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# Assessment of Bank Services Excellence in Iraq: A Comprehensive Investigation Employing the SERVQUAL Model

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*SUMMARY*

*This study employs the SERVQUAL model to investigate the service quality of banks operating in Iraq comprehensively. The objective is to identify gaps between customers' expectations and perceptions of the service quality of bank service providers in Iraq. The study utilizes data collected from customers from the Iraqi banking sector. An item-level analysis and Importance-Performance Analysis (IPA) were employed. The results reveal a significant level of perceived service quality among participants, indicating that customers generally experience satisfactory service from their respective banks. However, negative gap scores over dimensions suggest that there is a need for improvement. The findings of this study will contribute to the development of a better understanding of customer expectations and perceptions of service quality in the Iraqi banking sector and provide valuable insights for banks to enhance their service delivery.*
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## INTRODUCTION

The banking sector is pivotal in any nation's economic growth and job creation by providing essential financial infrastructure that facilitates transactions and mobilizes savings (Ifediora et al., 2022; Tabash, 2019). Banks offer various financial services, such as loans, savings accounts, and investment opportunities. They empower individuals and businesses to access funds and manage their finances efficiently, promoting economic activity and generating employment opportunities (Alkhowaiter, 2020). Moreover, a robust banking sector can attract foreign investment, further stimulating economic growth (Baabdullah et al., 2019).

Customer satisfaction is a critical aspect of the banking sector, as the quality of customer experiences can significantly impact customer loyalty and the likelihood of recommending the bank to others. High customer satisfaction can lead to increased trust, enhanced reputation, and, ultimately, greater profitability for the bank. Conversely, poor service quality can result in customer dissatisfaction, negative reviews, and loss of business. Consequently, prioritizing service quality is essential for banks to ensure customer satisfaction and long-term success.

In an increasingly competitive environment, the quality of banking services offered is vital for the growth and competitiveness of the banking sector. The SERVQUAL model, developed by Parasuraman et al. (1985) has been extensively applied across various industries to evaluate service quality. Customers often have expectations about the quality of service they will receive before engaging with a business. The experience after interacting with the business is compared to these initial expectations, allowing customers to evaluate the service's value and informing their decision to continue engaging with the business. Parasuraman et al. (1991) argue that customers' assessments of service quality are shaped by comparing their preconceived expectations and by the actual service received. This comparison enables customers to evaluate the service quality and determine its value.

Iraq, a developing country in the Middle East with a population of approximately 40 million people, has experienced significant economic changes since the fall of Saddam Hussein's regime in 2003. Political instability, economic sanctions and wars have impeded the development of the Iraqi banking sector. The recent transformation of the Iraqi banking system, characterized by the entry of new banks, increased competition, and technological advancements, has made the banking sector a vital component of the country's economic infrastructure. The banking sector plays a significant role in Iraq's economic growth and development by facilitating trade and investment, managing financial resources, and financing small and medium enterprises (SMEs). However, one of the significant challenges faced by the banking sector in Iraq is delivering high-quality services to customers, whose expectations of service quality have substantially increased in recent years. Understanding customer expectations and perceptions of service quality is essential for banks to remain competitive. Consequently, the primary goals of this study are as follows:

1.  To apply the SERVQUAL model to provide a general assessment of the service quality of banks in Iraq. This model provides a comprehensive approach to assessing the quality of services and gauging the level of satisfaction with the banking services in Iraq by focusing on the difference between the customer's expectations and perceptions of service performanc .
2.  To identify the gaps between customers' expectations and perceptions. Through the SERVQUAL model, this study aims to pinpoint specific areas where the actual service does not meet customer expectations, thus indicating potential areas of improvement.
3.  To propose potential improvements within the Iraqi banking sector utilizing an importance-performance matrix.
4.  To contribute to the body of knowledge on service quality in banking: Through analyzing the Iraqi context, this study aims to enrich the academic literature on service quality in the banking sector, particularly in emerging economies.

# LITERATURE REVIEW

Service quality has gained significant attention in both academia and industry due to its vital role in determining customer satisfaction, customer loyalty, and business success (Alam, 2021; Issalillah et al., 2021; Paiz et al., 2020; Teeroovengadum et al., 2019). Banks play a pivotal role in fostering economic growth through their ability to establish and maintain a robust financial infrastructure. As intermediaries between savers and borrowers, banks channel funds towards productive

investments, catalyzing economic activity and stimulating growth. Furthermore, banks' services, such as deposit-taking, lending and payment processing, create a stable financial system that facilitates transactions and enhances economic efficiency. Hence, the pivotal function of banks in providing a sound financial base infrastructure renders them indispensable to promoting sustainable economic development.

Service quality is conceptualized as the difference between customers' expectations and perceptions of the service received (Parasuraman et al., 1985). Over the years, several models and frameworks have been developed to measure service quality for different sectors of industries and service providers. The SERVQUAL model (Parasuraman et al., 1985) remains popular due to its comprehensiveness and applicability across various service industries. Other models, such as the SERVPERF model (Cronin & Taylor, 1992) and the Nordic model (Gronroos 1984), have also been used to assess service quality in various sectors, including banks (see Hanusukma et al., 2021; Rahmani-Nejad et al., 2014; Su et al., 2022; Zaibaf et al., 2013). From the standpoint of an organization, service quality, according to Futrell (2011), entails setting standards and specifications. Businesses must give exceptional service quality if they want a satisfiedcustomer to keep using their services.

The SERVQUAL model, initially introduced by Parasuraman and colleagues (1985, 1988), has gained widespread recognition and application across various industries as a prominent tool for measuring service quality. The model, initially created in 1985, stemmed from a series of studies conducted by Parasuraman and his associates. They characterized service quality as the gap between a customer's expectations and actual experiences. A positive or negative gap reflects customer satisfaction levels, stemming from the discrepancy between their initial expectations and the reality of their experiences (Parasuraman et al., 1988). A positive gap occurs when perceptions exceed expectations, while a negative gap arises when expectations surpass actual experiences. The SERVQUAL model consists of five elements: Tangibility, which encompasses the physical resources, facilities, and materials that contribute to a positive company image, as well as the appearance of the company (Berndt & Brink, 2004); Reliability, or the capacity to deliver accurate and consistent services, with some organizations prone to overpromising and underdelivering; Responsiveness, defined by the eagerness to help and address customer needs; Assurance, which centers on the employee's ability to foster trust and confidence in clients; and Empathy, which pertains to the degree of personalized, compassionate service provided (Govender et al., 2014). These five dimensions correspond to the gaps in the SERVQUAL model introduced by Parasuraman et al. (1985); see Figure 1.
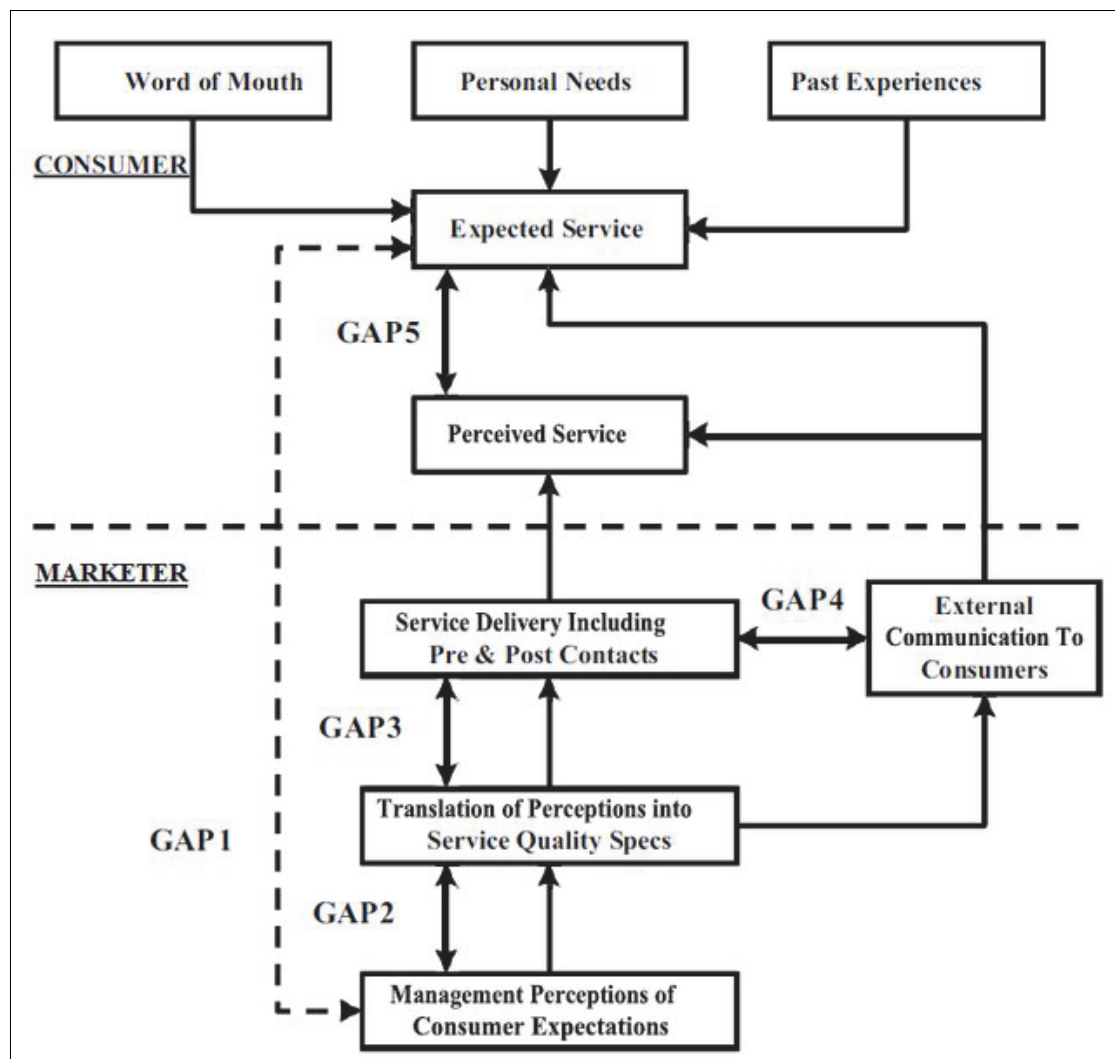
Source: (Parasuraman et al., 1985)

