and targets for improvement of the identified inefficiencies. Since DEA was introduced in the operational research (OR) literature by Charnes et al. (1978) and Banker et al. (1984), until the end of 2016, 10,300 DEA journal articles, according to the bibliography by Emrouznejad and Yang (2018), have been published. Cvetkoska and Savić (2021) provided the first bibliometric analysis on DEA in the banking industry by identifying the research hotspots in different periods. Kaffash et al. (2020) provided a literature survey of 132 DEA articles in the insurance industry from 1993 to 2018. Based on our literature survey insights, the insurance industry has not yet conducted a keyword co-occurrence analysis that helps in identifying relevant and essential research hotspots. That conclusion motivated us to conduct such a study and fill in the gap in the academic and expert literature.

We follow Cvetkoska and Savić (2021) in designing our bibliometric analysis research and conducting in-depth keyword co-occurrence analysis in different periods. We have extracted documents (journal articles and book chapters) from four relevant databases: Scopus, Web of Science, Ebsco, ProQuest. We use descriptive analytics to present the articles per year and category of the insurance sector, geographical distribution, relevancy as the top five journals and authors by citations, and the citation analysis. Despite this, our primary focus is on using text mining in the extracted abstracts of DEA insurance-related articles to create keyword co-occurrence maps for the total analyzed period (from 1993 to 2021), then for separate periods as before 2000, 2000-2010 and 2011-2021. Our article contributes to the existing literature by identifying the research hotspots in the analyzed periods and offers substantial future research directions and guidelines in the insurance industry with DEA, which will directly benefit the researchers and management practitioners in the insurance industry in developing conducting contemporary and applicative research.

The rest of the article is organized as follows. Section 2 describes the data and the methodology and tools used. Section 3 presents and analyzes the results obtained on DEA in the insurance industry regarding the annual trends, categories of the insurance industry, geographical distribution, top five journals and authors by citation, and citation analysis. Section 4 provides keyword co-occurrence maps and their analysis. Finally, section 5 provides concluding remarks.

2. DATA, METHODOLOGY AND TOOLS

The data used in our study is based on 55 DEA insurance-related articles from four relevant databases: Scopus, Web of Science, Ebsco, and ProQuest. The distribution of articles is conducted according to their dispersion per year, categories of the insurance sector, geographical distribution of articles, top five journals and authors by citation, and the top five most cited articles, has been made by using Excel. In addition, the keyword co-occurrence analysis is conducted by mining the 55 abstracts with the VOSviewer software version 1.6.17.

Van Eck and Waltman developed this software and more details can be found in Van Eck and Waltman (2010, 2014). Starting from April 2020, it provides the text mining option used in our research. Several VOSviewer applications include multiple criteria decision making (MCDM) by Yu et al. (2018); analyzing the evolution of research using Google Trends by Jun et al. (2018); social networking and academic performance by Doleck and Lajoie (2018); social media in psychology by Zyoud et al. (2018); evolution of entrepreneurship by Chandra (2018); and information sciences by Merigó et al. (2018).

3. RESULTS AND ANALYSIS

3.1 Distribution of DEA articles in the insurance industry by year

In our study, we analyzed 55 DEA insurance-related articles covering 29 (twenty-nine) years (1993-2021). The distribution of articles per year is shown in Figure 1. The highest number of published articles is identified in 2018 to 2019 (5 in each year), while four articles are published in each of the following years: 2012, 2013, and 2020. In addition, one article was published in the first seven years (1993, 1997-1999, 2002-2004), and one article in 2007 and 2017. In the last observed year, i.e. 2021, there were only two articles published, but we believe that this number should increase by the end of the year due to the durability of the issuing procedures.



Figure 1: Distribution of DEA articles in the insurance industry by year

Source: Authors Compilation

3.2 Distribution of DEA articles by insurance industry categories

Based on our analysis, 45 articles (81.8%) consider one of the following seven categories: non-life, life, composite, property-liability, health and family insurance sector, and the ownership structure in the insurance industry. Table 1 presents the distribution of DEA articles in each of the seven insurance industry categories. The highest number, i.e. 12 articles (21.8 %), are applied in the non-life insurance sector, followed by 11 or (20 %) in the non-life insurance sector, 9 (16.4 %) in the composite insurance sector, and so on.

Table 1: Distribution of DEA articles in one of the identified insurance industry categories

	Category	Number of articles
1	non-life	12
2	life	11
3	composite insurance	9
4	property-liability	8
5	health	2
6	family	2
7	ownership structure	1
	Total	45

Source: Authors Compilation

In addition, in the rest of the analyzed articles, i.e. 10 in total, DEA is applied in two or more insurance industry categories. The distribution of those articles per insurance category is presented in Table 2. According to Table 2, we can see that in the different categories, the articles dominate life insurance (in 5 articles), followed by non-life insurance (in 4 articles). Only once the family insurance article has been used, along with the non-insurance.

Table 2: Distribution of DEA articles in two or more of the insurance industry categories

Categories	Number of articles
property-liability insurance and ownership structure	2
life, non-life, and composite insurance	2
health and life insurance sector	1
life insurance and ownership structure	1
life, non-life and health insurance	1
non-life and family insurance	1
non-life and composite insurance	1
life, health, and property-liability insurance	1
Total	10

Source: Authors Compilation

3.3 Geographical distribution of DEA insurance-related articles

Based on our analysis, in 49 articles, the research considers only one country (Table 3), while in 6 articles, DEA is applied in two or more countries (Table 4). Table 3 shows that 23 countries are identified so that the data set from the U.S. is applied in 12 articles, followed by India in 6 articles, Malaysia in 4 articles, China in 3 articles, Austria, Japan, Taiwan, UAE and Pakistan in two countries each and the rest in one country. Table 4 shows that in 2 articles are from countries within the European Union, while the others are as follows: Global insurance industry from the GCC countries (UAE, Saudi Arabia, Qatar, Oman, Kuwait and Bahrain), Malaysia and the Gulf states, and the BRIC countries (Brazil, Russia, India, China and South Africa).

Table 3: Geographical distribution on DEA research within a single country

	Research in one country	Number of articles
1	U.S.	12
2	India	6
3	Malaysia	4
4	China	3
5	Austria	2
6	Japan	2
7	Taiwan	2
8	UAE	2
9	Pakistan	2
10	France	1
11	Greece	1
12	South Africa	1
13	Ghana	1
14	Ukraine	1
15	Spain	1
16	Ethiopia	1
17	North Macedonia	1
18	Ecuador	1

19	Iran	1
20	Australia	1
21	Portugal	1
22	Korea	1
23	Canada	1
	Total	49

Source: Authors Compilation

Table 4: Geographical distribution of DEA research in at least two countries

	Research in two or more countries	Number of articles
1	European Union	2
2	Global	1
3	GCC countries	1
4	Malaysia and the Gulf States	1
5	BRIC countries	1

Source: Authors Compilation

3.4 The top five journals in the insurance industry based on DEA articles

According to the total number of citations of each of the 55 articles published in 42 journals, we have identified the top five journals. Those journals are presented in Table 5. The first rank belongs to the *Journal of Productivity Analysis*, with a total of 294 citations, followed by *The Geneva Papers on Risk and Insurance-Issues and Practice* (269 citations), the *Journal of Empirical Economics* (176 citations), the *Journal of Banking & Finance* (175 citations), and *Omega* (105 citations).

Table 5: The top five journals in the insurance industry based on DEA articles

	Journal	Citations
1	<i>Journal of Productivity Analysis</i>	294
2	<i>The Geneva Papers on Risk and Insurance - Issues and Practice</i>	269
3	<i>Empirical Economics</i>	176
4	<i>Journal of Banking & Finance</i>	175
5	<i>Omega</i>	105

3.5 Top DEA insurance related-article authors based on citations

Table 6 presents the top authors based on the total number of citations of DEA insurance-related articles published in the identified top five journals in Section 3.4. According to Table 6, we can see that Cummins, J.D. has the highest number of citations (322) and has a rank of 1, followed by Zi, H. (196 citations), Mahlberg, B. and Url, T. (176 citations), Diacon, S.R, Starket, K. And O'Brien C.O. (150 citations) and Xie, X (126 citations).

Table 6: Top DEA insurance related-article authors based on citations

	Author(s)	Citations
1	Cummins, J.D.	322
2	Zi, H.	196
3	Mahlberg, B. and Url, T.	176
4	Diacon, S.R, Starkey, K. and O'Brien C.O.	150
5	Xie, X.	126

Source: Authors Compilation

Also, in Figure 2 below, we present the most cited authors in DEA related articles in the insurance industry in each of the top five journals. Cummins, J.D., and Zi, H. are most cited in the *Journal of Productivity Analysis*; Mahlberg, B., and Url, T. in the *Empirical Economics*; Cummins, J.D., and Xie, X. in the *Journal of Banking and Finance*; Diacon, S.R., Starkey, K., and O'Brien, C.O. in *The Geneva Papers on Risk and Insurance – Issues and Practice*; and Lu, W.-M., Wang, W.K., and Kweh, Q.L. in *Omega*. Based on Table 6, we have identified that Cummins, J. D. is the most-cited author, and from Figure 2, we can see that he is the most cited in two of the identified top five journals.

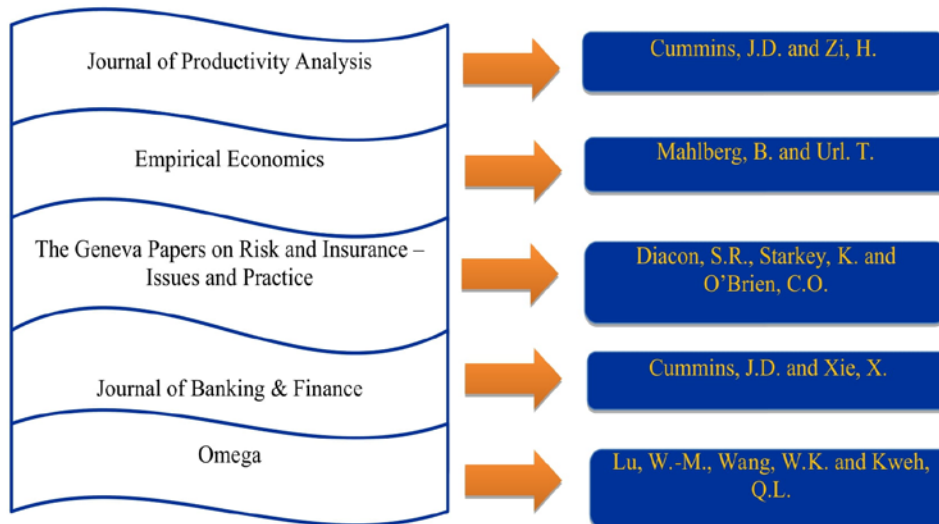


Figure 2: Top DEA insurance-related article authors based on citations

Source: Authors Compilation

3.6 The top five most cited DEA articles in the insurance industry

Table 7 presents the top five most-cited DEA-related articles in the insurance industry in the top identified journals.

The article with the highest number of citations (196) is “Comparison of Frontier Efficiency Methods: An Application to the U.S. Life Insurance Industry” by Cummins and Zi (1998) that is published in the *Journal of Productivity Analysis*. This article uses a sample of 445 life insurance companies in the U.S. between 1988 to 1992. With 20 citations less, it is the second most cited DEA article in the insurance industry, entitled: "Effects of the single market on the Austrian insurance industry" by Mahlberg and Url (2003), published in *Empirical Economics*. It considers 52 companies from the following three categories of the insurance sector: health, life, and property-liability insurance in Austria, and the observed period is from 1992 to 1999. The article "Size and efficiency in

European long-term insurance companies: An international comparison" by Diacon et al. (2002), published in *The Geneva Articles on Risk and Insurance-Issues and Practice*, has 150 citations and is ranked third. It is applied in 15 European countries, and the sample consists of 454 insurance companies observed between 1996 and 1999. The article "Mergers and acquisitions in the US property-liability insurance industry: Productivity and efficiency effects" by Cummins and Xie (2008), with 126 citations, ranks fourth. This article was published in the *Journal of Banking & Finance*. It considers U.S. companies in the property-liability insurance sector observed in the period from 1994 to 2003 so that the total insurers-year observations are 14,592 and on average 768 insurers per year. The article by Fecher et al. (1993), entitled "Productive performance of the French Insurance Industry," published in the *Journal of Productivity Analysis*, is cited 98 times and ranked in fifth place. It considers a sample of 327 insurance companies (84 from the life and 243 from the non-life insurance sector) in France.

Table 7: The top five most cited DEA articles in the insurance industry

	Authors	Year	Title	Journal	Citations
1	Cummins, J.D., Zi, H.	1998	Comparison of Frontier Efficiency Methods: An Application to the U.S. Life Insurance Industry	<i>Journal of Productivity Analysis</i>	196
2	Mahlberg, B., Url, T.	2003	Effects of the single market on the Austrian insurance industry	<i>Empirical Economics</i>	176
3	Diacon, S.R., Starkey, K., O'Brien, C.O.	2002	Size and efficiency in European longterm insurance companies: An international comparison	<i>The Geneva Papers on Risk and Insurance - Issues and Practice</i>	150
4	Cummins, J.D., Xie, X.	2008	Mergers and acquisitions in the US property-liability insurance industry: Productivity and efficiency effects	<i>Journal of Banking & Finance</i>	126
5	Fecher, F., Kessler, D., Perelman, S., Pestieau, P.	1993	Productive performance of the French insurance industry	<i>Journal of Productivity Analysis</i>	98

Source: Authors Compilation

4. Identification of research hotspots for DEA in the insurance industry based on mining keywords in the abstracts

The first bibliometric analysis on DEA in banking to identify the research hotspots based on mining keywords in the 791 abstracts in 34 years (1986–2019) was carried out by Cvetkoska and Savić (2021). In this article, we follow Cvetkoska and Savić (2021) work and provide in-depth keyword co-occurrence analysis on DEA articles in the insurance industry in the period under review (1993-2021) by setting the minimum number of keyword co-occurrence to be 2 (two). In addition, we created separate keyword co-occurrence maps for the periods before-2000, 2000-2010, and 2011-2021 to identify whether and how researchers changed, transformed or integrated their evolving research interests. We have also created an overlay visualization map for the last six years (2016-2021) to identify the research hotspots in each year. In this case, we do not set a minimum number of keyword occurrences. Instead, we use the VOSviewer software 1.6.17 to conduct abstract mining and create and visualize the maps.

4.1 DEA research hotspots in the insurance industry (1993-2021)

The creation of the keywords co-occurrence map based on text data, more specifically abstracts from the 55 journal articles and book chapters from Scopus, Web of Science, Ebsco and ProQuest, is made by using the VosViewer Software. We have chosen to create a co-occurrence map based on text data, and in the 55 abstracts, we ignore structured abstract labels and copyright statements (if any). The counting method is binary counting. The total number of extracted keywords is 1318, and we have set the minimum number of keyword occurrences to be two so that 243 keywords satisfy the set threshold. Then, a relevance score is calculated for each keyword, and 60% of the most relevant keywords are selected by default, in our case, 146 keywords. We have thoroughly checked the extracted 146 keywords and have excluded the country names (because we provided geographical distribution in Section 3.3) and keywords that are not adequate for our analysis (presented in Appendix 1a). As a result, a total of 42 keywords were eliminated from our side, and our keyword co-occurrence map consists of a final 104 keywords. The network visualization for the keywords co-occurrence map for the observed period is given in Figure 3.

Based on Figure 3, we can see that the keywords are grouped into seven clusters so that those that have the same colour belong to the same cluster. The network visualization consists of items (labels and circles) and lines. The larger the item and the label, the higher the weight of the keyword. The founders of the VosViewer software, van Eck and Waltman (2020) point out that if some labels are not presented, that does not appear to be an overlapping problem. If between two items, the line is thicker and the distance is shorter, that indicates that their relationship is stronger (Cvetkoska and Savic, 2021). Also, the strength of a link is given by a binary number, which is a positive value. Furthermore, if this value is higher, it indicates that the link is stronger, and the total link strength (TLS) of one item is the strength of the links of one item related to the other items, calculated as a sum (van Eck and Waltman, 2020).

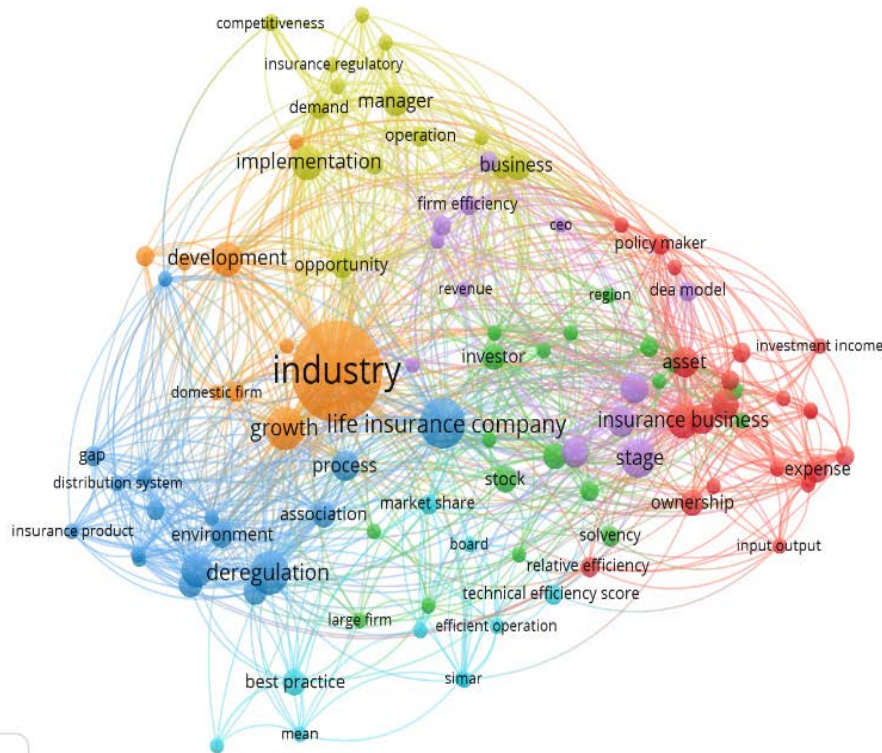


Figure 3: Network visualization of keyword co-occurrence map on DEA insurance-related articles from 1993 to 2021

Source: Authors Compilation

In Table 8, we present the largest item in each cluster, its links, occurrences and the total link strength. For example, the largest item in the orange cluster is industry, and it is also the largest on the whole map. It has 84 links, 26 occurrences and a TLS of 160.

Table 8. The largest item in each cluster for the period 1993-2021

	Clusters	Keywords	Links	Occurrences	Total link strength (TLS)
1	orange	industry	84	26	160
2	violet	stage	40	7	58
3	blue	life insurance company	59	82	10
4	yellow	implementation	30	38	6
5	red	insurance business	36	46	6
6	green	investor	26	27	4
7	light blue	best practice	15	18	4

Source: Authors Compilation

4.2 DEA research hotspots in the insurance industry (before 2000, 2000-2010 and 2011-2021)

In order to show whether and how the keywords in the analyzed DEA articles in the insurance industry changed in the different periods (before 2000, 2000-2010, and 2011-2021), we created a keyword co-occurrence map for each period as described in Section 4.1, but the minimum number of keywords co-occurrence is set to 1 (one).

From the abstracts of 5 articles published before 2000, 180 keywords are extracted, out of which 108 (60%) are selected by default. By eliminating 32 that consist of country names and irrelevant keywords for our analysis, the sample of keywords is decreased to 76. The eliminated keywords are presented in Appendix 1b. The network visualization for keyword co-occurrence map on DEA insurance related articles for the period before 2000 is shown in Figure 4. From Figure 4, we can see that the keywords are grouped into five clusters. In this period, we have investigated the efficiency of life and non-life insurers and the ownership structure (stock and mutual). Despite DEA, some studies also used parametric methods, and Cummins et al. (1999) set agency theoretic hypothesis about the organizational form. The data sets considered included the insurance companies' data from the developed markets of the U.S., France, Italy, and Japan.