*Figure 1: : SERVQUAL gaps proposed by Parasuraman et al*

Figure 1: SERVQUAL gaps proposed by Parasuraman et al. (1985) identified five gaps in service quality. Gap 1 arises from the differences between how service providers perceive customer needs and the actual expectations of customers. The marketing analysis conducted by the business influences the size of this gap. Gap 2 concerns the inconsistency between the service's conceptual framework and tangible attributes. Factors affecting this gap include management's commitment to service quality, goal setting, standardization of tasks, and perception of opportunities. Gap 3 consists of discrepancies between the delivered services and the specific processes involved in their creation. Teamwork, employee-to-task alignment, technology, control perception, behaviour monitoring, and control systems influence this gap. Gap 4 refers to the inconsistency between the promised and provided services. Horizontal communication and tendencies to overpromise can affect the size of this disparity. The fifth and final gap, Gap 5, is the difference between customer expectations and their actual experiences, an outcome of the previous gaps.

The Importance-Performance Analysis (IPA) method, introduced by Martilla and James (1977) is another valuable tool for assessing the expectation-experience gap in the banking service sector in Iraq. This analytical technique allows service providers to assess expectations and perceptions simultaneously by identifying key service attributes considered necessary by customers and evaluating the service performance in those areas. Banks can effectively address any gaps between customer expectations and their actual experiences. The IPA framework, thus, enables banks to prioritize improvement strategies, allocate resources efficiently, and enhance overall customer satisfaction. By complementing the SERVQUAL model, IPA can

help identify areas where the banks can excel in the competitive market and ensure sustainable growth in the evolving banking landscape. The IPA technique is a highly efficient method of identifying service quality issues that require strategic corrective actions (Chu & Choi, 2000).

Deng (2008) posited that the IPA technique is a valuable tool for measuring the degree of service factors between importance and satisfaction during service innovation. Furthermore, Tzeng and Chang (2011) suggested that the IPA technique is highly effective in producing service quality improvements and high levels of customer satisfaction for managers' service quality improvement projects. Leong (2008), in turn, employed the IPA method to evaluate airline service quality. The IPA technique is grounded in the core premise that consumers' assessment of the essential services they receive (performance) and their expectations of a service provider are critical factors in determining their satisfaction with service attributes. Thus, documenting respondents' service encounter expectations and actual experiences is essential. When using the IPA method, The Expectation-Experience Analysis (EEA) grid, as depicted in Figure 2 and adapted from Chu and Choi (2000) serves as a tool for this purpose. High-quality services are essential for banks to remain competitive, grow, and contribute to the economy (Ayyagari et al., 2011). Studies have consistently found that service quality is a critical determinant of satisfaction and loyalty across various sectors, including banking, manufacturing, retail, and professional services (Ali et al., 2021; Famiyeh et al., 2018; Khudhair et al., 2020; Najib & Sosianika, 2019; Wang & Lo, 2002).

Banks in Iraq have faced numerous challenges in the past decades, such as political instability, economic sanctions, and inadequate infrastructure, which have adversely affected the quality of services offered (Prakash & Mohanty, 2013). With the gradual improvement in Iraq's political and economic environment, there is an opportunity for service providers across various sectors to enhance their service quality and contribute to their growth and development. However, there is limited research on the service quality of banks in Iraq, making it challenging to identify areas for improvement and develop effective strategies.

Practitioners and researchers use the SERVQUAL model to assess service quality in various sectors in developed and developing countries (e.g., Ali et al., 2021; Fida et al., 2020). These studies have provided valuable insights into the areas where service providers need to improve service quality and have helped formulate strategies to enhance satisfaction and loyalty.

While numerous studies have focused on assessing service quality in the banking sector using the SERVQUAL model, there is a noticeable lack of research specifically examining the service quality of banks in Iraq. The unique challenges Iraq's banking sectors face, make it essential to understand the current state of service quality in this context. Furthermore, as the political and economic environment in Iraq gradually improves, there is an opportunity for the banking sector to enhance its service quality and gain customer trust. The research gap identified in this study is the lack of comprehensive and up-to-date assessment of service quality in the Iraqi banking sector using the SERVQUAL model. By addressing this gap, this study will provide valuable insights into the areas where Iraqi banks need to improve their service quality and formulate effective strategies to enhance customer satisfaction and loyalty and will contribute to the broader literature on service quality in the banking sector, particularly in contexts with unique challenges and opportunities for growth, by using the SERVQUAL model to assess the service quality for banks in Iraq, contribute to filling the existing research gap and provide a comprehensive understanding of the current state of service quality for banks in the country. We will try to answer the following questions.

1. To what extent are customers in Iraq satisfied with the quality of banking services provided by their banks?
2. What is the magnitude of the gap between the expectations and perceptions of customers regarding the quality of banking services in Iraq?
3. What improvements can be proposed for the Iraqi banking sector using the importance-performance matrix?

## METHODOLOGY

A quantitative research design was adopted to assess banks' service quality in Iraq. The study employed an online questionnaire to collect responses from the target population. The population under investigation is the customers of banks in Iraq. A sample of 351 respondents was collected using a random sampling technique. The respondents were chosen based on their availability and willingness to participate in the online survey. The data was collected using an online questionnaire distributed via email and social media platforms.

The questionnaire incorporates the SERVQUAL model, 44 items using 5- Likert scale, which measures service quality across five dimensions: Tangibles, Reliability, Responsiveness, Assurance, and Empathy. The survey also includes demographic questions to gather relevant information about the respondents, such as age, gender, and the provider of bank services. The collected data was analysed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics summarize the responses' central tendency, dispersion, and distribution for each SERVQUAL dimension. Gap score analysis was adopted to identify areas where improvements in service quality are needed, and Importance-Performance Analysis (IPA) was employed

to evaluate the relative importance and performance of each SERVQUAL dimension.

## RESULTS AND FINDINGS

In the current study, responses from 351 participants were examined, with a relatively balanced gender distribution of 45.3% females and 54.7% males; the participants' educational backgrounds revealed that most participants held bachelor's degrees. The sample's diverse range of educational attainment allows for a comprehensive understanding of the population under study. The study also investigated participants' bank service providers. This diverse distribution of banks provides valuable insights into the banking preferences and experiences of the customers. The age distribution of the participants revealed a concentration of respondents in the younger age groups. See Table 1 for more details.

*Table 1*
*Demographic Characteristics and Respondent Profile*

| Demographic characteristics | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Female | 159 | 45.3% |
| Male | 192 | 54.7% |
| **Age group** | | |
| 25-29 | 99 | 28.2% |
| 30-34 | 102 | 29.1% |
| 35-39 | 66 | 18.8% |
| 40-44 | 37 | 10.5% |
| 45-49 | 23 | 6.6% |
| 50-54 | 12 | 3.4% |
| 55-59 | 10 | 2.8% |
| 60-64 | 2 | 0.6% |
| **Education** | | |
| High school | 64 | 18.2% |
| Bachelor | 202 | 57.5% |
| Master | 60 | 17.1% |
| Ph.D. | 25 | 7.1% |
| **Bank service provider** | | |
| Al Rasheed Bank | 53 | 15.1% |
| Almansour Bank | 10 | 2.8% |
| Bank of Baghdad | 12 | 3.4% |
| Gulf commercial Bank | 11 | 3.1% |
| International Development Bank | 50 | 14.2% |
| Iraqi Islamic Bank | 12 | 3.4% |
| janoub Islamic Bank | 11 | 3.1% |
| National Bank of Iraq | 10 | 2.8% |
| Rafidain Bank | 52 | 14.8% |
| Rajih Islamic Bank | 12 | 3.4% |
| Taif Islamic Bank | 48 | 13.7% |
| TBI | 48 | 13.7% |
| Trust International Islamic Bank | 11 | 3.1% |
| Union Bank of Iraq | 11 | 3.1% |

Source: own calculations

The study's primary question sought to explore the existence of a significant level of perceived service quality among the participants. A one-sample t-test is conducted to examine customer satisfaction, and the results are presented in Table 2.

*Table 2*
*One-Sample Test for perceived service quality*

| | t | df | Significance | | Mean Difference |
|---|---|---|---|---|---|
| | | | One-Sided p | Two-Sided p | |
| P_mean | 16.184 | 350 | 0.000 | 0.000 | 0.34136 |

Source: own calculations

The t-test revealed a statistically significant mean difference from the hypothetical mean in the perceived service quality (M = 0.34136) with a t-value of 16.184 (df = 350) and a two-sided p-value of 0.000, less than the significance level of 0.05. These results provide strong evidence to support the hypothesis that there is a significant level of perceived service quality among the participants in this study. This finding suggests that customers, on average, experience satisfactory levels of service quality from their banks, indicating that the banking sector is effectively meeting customers' needs and expectations.

Table 3 presents the results of an independent sample t-test conducted to compare the expectations and perceptions of customers regarding service quality. Levene's test for equality of variances indicated a significant difference (F = 7.851, p = 0.005), suggesting that the assumption of equal variances is violated. Consequently, the t-test results with equal variances not assumed are considered for interpretation.

*Table 3*
*Independent Samples Test between expectations and perceptions of customers*

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Significance | | | |
| | | | | | | One-Sided p | Two-Sided p | Mean Difference | Std. Error Difference |
| | | F | Sig. | t | df | | | | |
| E_mean | Equal variances assumed | 7.851 | 0.005 | 31.125 | 700 | 0.000 | 0.000 | 0.78438 | 0.02520 |
| | Equal variances are not assumed. | | | 31.125 | 603.053 | 0.000 | 0.000 | 0.78438 | 0.02520 |

Source: own calculations

The independent samples t-test revealed a statistically significant difference between the mean expectations and perceptions of customers (mean difference = 0.78438, std. error difference = 0.02520) with a t-value of 31.125 and degrees of freedom (df) of 603.053. The two-sided p-value was 0.000 and is below the significance level of 0.05.

These findings suggest a notable gap between customers' expectations and perceptions of service quality in the banking sector. This discrepancy implies that banks may need to better align their service offerings with customer expectations and enhance overall customer satisfaction.

Table 4 compares each service quality dimension's mean perceived and expected scores and its corresponding items. The gap scores, calculated by subtracting the mean expected scores from the mean perceived scores, provide insight into how much the banks meet or exceed customer expectations. The data presented in the table are used to evaluate the perceived service quality of banks in Iraq using the SERVQUAL model. The study collected data from customers of the banks, and the results indicate a gap between the customers' expectations and their perceived service quality in all dimensions.

*Table 4*

*Comparison of Expected and Perceived Service Quality Scores using SERVQUAL Dimensions in Iraqi Banks*

| Variable | Mean (Expected) | Mean (Perceived) | Gap Score |
|---|---|---|---|
| **Tangibility** | **4.205** | **3.277** | **- 0.927** |
| TN1 | 4.17 | 2.97 | -1.2 |
| TN2 | 4.13 | 2.97 | -1.16 |
| TN3 | 4.2 | 3.1 | -1.1 |
| TN4 | 4.32 | 4.07 | -0.25 |
| **Reliability** | **4.24** | **3.122** | **-1.118** |
| RL1 | 4.31 | 3.35 | -0.96 |
| RL2 | 4.22 | 3.34 | -0.88 |
| RL3 | 4.23 | 2.78 | -1.45 |
| RL4 | 4.14 | 3.07 | -1.07 |
| RL5 | 4.3 | 3.07 | -1.23 |
| **Responsiveness** | **4.16** | **3.4125** | **-0.7475** |
| RS1 | 3.99 | 3.71 | -0.28 |
| RS2 | 4.27 | 3.69 | -0.58 |
| RS3 | 4.25 | 2.93 | -1.32 |
| RS4 | 4.13 | 3.32 | -0.81 |
| **Assurance** | **4.0225** | **3.6425** | **-0.38** |
| ASR1 | 4 | 3.54 | -0.46 |
| ASR2 | 4.03 | 3.67 | -0.36 |
| ASR3 | 4.03 | 3.68 | -0.35 |
| ASR4 | 4.03 | 3.68 | -0.35 |
| **Empathy** | **4.008** | **3.316** | **-0.692** |
| EMP1 | 4.08 | 3.37 | -0.71 |
| EMP2 | 4.01 | 3.07 | -0.94 |
| EMP3 | 4.07 | 3.39 | -0.68 |
| EMP4 | 3.9 | 3.13 | -0.77 |
| EMP5 | 3.98 | 3.62 | -0.36 |

Note: codes for variables: Reliability (RL), Tangibility (TN), Empathy (EMP), responsiveness (RS), Assurance (ASR)

Source: own calculations

The dimension of Tangibility had a mean expected score of 4.205 and a mean perceived score of 3.277, resulting in a negative gap score of -0.927; this suggests that customers expected the physical facilities and personnel's appearance to be higher quality than what they experienced. The mean expected score for the Reliability dimension is 4.24, while the mean perceived score is 3.122, resulting in a negative gap score of -1.118. The findings indicate that customers expected the service to be more dependable and accurate than they had experienced. The dimension of Responsiveness has a mean expected score of 4.16 and a mean perceived score of 3.4125, resulting in a negative gap score of -0.7475; this suggests that customers expected the service to be more prompt and helpful than they experienced. In the dimension of Assurance, the mean expected score is 4.0225, while the mean perceived score is 3.6425, resulting in a negative gap score of -0.38. The result indicates that customers hoped employees to have higher knowledge and courtesy and inspire greater trust and confidence than they experienced. Finally, the dimension of Empathy has a mean expected score of 4.008 and a mean perceived score of 3.316, resulting in a negative gap score of -0.692; this suggests that customers expected the service provider to better understand and care about their needs than what they experienced.

The negative gap scores across all dimensions suggest that there is a need for banks in Iraq to improve their service quality to meet or exceed their customers' expectations. By employing the SERVQUAL model, the study provides valuable insights into the specific areas where service improvements are needed. Service providers in the banking industry can use these findings to identify areas for improvement and take appropriate action to improve their service delivery, and this can help improve customer satisfaction and loyalty, leading to tremendous success for the banks in the long term.

One critical insight that can be gleaned from the results is that customers of banks in Iraq have relatively high expectations regarding service quality, evidenced by the mean expected scores across all dimensions, consistently above 4. The result suggests that customers expect a high level of service from their banks.

However, the mean perceived scores across all dimensions are consistently lower than the mean expected scores, indicating that customers perceive the service quality of their banks to be lower than their expectations. This gap between expected and perceived service quality highlights the need for banks in Iraq to improve their service delivery to meet or exceed the expectations of their customers. For example, in the Reliability dimension, customers perceive the service as less dependable and accurate than expected. Regarding Responsiveness, customers perceive the service as less prompt and helpful than expected. These specific areas can guide banks in Iraq as they seek to improve their service quality.

Additionally, the negative gap scores across all dimensions indicate room for improvement in all areas of service quality. By addressing the areas where the gap between expected and perceived service quality is most significant, banks can take targeted action to improve customer satisfaction and loyalty. By doing so, they can ultimately lead to significant success for the banks in the long term. The item-level analysis in the table also provides valuable insights into areas in which banks in Iraq can improve their service quality. By identifying these areas, banks can take targeted action to improve customer satisfaction and loyalty.

The radar graph in Figure 2 indicates the relative strengths and weaknesses of the service across the dimensions. In this case, the shape suggests that the service performs similarly across all dimensions. However, there are some differences in the scores for each dimension, reflected in the length of each axis. The longest axis in the graph corresponds to the dimension of Assurance, which suggests that customers perceive the service to be strongest in this area. The shortest axis corresponds to the Reliability dimension, indicating that customers perceive the service as relatively weaker in this area.