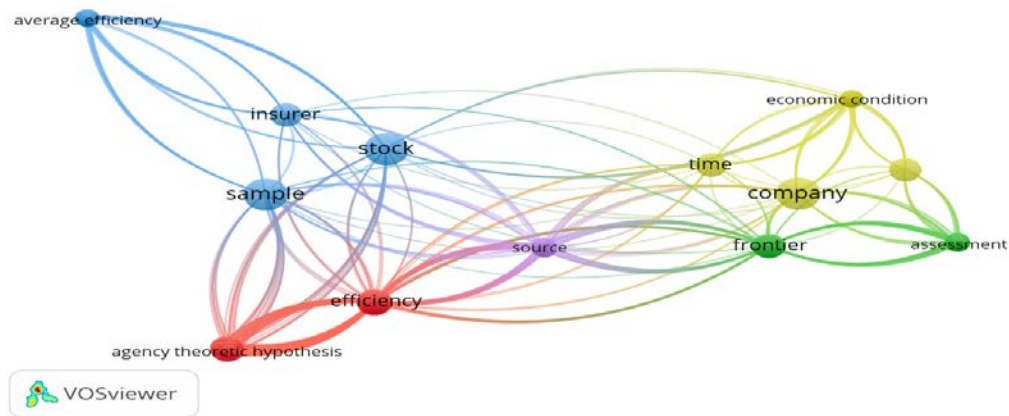


Figure 4: A network visualization of keyword co-occurrence in DEA insurance-related articles prior to 2000

Source: Authors Compilation

The keyword co-occurrence map on DEA related articles in the insurance industry presented in Figure 5 was created by mining the abstracts in this period, so there are 470 keywords in total, out of which 60% (282 keywords) are selected as relevant by default, and 104 are eliminated. The eliminated keywords are given in Appendix 1c. The map consists of 178 keywords grouped into 12 clusters. Between 2000 and 2010, we considered more specialized lines of business life, non-life, health, and property-liability insurers. We measured their efficiency, the effects of mergers and acquisitions, liberalization, and deregulation on efficiency, and we also compared the efficiency between domestic and foreign insurers, namely the influence of the ownership structure. In the analysis, we have used DEA, DEA with Malmquist, stochastic frontier and DEA, a two-stage DEA procedure proposed by Simar and Wilson (2007) and DEA with econometric methods to investigate the determinants of efficiency. The DEA study is applied to data sets from Austria, China, the United Arab Emirates (UAE), Portugal, India, Greece, Ukraine, and Taiwan and in one study, a set of various 15 European insurance industries are analyzed.

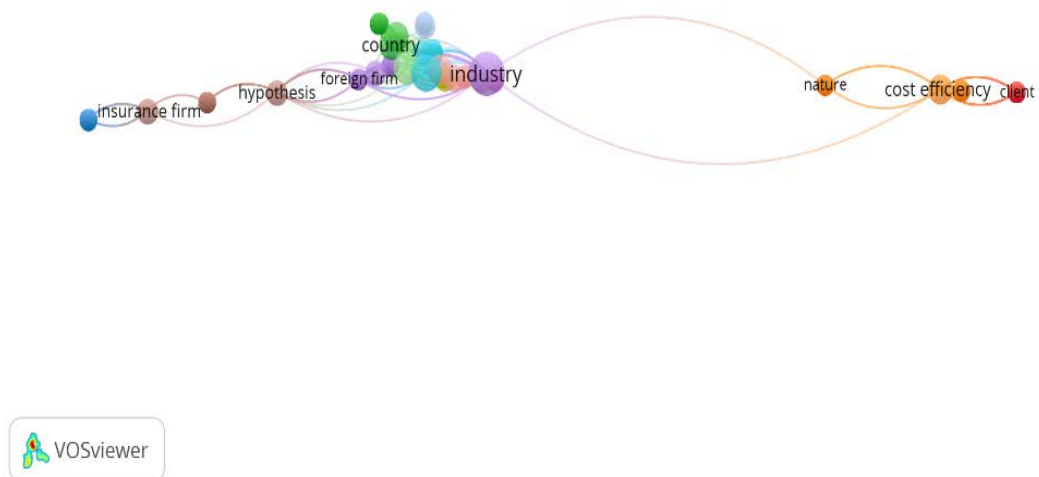


Figure 5: A network visualization of keyword co-occurrence in DEA insurance-related articles in the period 2000-2010

Source: Authors Compilation

From the 34 abstracts in the last observed period 2011–2021, 879 keywords were extracted, out of which 527 (60%) were selected by default. By eliminating 125 (presented in Appendix 1d), 402 keywords remained and were used to create the network visualization of the co-occurrence map on DEA insurance-related articles presented in Figure 6. From Figure 4, we can see that the keywords are grouped into 19 (nineteen) clusters. This period covers a variety of life, non-life, property-liability, private health insurers, general insurance, life-micro insurance portfolio of insurance companies, and ownership (local and foreign). Furthermore, we investigate efficiency, change in the productivity of insurers, risk management efficiency, the impact of the characteristics of corporate governance as well as the financial sector reforms on insurance efficiency, whether the insurers that have applied ERP systems to improve their efficiency have increased their efficiency, the link between CEO compensation and the insurers' performance, and managerial ability. In the analyzed studies, two-stage DEA (DEA and truncated bootstrapped regression, DEA and Panzar-Rosse H statistic method, DEA and Simar-Wilson (2007) procedure, two-stage network DEA, DEA and Tobit regression, DEA-translog model), but also DEA and Malmquist, DEA and the Analytic Hierarchy Process (AHP), DEA-Malmquist-Tobit were used. In addition, the variety of countries is the highest in this period, so DEA is applied in the U.S., China, India, Malaysia, Pakistan, Korea, Ghana, Ecuador, Taiwan, Japan, Republic of Macedonia, Australia, South Africa, the BRIC countries, Gulf Cooperation Council Countries, and on a global data set.

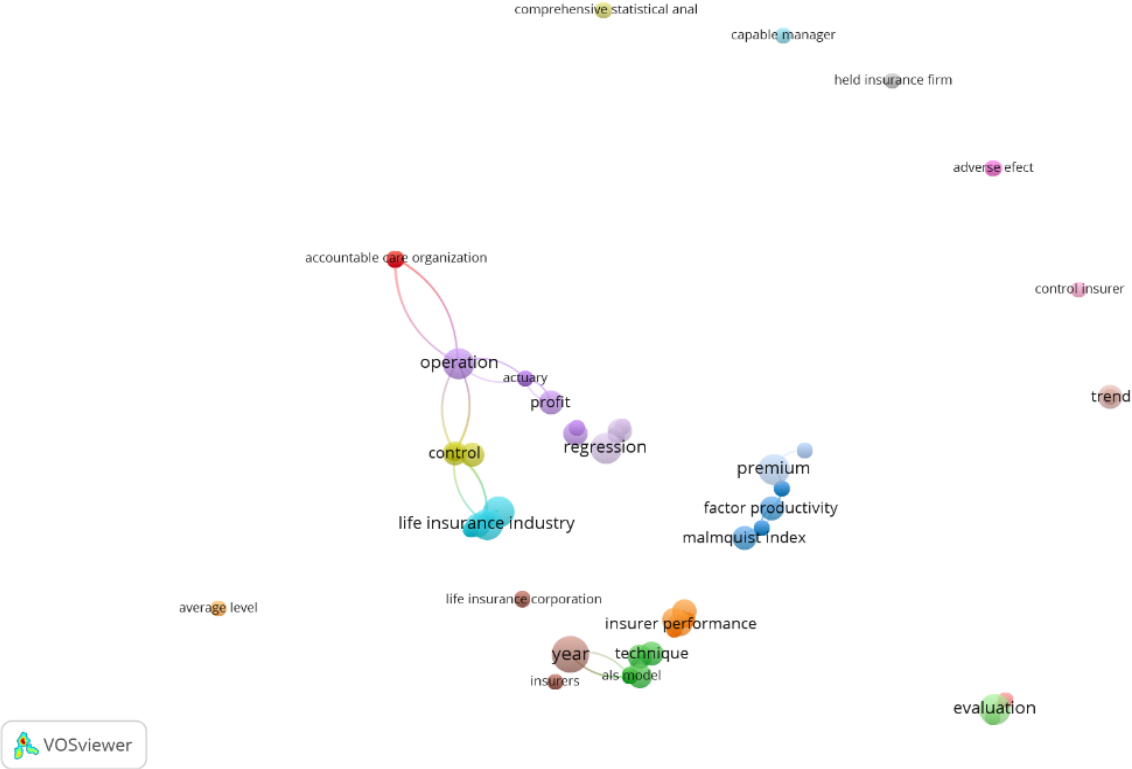


Figure 6: A network visualization of keyword co-occurrence in DEA insurance-related articles in the period 2011-2021

Source: Authors Compilation

4.3 Research hotspots in the insurance industry in the period 2016-2021 and future trends

In Figure 7, we present an overlay visualization regarding the eighteen DEA mined abstracts in the period 2016-2021, based on which we can see the research hotspots in the most recent period. In creating this map, we have considered 254 keywords (562 were the total, 60% of the most relevant were selected by default, which gives a total of 337, and we have eliminated 83). The eliminated keywords by us are given in Appendix 1e. In this period we have investigated the following issues: how the financial sector reforms affect the efficiency and productivity (Noreen and Ahmad, 2016), efficiency and productivity of property-liability insurers (Cummins and Xie, 2016), efficiency-solvency linkage (Sinha, 2017) the performance evaluation of life, general insurers and its' ownership (Nourani et al. 2018), the corporate performance (Tone et al. 2019) and the corporate governance effect (board characteristics) on efficiency of life insurance companies (Alhassan and Boakye, 2020), the efficiency and competitiveness (Lee et al. 2018), efficiency of the Medicare plans (Brockett et al. 2018), efficiency of the publicly held insurance industry (Copeland and Cabanda, 2018), the determinants of the insurance profitability (Camino-Morgo and Bermudez-Barrezueta, 2019), the effect of risk-based capital on efficiency, productivity and competitiveness (Lee et al. 2019), the life micro-insurance portfolio of insurance companies (Savitha et al. 2019), the relationship between efficiency and profitability of insurance companies (Eling and Jia, 2019), the performance of non-life companies and its determinants (Ilyas and Rajasekaran, 2019), the measure and rank efficiency of general insurance companies (Meher et al. 2020), the risk-management efficiency and determinants of non-life insurance companies (Noreen, 2020), private health insurance (Nguyen and Worthington, 2021) and lastly managerial ability (Banker et al. 2021).

In most studies, the two-stage DEA (bootstrap DEA, network DEA, DEA+Tobit regression, DEA+Panzar-Rosse H statistic method, and bootstrap Malmquist index) and the three methods: DEA-Malmquist-Panzar-Rosse, DEA-Malmquist-Tobit regression were used.

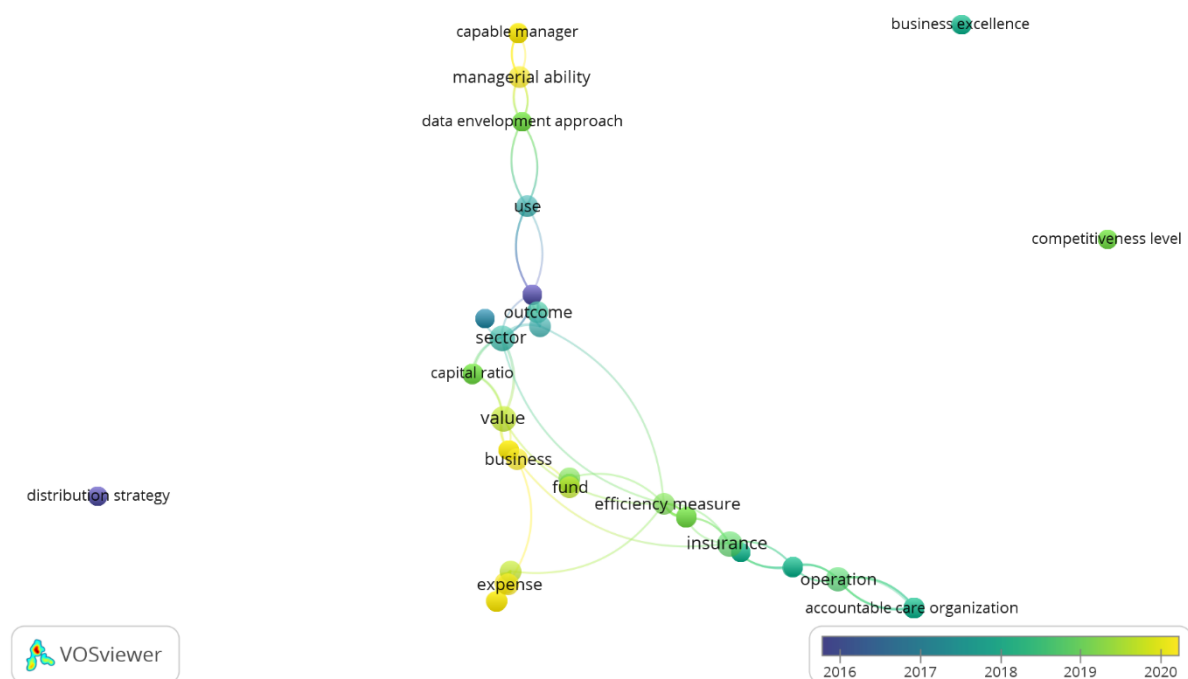


Figure 7: Overlay visualization for keywords in DEA insurance-related articles in the period 2016-2021

Source: Authors Compilation

As for future research directions in the insurance industry, researchers could investigate the multi-factor performance of the insurance companies before, during, and post-Covid-19 to explore whether the use of modern technologies impacts the performance of insurers by using stage-DEA (DEA with parametric methods, DEA+multi criteria decision making (MCDM) methods, DEA + machine learning models as well as measure their organizational (managerial) ability and identify the determinants of that ability by using the Banker et al. (2021) measure.

CONCLUSION

In our study, we provide analysis and visualization of the bibliometric data on DEA articles in the insurance industry published in journals and as book chapters listed in the following relevant databases: Scopus, Web of Science, Ebsco and ProQuest, with a focus on the identification of research hotspots concerning the analysis of keywords. We use descriptive statistics and text mining as the main methods in our analysis. The analysis covers 55 DEA insurance articles published over 29 years (from 1993 to 2021).

We have summarized the main findings from this study analysis in 7 points: **(1)** Based on the distribution of DEA articles in insurance in the observed period, the highest number of articles (5) has been published in the period 2018-2019, and four articles each were published in the following years: 2012, 2013 and 2020; **(2)** In 45 articles, DEA is applied in one of the seven identified insurance categories, which leads the non-life with 12 articles, life with 11 articles, and composite insurance with nine articles. In addition, in the other ten articles, DEA is applied in at least two insurance categories; **(3)** Based on the geographical distribution of the data sets used, the data set is used in a single country in 23 articles, so that the highest number is applied in the U.S. (12 articles), followed by India (6), and Malaysia (4). Also, we have found five studies where DEA in the insurance industry is applied to a data set from at least two countries, so that in two studies, the EU countries are considered, followed by the BRIC and GCC countries, Malaysia, and the Gulf States, and on a global data set (each considered in one separate article); **(4)** The five top journals where DEA insurance-related articles are published, based on citations, are: the *Journal of Productivity Analysis* in first place with 294 citations, followed by *The Geneva Papers on Risk and Insurance - Issues and Practice* with 269 citations, *Empirical Economics* with 176 citations, and *Journal of Banking & Finance* with 175 citations, and *Omega* with 105 citations; **(5)** The top authors on DEA articles in insurance based on their citations in the top identified journals are: Cummins, J.D. with the highest number of citations (322) and has a rank 1, followed by Zi, H. (196 citations), Mahlberg, B. and Url, T. (176 citations), Diacon, S.R, Starket, K. And O'Brien C.O. (150 citations), and Xie, X (126 citations); **(6)** We have identified the top five most-cited DEA insurance-related articles so that the article with the highest number of citations (196) is "Comparison of Frontier Efficiency Methods: An Application to the U.S. Life Insurance Industry" by Cummins and Zi (1998) published in *Journal of Productivity Analysis*. This article uses a sample of 445 life insurance companies in the U.S. and observes the period between 1988 and 1992; **(7)** Based on in-depth keyword co-occurrence analysis by mining the 55 abstracts, we provide network visualization for the whole period (1993-2021), but also each of the following periods: before 2000, 2000-2010, and 2011-2021. The number of keywords is large and diverse, which implies that the interest of researchers has increased and changed over the years. Our overlay visualization for the last six years (2016-2021) highlights the most recent research hotspots.

Our detailed analysis shows that efficiency and its determinants, corporate governance, risk management efficiency, and managerial ability, have been investigated during this time. In most studies, two-stage DEA is used, i.e., bootstrap DEA, network DEA, DEA+Tobit regression, DEA+Panzar-Rosse H statistic method, and bootstrap Malmquist index), but also three methods are used: DEA-Malmquist-Panzar-Rosse, DEA-Malmquist-Tobit regression.

We do not claim that all DEA insurance-related articles (published in journals and as book chapters) listed in the four databases are included so that some data may be omitted. Instead, the findings of our analysis aim to contribute to researchers and insurance practitioners as an empirical and applicative point for initiating and developing ongoing and future research.

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Appendix 1a. Eliminated keywords for the co-occurrence map in the period 1993-2021

Eliminated keywords	
adoption, assessment, average, beginning, cause, challenge, China, choice, claim, consistent, DEA result, decline, empirical result, end, entry, European country, European Union, further development, future development, Germany, important issue, India, influence, interest, key concern, kind, long run, main finding, Malaysia, MPI, nature, new information, number, percent, point, reduction, research limitation implications , significant increase, Takaful insurer, Takaful operator, UAE, view	

Source: Authors Compilation

Appendix 1b. Eliminated keywords for the co-occurrence map in the before-2000 period

Period	Eliminated keywords
Pre-2000	article, choice, consistent, data basis, difference, dispersion, display, distribution, efficiency study, estimation method, French company, incentive, Japanese life insurance company, main finding, mutual, new information, non-parametric result, paper, previous, reference, research, researcher, return, richer interpretation, sample, scale, significant effect, Spanish savings bank, technique, US life insurer, use, wide range

Source: Authors Compilation

Appendix 1c. Eliminated keywords for the co-occurrence map in the 2000-2010 period

Period	Eliminated keywords
2000-2010	adoption, Anglo minimal regulated UK industry, approach firm, approach use, article, Austrian experience,, Austrian insurance market, Austrian insurance regulatory, Austrian insurer, authority, benefit, broad agreement, Canadian i&h insurance industry, Canadian life, central, challenge, Chinese life insurance industry, Chinese market, claim, combination, concern, conflict, consequence, continental maximal regulated German, course, Denmark, direct implication, direction, dual impact, Eastern European country, efficient value, empirical result, entry, European counterpart, European country, European insurance industry, European insurer, European specialist, examination, firm specific data, firm specific estimate, first attempt, flow, further development, future competition, future development, German industry, German insurance company, German regulation, Germany, good stead, greater competition, hand UK insurer, i&h, importance, important issue,

	important light, India, interest, interpretation, intra, investigation, issue, key concern, key determinant, Korea, low level, main finding, major structural change, mutual form, mutuality, new variant, non state, number, optimism, Philippine life insurance industry, Philippines, positive effect, potential, potential improvement, primary concern, recent year, relationship, significant growth, significant heterogeneity, significant increase, similar benefit, similar pattern, Spanish insurance industry, Spanish insurance market, strong evidence, Sweden, Taiwan, Taiwanese, Thai life insurance business, Thailand, theoretical concern, UK cost efficiency, UK Spain, Ukrainian insurance firm, Ukrainian insurance industry, Unit price, United Arab Emirates, Wide variation
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Source: Authors Compilation

Appendix 1d. Eliminated keywords for the co-occurrence map in the 2011-2021 period

Period	Eliminated keywords
2011-2021	adjacent year, adoption, African insurance market, alternative, annual basis, attempt, attention, Australian private health insurance industry, Australian private health insurer, benefit, Brazil, BRIC country, Caribbean insurer, cent, central objective, chapter, China, claim, comparing, consideration, consistent, context, coordination, creation, distinguishing, document, Ecuadorian insurance sector, efficiency pre, empirical evidence, empirical finding, entry, European country, European life insurance industry, extant evidence, first empirical assessment, first research, first result, first time, following variable, France, Germany, ground, handbook, high level, higher level, idea, inappropriate use, incorporation, Indian general insurance sector, Indian insurance market, Indian insurance statistic, Indian life, interaction, interest, Iranian insurance market, Islamic country, Italy, Japan, Japanese non-life insurance market, key reason, lack, large extent, Latin American, light, link, long run, Macedonia, Macedonian insurance company, main determinant, main objective, main source, Malaysian insurance company, marginal impact, means, monitor, new finding, number, opportunity, order, overall result, Pakistan insurance sector, percent, Philippine, point, positive correlation, post, post conversion, potential negative association, pre, present study, previous study, reason, regard, relative influence, republic, respect, response, Russia, sample public, separation, shift, side, significant effect, significant finding, significant impact, significant relationship, source, South African life insurance industry, Spain, study period, Taiwan, Takaful industry, Takaful insurance, Takaful insurance market, Takaful insurer, Takaful operations, understanding, underwriting discipline, unfavorable impact, US insurance industry, US property liability insurer, whole, whole observed period, world the BRIC

Source: Authors Compilation

Appendix 1d. Eliminated keywords for the co-occurrence map in the 2016-2021 period

Period	Eliminated keywords
2016-2021	adjacent year, adverse effect, attention, Australian private health insurance industry, Australian private health, insurer, better efficiency, Caribbean insurer, central objective, chapter, claim, consistent, context, contributing factor, DMU3, document, Ecuadorian insurance sector, efficient implementation, empirical evidence, empirical, finding, extant evidence, family Takaful operators, first research, first time, following variable, general segment, greater benefit, handbook, high usage, higher managerial ability, idea, inappropriate use, increase, India, Indian general insurance sector, Indian insurance market, Indian insurance statistic, key reason, large extent, Latin American, light, luck, Malaysian insurance company, marginal impact, means, Medicaid, Medicare, Medicare advantage, Medicare beneficiary, Medicare market penetration, Medicare obtainable, Medicare plan, Medicare plan, Medicare privatization, Medicare reform, Medicare reform effort, Motivation, new finding, nonspecialized segment, outstanding claim, Pakistan insurance, percent, Philippine, present study, previous study, reasonable level, response, sample public, sector, side, significant effect, significant finding, significant impact, significant relationship, structural change, substantial scope, Takaful industry, Takaful insurance, Takaful insurer, Takaful market, Takaful operation, underwriting, US insurance industry, year

Source: Authors Compilation

The Impact of Corporate Governance on the Performance of Large Listed American Companies

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ABSTRACT

In an environment where competition is becoming increasingly fierce, the primary concern of entities is to find effective solutions to cope with the risks to which they are exposed. In this context, through the entire collection of mechanisms available to corporate governance, companies can limit their risk exposure and thus achieve their goals more quickly. This research aims to study the relationship between the characteristics of corporate governance and the financial performance of the top 65 listed American companies. The research was carried out over a period of 5 years (2015-2019). Regarding the characteristics of corporate governance, four variables were used: the duality of the CEO, the size of the Board of Directors, the independence of the Board, and the frequency of its meetings. In addition, to reflect financial performance, we tracked the rate of financial return (ROE) and return on assets (ROA). The data were processed using the SPSS statistical program, using multiple linear regressions as the quantitative method. The analysis results indicate the existence of a significant positive relationship between the variable of corporate governance represented by the frequency of Board meetings and the financial performance expressed by ROA and ROE. However, variables relating to the duality of the CEO, the size and the independence of the Board were statistically insignificant.

ARTICLE INFO

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1. INTRODUCTION

Although corporate governance has been intensely debated over time, it is still in the interest of theorists and practitioners. Moreover, given that the economic, legal and social environment is constantly changing, the subject of corporate governance can always be

considered relevant, requiring a constant development of governance practices to cope with the various changes that occur. However, the main objective will always be unchanged, namely: to create a system capable of clarifying possible discrepancies and, at the same time, to support the management of an entity in achieving the proposed goal (Principles of Corporate Governance and Recommendations on their Implementation, 2010).

Given that the microeconomic level has a significant role in ensuring macroeconomic well-being, good corporate governance can be considered the key ingredient that has a positive influence on the situation of all economic actors.

Taking into account the aspects presented, to understand the relationship between corporate governance and performance, this paper will study the influence of governance characteristics (expressed by the duality of the CEO, size and independence of the Board and frequency of meetings) on performance (calculated by the rate of return on assets and the rate of financial return).

2. LITERATURE REVIEW

Although it is generally accepted that good corporate governance is essential to the success of an entity, following a review of the literature, conflicting evidence has been found regarding the relationship between the following four variables for measuring possibility, namely: CEO duality, frequency of meetings, size and independence of the Council; and entity performance. Thus, using the duality of the CEO to assess the quality of corporate governance, the conclusion reached by most researchers was that this variable has a significant negative influence on the performance of the entity (Onofrei et al., 2019; Arif, 2019; Shrivastav and Kalsie, 2016; Nazar, 2016), as the holding of the titles of Executive Director and Chair by the same person will affect the ability of the Council to exercise its governing function (Rashid, 2010). However, some studies found either the lack of a link between the governance variable mentioned above and the performance expressed by ROE (Korir and Tenai, 2020), ROA and Tobin's Q (Kyere and Ausloos, 2020); or mixed results, such as a significant positive relationship with ROE, but insignificant and positive with ROA, ROC (return on capital) and MTBV (market to book value of equity) (Marcio et al., 2011); or a significant positive relationship between the duality of the CEO and ROA and EPS, but insignificant with ROE. According to Yang (2021), the positive effect is that the general manager is motivated to become more dedicated to the company's interests by combining the two positions.

Another feature of intensively studied governance is the size of the Board of Directors.

The article by Arif (2019) shows that a Board with a more significant number of members positively influences the performance of the entity (expressed through ROA and ROE), as it benefits from "diverse experience, more points of view and competitive and experienced individuals". Furthermore, Güngör Tanç and Çetinel (2020), studied a sample of 179 producing entities listed on the Istanbul Stock Exchange, and Bashir and Asad (2018) highlighted the significant positive link between the mentioned governance variable and the ROA. However, opinions on the impact of the size of the Council are divided. Thus, conducting a survey of 329 listed companies in Saudi Arabia in the period 2013-2015, Alshetwi (2017) found that the size of the Board does not significantly contribute to improving the performance of the entity (expressed by ROA), as "there is a discrepancy between the requirements of the job and the official qualification of the appointees" (Alshetwi, 2017).

Another element considered essential for maximizing performance (expressed by ROA and ROE) is the independence of the Board (Qadorah and Hanim, 2018; Güngör Tanç and Çetinel, 2020; Hwang et al., 2020), which, according to researchers (Liu et al., 2014), ensures more effective monitoring of an entity's management, thus mitigating some of the inefficiencies that may arise. However, the results of the study conducted by Alshetwi (2017) refute the findings of the authors above, not identifying any link between the studied governance variable and performance (expressed by ROA). This can be explained by the close control that executives have over the information given to non-executive directors, which affects their "ability to contribute effectively to the company's performance" (Alshetwi, 2017).

Researchers are also interested in the relationship between the frequency of Council meetings and performance.

According to research conducted by Ntim and Osei (2011), a higher number of sessions will lead to a significant increase in the performance of an entity (expressed by Tobin Q, ROA, TSR). The reason behind this is that, through a higher frequency of meetings, management will be "advised, monitored and disciplined effectively" (Ntim and Osei, 2011) and thus better perform its tasks. However, works were also found that refuted these results. Thus, analyzing a sample of 94 companies listed on the Ho Chi Minh Stock Exchange for the period 2013-2015, Hanh et al. (2018) found that between the mentioned governance variable and ROA, ROE and ROS (return on sales), there is a negative relationship, but statistically insignificant. The same conclusion was reached by Eburn and Emmanuel (2019), following a study of insurance companies listed on the Nigerian Stock Exchange between 2006-2017. In their

opinion, to obtain a positive effect, more attention should be paid to the skills and experience of the Council members present at the meetings (Eburn and Emmanuel, 2019).

Taking into account previous research presented during this paper, the following hypotheses are proposed:

• For the performance-duality dependency of the CEO:

H1A: There is a significant negative correlation between CEO duality and performance; (Onofrei et al., 2019; Arif, 2019; Shrivastav and Kalsie, 2016; Nazar, 2016)

H1B: There is a significant positive correlation between CEO duality and performance; (Marcio et al., 2011; Yang, 2021)

H1C: There is no statistically significant relationship between CEO duality and performance; (Korir and Tenai, 2020; Kyere and Ausloos, 2020)

• For the performance dependency-size of the Board:

H2A: There is a significant positive correlation between Board size and performance; (Arif, 2019; Güngör Tanç and Çetinel, 2020; Bashir and Asad, 2018)

H2B: There is no statistically significant relationship between board size and performance; (Alshetwi, 2017)

• For performance dependence-independence of Board members:

H3A: There is a significant positive correlation between the independence of Board members and performance; (Liu et al., 2014; Qadorah and Hanim, 2018; Güngör Tanç and Çetinel, 2020; Hwang et al., 2020)

H3B: There is no statistically significant relationship between the independence of Board members and performance; (Alshetwi, 2017)

• For the performance-frequency dependence of the Council meetings:

H4A: There is a significant positive correlation between the frequency of Board meetings and performance; (Ntim and Osei, 2011)

H4B: There is no statistically significant relationship between the frequency of Board meetings and performance; (Hanh et al., 2018; Eburn and Emmanuel 2019).

3. DATA AND METHOD

This paper aims to determine whether the four governance variables discussed above contribute to improving the performance of the entities.

ROA and ROE were used to measure performance since, as seen from the review of the framework, they have always been in the interest of theorists and practitioners.

The top 100 companies whose shares are listed on the NYSE and NASDAQ have been selected to achieve the proposed goal because they invest the most resources to ensure good corporate governance, thus being the best choice for obtaining a relevant result. To have a homogeneous sample, the companies for which all the necessary data were not found and the companies that recorded aberrant values were excluded, resulting in a total number of 65 companies for the present study.

The analysis period covered the years 2015-2019. The time was intended to be longer, but no sufficient data was found until this period for many of the selected companies.

The information published on the website www.stock_analysis-on.net regarding the elements of corporate governance and the annual reports and the Proxy Statements prepared by the entities helped collect the financial accounting data. All data collected were processed using the SPSS program, using multiple linear regression as a quantitative method.

Based on the variables presented in Table 1, the equations of the econometric model were constructed as follows:

$$ROA = \alpha + \beta_1 \text{BOARD}_{\text{SIZE}} + \beta_2 \text{BOARD}_{\text{IND}} + \beta_3 \text{BOARD}_{\text{MET}} + \beta_4 \text{CEO}_{\text{DUALITY}} + \varepsilon \quad (1)$$

$$ROE = \alpha + \beta_1 \text{BOARD}_{\text{SIZE}} + \beta_2 \text{BOARD}_{\text{IND}} + \beta_3 \text{BOARD}_{\text{MET}} + \beta_4 \text{CEO}_{\text{DUALITY}} + \varepsilon \quad (2)$$

Where:

- ROA and ROE are the dependent variables;
- Board_SIZE, Board_IND, Board_MET, CEO_DUALITY are independent variables;
- β_1 , β_2 , β_3 represent the beta coefficients of the independent variables;
- α is the constant of the regression model;
- ε means error.

Table 1: Presentation of variables

Variables	Symbol	Explanations	Data source
Economic profitability	ROA	$ROA = \frac{net\ result}{total\ assets}$	www.stock-analysis-on.net
Financial profitability	ROE	$ROE = \frac{net\ result}{equity}$	www.stock-analysis-on.net
Dimension of the Council	Board_SIZE	It represents the total number of members of the Board of Directors.	Annual reports and Proxy Statement
Independence of Board members	Board_IND	It represents the total number of non-executive directors who are part of the Board of Directors.	Annual reports and Proxy Statement
Frequency of meetings	Board_MET	It represents the total number of meetings in a year	Annual reports and Proxy Statement
Duality of CEO	CEO_DUALITY	We used the dummy variable, which has the value 1 if the Chairman of the Board is the same as the General Manager and the value 0 otherwise.	Annual reports and Proxy Statement

SOURCE: AUTHORS' COMPILATION

4. DESCRIPTIVE ANALYSIS

This section presents a descriptive summary of all the governance and performance characteristics used in the research.

Table 2: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CEO_DUALITY	325	0	1	,57	,496
Board_SIZE	325	7	18	11,48	1,848
Board_IND	325	5	17	9,91	1,901
Board_MET	325	4	22	7,99	2,943
ROE	325	-5,2414	2,1709	,265926	,4540598
ROA	325	-,2226	,3493	,088599	,0738905
Valid N	325				

SOURCE: AUTHORS' COMPILATION

Table 2 shows that both rates of return show significant variations over the five years analyzed, registering values between -524.14% and 217.09% for the rate of financial return, and between -22, 26% and 34.93%, for the rate of return on assets.

Another variable whose values fluctuate quite a lot is the frequency of meetings (between 4 and 22 sessions per year). On average, board members meet about eight times a year.

Regarding the size of the Board, the average Board has 11 members, of which 10 are independent directors (mean 9.91).

More than half of the companies surveyed offer the titles of executive director and president to a single person.

5. RESULTS AND DISCUSSIONS

Next, the influence of governance variables on performance expressed by ROA and ROE performance will be tested.

The two measures are considered essential for this study, as both capture the results of management activity.

5.1 Studying the link between ROA and the influencing factors characteristic of corporate governance

In order to investigate the relationship between the rate of return on assets and the independent variables mentioned (Table 1), the following econometric model was constructed:

$$ROA = \alpha + \beta_1 \text{BOARD_SIZE} + \beta_2 \text{BOARD_IND} + \beta_3 \text{BOARD_MET} + \beta_4 \text{CEO_DUALITY} + \varepsilon \quad (1)$$

With the help of the SPSS program, a correlation matrix was created that presents the Spearman correlation coefficients and the value of significance related to each coefficient.

Table 3: Correlation matrix of the ROA dependent variable

Spearman's rho		ROA	CEO_DUALITY	Board_SIZE	Board_IND	Board_MET
ROA	Correlation Coefficient	1,000	-,087	-,106	-,102	-,136(*)
	Sig. (2-tailed)	.	,115	,055	,066	,014
	N	325	325	325	325	325
CEO_DUALITY	Correlation Coefficient	-,087	1,000	,149(**)	,384(**)	,032
	Sig. (2-tailed)	,115	.	,007	,000	,565
	N	325	325	325	325	325
Board_SIZE	Correlation Coefficient	-,106	,149(**)	1,000	,846(**)	,073
	Sig. (2-tailed)	,055	,007	.	,000	,189
	N	325	325	325	325	325
Board_IND	Correlation Coefficient	-,102	,384(**)	,846(**)	1,000	,147(**)
	Sig. (2-tailed)	,066	,000	,000	.	,008
	N	325	325	325	325	325
Board_MET	Correlation Coefficient	-,136(*)	,032	,073	,147(**)	1,000
	Sig. (2-tailed)	,014	,565	,189	,008	.
	N	325	325	325	325	325

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

SOURCE: AUTHORS' COMPILATION

As shown in Table 3, Board_MET is the only significant variable because the significance level (Sig) is less than 0.05. Therefore, this variable has a negative influence on ROA. A possible explanation for the negative effect could be represented by the fact that "frequent meetings can lead to the channelling of resources to less productive activities" (Johl et al. 2015, 242).

The Enter method obtains punctually estimated values for the established regression model (Table 4).

Table 4: Estimation of the values of the multiple linear regression model for ROA

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	B	Std. Error
(Constant)	,138	,027		5,044	,000
CE0_DUALITY	-,011	,010	-,075	-1,150	,251
Board_SIZE	-,009	,004	-,219	-1,962	,051
Board_IND	,008	,005	,208	1,716	,087
Board_MET	-,003	,001	-,113	-1,972	,049

SOURCE: AUTHORS' COMPILATION

According to Table 4, only the Board_MET variable is statistically significant (Sig = 0.049).

Based on the obtained result, the equation of the econometric model for ROA was determined:

$$ROA = 0.138 - 0.003 \text{BOARD_MET} + \varepsilon \quad (1)$$

Interpretation of values:

$\alpha = 0.138$, which means that the ROA is 0.138 when Board_MET is equal to 0.

$\beta_3 = -0.003$, which means that the ROA decreased by 0.3% when the number of Board meetings increased by one unit per year; aspect was interpreted negatively, both by investors and other interested parties.

Table 5: Testing the regression model parameters

Board_MET	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
	48,932	324	,000	7,988	7,67	8,31

SOURCE: AUTHORS' COMPILATION

Because the regression coefficient has a significance level Sig < 0.05, it is significant.

By comparing t_{computer} with t_{table} it can be seen that $t_{\text{computer}} > t_{\text{table}}$ ($t_{\alpha/2; n-5} = 1,960$), which results in the null hypothesis being rejected, the correlation coefficient being different from 0.

5.2 Studying the link between ROE and influencing factors characteristic of corporate governance

To investigate the relationship between the rate of financial return and the mentioned independent variables (Table 1), the following econometric model was constructed:

$$ROE = \alpha + \beta_1 \text{BOARD_SIZE} + \beta_2 \text{BOARD_IND} + \beta_3 \text{BOARD_MET} + \beta_4 \text{CEO_DUALITY} + \varepsilon \quad (2)$$

With the help of the SPSS program, a correlation matrix was created that presents the Spearman correlation coefficients and the value of significance related to each coefficient.

Table 6: ROE dependent variable correlation matrix

Spearman's rho		ROE	CEO_DUALITY	Board_SIZE	Board_IND	Board_MET
ROE	Correlation Coefficient	1,000	-,051	-,053	,011	-,145(**)
	Sig. (2-tailed)	.	,362	,337	,839	,009
	N	325	325	325	325	325
CEO_DUALITY	Correlation Coefficient	-,051	1,000	,149(**)	,384(**)	,032
	Sig. (2-tailed)	,362	.	,007	,000	,565
	N	325	325	325	325	325
Board_SIZE	Correlation Coefficient	-,053	,149(**)	1,000	,846(**)	,073
	Sig. (2-tailed)	,337	,007	.	,000	,189
	N	325	325	325	325	325
Board_IND	Correlation Coefficient	,011	,384(**)	,846(**)	1,000	,147(**)
	Sig. (2-tailed)	,839	,000	,000	.	,008
	N	325	325	325	325	325
Board_MET	Correlation Coefficient	-,145(**)	,032	,073	,147(**)	1,000
	Sig. (2-tailed)	,009	,565	,189	,008	.
	N	325	325	325	325	325

** Correlation is significant at the 0.01 level (2-tailed).

SOURCE: AUTHORS' COMPILATION

As shown in Table 6, Board_MET is the only significant variable because the significance level (Sig) is less than 0.05. This has a negative influence on ROE.

The Enter method obtains punctually estimated values for the established regression model (Table 7).

Table 7: Estimation of the values of the multiple linear regression model for ROE

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	B	Std. Error
(Constant)	,350	,168		2,084	,038
CEO_DUALITY	-,057	,059	-,063	-,966	,335
Board_SIZE	-,040	,027	-,161	-1,442	,150
Board_IND	,055	,029	,229	1,885	,060
Board_MET	-,018	,009	-,114	-1,985	,048

SOURCE: AUTHORS' COMPILATION

According to Table 7, only the Meetings_board variable is statistically significant (Sig = 0.048).