Overall, the shape of the radar graph can provide us with a quick and easy-to-understand overview of the perceived service quality across different dimensions, allowing service providers to identify areas of strength and weakness and take appropriate action to improve customer satisfaction.
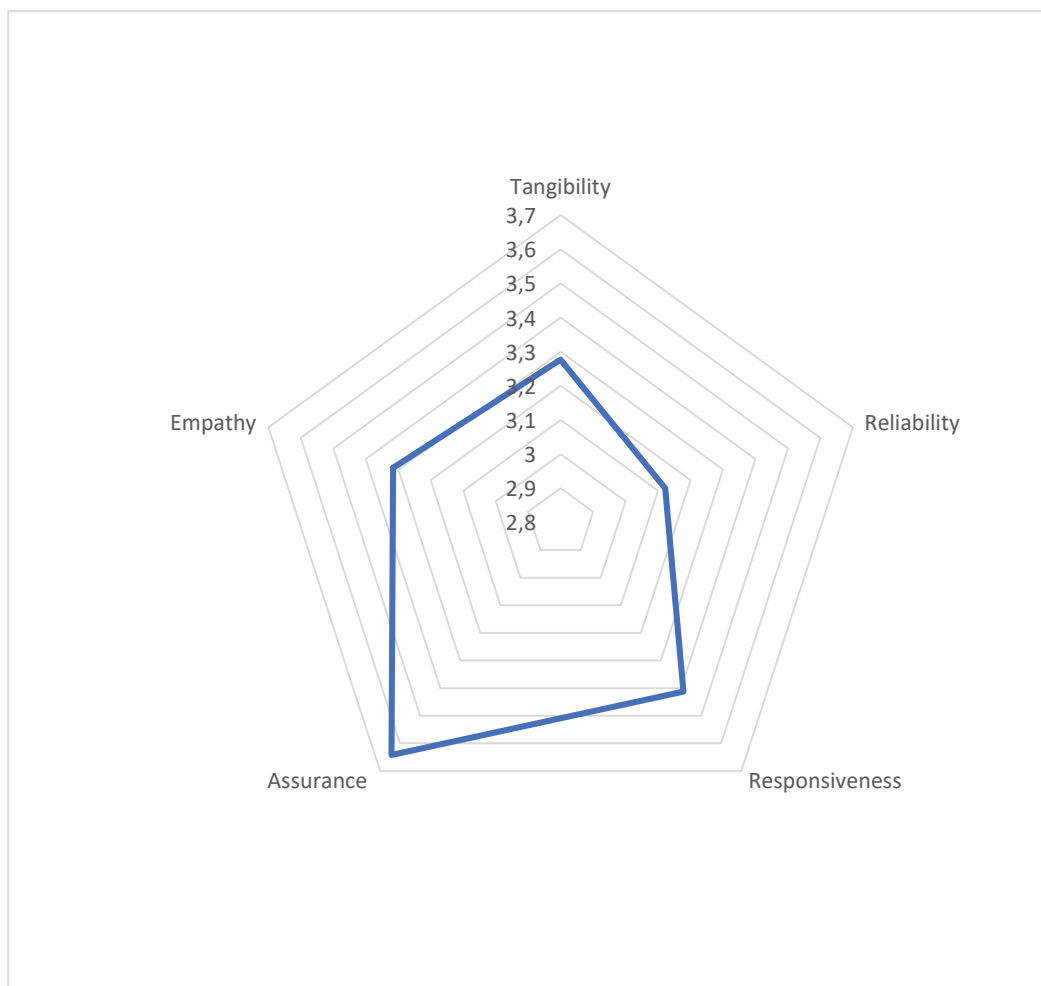


Source: own work

*Figure 2: A comparison of perceived service quality on the dimensional level*
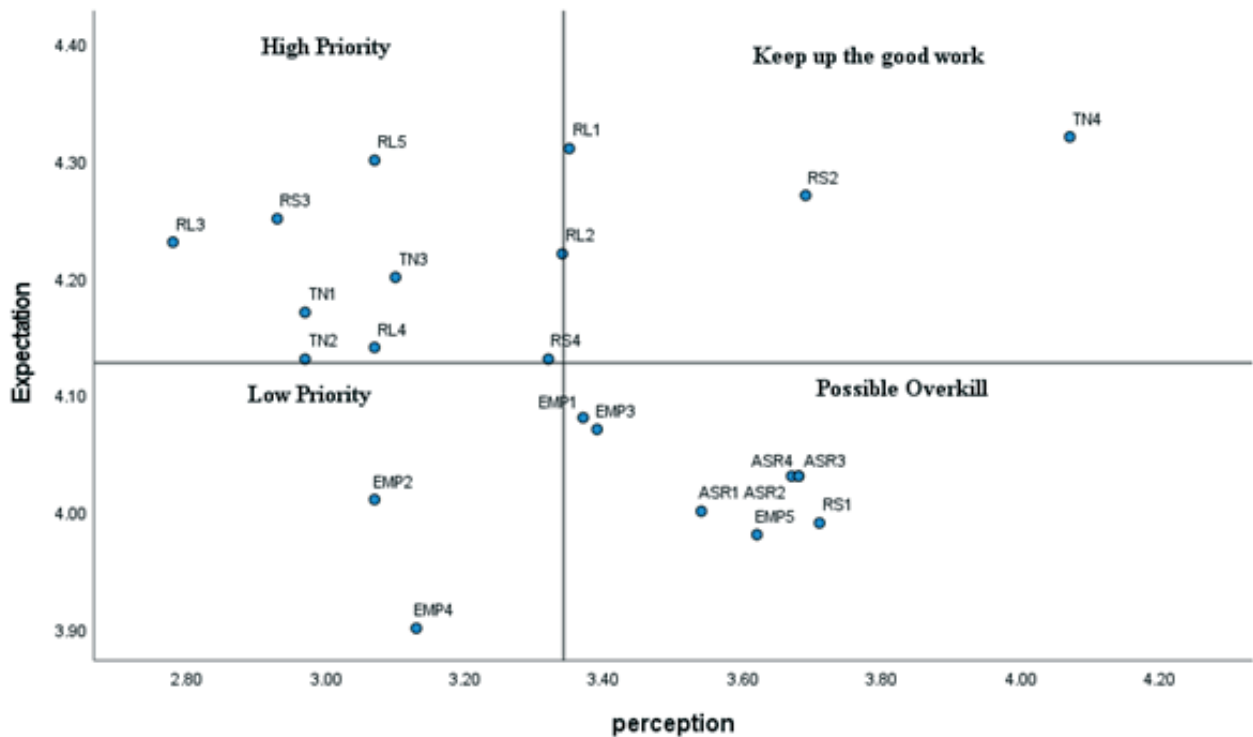
# RESULTS OF PERCEPTIONS – EXPECTATIONS GAP

To ascertain the discrepancies between customer expectations and perceptions and determine the polarity of these gaps, we conducted a comprehensive analysis by juxtaposing the mean scores derived from the 22-assessment measurement. This evaluation employed an item-by-item approach, ensuring a rigorous examination of the data to elucidate the nuances within customer sentiment.

To perform an Importance-Performance Analysis (IPA), we operationalized the importance score as the expectation score, while the performance score is the perception score. Figure 3 represents the IPA graph, a scatter plot with the x-axis representing the Importance (Expectation) scores and the y-axis representing the Performance (Perception) scores. The Importance Performance Analysis (IPA) was conducted on 22 items. The IPA graph is divided into four quadrants, each representing a different performance category. In

Quadrant 1, items are considered important and perform well. The items in this quadrant were TN1, TN2, TN3, RL3, RL4, RL5, RS3 and RS4. In Quadrant 2, items are important and performing well; the items in this quadrant were RL1, RL2, RS2 and TN4. Quadrant 3 had lower importance and lower performance items, indicating they may not require immediate attention. The items in this quadrant were EMP2 and EMP4. Quadrant 4 had items with lower importance but were performing well, suggesting that resources could be allocated elsewhere that were not performing well. The items in this quadrant were EMP1, EMP3, EMP5, ASR1, ASR2, ASR3, ASR4 and RS1.

Overall, the IPA provides insights into the areas where performance is lacking and where resources can be focused to improve performance. In conclusion, the IPA results suggest that the main areas that need improvement are Tangibility, Reliability, and some aspects of Responsiveness and Empathy. Maintaining and potentially reallocating resources from the over-performing items in Quadrant IV could help address the underperforming items in Quadrant II, leading to higher customer satisfaction.



Note: codes for variables: Reliability (RL),Tangibility (TN), Empathy (EMP), responsiveness (RS), Assurance (ASR)

Source: own work

*Figure 3*: *Scatter plot of Perceptions–Expectations gaps*

# CONCLUSION

The results of this study emphasize the importance of perceived service quality in the banking sector in Iraq and offer critical insights for service improvement and customer satisfaction enhancement. Our study reveals a high level of perceived service quality among the participants, suggesting that banking institutions in Iraq generally satisfy customer needs and expectations. However, this perception of satisfactory service quality is qualified by the significant difference between customer expectations and perceptions.

Our analysis using the independent samples t-test showed a large gap between what customers expect and how they perceive the quality of banking services. The SERVQUAL model showed negative gap scores for all service dimensions, indicating that the perceived quality of the service in Iraqi banks falls short of customers' expectations. Specifically, the largest gaps were found in Reliability and Tangibility, implying that customers expected more dependability, accuracy, and physical tangibles than they received.

By using the Importance-Performance Analysis (IPA), we suggested improvements for the Iraqi banking sector. According to the IPA results, the most urgent areas for improvement are Tangibility, Reliability, and some aspects of Responsiveness and Empathy. Items within the Assurance and some elements of Responsiveness and Empathy dimensions were performing well. However, they were seen as less important, indicating the possibility to reallocate resources towards dimensions with larger performance gaps.

Customers' high expectations about the quality of banking services are reflected in the high expectation scores for all service aspects. Therefore, efforts are required to raise performance where significant discrepancies between expectation and performance were identified, especially in the Tangibility and Reliability dimensions.

In conclusion, the study provides strong evidence of a need for improvement in service quality across various dimensions within the banking sector in Iraq. We hope that these findings will serve as a catalyst for a more customer-oriented approach in the banking sector, thereby driving the industry towards greater success in the long term. Banks can use these insights to implement specific strategies for service improvement, better align their offerings with customer expectations and ultimately increase customer satisfaction and loyalty.

According to the findings, customers' overall experiences with banks in Iraq are characterized by a gap between their expectations and perceptions of service quality. This gap exists for all SERVQUAL model dimensions, suggesting potential for improvement.

These findings have important implications for the financial industry in Iraq and possibly beyond. The banks need to improve their service quality in these areas by better fulfilling the needs and expectations of their customers. Banks can enhance customer satisfaction, foster customer loyalty, and ensure long-term business success by focusing on these key areas. For practical application, banks should prioritize improvements in the physical aspects of their service (Tangibility) and the dependability and accuracy of their service delivery (Reliability). Achieving this could involve investment in renovating physical facilities, system upgrades for better reliability, and ongoing training programs to improve staff skills and competencies. A customer-oriented approach should guide the banks' decision-making processes. Regular customer surveys could provide useful feedback, and the results could direct service improvements. This would ensure that services match more closely with customer needs and expectations, which is essential to achieving higher customer satisfaction. These findings also affect policymakers, especially those regulating the banking sector in Iraq. Regulatory bodies could introduce stricter quality standards and monitor compliance through regular audits. This would motivate banks to improve service quality, thus increasing customer satisfaction and creating a healthier banking sector. This study provides compelling evidence of the need for continued efforts to meet or exceed customer expectations. While the focus here has been on the banking sector in Iraq, the findings may also be relevant to other sectors where the SERVQUAL model could be applied.

Despite its promising findings, this study has some limitations. Results may have differed with a larger sample size; the study relied on a relatively small number of customer responses, which introduces the possibility of selection bias. Using self-reported data within the SERVQUAL model introduces the potential for subjectivity and bias. The study's cross-sectional nature posed a limitation as it captured customer expectations and perceptions at a specific time, not accounting for possible changes over time. Finally, while the SERVQUAL model is widely accepted for measuring service quality, it might not cover all aspects relevant to the banking sector. Other models or supplementary measures might provide additional, potentially significant insights. Future research should consider these limitations for a more comprehensive understanding of service quality gaps in the banking sector.

*Author's contribution*

Al Laheebi Ghayth was responsible for 75% of the overall work. His tasks included data collection, analysis, and crafting the discussion and conclusion sections.

László Molnár contributed 25% to the study. He conceived and designed the study, penned the introduction and the literature review, and also provided supervision throughout the study.

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# Transformational Leadership Impact on Employee's Motivation: A Comparative Study of National and Multinational Pharmaceutical Companies in Pakistan

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*Summary*

*Pakistan, being a developing economy, is in continuous transition to achieve its targeted developmental goals. In this regards, prime attention to the industrial sector is gaining importance. In the industrial sector, the pharmaceutical industry holds a significant role in meeting the national medicine demands and contributing to the country's economic growth at the same time. Promoting the manufacturing sector not only requires appropriate leadership but also a pool of motivated workers who can achieve the objectives. This paper investigates the effects of transformational leadership on employees' motivation in the pharmaceutical sector of Pakistan. Both local and multinational firms are taken into consideration. Data collected through a structured questionnaire from 503 respondents is analysed using SPSS 25. Results show that the application level of transformational leadership is higher in multinational companies as compared to the native companies. However, the impact of transformational leadership on employees' motivation is almost the same for both local and multinational companies.*

*Keywords: Transformational leadership; Motivation; Pakistan*

*JEL codes: M10; M54; O17*

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## INTRODUCTION

Global corporate competition and technological advancements have embedded a sense in the organizations to concentrate on their human resources, as this can be a critical factor in the success or failure, sustainable development, profitability, and reputation of any firm. Possession of unique resources or having an abundance of resources alone cannot determine the fortune of a firm. Similarly, depending solely on the achievement of organisational goals to keep the employees motivated cannot be sufficient unless the individuals' personal and career goals are met. A feasible solution comes with the application of an appropriate leadership approach that frames the actions and behaviours of employees in such a way that leads to

higher employee motivation and productivity. Realising the fact that employee motivation and leadership are interactive, contemporary organisations are dedicated to having proper leadership in all elements of the organisation to yield positive and desirable impacts at the individual and organisational levels (Vondey, 2008; Zenger et al., 2009).

Leadership can be understood as a binding relationship between a leader and the followers in such a way that the leader shapes the attitude, behaviours and actions of the followers with an intention to achieve the planned goals and objectives (Lo et al., 2010), providing the respective firm with robust opportunities to grow extensively and make more profits (Ben-Oz & Greve, 2015). Appropriate leadership develops a system of organisational values and presents it attractively and practically, in a way that enhances the inspiration and

motivation of the employees to achieve short-term objectives and long-term goals (Dola, 2015; Kolzow, 2014). It is one of the central functions of organisational management because the organizational success and efficiency can be achieved through competent leadership (Hartnell et al., 2016).

All of the contemporary leadership theories were put forwarded to benefit organisations in every possible way with their unique characteristics. Among these theories, transformational leadership is widely accepted, as this leadership style not only benefits the organisations but also comes up with desirable personal outcomes by focusing on the individual needs of the employees (Keskes et al., 2018). Productive results can be obtained by applying the leadership style in varied organisational contexts, including organisations in the education sector, health sector, engineering and manufacturing sector, and also in the military (Bass & Avolio, 1990). Higher levels of motivation and morality among employees, enlarging individual and organisational vision, bringing compatibility between organisational values and individuals' behaviours, promoting openness to accept change, and giving preference to group-interest over self-interest are the distinctive deliverables that over-weigh transformational leadership as compared to other leadership approaches (Bass, 1985; Keskes et al., 2018; Nanjundeswaraswamy & Swamy, 2014).

According to Bernard Bass (1985), transformational leadership is comprised of four dimensions: *idealized influence*, which refers to the fact that a leader is powerful, charismatic and confident whose behaviour is in accordance with the mission, ethical code and value system of the firm; *inspirational motivation,* which means that the leader can instil motivation and optimism in the followers via effective communication, elaborating organizational vision and by persuading the followers that the goals are achievable; *intellectual stimulation*, which highlights that the leader will always encourage the subordinate to challenge the status quo by adopting creativity and innovation; and *individualized consideration*, which focuses on the fact that the leader will pay attention to individual followers and their needs, and provide support and guidance to the followers whenever needed (Bass & Avolio, 1990). Recently, firms around the globe are increasingly interested in transformational leadership as it can assist in developing a value system that enhances employees' motivation and polishes the skills of the individuals simultaneously. Various studies have concluded that transformational leadership is a superior approach based on its multi-faceted favourable outcomes (Ahmad & Ejaz, 2019; Khan et al., 2014).

Motivation can be referred to as a driving force that influences behaviours of individuals in a way that can assist in achieving goals and certain outcomes by providing strength and right directions (Kontodimopoulos et al., 2009). In today's corporate environment, organisational authorities are inclined to practice varied leadership styles that can yield motivation and positive energies among the employees. As a result, the personnel engage in productive organisational behaviours that can make the achievement of planned targets and organizational goals realistic, thus ensuring the given firm as a going concern. The commitment, creativity and extra efforts of the employees at the workplace represent their level of motivation. A pool of motivated workers is essential for achieving organisational prosperity because it is the motivation that provides courage and spirit to employees in the prevalence of challenges and constraints to remain successful (Islam & Ismail, 2008; Manolopoulos, 2008). The employees' motivation level, job satisfaction and morale is usually determined by the leadership style adopted by a firm (Naile & Selesho, 2014).