Based on the obtained result, the equation of the econometric model for ROE was determined:

$$ROE = 0.350 - 0.018BOARD_MET + \epsilon \quad (2)$$

Interpretation of values:

$\alpha = 0.350$, which means that the ROE takes 0.350 when Board_MET is equal to 0.

$\beta_3 = -0.018$, which means that the ROE decreases by 1.8% when the number of Council meetings increases by one unit per year. Compared to asset management, the negative effects determined on the rate of financial return are 500% higher.

Table 8. Testing the regression model parameters

Board_MET	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
	48,932	324	,000	7,988	7,67	8,31

SOURCE: AUTHORS' COMPILATION

Because the regression coefficient has a significance level Sig < 0.05, it is significant.

By comparing $t_{computer}$ with t_{table} it can be seen that $t_{computer} > t_{table}$ ($t_{\alpha / 2; n-5} = 1,960$), which results in the null hypothesis being rejected, the correlation coefficient being different from 0.

Table 9: Research results

Hypotheses	Anterior studies	Results obtained
THE DEPENDENCE PERFORMANCE-CEO DUALITY		
H1 _A : There is a significant negative correlation between CEO Duality and performance	(Onofrei et al., 2019; Arif, 2019; Shrivastav and Kalsie, 2016; Nazar, 2016)	Denied
H1 _B : There is a significant positive correlation between CEO Duality and performance	(Marcio et al., 2011; Yang, 2021)	Denied
H1 _C : There is no statistically significant relationship between the CEO Duality and performance	(Korir and Tenai, 2020; Kyere and Ausloos, 2020)	Validated
THE DEPENDENCE PERFORMANCE-DIMENSION OF THE COUNCIL		
H2 _A : There is a significant positive correlation between the dimension of the Council and performance	(Arif, 2019; Güngör Tanç and Çetinel, 2020; Bashir and Asad, 2018)	Denied
H2 _B : There is no statistically significant relationship between the dimension of the Council and performance	(Alshetwi, 2017)	Validated
THE DEPENDENCE PERFORMANCE-INDEPENDENCE OF BOARD MEMBERS		
H3 _A : There is a significant positive correlation between the independence of board members and performance	(Liu et al., 2014; Qadorah and Hanim, 2018; Güngör Tanç and Çetinel, 2020; Hwang et al., 2020)	Denied
H3 _B : There is no statistically significant relationship between the independence of board members and performance	(Alshetwi, 2017)	Validated
DEPENDENCE PERFORMANCE-FREQUENCY OF BOARD MEETINGS OF THE COUNCIL		
H4 _A : There is a significant positive correlation between the frequency of board meetings and performance	(Ntim and Osei, 2011)	Denied
H4 _B : There is no statistically significant relationship between the frequency of Board meetings and performance	(Hanh et al., 2018; Ebun and Emmanuel, 2019)	Denied

SOURCE: AUTHORS' COMPILATION

6. CONCLUSIONS

This paper sought to determine whether the governance variables represented by: the duality of the CEO, the independence of the Board, the number of its members and the frequency of meetings contribute to improving the performance of entities, expressed by ROA and ROE.

To achieve this goal, the top 100 entities whose shares are listed on the NYSE and NASDAQ are selected, as they invest the most resources to ensure good corporate governance, which is why it is considered the best choice for a relevant result. After excluding the companies for which not all the necessary data were found and the companies that registered aberrant values, the final research sample included 65 companies that are part of various fields of activity. The analysis period covered the years 2015-2019.

Empirical testing has shown that only the variable represented by the frequency of Board meetings has a statistically significant influence on the entity's performance. Its impact is negative on both ROA and ROE. According to Johl et al. (2015, 242), a possible explanation could be represented by the fact that: "frequent meetings can lead to the channelling of resources to less productive activities".

Regarding the variables represented by the duality of the CEO and the size and independence of the Board, there is no significant association between them and the entity's performance. The conclusions obtained are consistent with studies of Alshetwi (2017), Korir and Tenai (2020), Kyere and Ausloos (2020).

The research results show that investing a large number of resources is not necessarily enough to improve performance. A crucial aspect is the way these resources are distributed. Thus, to achieve the desired objectives, the entities should identify the governance characteristics that significantly and positively influence their activity and focus on them.

Out of the desire to improve this research, we will consider comparing the impact that the studied characteristics had on the largest companies and the impact that the same characteristics have on smaller companies.

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A General Profile of Artificial Intelligence Adoption in Banking Sector: A Survey of Banks in Afyonkarahisar Province of Turkey

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ABSTRACT

Artificial Intelligence (AI) is rapidly transforming the global financial services industry. The new digitalization model is powered by artificial intelligence technology, and AI has the potential to disrupt and refine the existing financial services industry. The increasing amount of data in banking has revealed the need for fast and reliable service. Banks are financial service organizations that have used AI effectively in recent years. This paper reveals the general profile of artificial intelligence adoption by banks. Based on the evidence from all 17 banks operating in the Afyonkarahisar province of Turkey, it is concluded that AI technologies are applied in almost every area of the banking sector to improve the overall service offered. Moreover, the use of AI is evaluated as a potential that provides ease of use and reduces costs. As for the operations in future, the participants think AI will provide high levels of benefit to banks in their financial services in the incoming years. Given no similar study, this study appears to provide an original contribution to the literature regarding the use of AI in banking services within the Turkish context.

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1. INTRODUCTION

Charles Babbage is known to have created the first mechanical computer in the first half of the 19th century. However, the first programmable, electronic, general-purpose digital computer, ENIAC (Electronic Numerical Integrator and Computer), was made in 1945 (Kaplan and Haenlein, 2020). Nevertheless, in the 1950s, developments in computer sciences witnessed the birth of Artificial Intelligence. In the first year of that decade, Alan Turing (1950), often considered the father of modern computer science, proposed, in his first sentence of his article "Computing Machinery and Intelligence" in the Mind Journal, to consider the question "Can machines think?". Not long after that, the term 'Artificial Intelligence (AI) was coined in 1956 by John McCarthy at the first conference on the subject at Dartmouth College in Hanover, New Hampshire (Lewis, 2014).

AI has nowadays penetrated the daily routines of business life, progressively taking up the tasks ordinarily performed by human beings. Having strong proponents, it is, however, exposed to severe

criticisms. Harari (2019), for example, considers Artificial Intelligence among the existential dangers humanity faces. Inventor Elon Musk (2018) is much cited for having called AI far “more dangerous than nukes”, while acclaimed physicist Steven Hawking (2017) warned that the advent of true AI could be the “worst event in the history of our civilization”. On the other hand, Andrew Ng (2017) called AI the 'new electricity' and went on claiming that “just as electricity transformed many industries roughly one hundred years ago, AI will also now change every major industry”.

Artificial Intelligence is defined in the Oxford English Dictionary (2021) as “the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making and translation between languages.” Similarly, Gottfredson (1997) describes AI as “a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience. It is not merely book learning, a narrow academic skill, or test-taking smarts. Rather, it reflects a broader and deeper capability for comprehending our surroundings—'catching on', 'making sense of things', or 'figuring out what to do'."

The rapid and continuous advancement in AI have permeated important aspects of human behaviour. According to Ahmad et al. (2021), AI systems were available in 1964 for understanding algebra problems, 1976 for medical treatments, 1994 for military logistic programming, and 2014 for fast translation. Indeed, Lauterbach (2019) and Samala et al. (2020) underlined that since artificial intelligence technology entered our lives, they have advanced quite quickly in numerous domains. Artificial intelligence has lately acquired popularity, according to Fernandez (2019), owing to the large amount of digital data available, enhanced data storage and computational processing capability at a reduced cost, and advances in the algorithms used. Research by McKinsey Global Institute (2017) on 14 sectors over ten countries across Europe, North America, and Asia highlighted the potential of AI in sourcing, optimizing operations, targeting marketing, improving pricing and improving customer experience. As Wamba-Taguimdje et al. (2020) state, artificial intelligence technologies are used in several sectors in machine learning, deep learning, chatbot, neural network, and virtual assistance for companies. Ahmad et al. (2021) assert that AI techniques in the energy industry outperform traditional models in controllability, big data handling, cyberattack prevention, smart grid, robotics, energy efficiency optimization, predictive maintenance control, and computational efficiency. The tourism sector is another sector that uses artificial intelligence technologies in facial recognition, virtual reality applications, chatbots, google maps, language translators, and audio tours that help deliver a novel experience to the customers (Samala et al., 2020).

As in other sectors, Artificial Intelligence is used effectively in the financial services sector. The use of Artificial Intelligence in financial services has many advantages. An increase in efficiency and productivity through automation and minimizing errors caused by psychological or emotional factors are a few of them (Buchanan, 2019). This study attempts to reveal the AI adoption profile of Turkish

banks by drawing on data obtained from the survey of all 17 banks in the Afyonkarahisar province of Turkey. The next part of the study will provide a literature review on the use of AI in financial services. The methodology and survey results will be presented in the following parts. Finally, the article will end with a conclusion.

2. LITERATURE REVIEW

Artificial Intelligence offers the opportunity to advance the transformation of the financial industry by improving decision making, enhancing analytical capabilities and automating business processes such as fraud detection, customer experience, chatbots, robot-trainer services, and calculation of insider trading (Nobanee and Blooshi, 2020). In the same vein, Buchanan (2019) asserts that AI is changing the direction of the financial services industry, especially in three specific areas, namely, fraud detection, banking chatbots and robot-advice services, and algorithmic trading. Hence, it is predicted that AI will become more pervasive in financial services.

Based on a survey of 151 firms from 33 countries, including both fintech and incumbents, Ryll et al. (2020) depict a global financial services sector undergoing profound digital transformation underpinned by the advancement in AI. The study results reveal an increase in the perceived strategic importance of Artificial Intelligence in key financial services sectors over time. Specifically, the use of AI in market infrastructure and professional services, payments, deposits and lending is expected to be more important in the near future.

Together with sifting through reams of data to spot fraud, banks are increasingly using Artificial Intelligence, a cutting-edge technology once the stuff of science fiction, to answer the questions of individual customers in a fast yet understandable manner (Daks, 2018). Saraswat (2017) indicates that AI is used in the financial sector for virtual assistance via text and speech to respond to user queries. Noonpakdee (2020) examined the adoption of AI for financial investment services using data drawn from a survey of 400 investors in Thailand. Multiple linear regression employed in the study revealed that among the factors affecting the use of Artificial Intelligence for financial investment services are trust, perceived usefulness, and knowledge of using the application.

There are, however, articles, such as Yuan and Jing (2018), stating that risks would emerge in financial services as they go digital. In support of his view that AI in financial services will present new threats, challenges, and new opportunities, Mehrotra (2019) cites an algorithm example used in an artificial intelligence application with bias and discrimination against certain races and gender. In addition, Saraswat (2017) asserts that even if time is saved and productivity is increased by using artificial intelligence technologies, issues such as prejudice, privacy violation, trust, lack of trained staff, and anxiety have been cited as ongoing challenges for AI.

There are mixed expectations regarding the effect of AI on future employment prospects. For example, Wheeler (2020) reports that the banking sector is expected to experience significant job losses, with the

tellers, loan officers, customer service representatives, loan interviewers/processors, and compliance personnel being the jobs anticipated to be impacted the most. However, Mehrotra (2019) puts forward a contradicting view emphasizing that the core component of banks is people rather than an automated platform, requiring warmth and human intervention rather than brief and mechanically formulated interactions. Eventually, due to branch closures and the incorporation of systematic investments into business models stemming from the increasing use of AI, the banking sector is estimated to save \$1 trillion by 2030 (Mehrotra, 2019; Wheeler, 2020).

The use of AI in several sectors is becoming increasingly evident in Turkey. AI has been applied in a wide range of fields such as neuropsychiatry (Erol and Erol, 2019), ophthalmology (Keskinbora and Güven, 2020), dairy farming (Akillı and Atıl, 2014), furniture design (Armağan, 2019), retailing (Gülşen, 2019), water quality assessment (Sengorur et al., 2015), accounting profession (Gacar, 2019), computer engineering and software (Uslu, 2015; Kayaönü, 2000), and predicting the course of Covid-19 (Uslu, 2021).

There are, however, not so many descriptive and empirical studies on artificial intelligence applications in financial services in Turkey. Kömürcüoğlu and Akyazı (2020), for example, investigated the development and possible effects of emerging financial technologies in Turkey, concluding that financial technologies have developed rapidly in Turkey in recent years though not as sufficiently as in other countries. Hancı and Özkoç (2019) explored the security of the use of chatbot applications by banks, asserting that chatbots, which have become a trend in banking, have brought significant advantages to banks in terms of customer relations, while also bringing concerns about security and privacy. The study, nevertheless, emphasizes cost savings arising from the use of AI.

Gümüş et al. (2020) surveyed a sample of 500 people and found out that as the age, income and education level of the people participating in the survey increase, the confidence in artificial intelligence increases, too. It has also been concluded that the effective use of Artificial Intelligence in the financial sector provides excellent convenience for users.

A survey of 215 people by Medetoğlu and Saldanlı (2018) investigated the use of Artificial Intelligence in the finance and banking sector and found that AI applications considerably reduce costs. In addition, another finding of the study is that the concept of financial technology is not very common yet, but Artificial Intelligence automation is thought to change the way of doing business in future.

Given the limited number of studies on the use of AI by banks in Turkey, the present study appears to fill a gap in the literature by investigating the AI adoption pattern of the banks operating in Afyonkarahisar province of Turkey.

3. METHODOLOGY

This research attempts to reveal the general profile of AI adoption in banking services and expected effects perceived by bank managers of AI on banking services in the future. In order to obtain data on these expected effects, a questionnaire was drawn based on the prior literature.

The questionnaire consisted of two parts, of which the first one was about unveiling significant attributes of the current use of AI by the banks. This first part of the questionnaire was made up of multiple-choice questions, allowing the respondents to tick more than one option where possible. The first question of that part, for example, probed whether the banks use AI in areas such as business advice, personal finance management solutions, and automatic data management. The following two questions looked at the generational range and customer portfolio targeted by the banks' artificial intelligence-supported financial services applications.

The second part of the questionnaire housed a set of questions configured to measure respondents' evaluations of the AI usage by banks using Likert scale questions. For example, respondents were asked to evaluate the statement "with the increase in the application of artificial intelligence, job losses are experienced in the banking sector" on a five-point scale ranging from "1=strongly disagree" to "5=strongly agree".

Of the 34 commercial and six participating banks operating in Turkey as of 31st March 2021 (Banks Association of Turkey, 2021), 12 and 5 have branches in Afyonkarahisar province, respectively. Information was drawn from all those 17 banks operating in Afyonkarahisar via a questionnaire. Twelve deposit banks surveyed constitute the largest banks in terms of the number of branches operating in Turkey. Furthermore, they are among the largest 14 deposit banks by asset size. Excluding a new entrant, five participation banks surveyed in the study represent all incumbent ones. So then, it appears that the sample has the attribute of representing the deposit and participating banks in Turkey.

This study collected the data set by conducting surveys in April 2021 with the senior officials of those 17 banks in Afyonkarahisar. The branch manager, or in her/his absence, the vice manager of each bank was requested to answer the self-administrated questionnaire. This research thus utilizes the data obtained from all 17 bank branches operating in the Afyonkarahisar province of Turkey.

4. ANALYSIS RESULTS

From Table 1 below, of the 17 banks surveyed, only one bank currently does not use artificial intelligence technologies. Except for one, all banks surveyed (16 banks, 91,4 per cent) have strategies to make their stakeholders adopt AI. More than half of the banks (11 banks, 64,7 per cent) collaborate with a fintech company to develop its Artificial Intelligence infrastructure. Moreover, all banks employ a cyber security measure for their digital operations. No bank considers Artificial Intelligence in banking services as a risk.

Table 1: Major Features of AI Adoption by Banks

	No	%
Using AI in operations		
Yes	16	94,1
No	1	5,9
Having a strategy to make stakeholders adopt AI		
Yes	16	94,1
No	1	5,9
Considering the use of AI in banking services is a risk		
Yes	0	0
No	17	100,0
Cooperating with a fintech company for AI infrastructure development		
Yes	11	64,8
No	3	17,6
Missing	3	17,6
Having cyber security measure		
Yes	17	100,0
No	0	0
Percentage of the transactions bank's customers can perform without visiting branches		
%10-%20	2	11,8
%30-%40	4	23,5
%50-%60	3	11,8
%70-%80	8	47,1
%90-%100	1	5,9
TOTAL	17	100,00

Source: Authors' Compilation

The respondents were asked to indicate what percentage of the transactions they think their banks' customers can perform, via mobile channels and chatbots, without personally visiting the branches. Almost half of the respondents (8 banks, 47,1 per cent) think that 70% to 80% of the operations could be carried out via digital means.

The banks' prevalent patterns in AI adoption are reported in Table 2. This Table intends to show the services where banks make use of AI. Therefore, the respondents were asked to specify whether their banks use chatbots and apply AI in QR code transactions, fraud detection, business advice, personal finance management solutions, automatic data management and authentication.

The two most frequently used AI applications are QR code transactions and fraud detection (13 banks, 76,5 per cent), followed by authentication and automated data management (12 banks, 70,6 per cent), chatbots and business advice (10 banks, 58,8 per cent).

The next question asked which generations were targeted by the AI-powered financial services applications. As shown in Table 2, the banks mainly target Y and Z generations (11 banks each, 64,7 per cent). However, baby boomers appear to be a somewhat neglected generation, falling within the target range of only two banks (11,7 per cent).

The respondents were asked to indicate the customer portfolios targeted by the banks' AI-based Bot services. As Table 2 clearly shows, all banks but one target individual customers (16 banks, 94,1 per

cent). Following individual customers, banks address SMEs with their services (13 banks, 76,5 per cent). Finally, large companies and non-profit organizations are also among the customer portfolios (11 banks each, 64,7 per cent) that the banks offer AI-based Bot services to.

Table 2: Prevalent Patterns in AI Use by Banks

	Rank	No	%
Fields AI used			
QR Code Transactions	1	13	76,5
Fraud Detection	1	13	76,5
Automatic Data Management	2	12	70,6
Authentication	2	12	70,6
Chatbots	3	10	58,8
Commercial Advice	3	10	58,8
Personal Finance Management Solutions	4	9	52,9
Targeted generation			
Y	1	11	64,7
Z	1	11	64,7
X	2	5	29,4
Baby Boomer	3	2	11,7
Customers Targeted by Artificial Intelligence-Based Bot Services			
Individuals	1	16	94,1
SMEs	2	13	76,5
Non-profit organizations	3	11	64,7
Large companies	3	11	64,7

Note: n=17

Source: Authors' Compilation

Adoption of AI is a rather strategic decision. Therefore, personal evaluations of bank managers could reflect the nature of strategic decision making about AI adoption. In order to explore the managerial evaluations towards AI, the respondents were asked to assess a set of statements in the form of a five-point Likert scale ranging from 1=strongly disagree to 5=strongly agree.

Table 3 shows that the banks have a positive attitude towards AI and expect it to have a more prominent role in banking operations in the future. The bank managers conceive of using financial technology as a convenience for customers (4,824 mean). Consequently, they perceive the use of Artificial Intelligence in their financial services as providing a cost-reduction advantage for their banks (4,7059 mean) and think their banks would experience a high level of benefit from Artificial Intelligence in the next decade (4,5295 mean). Furthermore, managers highly agree with the statement that the transition from traditional banking to modern banking is a reason for customers to choose their banks (4,4706 mean). The respondents believe that their banks have increased efficiency after introducing artificial intelligence applications (4,2941 mean).

As shown in Table 3, the increase in the use of Artificial Intelligence applications in the banking sector is expected to cause both a decrease in the number of branches (4.000 mean) and job losses (3.8824

mean). Overall, managers do not think the banking sector is late in using Artificial Intelligence compared to other sectors (2.4706).