Based on contemporary literature and keeping the importance of transformational leadership and employees' motivation at its core, the present study is intended to show the impacts of transformational leadership on employees' motivation in pharmaceutical companies in the context of Pakistan.

## Significance of the study

One of the decisive factors for the economic growth and development of a country is to transition from the agriculture sector to manufacturing and then to service sector (Fuchs, 1980). In this regard, a gradual shift has been seen in Pakistan's economic structure from agriculture to other sectors like manufacturing and services over the last few decades. In the past, most of the organizations in the country focused on transactional leadership, but in recent times these firms are moving towards transformational leadership (Paracha et al., 2012). This change in the leadership style is inevitable because the firms heavily rely on motivated human resources for organizational success, which can be ensured by the application of transformational leadership. The leadership style is preferred as it can be effective in diverse organizational settings (Ahmad & Ejaz, 2019; Bass, 1997), shows a higher level of flexibility to adopt change (Egan et al., 1995) and comes with extended support, productivity, innovation and employees' motivation (Bastari et al., 2020; Bushra et al., 2011). The effects of transformational leadership have been analysed by carrying out many studies in the developed economies, but there is a dire need to investigate the leadership style in a developing economy like Pakistan in such a way that it can assist in drafting organizational policies while focusing on the personnel (Bodla & Nawaz, 2010; Rabia et al., 2009).

In the quest for economic prosperity and growth, pharmaceutical companies in the industrial sector of Pakistan play a vital role in terms of job creation, GDP growth and meeting the demand for medicine of over 70% of the population of the country. With a total worth

of USD 3.1 billion, the country holds a 0.5% share in the global pharmaceutical market. The industrial segment has the capability of providing employment to over ninety thousand individuals (Pakistan Pharmaceutical Manufacturer's Association, 2021). Considering contributions of the pharmaceutical sector of Pakistan in the country's economic growth and the role of such a huge pool of workers in the sector, it is essential to carry out research in the context of this industry to know the impacts of transformational leadership on employees' motivation, as no such contextual study has been carried out in the past.

## Objectives of the study

The study serves a number of objectives:

i) To determine the level of transformational leadership in local pharmaceutical companies of Pakistan,
ii) To determine the level of transformational leadership in multi-national pharmaceutical companies operating in Pakistan,
iii) To analyse the impact of transformational leadership on employees' motivation in local pharmaceutical companies of Pakistan,
iv) To investigate the impact of transformational leadership on employees' motivation in multi-national pharmaceutical companies operating in Pakistan, and
v) To carry out a comparative analysis of how the transformational leadership affects employees' motivation in local pharmaceutical companies and multi-national pharmaceutical companies in Pakistan.

# LITERATURE REVIEW

The philosophy of transformational leadership has three distinctive practical features. The first feature is to plan, shape and develop a crystal-clear organizational vision. The second feature is to disseminate information about the developed vision among the organizational members. The roles and responsibilities of employees are defined, which determine a diverse and rich set of actions to achieve the firm's vision. The third feature comprises efforts that can sustain the shared vision, not only in the short run but also in the long run. Acceptance and collaboration are the central convictions to motivate the work force and accomplish the organizational vision (Andersen et al., 2018). Collectivistic, spiritual and intellectual characteristics of transformational

leadership address the personal development and individual needs of employees, which motivates them to ensure organizational well-being and smooth functioning (Belias & Koustelios, 2014).

Organizational success can be guaranteed when there is a presence of mutual trust between the organization and its employees. Motivating and empowering the employees can give rise to such trust, which is possible only if the business entity has a suitable leadership style. In the current dynamic environment, transformational leadership can serve this purpose (Givens, 2008). The ideology of transformational leadership is so extensive and flexible that it can motivate personnel by encompassing several domains, including frequent and effective communication, prioritizing and targeting specific goals, bringing optimism among employees about the goals' achievement, upgrading employees' competences and promoting openness to embrace change with an ease (Bass, 1985; Keskes et al., 2018; Nanjundeswaraswamy & Swamy, 2014). Among all other leadership styles, transformational leadership holds a distinctive and superior position due to its multi-faceted substantial and favourable outcomes (Ahmad & Ejaz, 2019; Khan et al., 2014).

Early preparedness of an organization is crucial to be competitive and to embed changes according to the surrounding economic conditions. Transformational leaders are pro-active and act in a way that develops a positive perception about job characteristics among the employees. As a result, not only the job performance increases but also the self-confidence and attitude of employees (Fernet et al., 2015). Individuals' motivation level is raised as the leaders provide proper guidance, desirable feedback and mental support that enable the employees to take risks, carry out unconventional work and be involved in creative activities to boost the organizational output (Mahmood et al., 2018; Ng, 2017).

Analysis of data from a sample size of 285 employees working in a state-owned enterprise in Indonesia concluded that transformational leadership significantly and positively affects employees' motivation, which is the main factor to get the desired level of individuals' performance. The leadership has the capability to mould the beliefs and attitudes of subordinates to develop a sense of unity among them. Furthermore, the individuals can enhance their potential and upgrade their competencies by getting extensive support from the leaders (Bastari et al., 2020). Similarly, another study carried out in six different telecommunication firms with a sample size of 294 respondents concluded that all of the dimensions of transformational leadership can influence employees' motivation in a positive manner (Ahmad et al., 2014). One study suggested that the leadership approach can be effective to improve the motivation and commitment

level of teaching staff. A thorough analysis of data received from 184 tutors working in 13 different high schools confirmed that the transformational leaders are able to inspire shared values and vision, promote development, encourage creativity and build trust among the members of the teaching faculty (Naile & Selesho, 2014).

Transformational leaders can bring organizational change without breaking the rhythm of routine operations and productivity. The leadership style has unique attributes which make it convenient to easily manage complex targets and job patterns. Frequent and effective communication with all levels of workers brings positive energies to employees and keeps them engaged in their jobs (Avolio et al., 2004). Challenges can be resolved where individuals are encouraged to come up with innovative ideas and solutions. The leader gives importance and due attention to employees and boosts their confidence level. Such behaviour of the leader ends up in higher motivation, loyalty and commitment among the followers (Walumbwa et al., 2004).

An organization can sustain competition only if it changes gradually and continually according to the needs of prevailing digitization, demographic fluctuations, and globalization. Implementation of planned change starts at the individual level and extends to the organizational level. Without change at the individual level, the change process at the firm level cannot be successful. Change at the individual level is effective if the employees are motivated, and that is possible with the presence of proper leadership. Transformational leadership has been proven to motivate personnel and improve their performance during such a transitional phase (Carter et al., 2013). A set of two motivational mechanisms is used by the leadership to bring about organizational change. In the first mechanism, individuals are prepared for the transition by developing a positive perception of the transformation among employees, and by persuading them that the resulting consequences are attractive and desirable. The second motivational mechanism is dedicated to engaging personnel in productive activities that can make the change implementation process achievable. These approaches not only confirm the direct engagement and support of employees in the change process but also enhance the openness of individual to embrace such transformation (Faupel & Süß, 2019).

It has been observed that transformational leadership can also motivate employees in the manufacturing sector. Findings based on data from 627 workers in the Indonesian manufacturing sector showed that such leadership provides a conducive work environment and instils higher motivation among employees, which leads to the robust performance of the human resources (Nugroho et al., 2020). Teams can be managed effectively to pave the path for creativity, innovation and productivity. A higher level of collaboration and cooperation among colleagues is promised, where the transformational leader serves as a role model for the subordinates (Bass, 1985). The desirability and elasticity of the guiding strategy bring noteworthy improvement in the quality of deliverables. The organizational crew is inspired to take risks and exploit new opportunities (Tucker & Russell, 2004).

With the application of varied theories, efforts have been made to dig out how transformational leadership can alter the average achievements of employees into above-average accomplishments. The majority of these studies present the same stance: that the leadership brings about personal changes within the individuals, which is the main reason for their high motivation level (Sandell, 2012). Each dimension of the leadership plays a vital role in the context of favourable outcomes. Idealized influence makes communication clear and effective, making it easier for the team members to meet high-performance expectations. Inspirational motivation builds the morale of employees and gives them a sense of self-efficacy to achieve the planned objectives. Intellectual stimulation is committed to providing meaningful work and making the tasks attractive for the followers. Individualized consideration is devoted to addressing the individual needs of the personnel, giving them a perception of high self-worth. All these distinguishing attributes of transformational leadership empower, energize and inspire the workforce to make the respective organization a perpetual success (Bass, 1997; Masi & Cooke, 2000).

## METHODOLOGY

A quantitative research approach is used for the investigation. Primary data was collected by developing a comprehensive survey questionnaire. The Multifactor Leadership Questionnaire developed by Bass and Avolio (1996) was the instrument used to collect data about transformational leadership. The instrument included a total of twenty items: five items for each dimension of transformational leadership. For Employee motivation, an instrument developed by Manolopoulos (2008) was used which consists of twelve items. Response to each item (question) of the survey was recorded by the application of a 5-point Likert scale, ranging from strongly disagree (1) to strongly agree (5). Random sampling technique was used to ensure smooth data collection. The unit of analysis in this investigation was limited to sales representatives employed in different pharmaceutical companies of Pakistan. In all, 503 responses were received from sales representatives working in various pharmaceutical companies through a structured questionnaire using Google Forms. SPSS (Statistical Package for Social Sciences) 25 was used to carry out effective data analysis.

# FINDINGS AND ANALYSIS OF THE DATA

The demographics of the data, as illustrated in Table 1, shows that out of 503 responses, 160 responses (32%) were received from employees in multinational pharmaceutical companies while 343 (68%) responses were retrieved from employees of Pakistani pharmaceutical companies. This difference in response ratio is due to the difference in the number of multinational and local pharmaceutical companies in Pakistan, i.e. 25 companies are multinational while 734 are local. The majority of the respondents were male; only 98 respondents were female. This is because the industry is dominated by men due to the cultural restrictions and high-paced nature of the job. Respondents in the age range 31-40 years made up the largest group. Most of the survey participants hold a master's degree, followed by a number of participants that hold bachelor's degree (generally the minimum qualification to hold a job in the industry), with a few respondents having only a high school diploma (Intermediate).

*Table 1*
*Demographic statistics*

| | | Age (in years) | | | | Gender | | Highest academic qualification | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 18-30 | 31-40 | 41-50 | 51-60 | Male | Female | High school | Bachelor degree | Master degree |
| **Company Status** | **Local** | 113 | 221 | 9 | 0 | 273 | 70 | 0 | 143 | 200 |
| | **Multinational** | 59 | 96 | 5 | 0 | 132 | 28 | 2 | 28 | 130 |
| **Experience in years** | **1-5 years** | 136 | 9 | 0 | 0 | 83 | 62 | 2 | 27 | 116 |
| | **6-10 years** | 35 | 163 | 0 | 0 | 163 | 35 | 0 | 56 | 142 |
| | **11-15 years** | 0 | 143 | 3 | 0 | 145 | 1 | 0 | 81 | 65 |
| | **16-20 years** | 1 | 2 | 8 | 0 | 11 | 0 | 0 | 6 | 5 |
| | **above 20** | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 1 | 2 |

Source: By author
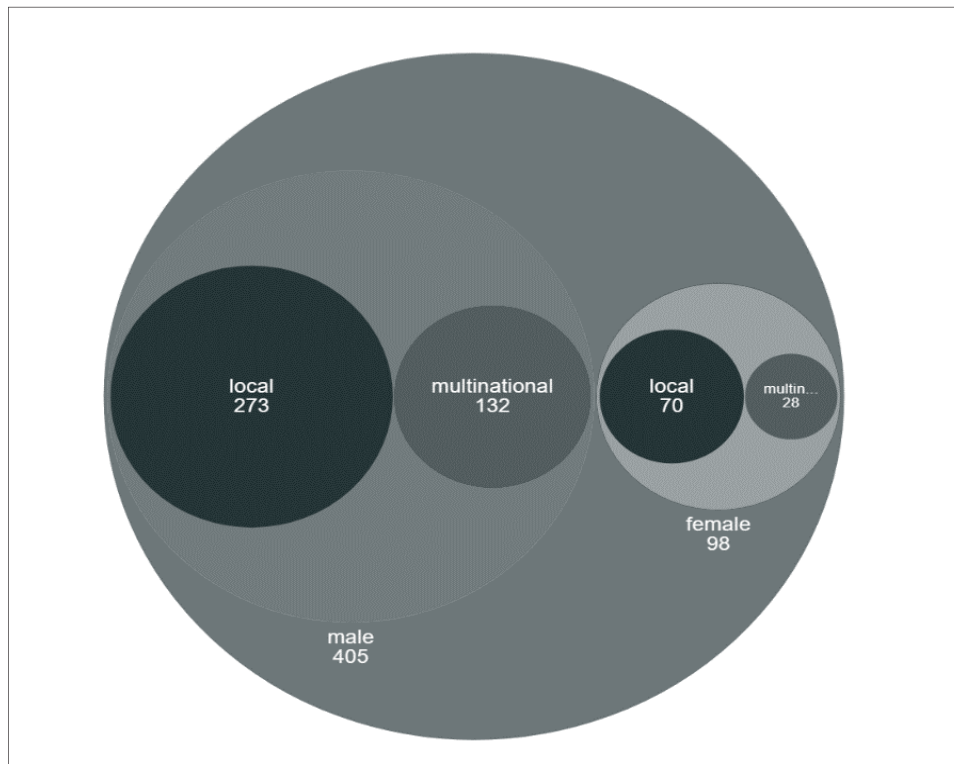


Source: By author

*Figure 1. Circle packing of respondent numbers by gender and type of company*

To understand the level of adoption of transformational leadership in both the local and multinational companies, one sample *T*-test was conducted. The test shows that both local and multinational companies have above average levels of transformational leadership compared to the hypothetical mean. This shows that both the local and multinational companies have applied the concept of transformational leadership on a reasonable level. The *T* value for local companies is 66.6 with a mean value of 37.5, and degree of freedom 342 while for the multinational companies, *T*-test value is 101.2 with 46.6 mean and the degree of freedom 159, as shown in Table 2.

*Table 2*
*One sample T-test*

| One-Sample Test | | | | | | | |
|---|---|---|---|---|---|---|---|
| Company Status | **Test Value = 50** | | | | | | |
| | t | df | Significance | | Mean Difference | 95% Confidence Interval of the Difference | |
| | | | One-Sided p | Two-Sided p | | Lower | Upper |
| **Local** | 66.603 | 342 | 0.000 | 0.000 | 37.48397 | 36.3770 | 38.5909 |
| **Multinational** | 101.211 | 159 | 0.000 | 0.000 | 46.61250 | 45.7029 | 47.5221 |

Source: By author

To find out if there is any difference between the multinational companies and local companies in terms of transformational leadership application level, an independent sample *T*-test was conducted. The results showed that there is a statistically significant difference between the local and multinational companies (Sig=0.000, F=34.246). Multinational companies have a higher level of transformational leadership application than local companies, as is clear from the mean values of 96.6 for multinational entities and a mean value of 87.5 for the local firms, as shown in Tables 3 and 4 below:

*Table 3*
*Independent Samples Test (a)*

| Transformational Leadership | | | | | |
|---|---|---|---|---|---|
| F | Sig. | t | df | Mean Difference | Std. Error Difference |
| 34.246 | 0.000 | -10.346 | 501 | -9.12853 | 0.88230 |
| | | -12.553 | 485.304 | -9.12853 | 0.72722 |

Source: By author

*Table 4*
*Independent Samples Test (b)*

| Group Statistics | | | | | |
|---|---|---|---|---|---|
| Company Status | | N | Mean | Std. Deviation | Std. Error Mean |
| **Transformational Leadership** | **Local** | 343 | 87.4840 | 10.42316 | 0.56280 |
| | **Multinational** | 160 | 96.6125 | 5.82554 | 0.46055 |

Source: By author

In order to address one of the research objectives, linear regression analysis was carried out to find the association level and the impact of transformational leadership on employee motivation. The whole sample size was taken into consideration while running this analysis. The resulting statistics revealed that the R square value was 0.97, which indicates that transformational leadership has a significant impact on employee motivation.