Table 3: AI Usage Evaluations by Banks

	Mean	SD
The use of financial technology services is a convenience for customers.	4,8824	,33211
Using Artificial Intelligence in our financial services provides cost reduction for our bank.	4,7059	,46967
The use of artificial Intelligence in our bank's financial services will provide a high level of benefit to your bank in the next 10 years.	4,5294	,62426
The transition from traditional banking to modern banking is a reason for customers to choose our bank.	4,4706	,79982
Our bank has increased efficiency compared to the situation before using artificial intelligence applications.	4,2941	,77174
The increase in the use of Artificial Intelligence applications in the banking sector in financial services is expected to cause a decrease in the number of branches.	4,0000	1,06066
The banking sector is late in using Artificial Intelligence compared to other sectors.	2,4706	1,17886
With the increase in the percentage / area of application of Artificial Intelligence, job losses will be inescapable in the banking sector.	3,8824	1,21873
Notes: n=17, The mean is an average on a scale ranging from 1=strongly disagree to 5=strongly agree; SD=standard deviation		

Source: Authors' Compilation

5. CONCLUSION

This study has investigated the underlying nature of AI adoption by Turkish deposit and participation banks. Though the banking sector in Turkey has increased the use of AI in its operations, there are only a limited number of studies on the subject. Hence, this study attempts to contribute to the literature by delineating the prominent patterns, as perceived by the bank managers, of AI usage in the financial services banks render.

Drawn on the evidence from all 12 deposit and five participating banks operating in Afyonkarahisar province of Turkey, the banks, in general, are found to display a positive attitude towards AI use. All banks in the sample except one are already using AI to cover QR code transactions, fraud detection, automatic data management, authentication, chatbots, commercial advice, and personal finance management solutions. This shows that Turkish banks are not being outdone by their foreign counterparts who apply AI in various areas, as Wamba-Taguimdje et al. (2020) report.

The technology and innovation aiming to compete with traditional financial methods in delivering financial services are regarded by the banks surveyed as a convenience for customers. This result conforms with the finding by Noonpakde (2020). Additionally, similar to the results of the studies by Wheeler (2020) and Medetoğlu and Saldanli (2018), the bank managers in the current research consider using Artificial Intelligence in their financial services as a cost-reducing exercise. Therefore, the increase in the use of artificial intelligence applications in the banking sector is expected to decrease the number of branches and cause job losses in the future.

In their AI-based services, the banks mainly target individual customers and SMEs, focusing less on non-profit institutions and large companies. However, the perceived prevalence of human existence in the relations with non-profit institutions and large companies might be the consequence of the large magnitude of deposit and credit relations with those entities.

The banks primarily focus on Y and Z generations whilst neglecting baby boomers. This result conforms with Wheeler (2020). Though AI applications might not involve a steep learning curve, it appears older generations are not as adept as younger ones at mastering AI-backed applications.

Saraswat (2017) cited that AI applications are laden with potential risk factors such as prejudice, privacy violation and transparency issues. However, an interesting and important finding of the current study is that the bank managers do not consider the use of AI in banking services as a risky venture. This optimistic approach sounds plausible given the already proven success of digital technologies and AI applications as perceived by the bank managers. The bank managers regard the transition from traditional to modern banking as a factor for customers choosing their banks. Almost half of the bank managers think that around 70 to 80 per cent of operations can nowadays be handled via digital platforms without visiting branches in person. The bank managers also declare that the banks have already experienced increased efficiency with the Artificial Intelligence applications. Therefore, Artificial Intelligence in financial services is thought to provide a high level of benefit to the banks in the following decades. The assessments by the bank managers imply the irreversible role that AI applications would play in the services the banks will provide in future.

The study has attempted to provide the general profile of AI adoption by banks based on the data gathered from the banks operating in the Afyonkarahisar province of Turkey. Future studies could explore the differences in AI usage among public deposit, private deposit, and participation banks by enlarging the sample size. In addition, the link between AI adoption and its possible environmental determinants could be a venue for future researches.

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Causality Relationship between Spot and Futures Bitcoin Prices in CME

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ABSTRACT

To protect against risks arising from fluctuations in spot prices and better manage risk, investors might evaluate futures markets. The role of price discovery in the futures markets and the possibility of reducing certain risks increase the importance of researching the relationship between spot and futures prices. This study aims to determine whether there is a relationship between the Bitcoin spot prices and the Bitcoin futures prices. To this end, the relationship between the two markets is analyzed using Johansen Cointegration analysis and Vector Error Correction Model (VECM) using the daily data of the period 02.23.2017 – 08.31.2021. Unit root tests show that each series are not stationary at the level values and that the first differences of the series are stationary. The results of the cointegration analysis show that there is a long-term equilibrium relationship between the bitcoin spot market and the bitcoin futures market, and it is a single cointegration vector. The Granger causality test based on the vector error correction model was used to determine the causality relationship between the series. It has been determined that there is a unidirectional causality relationship from the Bitcoin spot market to the Bitcoin futures market. Bitcoin is a new financial tool that attracts the attention of investors. Investors make transactions on Bitcoin for speculative purposes. Therefore, unlike other investment instruments, spot prices in the bitcoin market affect futures prices.

ARTICLE INFO

Keywords:

Bitcoin Spot Market, Bitcoin Futures Market, Cointegration, Vector Error Correction Model (VECM)

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1. INTRODUCTION

Cryptocurrency is a virtual money system traded in a digital and technology-based financial system. It is money issued digitally by individuals or institutions rather than states. Cryptocurrencies are used for investment purposes rather than commercial transactions. Bitcoin is the first digital currency. Although thousands of cryptocurrencies were subsequently mined, bitcoin still has the largest trading volume. Since Bitcoin is bought and sold on private exchanges, its returns are usually high, which causes Bitcoin to become an investment asset (Bouri et al., 2020).

Bitcoin has also become a new financial asset that portfolio managers consider in their short and long-term investment decisions. So, estimating the price is an important issue that should be emphasized. At the same time, investors need to manage the risks arising from fluctuations in bitcoin prices.

Investors evaluate futures markets to protect themselves from the risks that arise from fluctuations in spot prices and to manage the risk better. The other primary function of futures markets is future price determination. The prices formed in the futures markets indicate the future and are effective in making investors' investment decisions. By this function, futures markets are always in contact with spot markets. Although futures is one of the tools used primarily for hedging purposes, it can be said that it is also used for speculation and arbitrage purposes.

Bitcoin gained significant recognition in a short period of time and reached a significant investor base worldwide. With Bitcoin becoming the centre of attention of investors, in December 2017, the Chicago Board Options Exchange (CBOE) and Chicago Mercantile Exchange (CME) issued and offered Bitcoin futures contracts. Thus, investors provide risk management by including bitcoin futures contracts in their portfolios.

The price discovery role of futures markets and the possibility to mitigate specific risks increase the importance of investigating the relationship between spot and futures markets. However, most studies analyzing the relationship between markets have dealt with stock, foreign exchange and commodity markets. This study contributes to the literature by examining the relationship between bitcoin spot and futures markets. The study, using daily data for the period 02.23.2017 – 08.31.2021, tried to determine whether there is a long-term relationship between the two markets with the Johansen cointegration test. In addition, the Vector Error Correction Model (VECM) was used to investigate whether there is a causal relationship between the markets.

The remainder of the study is organized as follows: Existing literature investigating the relationship between markets is summarized in the second section. The third section introduces the econometric methodology, and the fourth section introduces data. In the fifth section, the relationship between the markets is analyzed econometrically. Finally, the study is completed with the conclusion, where the empirical analysis results are evaluated.

2. LITERATURE REVIEW

The price discovery role of the futures market and its ability to mitigate certain risks has increased the importance of examining the relationship between futures markets and spot prices. Therefore, there is substantial research examining the relationship between futures and spot prices. There are many studies in the literature investigating the relationships between spot prices related to futures contracts based on stocks, foreign exchange and commodities (Pok and Poshakwale, 2004; Ryoo and Smith, 2004; Srinivasan, 2009; Lafuente-Luengo, 2009; Tse and Chan, 2010; Jerry Ho et al. 2010; Ersoy and Bayrakdaroğlu, 2013; İşeri and Kaçmaz, 2016; Kirkulak-Uludağ and Lkhamazhapov, 2016; Ruan et

al. 2016). However, studies examining the relationship between Bitcoin spot and futures market are limited.

Hu et al. (2019) examined causality relationships, cointegration and price discovery between Bitcoin's spot and futures markets using daily data. As a result of the Granger causality test, they concluded that there is a bidirectional causality relationship between the spot price and the CME futures prices. In addition, a cointegration relationship between spot and futures markets has been determined. In the price discovery process, it has been seen that futures prices dominate, implying a leading informative role. Shynkevich (2019) suggests that the introduction of bitcoin futures has increased the informational efficiency of the bitcoin spot market.

Kapar and Olmo (2019) analyzed the Bitcoin price discovery process. Using data from December 2017 to May 2018, they compute Hasbrouck's information share and Gonzalo and Granger's common factor component to quantify the contribution of each market to the price discovery process. Both methods coincide with suggesting that the Bitcoin futures market dominates the price discovery process. Likewise, Fassas et al. (2020) examine the contribution of bitcoin futures contracts to the bitcoin price discovery process. They find evidence that although the volume of bitcoin traded on the spot market exceeds the volume of the futures market, the futures market plays a more critical role in incorporating new information about the value of bitcoin. The empirical research also provides evidence of strong bidirectional dependence in the intraday volatility of the spot and futures markets.

Wu et al. (2021) use the fractional cointegrating vector autoregressive (FCVAR) model to examine high-frequency price discovery of bitcoin spot and futures prices from 18 December 2017 to 31 July 2020. The results show that the bitcoin futures market dominates the price discovery process. In addition, it has been determined that bitcoin price discovery leadership has moved to the spot market during the Covid-19 pandemic.

Baur and Dimpfle (2019) examine the contribution of the 2017 launch of bitcoin futures by the CBOE and CME to price discovery. As a result of the analysis, it has been determined that the Bitcoin spot price drives the futures price. This result has been attributed to the higher trading volume and longer trading hours of the globally distributed bitcoin spot market, compared to the relatively limited access to US-based futures markets.

Jalan et al. (2021) indicate that the introduction of bitcoin futures potentially exerted a downward impact on the USD bitcoin spot market return and skewness and an upward one on volatility, kurtosis and liquidity, which became higher after futures were introduced.

3. METHODOLOGY

To measure the causality relationship between the Bitcoin spot market and the futures market, the Johansen cointegration test is used to determine whether there is a long-term relationship between the markets. Then, the causality relationship between the markets was investigated with the Vector Error Correction Model.

3.1. Cointegration Test

Cointegration means that the variables move together in the long run. If all variables are stationary at the same level, cointegration methods test whether there is a long-term relationship between the series. The existence of a long-term equilibrium relationship between variables was investigated according to the cointegration method developed by Johansen (1988) and Johansen and Juselius (1990). The Johansen cointegration test is based on the vector autoregression model (VAR) analysis. The VAR model is shown as follows (Brooks, 2008);

$$y_t = \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_k y_{t-k} + u_t \quad (1)$$

$$\Delta y_t = \Pi y_{t-k} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \dots + \Gamma_{k-1} \Delta y_{t-(k-1)} + u_t \quad (2)$$

where Γ and Π represent coefficient matrices. Coefficient matrix Π contains information about long-term relationships. In Johansen and Juselius's cointegration method, two different test statistics, trace test statistics and maximum eigenvalue test statistics, have been developed to reveal the existence of the cointegration relationship and the number of a cointegrated vector. These test statistics are as follows;

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^g \ln(1 - \hat{\lambda}_i) \quad (3)$$

$$\lambda_{max}(r, r + 1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad (4)$$

The cointegration vector number is represented by r . Trace test statistics investigate the cointegration relationship as r , and maximum eigenvalue test statistics investigate the cointegration relationship as much as $r + 1$ (Brooks, 2008).

3.2. Vector Error Correction Model

According to Engle and Granger (1987), if there is cointegration between the variables, it is possible to discuss at least a unidirectional causality relationship between the variables. The fact that the variables are stationary in their first difference and their integration degree is $I(1)$, enables the vector error correction model (VECM) to be used for causality analysis. To determine the direction of possible causality in the VAR model, error correction terms (ECT) should be included in the VECM model, where each variable is used as an independent variable. The vector error correction model is shown as follows: (Charemza and Deadman, 1993).

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^p \beta_{1i} \Delta X_{t-1} + \sum_{i=1}^p \gamma_{1i} \Delta Y_{t-1} + \varphi ECM_{t-1} + u_{1t} \quad (5)$$

$$\Delta X_t = \alpha_2 + \sum_{i=1}^p \beta_{2i} \Delta X_{t-1} + \sum_{i=1}^p \gamma_{2i} \Delta Y_{t-1} + \varphi ECM_{t-1} + u_{2t} \quad (6)$$

In the model, the ECM represents the error correction term. Therefore, the coefficient in front of the error correction term is expected to be negative, between zero and minus one, and to be statistically significant. In this case, it is stated that there will be a long-run causality relationship between the variables. At the same time, the negative value and statistical significance of the ECM coefficient show that the short-term deviations between the series disappear in the long term, and the series comes to equilibrium together in the long term.

4. DATA

This study aims to determine whether there is a relationship between the Bitcoin spot market and the Bitcoin futures market. The analysis used the Bitcoin/Dollar exchange rate representing the bitcoin spot market and Bitcoin Futures CME data representing the futures market. The study analyzed daily price data for the period 23.02.2017 to 31.08.2021. Since the data available for the Bitcoin futures contract started on 23.02.2017, the data period started from this date. The data of the variables were taken from the investing database (<https://tr.investing.com/crypto/bitcoin>, <https://tr.investing.com/crypto/bitcoin/bitcoin-futures>). Whether there is a relationship between the Bitcoin spot market and the futures market was analyzed with the Eviews 9 package program by taking the logarithm of the daily data of the variables.

5. ANALYSIS AND FINDINGS

To determine the relationship between Bitcoin spot and futures price series, it is first necessary to determine whether the series are stationary or not. The ADF (Augmented Dickey-Fuller) unit root test developed by Dickey and Fuller (1979) and PP (Phillips-Perron) unit root test developed by Phillips Perron (1990) were used for stationarity analysis. The unit root test results for the regression models with constant term and trend terms for price series are presented in Table 1.

Table 1. Results for Unit Root Tests

Series		Augmented Dickey-Fuller (ADF) Test	Philips-Perron (PP) Test	Stationary
Spot	Level	-1.906443(0)	-1.954119(8)	I(1)
	1 st Diff.	-38.51649(0)***	-38.48215(8)***	
Future	Level	-2.327303(1)	-2.407751(5)	I(1)
	1 st Diff.	-40.07898(0)***	-40.04926(4)***	

*** indicates 1% of the significance level. Values in parentheses are based on Schwarz statistical information criteria for ADF; For PP, the kernel method “Barlettkernel” and the bandwidth show the optimal lag length according to the “Newey West Bandwith” method.

Source: Authors' calculations.

In the ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) tests, the H0 (basic hypothesis) is established as the series has a unit root, that is, it is not stationary. Since the absolute values of the t values obtained for the ADF test statistic are smaller than the absolute values of the critical values of the 1%, 5% and 10% significance levels, it is seen that the price series have a unit root, that is, the price series are not stationary at the level values. The Phillips Perron test statistic also gives results that support the ADF test statistic. Therefore, it has been concluded that the price series that are not stationary in level values do not have a unit root in the first difference, that is, their integration degree is I(1).

5.1. Cointegration Analysis

The fact that the price series are integrated to the same degree does not mean that they always move together in the long run. After determining that the price series are stationary at the first difference, the existence of a long-term equilibrium relationship between the series was investigated according to the cointegration method developed by Johansen (1988) and Johansen and Juselius (1990). To perform a cointegration test, an unconstrained VAR model should be estimated with the variables used in the model, and the lag number of the model should be determined. The appropriate lag length for cointegration tests was determined with the help of the classical VAR model. Suitable lag lengths for the VAR model are shown in Table 2.

Table 2. Suitable lag lengths for the VAR model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1946.461	NA	0.062676	2.905981	2.913739	2.908887
1	3856.599	11580.15	1.10e-05	-5.742876	-5.719605	-5.734158
2	3889.414	65.38692*	1.05e-05*	-5.785853*	-5.747067*	-5.771323*
3	3893.194	7.519260	1.05e-05	-5.785524	-5.731224	-5.765182
4	3894.202	2.003739	1.06e-05	-5.781062	-5.711248	-5.754908
5	3894.532	0.653811	1.06e-05	-5.775588	-5.690260	-5.743622
6	3898.063	6.994557	1.06e-05	-5.774890	-5.674047	-5.737111
7	3902.189	8.158152	1.06e-05	-5.775076	-5.658719	-5.731486
8	3904.992	5.535994	1.07e-05	-5.773292	-5.641420	-5.723890

Indicates the optimal lag length determined by the criteria. LR: Likelihood Ratio; FPE: Final Prediction error; AIC: Akaike Information criteria; SC: Schwarz Information criteria; HQ: Hannan-Quinn information criterion. Source: Authors' calculations.

The appropriate lag length for the estimated VAR model was determined as two according to the FPE, AIC, SC and HQ information criteria. To determine whether the VAR model estimated for two lag lengths includes the unit root, the inverse roots of the AR characteristic polynomial within the unit circle were examined. It is understood from the following figure that all of the reverse roots of the AR characteristic polynomial are located within the unit circle. Therefore, the inverse roots are located within the unit circle reveal that the estimated model has a stationary structure.

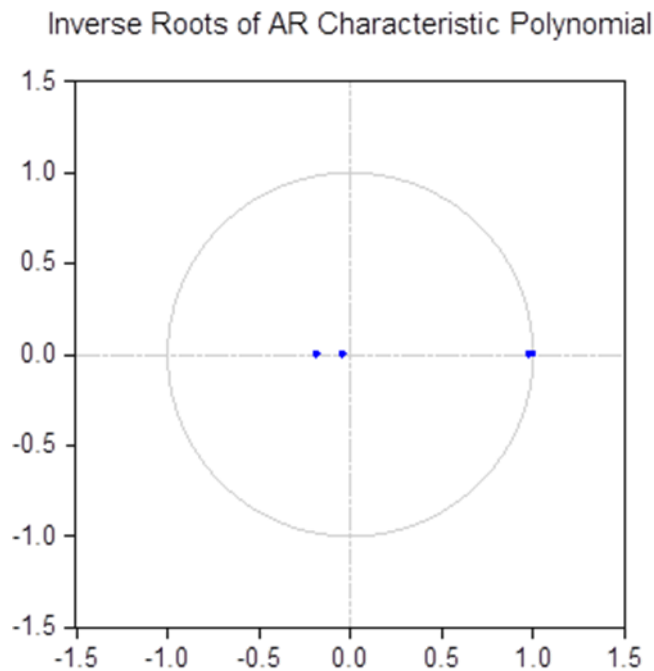


Figure 1. Inverse Roots of AR Characteristic Polynomial of Bitcoin Spot-Futures Model
Source: Authors' calculations.

The Johansen cointegration test (Johansen, 1988; Johansen and Juselius, 1990) was used to determine the existence of a long-term relationship between the Bitcoin Spot and Futures Prices. Cointegration test results with the determined lag length are given in Table 3.

Table 3. Results of Johansen Cointegration Test

Hypothesis	Trace Statistics	5% Critical Value	Probability**
$r=0^*$	38.84436	25.87211	0.0007
$r \leq 1$	6.554089	12.51798	0.3933
Hypothesis	Max-Eigenvalue Statistics	5% Critical Value	Probability**
$r=0^*$	32.29027	19.38704	0.0004
$r \leq 1$	6.554089	12.51798	0.3933

Existence of one cointegrating vector at 5% significance level.

*Indicates the rejection of the null hypothesis at 5% significance level.

**Indicates MacKinnon, Haug, and Michelis (1999) *p*-values.

Source: Authors' calculations.

According to the maximum eigenvalue and trace statistics obtained as a result of the Johansen cointegration test, the null hypothesis is rejected, that is, the hypothesis that predicts at least one cointegration vector is accepted at the level of 5% significance. During the analysis period, these results indicate a long-term equilibrium relationship between Bitcoin Spot and Futures prices.

5.2. Vector Error Correction Model

Although cointegration analysis shows a long-term relationship between the variables, it does not provide any information about the direction of Granger causality. Therefore, the causality relationship

and the direction of the relationship between Bitcoin spot and futures price series were investigated with the Vector Error Correction Model (VECM) proposed by Engle and Granger (1987). According to the VECM model, it is possible to model the changes in the dependent variable as a lagged function of the changes in the explanatory variables and the error correction coefficient as follows.

$$\Delta Spot_t = \alpha_1 + \sum_{i=1}^p \beta_{1i} \Delta Spot_{t-i} + \sum_{i=1}^p \gamma_{1i} \Delta Futures_{t-i} + \psi_1 ECM_{t-1} + \varepsilon_{1t} \quad (7)$$

$$\Delta Futures_t = \alpha_2 + \sum_{i=1}^p \beta_{2i} \Delta Futures_{t-i} + \sum_{i=1}^p \gamma_{2i} \Delta Spot_{t-i} + \psi_2 ECM_{t-1} + \varepsilon_{2t} \quad (8)$$

There is an assumption of long-term equilibrium between the variables, and there will be deviations from this long-run equilibrium in the short run. How long it will take for these deviations to disappear in the long term is determined by the Vector Error Correction Model. ECM represents the error correction term in the Error Correction model. The coefficient of the error correction term being between zero and minus one and being statistically significant indicates a long-term causality relationship between the variables. The Vector error correction model results are given in Table 4.

Table 4. Vector Error Correction Model (VECM)

	D(SPOT)	D(FUTURES)
CointEq1	-0.019704	-0.041233
	(0.00496)	(0.00773)
	[-3.97627]	[-5.33743]

Source: Authors' calculations.

While Bitcoin spot prices are the dependent variable, the error correction coefficient is negative and statistically significant. This shows that there is a long-run causality relationship between Bitcoin spot and futures prices. The error correction coefficient was found to be 0.019704. Accordingly, approximately 0.019704 of the deviations that occur in a short time in the Bitcoin spot market disappear every day. That is, these deviations will reach long-term equilibrium again in about 51 days ($1/ECM = 1/0.019704$). While Bitcoin futures prices are the dependent variable, the error correction coefficient is negative and statistically significant. This shows that there is a long-run causality relationship between Bitcoin spot and futures prices. According to the error correction coefficient, approximately 0.041233 of the deviations that occur in a short time in the Bitcoin futures market disappear every day. That is, these deviations will reach the long-term equilibrium again in about 24 days ($1/ECM = 1/0.041233$).

The Granger causality test based on the Vector error correction model was applied to investigate the direction of causality relationship between Bitcoin spot and futures market. The causality test results are presented in Table 5.

Table 5. Results of VECM Granger Causality Test

Hypothesis	Chi-Square	Probability	Direction of Causality
The Bitcoin Spot market is not the Granger cause of the Bitcoin Futures Market.	32.97852	0.0000	S → F
The Bitcoin Futures Market is not the Granger cause of the Bitcoin Spot Market.	2.625817	0.2690	

Source: Authors' calculations.

When Table 5 is examined, the null hypothesis that the Bitcoin spot market does not have Granger causality over the Bitcoin futures market is rejected. However, the null hypothesis that the bitcoin futures market has no Granger causality over the bitcoin spot market is accepted. Granger causality test results show a unidirectional causality relationship from the bitcoin spot market to the futures market.

6. CONCLUSION

While the popularity and value of Bitcoin are increasing day by day in the world, the number of studies on future price prediction is also increasing. Identifying the relationship between the bitcoin spot market and the bitcoin futures market is essential for bitcoin investors and portfolio managers. This study investigated the relationship between the bitcoin spot market and the bitcoin futures market. To examine the relationship between the markets, it is necessary to test whether the price series are stationary. As a result of ADF and PP unit root tests, it could be concluded that bitcoin spot and futures price series are not stationary at level values. When the first difference of the series is taken, it is determined that they are stationary, that is, the degree of integration is I(1). The fact that price series are integrated to the same degree does not mean that they always act together in the long run. The Johansen cointegration test was used to determine the existence of a long-term relationship between bitcoin spot and futures prices, which are equally integrated. As a result of the Johansen cointegration test, it was determined that there was a long-term equilibrium relationship between the markets during the analysis period. This conclusion supports the cointegration test results done by Hu et al. (2019). Since there is cointegration between the series, the causality test was performed using the VECM model. According to the VECM model, it has been determined that there is a long-term causality relationship between the bitcoin spot and the futures market. The Granger causality test based on the Vector Error Correction Model was used to determine the direction of the causal relationship between the bitcoin spot market and the bitcoin futures market. As a result of the causality test, it was determined that there is a unidirectional causality relationship from the bitcoin spot market to the futures market. The study's findings showing that there is a relationship from the spot market to

the futures market are in line with the results of the study by Baur and Dimpfle (2019). Bitcoin is a new financial investment tool that attracts investors. There is much interest in Bitcoin for speculative purposes by investors. The fact that the transaction volume of the Bitcoin spot market is higher than the futures market, unlike other investment instruments, the spot prices in the bitcoin market affect the futures prices. Portfolio managers and investors considering investing in Bitcoin can increase their profitability and reduce their risks by considering the interaction between the bitcoin spot and the futures market.

The most significant limitation of this study is that bitcoin futures contracts started to be traded on 23.02.2017. The study can be renewed in the future, and the results can be compared by considering a broader time interval. In addition, if each bitcoin futures contract is analyzed and the relationship between the spot market is examined, time-dependent information can be presented to investors. Future studies could use different econometric models, determining the interaction direction of the spot and futures markets as well as the level of impact.

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Comparison of Banks with Cluster Analysis Before and After Covid-19 Pandemic

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ABSTRACT

The Covid-19 virus, which emerged in Wuhan, China, in December 2019, spread all over the world in 2020, bringing commercial, social and economic life to a standstill. Governments have applied many support practices to reduce the impact of the virus on the economy. With public banks' social life support loans, those who lost their income due to the pandemic were supported. In 2020, when the most intense effects of the Covid-19 pandemic were experienced, public banks' loan and deposit volumes grew significantly. Banks profit by using the deposits they hold or collect as loans. Therefore, the efficiency of fiscal and monetary policies is increased through banks. The study aims to investigate whether the Covid-19 pandemic has caused a change in the clustering of banks by using the financial and size data of the deposit banks in the BIST Liquid Bank Index. The study tried to determine which banks included in the Borsa İstanbul (BIST) Liquid Bank Index were clustered using the values published in the 2019 and 2020 year-end annual reports. Cluster analysis was applied using the SPSS program. The study's findings determined that the pandemic process affected the clustering of banks and that public banks were in a different cluster compared to 2019.

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1. INTRODUCTION

The bank's name is derived from the Italian word banca and passed into Turkish. It means a place of exchange. It is estimated that banking history dates back to Sumer and Babylon. In 3500 B.C., the first bank named "model" was established in the Sumerians. In recent times, however, there are different views on the development of banking. One of them started with the use of church pastors as custodians due to people's need to deliver their valuables to a place they can trust when travelling to distant places. Traders used to deliver their goods to church priests, fearing that their valuables would be stolen on the road. Modern banks were first established in Mesopotamia. They made banks use loans in exchange for bail.

According to Islam, interest was haram that caused Muslims in the Ottoman Empire to stay away from banking. Therefore, the money market has always been owned by non-Muslims. Galata bankers

bought and sold money to Muslims in exchange for interest. Later, in 1845, Istanbul Bank was established, operating as the first bank. Ottoman Bank was established in 1856 to replace this institution, which was closed five years later. The Committee of Union and Progress wanted to end non-Muslim moneylenders by supporting Turkish companies. The foundations of İş Bank, the first bank of the Republic, were laid at the İzmir Economics Congress. It was founded by M. Kemal Atatürk on August 26, 1924.

Fifty-five active banks operate in Turkey; 32 deposit banks, 15 development and investment banks, and six participation banks. In addition, there are two banks transferred to the Savings Deposit Insurance Fund. The primary duty of deposit banks is to collect funds from individuals and organizations with surplus funds in return for a specific interest rate and to fund individuals and organizations in need of funds in return for a certain interest. The economy brings together those who supply and demand funds, and all benefit from this relationship. For example, banks give 10% interest to customers who have surplus funds and give loans at 12% to those who request funds, thus making a profit of 2%. Ziraat Bank, Halk Bank and VakıfBank belong to the state. The other 29 banks are private institutions, mostly with foreign capital. In addition, the Ministry of Treasury and Finance assigned 11 of 32 deposit banks to be market maker banks. The functioning of monetary and fiscal policies is facilitated through these banks. Fund flow is provided to the real market, and income distribution is intervened (Yetiz, 2016).

The importance of the development of investment banks in the economy is very significant. They provide the necessary funds to develop the country's industry and economy. They do not collect funds like deposit banks and do not engage in retail banking. Instead, they provide project support to foreign investors for the revival and development of the industry in the country. İller Bank, Turk Eximbank, Development and Investment Bank of Turkey are state-owned. The others are private and foreign capital development banks.

Participation banking carries out a different type of banking compared to deposit banking. The concept of interest is not used in participation banking. Instead, it operates with the logic of Islamic banking. It evaluates the funds it collects in participation accounts and gives dividends to individuals and organizations. Instead of providing cash support to the people and organizations in need of funds to purchase commercial goods or movable/immovable goods, the bank first buys the goods in need and then sells them to the requesting person or organization by adding the profit share. Thus, the bank carries out its activities with the logic of trade, apart from the interest system. Ziraat Participation and Emlak Participation banks are state-owned banks. The shares of Vakıf Katılım belong to the General Directorate of Foundations. Other participation banks are private and foreign capital.

Two active banks are transferred to the Saving Deposit Insurance Fund (TMSF), protecting the savers' rights from corruption and irregularities. As a result, Adabank and United Fund Bank cannot continue their activities like other banks. Instead, they continue their activities under the TMSF.

The first official Covid-19 case in Turkey appeared on March 11, 2020. On this date, it was declared a pandemic by the World Health Organization (WHO). Considering the rate of spread of Covid-19 and the threat it poses to human health, the World Health Organization had declared a pandemic not to endanger more human lives.

In China's Wuhan Province, the first cases of Covid-19 began to appear in December 2019. The disease diagnosis, which showed symptoms such as cough, fever, and shortness of breath, took place in January 2020. It is thought to be transmitted from bats to humans due to the Chinese people consuming wild animals. Covid-19 continues its effect by spreading first to the Wuhan Province, then to the whole of China and then to the whole world. Many industries had to close due to the virus. Governments have imposed many restrictions to decrease crowded environments necessary for the virus to survive. Many sectors such as workplaces, cinemas, theatres, schools, coffee shops, patisseries and restaurants had to close their workplaces in this process. When commercial life came to a standstill, producers and sellers suffered great losses.

Many commercial enterprises were unable to repay their bank loans. The checks of the companies were written, and their unpaid loans were transferred to the follow-up. The economic situation of the people who were out of work deteriorated. Unable to pay off their debts, their credit scores plummeted. The tourism industry has also been hit hard by Covid-19. The lack of tourism revenues, especially in a country like ours, where tourism revenues are in great need, created another reason for the current account deficit problem in the Turkish economy.

Today, the number of cases reached 250 million, and there have been 5 million deaths worldwide. Today, 7 billion vaccine doses have been administered worldwide. The vast majority of cases are located in the Americas. In Turkey, 8.26 million cases have been detected so far, and 72,314 people have died. Approximately 115 million doses of vaccine were administered (www.who.int). Countries have started to take normalization steps because they trust the vaccine and need to revive their economies. However, switching the education system online for a long time has caused students to remain passive and away from the educational environment. It is predicted that the reopening of schools will cause an increase in Covid-19 cases.

2. BIST LIQUID BANK INDEX

The "Star Market" is the market in which shares with a market value of 300 million Turkish Lira and above and listed on the BIST are traded. The BIST Liquid Bank Index is the index where companies with high trading volume operate. The number of shares to be included in the index is at least six. BIST Liquid Bank Index started to be calculated on 04.11.2019. Banks included in the index: Akbank, Garanti Bank, Halk Bank, Turkey İş Bank, Turkey Industrial Development Bank, Turkey VakıfBank, Yapı ve Kredi Bank.

One of the banks in the BIST Liquid Bank Index, Turkey Industrial Development Bank, is not included in the analysis as it is not a bank that collects deposits. Information on other banks subject to the analysis is given in Table 1. A comparison was made with the data obtained from the banks' 2020 year-end activity reports. The financial and size values obtained from the annual reports are shown in Table 1.

Table 1: 2020 Financial and Size Values of Banks Included in the BIST Liquid Bank Index

	Akbank	Garanti Bank	Halk Bank	İş Bank	VakıfBank	Yapı ve Kredi Bank
Total Assets (Billion TL)	478	541	680	594	699	486
Loans (Billion TL)	279	335	450	345	422	282
Deposit (Billion TL)	293	358	457	369	414	259
Equity (Billion TL)	63	62	43	68	46	48
Net Profit (Billion TL)	6	6,4	1,7	6,8	5	5
Number of Branches	714	894	1007	1227	936	835
Number of ATM	5000	5309	4060	6521	4247	4535
Capital Adequacy Ratio	20,7	16,9	15,2	18,7	16,44	16,7
Number of Personnel	12446	18656	20171	23518	16748	16037
TL Housing Loan (Million TL)	9,582	21,283	48,581	21,129	40,609	11,146
TL Vehicle Loan (Million TL)	0,229	2,092	0,513	1,236	0,478	1,519
TL Consumer Loan (Million TL)	30,276	39,079	26,062	43,913	49,179	35,078
Interest Income (Billion TL)	35	39	55	48	48	35
Interest Expenses (Billion TL)	14	14	35	19	28	17

Source: Compiled by the authors from the annual reports of banks.

VakıfBank was the leading bank in total assets at the end of 2020. Akbank has the lowest total asset value. Funding the market through public banks in order to reduce the economic effects of Covid-19, provided a rapid increase in the assets of VakıfBank and Halk Bank. The bank with the lowest loan volume is Akbank. As of the end of 2020, the bank that collected the most deposits was Halk Bank, while the bank that collected the least deposits was Yapı ve Kredi Bank. When examining banks' equity capital, private and foreign capital banks are better than public banks. Regarding net profit, İş Bank achieved a high income as in the previous periods and ranked first with TL 6.8 billion. On the other hand, Halk Bank came in last with a low net profit of TL 1.7 billion. The bank with the most branches is İş Bank, whilst Akbank has the least branches. While İş Bank had the highest number of ATMs, Halkbank had the lowest number. While the bank with the most personnel is İş Bank, the bank with the least personnel is Akbank. In order to reduce the damage of the Covid-19 pandemic done to the construction sector, government-supported housing loans were given through public banks. Housing loans were given with 0.64% interest rates for new houses and 0.74% for second-hand houses. This situation highlights the public banks as the banks that give the most loans in the housing loans section. Private banks give more loans related to vehicles. Particularly, Garanti Bank stands out with TL 2 million. The leading bank in consumer loans was VakıfBank, followed by İş Bank. The bank with the highest interest income and expense is Halk Bank, while the bank with the lowest interest income and expense is Akbank.

3. LITERATURE

There is no study conducted with cluster analysis between the banks in the BIST Liquid Bank Index and Covid-19. However, there are studies in the literature between deposit banks and cluster analysis. There are also existing studies between the banking sector and Covid-19.

Ersoy, Gürbüz and Erdoğan (2020) examine the banking data for the ten weeks after March 11, 2020, and the ten weeks before that date when the Covid-19 outbreak occurred in Turkey. They examined the effects of the measures taken in the fight against the disease on the banking sector and included deposit and participation banks in the analysis. They emphasize that the banks included in the analysis contributed to the economy with practices such as providing liquidity, extending loans, extending the maturity of loans and reducing the follow-up rates in order to reduce the impact of adverse economic developments that may occur on the real sector and households during the pandemic process.

Arabaci and Yücel (2020) put forward the policies implemented to eliminate the negative effects of Covid-19 on the economy in their research. In the fight against the pandemic, countries emphasized that some regulations, including monetary policies such as restructuring of loan debts, providing liquidity support to the market, low-interest loan options and changes in policy interest rates were put into effect. They also stated that financial institutions such as the International Monetary Fund (IMF), European Central Bank (ECB), and the World Bank quickly put into effect credit support packages. They declared that Turkey announced the Economic Stability Shield Package on 18.03.2020 to reduce the effects of the Covid-19 pandemic on the economy and that the most detailed part of the 21-item package is related to public banks. In order to reduce the adverse effects of the pandemic on the economy, the loan principal and interest payments of the companies whose cash flow has deteriorated will be postponed for a minimum of 3 months, and additional financial support will be provided to them when necessary. The loan debts, principal and interest payments due to Halk Bank for April, May and June 2020 of the tradesmen and craftsmen whose work was adversely affected will be postponed for three months without any interest. Credit Guarantee Fund limit will be increased from 25 billion Lira to 50 billion lira, and loans will be given primarily to firms and SMEs in need of liquidity. Measures have been taken regarding loans, such as introducing social loan packages under favourable and advantageous conditions to encourage citizens. The loanable amount will be increased from 80% to 90% in housing purchases under 500 thousand lira, and the minimum down payment will be reduced to 10%. They stated that four loan programs were announced through Ziraat Bank, Halk Bank and VakıfBank, including low-interest holiday support loans, housing loans, vehicle loans and consumer loans.

Cengiz (2010) aimed to cluster the deposit banks in Turkey using their ratios and evaluated them by comparing the clustering methods. The analysis was carried out with 29 deposit banks. He included many different variables in his study, such as the size and capital structure of banks. He did not include the banks whose ratios he could not access. In order to eliminate the multicollinearity problem between the ratios of the banks, factor analysis presents a total of 5 factors and an explanation rate of 84%. He applied all rotation methods to measure the conceptual significance of the factors and decided that the varimax method was appropriate. He applied the k-means analysis and tried the number of clusters as 3 and 4. In the analysis where he determined the number of clusters as 4, the results of the clustering of banks and the ANOVA table were not suitable. When he considered the number of clusters as 3, the banks in the clusters were not significant. At the end of the analysis, it was stated that a cluster analysis made by only considering the ratios of banks gave unreasonable results.

In Doğan (2008)'s doctoral study, cluster analysis was applied based on the financial ratios of active commercial banks between 1998 and 2006. With the test result, the compatibility of the financial structures of the banks was observed. The clusters determined as a result of the study included variables such as capital adequacy, asset quality, balance sheet structure, income and expense ratios, liquidity, profitability, and asset size. According to these variables, it was stated that the banks that were most similar to each other came together. The 1997 Russian crisis and the 2000-2001 crises in the Turkish banking sector deeply shook the banking sector. In the analysis, he concluded that banks were separated into clusters in a meaningful way and that the banks in the clusters were close to each other in terms of financial value. It has been concluded that the ownership structures of banks (public, foreign, private) do not have any effect on cluster formations. Also, banks can use existing methods as complementary methods to identify their strengths and weaknesses.

Akgöz (2010) applied cluster analysis with the data obtained from the balance sheets and income statements of commercial banks operating in Turkey in his master's thesis. According to the analysis he made regarding profitability indicators, he determined that 25 commercial banks were not around the average, and they differed from each other according to their profitability. Therefore, the number of clusters was determined as 4. In the first cluster, 13 banks are clustered and include public and private banks. Akgöz (2010) concluded that Adabank and Deutsche Bank are in the second cluster, and domestic and foreign capital banks are in the third cluster. In the fourth cluster, CitiBank was clustered alone. When he examined banks in terms of capital adequacy, asset quality, income-expenditure structure, he stated in his study that there were different groups similar to the above.

Akgül and Başkir (2013) take the criteria affecting the asset sizes of the banks subject to analysis between 2008 and 2012 as a basis and applied clustering analysis. They examine why businesses consider the banks included in the analysis as working partners. The appropriate number of clusters required for cluster analysis was found using the Silhouette index, and the cluster numbers and differences of clusters were compared as a result of the Ward technique and PAM algorithm. According to the analysis, the number of clusters should be two. They are classified as large and

small-scale banks. Seven banks, consisting of state-owned and some privately-owned banks, were clustered in the first group. In the other group, some banks are not included in the first group. They also stated that the groups are likely to change if a different variable is included in the application.

Çalış and Baynal (2016) examine the determination of sales strategies in the banking sector by using the cluster analysis technique. Data mining is a way of extracting meaningful information from large amounts of data. They stated that data mining is also used in the field of banking. They aimed to cluster two hundred customers of a bank branch operating in Turkey into twelve different variables and to develop sales strategies according to the customer profiles in the clusters. For businesses to succeed in a competitive environment, they need to implement effective and low-cost marketing strategies. The correct information is needed for correct marketing. In order to obtain accurate information, tools such as VMs that can analyze data in multidimensional ways are needed. VM tools are also used in the banking sector. Their studies aim to evaluate the existing customers by dividing them into clusters with KA, one of the VM techniques. The first cluster consists of retired male customers, aged 45-51, who do not have their own houses and vehicles, and whose monthly income is between 751-1400 TL. The second cluster includes public and private sector employees aged 24-30 who are unmarried. The number of women in this cluster is higher than in the other cluster. Most of them have their own home. They also have normal payment status. The third cluster consists of retired male customers between the ages of 38 and 44 who own a house and a car, with a monthly income between 1401 and 2050 TL. Their salaries come from the bank they have a loan from. 98% of the people in this cluster have a spouse income and have regular payments. They suggested that it would be more appropriate to market banking products and services, taking into account the characteristic features of the groups.

Aksarayli and Pala (2017) conducted a study on performance ranking, clustering and productivity analysis according to capital structure in the Turkish banking sector. Their study determined the relative efficiency of 28 deposit banks between 2010 and 2014 and set targets for ineffective banks using reference sets. They examined the similarities and divergences of banks with cluster analysis, ranked the banks with the multi-criteria decision-making methods PROMETHEE and TOPSIS, and obtained important information by making detailed comparative analyzes. In the study, clustering and MCDM results provide information that will help in target setting. The analysis results are important for banks to have information about the future. In addition, it provides a resource to help managers determine their strategies.

Bekci, Köse and Aksoy (2020) estimate the economic impact of the Covid-19 virus on banks in Turkey. After the adverse developments with Covid-19, interest rates were reduced in the short term, and the demand for loans increased in the banking sector. Their studies tried to get information about the future periods of the banks selected over the total loans/total deposit ratio, which shows the banks' asset quality. They analyzed nine banks and used quarters in the range of 2019/1 – 2020/2. The application was made with the GM (1,1) estimation model. Until the second quarter of 2021, the

measurement of the asset quality of selected banks was carried out. At the end of their analysis, they predicted that there would be a decreasing trend in the ratios showing the asset quality of state-owned deposit banks for the following four periods. In addition, Turkey İş Bank, Kuwait Turkish Participation Bank and Finance Participation Bank of Turkey have also predicted that they will have a decreasing trend in the subsequent four periods. Apart from these, Turkey Garanti Bank, Yapı ve Kredi Bank and Albaraka Turkish Participation Bank have predicted an increasing trend in the next four quarters.

Yetiz (2021) measures the impact of the pandemic process on its employees and customers in the banking sector with a SWOT Analysis. In his study, he included the measures taken for the banking sector during the pandemic, support packages and service items that changed in banking activities. In the face of the threat posed by Covid-19, the banking sector has started to take many precautions. Some of the measures and precautions taken include making arrangements in the employees' working hours in the sector; remote connection solutions for new customer acquisition; positioning the customers according to social distance; updating the information technology systems of the banks, and creating a healthy and hygienic environment. Thanks to the systems developed, many banking activities have been made available via the internet and mobile banking. The measures taken in the banking sector supported the banking sector's technological infrastructure and systemic development. Therefore, it can be said that the regulations brought to the banking sector do not impose an excessive burden on the sector and do not reduce the mobility of banks.

Karaatlı and Yıldız (2021) analysed the financial structures of deposit banks and classified them using cluster analysis. As of 2017, they performed clustering analysis with the financial data of 20 active deposit banks. They used the Expectation-Maximization Algorithm. They concluded that the ownership of banks (public, private, foreign) in the clusters they obtained does not affect cluster formation. It has been determined that two banks with fewer branches are in the first cluster, while the other cluster includes banks with a high sector share and two public banks. This cluster includes both private and foreign capital banks. In another cluster, privately owned banks that are not very popular are clustered. In the last cluster, it has been determined that banks with many branches with public and foreign capital are clustered. It reveals that working with the banks in the cluster, which is strong in terms of asset size, will be more reliable in crisis environments. They also stated that a bank experiencing a financial crisis might also affect other cluster members.

4. DATA AND METHOD

The study examines the activity reports of 6 deposit banks included in the BIST Liquid Bank Index between 2019 and 2020. Data obtained on the financial values of the banks were analyzed in the SPSS program. The 2019 year-end and 2020 year-end reports of the analyzed banks were obtained from the banks' official websites. Consolidated data were used in the analysis. The number of groups was set at 2 and 3 using the k-means method. It was observed that there was a significant distribution in the

analysis where the number of groups was 3. Information on the variables that make up the study are as follows:

Table 2: Data Set

Formula	Explanation
Net Profit / Total Assets	Profitability rate of total assets
Net Profit / Equity	Rate of return on equity
Loan / Deposit	Conversion ratio of total deposit to loan
Branch / Total Assets	Branch ratio by total assets
ATM / Total Assets	ATM ratio by total assets
Capital Adequacy Ratio	Capital Adequacy Ratio
Number of Personnel / Total Assets	Personnel ratio by total assets
Housing Loan / Deposit	Housing loan ratio by total deposit
Vehicle Loan / Deposit	Automotive loan ratio by total deposit
Consumer Loan / Deposit	Consumer loan ratio according to total deposit
Interest income / Interest expense	Ratio of interest income to interest expenses

Source: Authors' Compilation

A more accurate analysis can be made by proportioning the data obtained from the year-end activity reports published by the banks on their official websites, as in Table 2. Otherwise, it is not possible to make a fair comparison. For example, it would be wrong to evaluate the banks subject to the analysis only on net profit figures. This is because the size of each bank is different. If we compare a large bank in the banking market with a small bank only on net profit, the numerically small bank may seem left behind. However, considering how much profit it has made according to its total asset size, it can be seen that the smaller bank performs better than the larger bank. For this reason, K-means analysis was performed over the SPSS program according to the ratios in Table 2.

4.1 Findings

Results show that only Akbank is in the first group according to the financial values of the banks for 2019. In the second group, only İş Bank is present. The third group included Garanti Bank, Halk Bank, VakıfBank and Yapı ve Kredi Bank. When we examine the financial values of banks, one observes that Akbank lags behind other banks in many values in 2019. The analysis explains why Akbank is separated from the others and is in the first group on its own.

When we re-examine the financial indicators, it is observed that İş Bank is superior to other banks on many values. This explains the reason why İş Bank is alone in the second group. According to financial indicators in 2019, the other four banks are close to each other. This situation enabled these four banks to gather in a single group.

The analysis results made with the k-means technique over SPSS are presented in Table 3.

Table 3: Clustering Results of 2019

Case Number	Bank	Cluster	Distance
1	Akbank	1	,000
2	Garanti Bank	3	3,290
3	Halk Bank	3	2,611
4	İş Bank	2	,000
5	VakıfBank	3	1,380
6	Yapı ve Kredi Bank	3	1,089

Source: Authors' Compilation

Akbank is clustered in the first group. İş Bank is clustered in the second group. Garanti Bank, Halk Bank, VakıfBank, Yapı ve Kredi Bank are clustered in the third group. The K-means analysis results for 2020 are given in Table 4.

Table 4: Clustering Results of 2020

Case Number	Bank	Cluster	Distance
1	Akbank	1	,000
2	Garanti Bank	2	1,389
3	Halk Bank	3	2,921
4	İş Bank	2	4,216
5	VakıfBank	3	2,921
6	Yapı ve Kredi Bank	2	2,911

Source: Authors' Compilation

According to the first analysis, one observes differences in clusters. As in 2019, Akbank was clustered again in the first group alone. In the third group, Garanti Bank and Yapı ve Kredi Bank were separated from the other two banks and clustered next to İşbank in the second group. Finally, in the third group, Halk Bank and VakıfBank take place together.

In the clustering in 2019, Akbank was clustered alone due to its lower financial values when compared to other banks. İş Bank, on the other hand, has been clustered alone due to its higher values compared to other banks. The other four banks are clustered together as they have similar values. In 2020, Akbank continued to have lower values than the others and clustered alone. Governments have taken many measures to reduce the impact of the pandemic on the economy. With the significant effect of the Social Life Support Loans given through public banks, VakıfBank and Halk Bank gained more financial value than other banks due to the growth in their total assets, the increase in the number of

loans, and the increase in the number of deposits. As a result of this increase, VakıfBank and Halk Bank were separated from other banks and clustered in the third group in the 2020 K-means analysis. Since the 2020 financial values of Yapı ve Kredi Bank and Garanti Bank are closer to those of İş Bank, three banks are clustered in the second group.

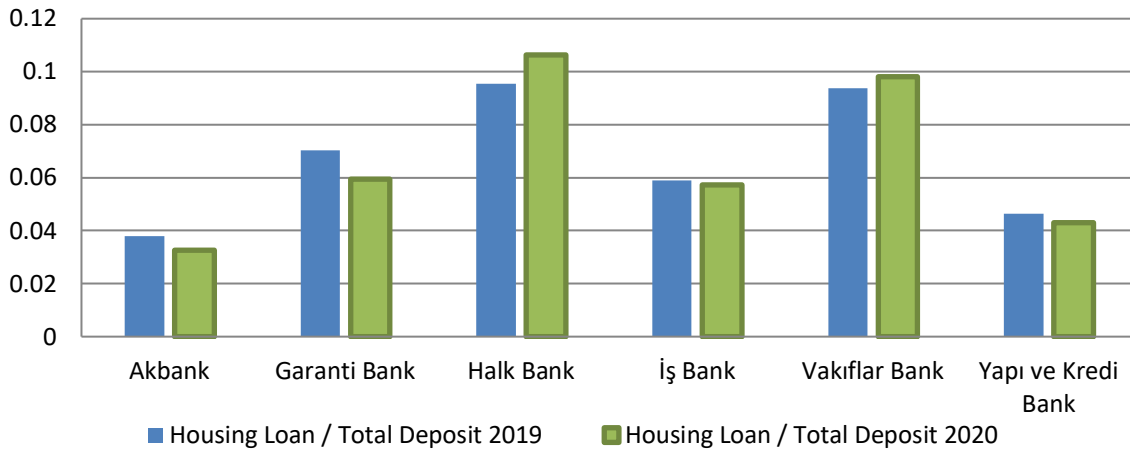


Figure 1: Conversion Ratio of Total Deposits to Housing Loans

Source: Authors' Compilation

The conversion rates of total deposits to housing loans for 2019 and 2020 are shown in Figure 1. The blue column shows the rate for 2019, while the green column shows the conversion rate for 2020. Comparing Akbank's conversion rate in 2020 and 2019, one notes that it has given fewer housing loans than its total deposits in 2020 compared to 2019. If we compare the conversion rate of İş Bank, Yapı ve Kredi Bank, Garanti Bank and Akbank in 2020 with the conversion rate of 2019, in 2020, they gave fewer housing loans than their total deposits. We found that SPSS K-means analysis resulted in different clusters in 2020. The graphic above shows one reason why Halk Bank and VakıfBank are in a different cluster. The rate of conversion of Halk Bank and Foundations Bank deposits to housing loans in 2020 has increased compared to 2019. State-supported low-interest housing loans provided by public banks constituted the source of this differentiation.

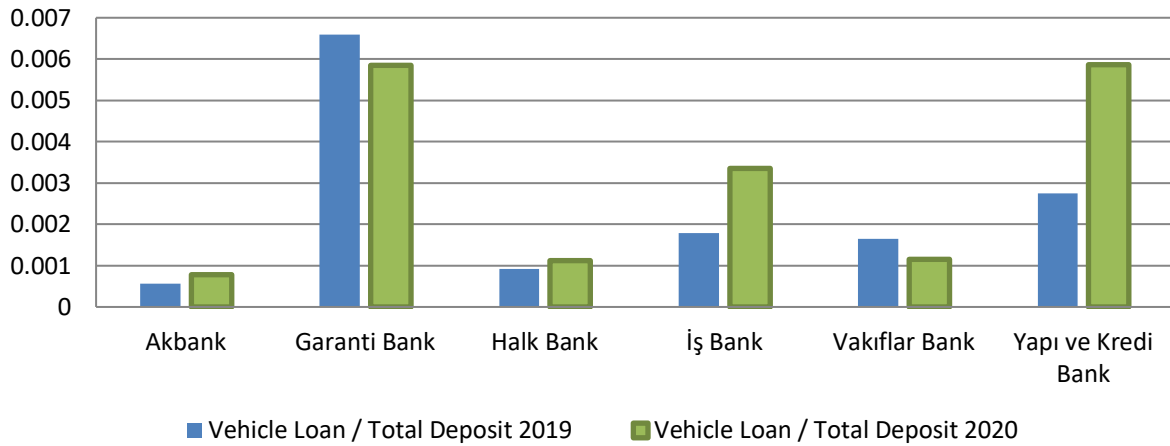


Figure 2: Ratio of Conversion of Total Deposits to Vehicle Loans

Source: Authors' Compilation

The conversion rates of the total deposits of 2019 and 2020 to vehicle loans are given in Figure 2 above. The blue column represents 2019, and the green column represents 2020. Akbank increased its conversion rate to vehicle loans at a low level in 2020 compared to 2019 and lagged behind other banks in terms of total conversion rate, revealing one reason for its clustering on its own. Compared to 2019, İş Bank and Yapı ve Kredi Bank have significantly increased their conversion rates to vehicle loans. At Garanti Bank, on the other hand, there was a decrease in the rate of conversion to vehicle loans in 2020 compared to 2019. When the total transformation levels are considered, Yapı ve Kredi Bank, İş Bank and Garanti Bank are at very close levels. While Halk Bank experienced a slight increase in its conversion rate to vehicle loans in 2020 compared to 2019, VakıfBank experienced a decrease. However, the conversion rates for 2020 were almost at the same level in these two public banks. Another reason why they were included in the same cluster emerged here.

The conversion rates of total deposits to consumer loans in 2019 and 2020 are shown in Figure 3. The year 2019 is shown in blue, and 2020 is shown in green. While the conversion rates of private and foreign banks increased more in 2020 compared to 2019, this rate of change increased less in public banks. This is one of the reasons why Halk Bank and VakıfBank are in the same cluster.

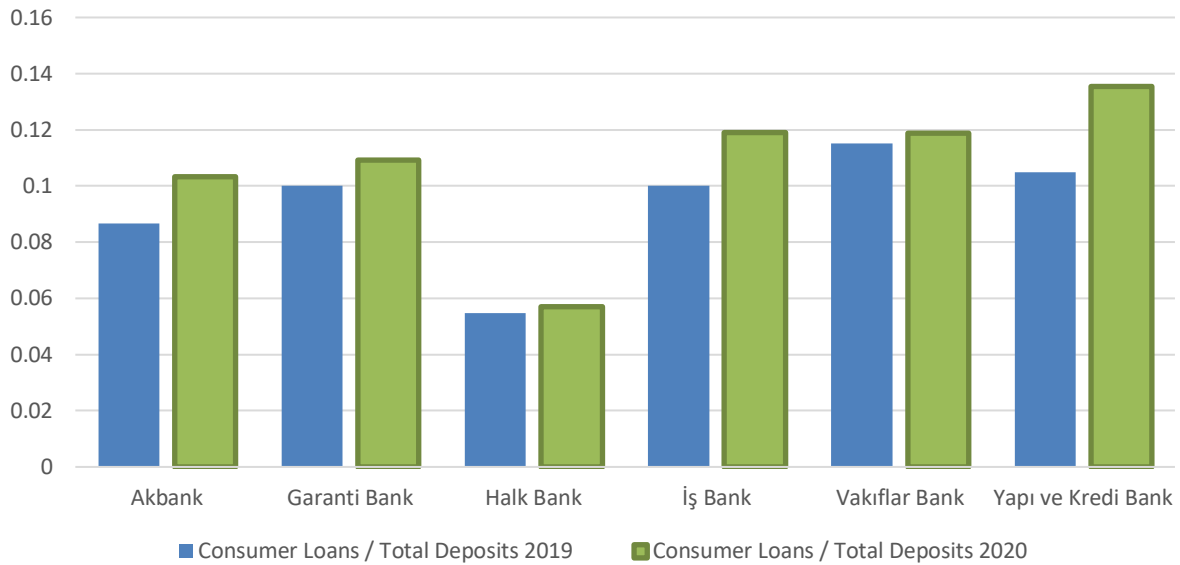


Figure 3: Conversion Ratio of Total Deposits to Consumer Loans

Source: Authors' Compilation

5. CONCLUSION

The Covid-19 virus affected the economies of all countries and brought many sectors to a standstill. The banking sector has also been affected by this epidemic in different ways. Governments have taken many measures to reduce the negative impact of the epidemic on the economy. The downward pull in interest rates increased the liquidity in the market. State-supported housing loans were introduced to support the construction industry affected by COVID-19. State-supported vehicle loans were introduced to revive the automotive sector. In addition, small amounts of low-interest consumer loans were given to meet the needs of consumers. These loans were made available to those who requested them through public banks.

The study aims to investigate how the banking sector has been affected by the Covid-19 pandemic. Six deposit banks included in the BIST Liquid Bank Index were used. There are two public banks and four private and foreign capital deposit banks in the index. The test was carried out using the K-means analysis using the SPSS program. In addition, the financial values and size data obtained from the year-end annual reports published by the banks in 2019 and 2020 were used.

It was thought that objective results could not be obtained when the data obtained from the year-end activity reports were included in the analysis, and it was concluded that a more accurate analysis would be made by proportioning the data to each other. Comparisons were made, such as loans given by the banks according to their asset size, profits they obtained, the number of personnel, the number of branches, and the number of ATMs. Only capital adequacy ratios are included in the analysis as is. Data obtained from year-end activity reports are consolidated data.

As a result of the analysis, Akbank clustered alone in 2019 due to its lower financial and size values compared to other banks. On the other hand, due to its higher values compared to other banks in 2019, İşbank is clustered alone in the second cluster Yapı ve Kredi Bank, Garanti Bank, Halk Bank and VakıfBank clustered together in the third cluster since they had the same average values in 2019.

The analysis results obtained with the data of 2020, it was determined that Akbank is again in the first cluster alone. Yapı ve Kredi Bank, Garanti Bank, and İş Bank clustered together in the second cluster according to their 2020 financial and size values. Following the growth in the financial values of Halk Bank and VakıfBank, due to the support loans given through public banks to reduce the impact of the epidemic, it has been determined that they cluster together in the third cluster.

The Covid-19 virus has caused many things to change all over the world. The banking sector has invested more in internet and mobile banking. People started to use more virtual banking instead of branches. There have been significant changes in the working conditions of banks and their balance sheets. Social Life Support Loans caused the assets of public banks to grow. This change has enabled public banks to separate from private and foreign banks and merge into a different cluster.

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Elements of Organizational Culture That Facilitate The Conduct of Efficient Activities Within Modern Organizations

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ABSTRACT

Because of its impact on an institution's functionality and performance, organisational culture is one of the most discussed topics in management, organisational behaviour, and sociology. The majority of the debates centre on this organisational phenomenon's ability to significantly contribute to the entity's competitive evolution by mobilising its resources, particularly human resources. Even though there is still debate about the definition of organisational culture, experts agree that most of its components contain the fundamental values of any institution. Any institution considers a strong organisational culture to be an important resource for outstanding performance. This paper aims to highlight the concepts of organisational culture at the organisational level from the standpoint of modern economics. A questionnaire was used as a research tool, and the data collected from it was analysed using quantitative statistical-mathematical analysis. The non-implementation or functioning with deficiencies in organisational culture can raise concerns about the entity's functioning and the quality of the managerial act in terms of quality and efficiency.

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1. INTRODUCTION

Organisational culture is one of the most addressed topics in management, organisational behaviour, and sociology due to its impact on the functionality and performance of an institution. Most of the debates focus on the ability of this organisational phenomenon to contribute substantially to the competitive evolution of the entity by mobilising its resources and, in particular, human resources. Even though there is still disagreement about the definition of organisational culture, specialists agree that most of its components contain the fundamental values of any institution. A strong organisational culture is considered an important resource for outstanding performance by any institution. The paper aims to highlight the concepts of organisational culture at the organisational level from the perspective of modern economics. A *quantitative* statistical-mathematical analysis was used to collect the data using the questionnaire as a research tool. Non-implementation or functioning with deficiencies in the

The study aims to highlight the main elements of organisational culture at the level of organisations from the perspective of modern economics.

2. LITERATURE REVIEW

Organisational culture is a concept that is becoming more prevalent not only in the concerns of teachers, students, and various types of specialists, but also in the approaches of managers, entrepreneurs, and even ordinary citizens., much attention is being paid to how cultural elements condition our behaviours. Indeed, many economics, management, sociology, and psychology experts agree that an organisation's culture is a major determinant of its functionality and performance (Renard, 2002).

Knowledge of the specific elements of organisational culture and management culture (as part of the overall organisational culture) is an important requirement for modern management, given the dynamism of the local, national, and international business environment, growing competition, shortening the manufacturing cycle of products and services, and the pace of change to which members of organisations are subjected. At the same time, however, organisational culture can be one of the important forces to oppose the changes proposed by the company's managers if its characteristics are not known or are not taken into account in the process of developing organisational change plans. The concept's complexity stems from the fact that it encompasses aspects related to human resources such that it treats not only from a rational point of view but also from an emotional, sentimental point of view, both at the conscious and subconscious level, which determines that individual, group, and organisational level to witness a particularly varied and dynamic range of links established formally and informally on the horizontal

Organisational culture is one of the important concepts that has recently emerged and has significantly influenced the thinking and actions of researchers, teachers, students, managers and entrepreneurs, and specialists from various organisations worldwide. This interest has grown exponentially as a result of pressures from within and outside organisations, which call for better knowledge and an increase in the competitiveness of organisations and their constituents in order to survive and thrive in the new conditions. The major consideration of the role that human resources play in the organisation's evolution also favoured the development of the concept of organisational culture. Organisational culture is regarded as the invisible force behind the easily observable and tangible aspects of a business; it is the social energy that drives people to act. We can compare a company's organisational culture to an individual's personality, which meets a number of visible and less visible aspects while also providing the vision, meaning, direction, and energy required for evolution. Organisational culture in a company helps us understand the differences between what managers formally state and what actually happens within it. Different rules, procedures, statements, or decisions are interpreted and, to some extent, even applicable through organisational culture. Furthermore, the organisational culture creates and develops its own certain behavioural models that may or may not be in line with the official versions, beyond the

formal elements that try to establish in a centralized way a certain attitude and behavior for the members of the organisation. Most of the time, a large portion of the elements that comprise organisational culture are intangible, unwritten, but extremely powerful (Thomas, 2010).

Organisational culture (also called "corporate culture") is a system of shared beliefs, values, attitudes, and experiences that govern how people behave in organisations. These common values have a strong influence on the organisation members and dictate how they dress, act, and perform their tasks. Each organisation develops and maintains a unique culture, which provides guidance and limits the behaviour of the organisation's members. This entails a slew of elements that will set the organisation apart from the competition (Preda, 2016). Organisational culture is also defined as the set of norms and values that people have within a particular organisation. Organisational culture is, in short, the psychology of a company. It consists of various elements such as its employees' values and attitudes; the image that the organisation provides to the company in which it operates, its identity; and the selection process of its employees and suppliers (Adler, 2019).

The values are the essence of culture, the essence of the organisation's philosophy of success, and the central element that gives the sense of a common direction and shows the members of the system how to work together. One caveat: in order for this critical function to be carried out, all organisation members must share the same values (Fayol, 2015). Organisations become institutions when the value system is crystallized, communicated, accepted, and appropriated by all participants in collective creation because values produce a distinct identity and the construction of common meaning, which involves modeling the system's social character. Social integration entails more than formal command and coordination, and it is reflected in all individual actions and interactions because shared values are socially legitimate and give meaning and significance to individual actions (Schein, 2014).

If the organisational culture is strong, the values will capture the general attention. Otherwise, the values will be ignored. Creating strong cultures requires the critical input of strong leaders who can communicate core values throughout the organisation through well-articulated visions and missions, directly determining the long-term performance of organisations. Long-term success can be the cause or fortification of strong cultures, but there is a mortal risk that a strong culture will become arrogant, internally focused, and bureaucratic, becoming extremely inertial. Public enterprises that perform poorly may also have strong but dysfunctional cultures based on value systems that only appear to define success (Stanciu and Ionescu, 2019).

Values play the role of an informal control system, which is stronger than any other control system because it provides purpose and significance for everything that needs to be done to achieve successful results. At the same time, there is multiple practical proof that for an organisation to be successful, the basic goal is to create a strong culture.

There are three characteristics of valuable systems belonging to strong cultures (Hofstede, 2011):

- 1) are the manifestation of a clear and explicit philosophy;
- 2) are communicated throughout the organisation and are known to all members

3) define the system's fundamental characteristics: create a sense of identity; influence all aspects of the system; define what kind of people are respected, and signal to the outside world what to expect from a specific organisation.

However, one clarification is needed: the stronger the values, the more inertial the culture. As a result, it is useful to highlight some of the major shortcomings of strong value systems as attributes of strong cultures (Certo, 2020):

- 1) the risk of inconsistency—if the behaviour contradicts the organisational values;
- 2) obsolescence risk-if the content changes and the value system is no longer in line with the new requirements;
- 3) the danger of instilling a resistance to change.

These risks, inherent in strong value systems, which ultimately influence the degree of cultural inertia with a dramatic impact on an organisation's ability to change and adapt to a particular context, lead to the idea of another critical dimension, which conditions the relationship between culture and performance: the environment or context of the organisation's evolution. However, strong cultures demonstrate the role of the system of common values in aligning, motivating, and controlling the organisation's members.

Organisational culture is not stagnant. Members of an organisation develop a shared belief around how good they look as they interact over time and learn what works and what does not. When these beliefs and assumptions lead to less successful outcomes, the culture must evolve for the organisation to remain relevant in a changing environment. Changing the organisational culture is not an easy operation. Employees often oppose change and may campaign against a new culture. As a result, it is the responsibility of leaders to persuade their employees of the benefits of change and demonstrate, through their own experiences and behaviours, that the new culture is the best way to function to achieve success.

3. AIM OF THE RESEARCH

The main purpose of the research is to identify the application of the main elements of organisational culture practiced by managers of organisations in Romania:

1. Rules of conduct and rituals practiced within organisations - define the set of values and principles underlying the activities, thus setting out the principles of conduct that the organisation recognizes as its own and must be respected by all employees;
2. Characteristic motivation characteristics - material incentives are important for employees;
3. Characteristics regarding human resources, innovation, teamwork - human resource is seen as a strategic one;
4. Hierarchy of values - supporting individual creativity and innovation, the human resource is the most valuable resource.

The objectives of the research are:

1. Analysing the implementation of the elements of organisational culture;
2. Analysing the managers' perception regarding the main elements of organisational culture;
3. Establishing the importance of each element of organisational culture.

The following hypotheses have been formulated that underlie scientific research:

H1: The hierarchy of values does not represent the main element of the organisational culture;

H2: Managers ultimately take on Human Resource Characteristics, Innovation, Teamwork;

H3: The field of IT activity gives the greatest importance to the organisational culture.

After establishing the objectives as well as the hypotheses underlying the scientific research study, the research plan was designed which included the following stages:

Step 1 - Establishing the research community: managers in Romania who perceive the activities of organisational culture.

The research carried out based on the questionnaire largely benefited from the answers of some people with management positions within the investigated companies, 62.7% of the subjects belonging to the senior management, and 37.3% of the subjects having management positions in the middle echelon of the managerial hierarchy.

Step 2 - Identification of the survey unit: it is represented by the managers of companies from four fields of activity: automotive, IT, energy, food - who perceive the elements of organisational culture.

Step 3 - Elaboration of the questionnaire: instrumental that was the basis of the article and with which the opinion of managers on organisational culture was surveyed, is the online questionnaire, method of data collection online survey conducted on the web, thus allowing analysis and explanation of causal relationships between variables.

A number of 372 valid questionnaires were obtained, which allows us to use a large number of statistical techniques to analyze the data collected. In developing the questionnaire we started from the personal definition of organisational culture according to which organisational culture represents the totality of values, symbols, rituals, ceremonies, myths, attitudes and behaviors that are predominant in an organisation, are passed on to future generations as normal, feel and act and which have a decisive influence on its results and evolution. Through managerial culture, we have defined all the beliefs, values, attitudes and behaviors of managers in an organisation, which are reflected in the decisions and actions they take and apply to ensure the competitive development of the company. We considered the organisational culture as a social construction, made up of a series of different elements and which are likely to send to the company's components messages that carry a strong symbolic load, messages that influence the decisions and actions of company staff and those outside who come in contact with it. The design of the questionnaire was based on the hypothesis that the ability of managers to perceive the specific elements of organisational and managerial culture and to use them properly in management processes, is vital for the functionality and performance of the managed company.

Step 4 - Determination of the sampling method: simple random sampling was used. Subjects who were the subject of the scientific research study were selected based on two criteria: availability and accessibility.

Step 5 - Exploratory quantitative analysis: data collection was carried out between January 2021 and June 2021, using the questionnaire, a quantitatively structured research tool. The duration of completing the questionnaire was about 20 minutes.

The main purpose of this stage was to outline, with the information generated by the questionnaire, as well as with other information obtained from secondary sources, the realistic image of the managers' behavior towards the elements of the organisational culture.

4. RESEARCH METHODOLOGY

In the socio-economic universe, the economic decision assisting problems are generated by the multi-criteria decision processes. This is why the *maximum method of global utility* in the study can be applied. The model tries to use, at maximum, in a scientific way, the informational base, and the procedures for imitating the rational mode of decision making is, in more or less elaborate forms, the conceptual essence of the models. The steps of the global utility method are as follows:

Step 1. Determining the utilities matrix with the elements x_{ij} , $i = 1, \dots, r$ and $j = 1, \dots, n$.

Each matrix element is calculated for the maximum criterion with the expression:

$$x_{ij} = u_{ij} = \frac{x_{ij} - x_{i \min}}{x_{i \max} - x_{i \min}}, \quad (1)$$

and each minimum criterion with the expression:

$$x_{ij} = u_{ij} = \frac{x_{i \max} - x_{ij}}{x_{i \max} - x_{i \min}} \quad (2)$$

where:

x_{ij} = value of the i indicator associated to the j indicator;

$x_{i \max}$ = maximum value of the i indicator;

$x_{i \min}$ = minimum value of the i indicator.

Step 2. Calculating the global utility for each project, as the sum of the products between the utility matrix elements (the column vector corresponding to the project) and the importance coefficient given for each indicator.

$$UG_j = \sum_{i=1}^r \alpha_i u_{ij}, \text{ where } \sum_{i=1}^r \alpha_i = 1 \quad (3)$$

Step 3. Choosing the project to which the maximum global utility corresponds.

$$\max \{UG_j\} \Rightarrow V_j \quad j = 1, \dots, n \quad (4)$$

For differentiating a decisional V_i variant (given n variants), and for selecting the best offer by simultaneously considering various assessment criteria ($C_j, j = 1, \dots, n$) using the maximum global utility method. Finding the best combinations of attributes (characteristic of a variant) forms the object of the multi-attribute problem. This involves the transformation of all number values a_{ij} (expressed in the associated measure units) and qualitative characteristics in utilities u_{ij} , that is, numerical (dimensionless) values located in the range $[0, 1]$. The basic assumption in the correct operation of the weighted sum method is the independence of the criteria. The largest of the synthesis utilities indicates the best option.

5. FINDINGS

Table 1 shows the informational basis of the study, respectively the share of importance that managers give to each element of the organisational culture.

Table 1: The importance of the elements of organisational culture

ELEMENTS OF ORGANISATIONAL CULTURE	FIELD OF ACTIVITY			
	IT % (v1)	AUTOMOTIVE % (v2)	ENERGY % (v3)	FOOD % (v4)
Rules of conduct and rituals practiced C_1	16.45	22.35	27.5	12.5
Characteristic motivation characteristics C_2	10.55	15.15	11.9	23.61
Characteristics regarding human resources, innovation, teamwork C_3	8.9	13.25	9.8	10.54
Hierarchy of values C_4	23.45	16	11.82	23.55

Source: developed by the authors based on the collected data

The resulting results indicate that the manager takes into account the C_4 - *Hierarchy of values* in which the employee offers a favorable opportunity to acquire professional specializations. Thus, it can be stated that ***Hypothesis 1 has not been validated.***

Ultimately, managers take into account C_3 - *Characteristics of human resources, innovation, teamwork* (Figure 1) - so the organisational culture is manifested mainly through specially chosen key people, according to a limited number of rules; decisions are made more as an effect of the balance of influences, than on a procedural or purely logical basis - ***Hypothesis 2 was validated.***

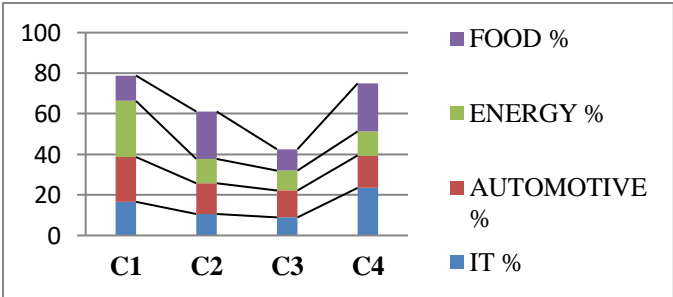


Figure 1: The share of elements of organisational culture
Source: developed by the authors based on the collected data

Going through the calculation algorithm involved:
Step 1 - building the matrix of units with the elements x_{ij} - Figure 2.

$$\begin{bmatrix} 0,26 & 0,66 & 1,00 & 0,00 \\ 1,00 & 0,65 & 0,90 & 0,00 \\ 0,00 & 1,00 & 0,21 & 0,38 \\ 0,99 & 0,36 & 0,00 & 1,00 \end{bmatrix}$$

Figure 2: Matrix of units

Source: developed by the authors based on the collected data

Step 2 - Calculation of global utilities for each organisation (Table 2):

Table 2: Results of the calculation of global units

GLOBAL UTILITY	RESULT
IT	2.25
AUTOMOTIVE	2.66
ENERGY	2.10
FOOD	1.38

Source: developed by the authors based on the collected data

Step 3 - From Table 2 is observed by the calculation of global utilities, the highest global utility of companies in the field of AUTOMOTIVE - so it can be stated that ***Hypothesis 3 has not been validated.*** Therefore, following the application of the algorithm for calculating the maximum global utilities method, it can be concluded that the AUTOMOTIVE organisation has best assessed the importance of the elements of organisational culture.

6. CONCLUSION

The research highlighted that despite a turbulent business environment, a period full of uncertainties, managers are still very concerned about the moral dimension of economic activity. This aspect is also highlighted by the placement in a superior position of the value aimed at the management with ethics and responsibility of the company.

The research aimed to capture several characteristics of organisational culture for Romanian companies. By way of design and development, we can say that the results obtained largely reflect the specifics of this organisational phenomenon which is organisational culture. Organisational culture is today one of the most important criteria for candidates when selecting their job. It is also an essential aspect for existing employees, as it is a powerful tool capable of developing a strong sense of belonging. An organisational culture must be built over time, but even so, it is not something that lasts very long. A solid culture is in a cohesive company, aligned with a unitary purpose and way of working, with a high level of internal cohesion and adherence to the values that define it. We are talking about synergy and the efficiency with which things are done in the organisation. A company without a solid culture, which has not convinced its employees of its own identity, is an organisation without an identity. Alternatively,

even more, it can suffer from the multiple personality syndrome given by the interest groups that end up forming and that act independently or even discordant with each other.

In order to maintain a system of values that a group considers socially acceptable, it is necessary for it to develop a system of rules of conduct to guide the actions of its members. Behavior rules foreshadow the attitudes and behaviors expected to be displayed by employees within and outside the organisation as well as the rewards / sanctions triggered by their observance / violation.

The advantages of understanding and adapting organisational culture to the internal and external environment far outweigh the work done in the transformation process. Moreover, organisational culture is the only sustainable competitive advantage that is completely under the control of the entrepreneur.

The application in practice of the concept of organisational culture proved to be more difficult than it could have been anticipated, to which the following aspects contributed:

- ✓ the tendency to bureaucratize;
- ✓ lack of practical guidelines for implementation in the fields of activity;
- ✓ insufficient training of employees;
- ✓ resistance to change in management and employees;
- ✓ absence of sanctions within the regulatory framework.

Organisational culture is fundamental in any organisation because it guides the direction of the company and guides how it should be run. It also directs the treatment that should be given to employees, customers and society in general.

Regarding the society in which the organisation operates, the organisational culture serves as a spokesperson to make known how that company relates to the community, ie its image, how it cares (or not) about the environment, the interest for social and business environment, influence and participation in community activities.

So here is an effective way to achieve remarkable results: to build the organisational culture that simply leads to success through the values and principles on which it is designed and that outlines an environment and climate that will almost implicitly generate performance.

A strong dynamism characterises the current business environment, a situation that tends to intensify as the phenomenon of globalisation intensifies, the unprecedented development of information technology and telecommunications and the increasingly free movement of resources of any kind. In this context, the human resource truly represents the strategic resource of a company, and the organisational culture is the binder that decisively determines how this resource uses or not, the potential for the good of the company.

The research showed that there is still a lack of knowledge of the concept of organisational culture, its forms of manifestation and the functions it performs in the company, elements highlighted during the interviews organised to complete the questionnaires.

In this sense, better training of managers is required by participating in various training programs and individual studies on a series of topics that include aspects specific to the field of human resources and, especially, in the field of organisational culture.

Noticing the impact of organisational culture on the company's performance can also be done by conducting diagnostic analyses, in which part of the research should focus on the correlation between the type of organisational culture and the company's performance.

An important aspect that should not be lost sight of is that, in any organisation, culture is a social construction. It highlights certain expectations from employees and shows how a company's staff shapes the environment around it to ensure the overall survival and development of that community.

The limits of the study undertaken are diverse, from which we point out: the time horizon chosen by us is quite narrow, because research topics often generate studies of 10-15 years; the scientific approach was channeled on the interpretation of the studies and not on the explanation of the use of the obtained findings; the inductive research methodology was easily realized.

Based on the research conducted and the analysis performed, we consider that the following recommendations are required for the remodelling of the organisational culture:

- 1) Consideration to a much greater extent, by managers and other categories of staff, of the role of organisational culture in the functionality and evolution of a company;
- 2) The approach by the managers of the components of the organisational culture as an important way of influencing the attitudes and behaviours manifested by the staff;
- 3) Periodic audit of the organisational culture;
- 4) Increasing staff motivation through better use by managers of elements of organisational culture.

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