*Table 5*
*Regression analysis (R-Square value)*

| R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|----------|-------------------|----------------------------|
| 0.985 | 0.971 | 0.971 | 2.64219 |

Source: By author

*Table 6*
*Regression analysis (coefficients values)*

| Coefficients | | | | | | | |
|--------------|--|--|--|--|--|--|--|
| **Model** | | Unstandardized Coefficients | | Standardized Coefficients | | t | Sig. |
| | | B | Std. Error | Beta | | | |
| 1 | (Constant) | 8.579 | 1.057 | | | 8.113 | 0.000 |
| | Transformational leadership | 1.502 | 0.012 | 0.985 | | 129.156 | 0.000 |

Source: By author

It was also observed that there is a linear relationship between transformational leadership and employee motivation, as illustrated in Figure 2. The scatter plot shows that this relationship is alike for both the local and multinational companies, and these findings are in line with other studies that have been carried out in varied contexts (Ahmad et al. 2014, Bastari et al. 2020, Naile and Selesho 2014, Nugroho et al. 2020).
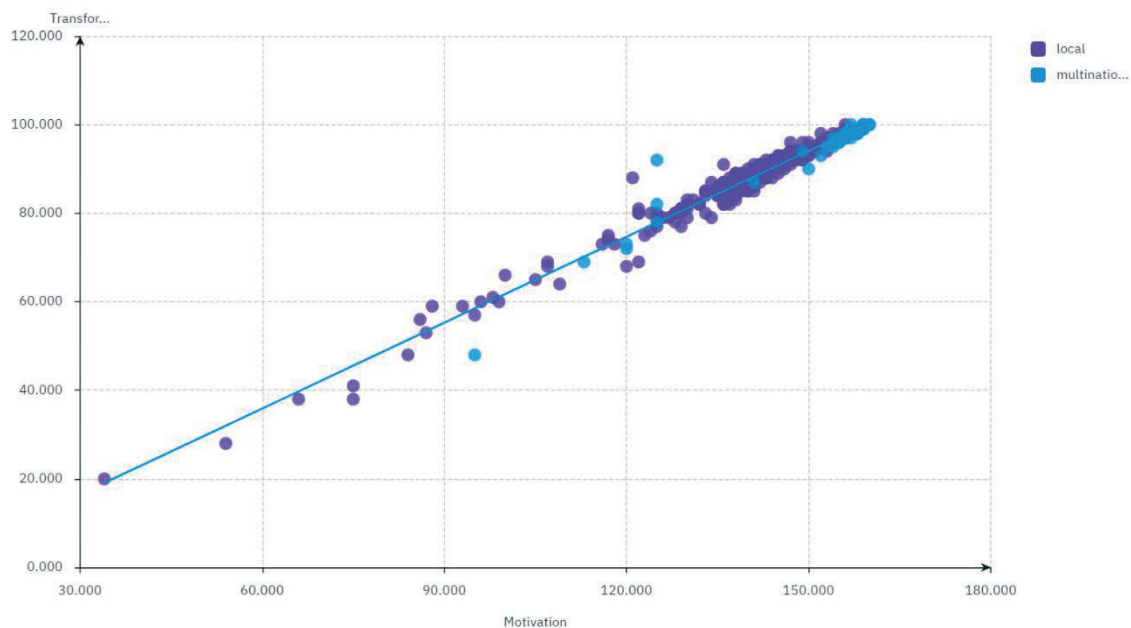


Source: By author

*Figure 2. Scatter plot of employee motivation and transformational leadership*
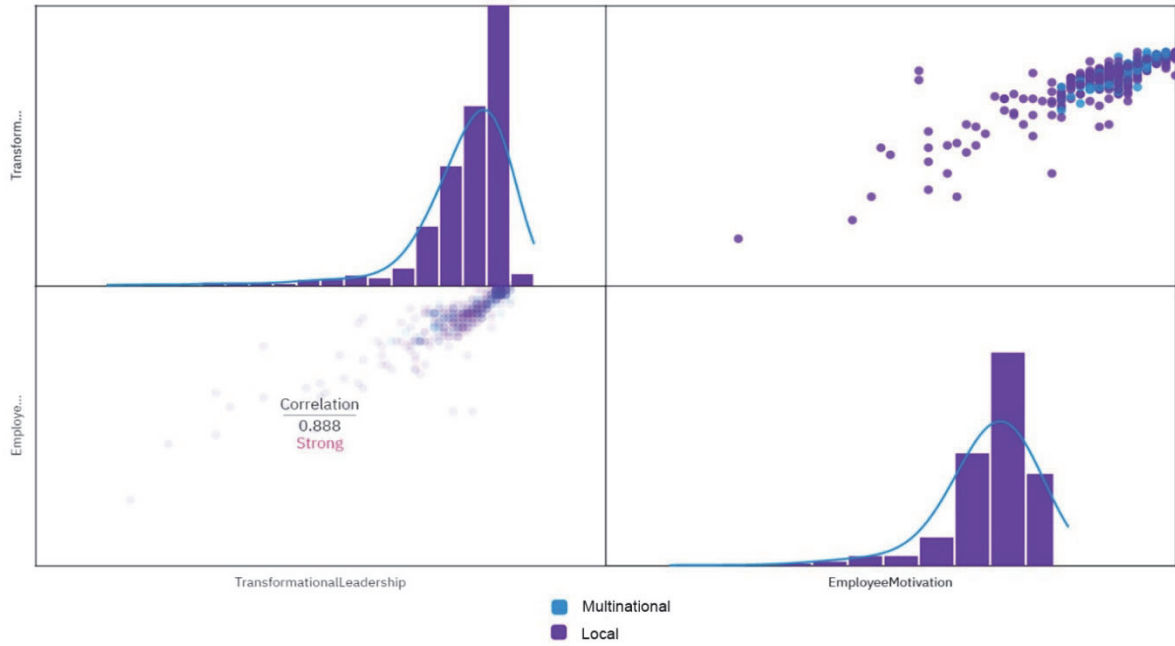
Source: by author

*Figure 3. Matrix Scatter of Transformational leadership and Employee motivation*

An ANOVA test was conducted to determine differences in the motivation level among the respondents on the basis of their academic background. The results show that there is a statistically significant difference in the motivation level between the academic groups. Bachelor and master degree holders are different in their motivation level. The master degree holders have a higher motivation level as compared to the bachelor degree holders. The main reason is probably that the employment system in the country usually provides additional financial and non-financial perks to the employees with higher academic qualifications, and that is why they are more motivated as compared to the individuals with lower academic qualifications. The difference of intermediate (high school) group with the other academic qualification groups cannot be considered significant and decisive as only two respondents of the study belong to this academic background. These comparative results can be understood from the results provided in Tables 7 and 8.

*Table 7*
*ANOVA test for employee motivation based on academic qualifications*

|  | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 4.044 | 2 | 2.022 | 9.150 | 0.000 |
| Within Groups | 110.497 | 500 | 0.221 |  |  |

Source: By author

*Table 8*
*Multiple Comparisons of ANOVA test for employee motivation*

| Academic Qualification of the respondent | | Mean Difference | Std. Error | Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|---|
|  |  |  |  |  | Lower Bound | Upper Bound |
| Intermediate | Bachelor degree | 0.08942 | 0.33435 | 0.961 | -0.6965 | 0.8754 |
|  | Master degree | -0.10000 | 0.33342 | 0.952 | -0.8838 | 0.6838 |
| Bachelor degree | Intermediate | -0.08942 | 0.33435 | 0.961 | -0.8754 | 0.6965 |

| | Master degree | -0.18942-* | 0.04430 | 0.000 | -0.2935 | -0.0853 |
|---|---|---|---|---|---|---|
| Master degree | Intermediate | 0.10000 | 0.33342 | 0.952 | -0.6838 | 0.8838 |
| | Bachelor degree | 0.18942* | 0.04430 | 0.000 | 0.0853 | 0.2935 |
| * The mean difference is significant at the 0.05 level. | | | | | | |

Source: By author

To compare if the impact of transformational leadership on employees' motivation is different for local and multi-national companies, the regression analysis was conducted for each group separately (Table 9). Statistics of the analysis show that there was almost the same level of impact for both local and multinational companies. This indicates that the leadership style is effective in motivating employees in the organizations regardless of their status. For more details refer to Table 10.

*Table 9*

*Regression analysis for local and multinational company comparison (R values)*

| Model Summary | | | | |
|---|---|---|---|---|
| Company Status | R | R Square | Adjusted R Square | Std. Error of the Estimate |
| **local** | 0.986 | 0.971 | 0.971 | 2.65084 |
| **multinational** | 0.963 | 0.928 | 0.928 | 2.26782 |

Source: By author

*Table 10*

*Regression analysis for local and multinational companies' comparison (coefficients values)*

| Coefficients | | | | | | |
|---|---|---|---|---|---|---|
| Company Status | Model | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
| | | B | Std. Error | Beta | | |
| **local** | **(Constant)** | 10.063 | 1.212 | | 8.306 | 0.000 |
| | **Transformational leadership** | 1.480 | 0.014 | 0.986 | 107.593 | 0.000 |
| **multinational** | **(Constant)** | 19.685 | 2.988 | | 6.588 | 0.000 |
| | **Transformational leadership** | 1.397 | 0.031 | 0.963 | 45.235 | 0.000 |

Source: By author

In general, the respondents were very positive when it comes to the statements related to employee motivation in the survey questionnaire as mentioned in Appendix 1. They tend to either agree or strongly agree on the statements that belonged to employee motivation on the survey questionnaire as shown in Figure 4. This indicates that they have a high level of motivation, and this may be related, of course, to the high-level application of the concepts of transformational management in the companies from which the responses were collected in general.
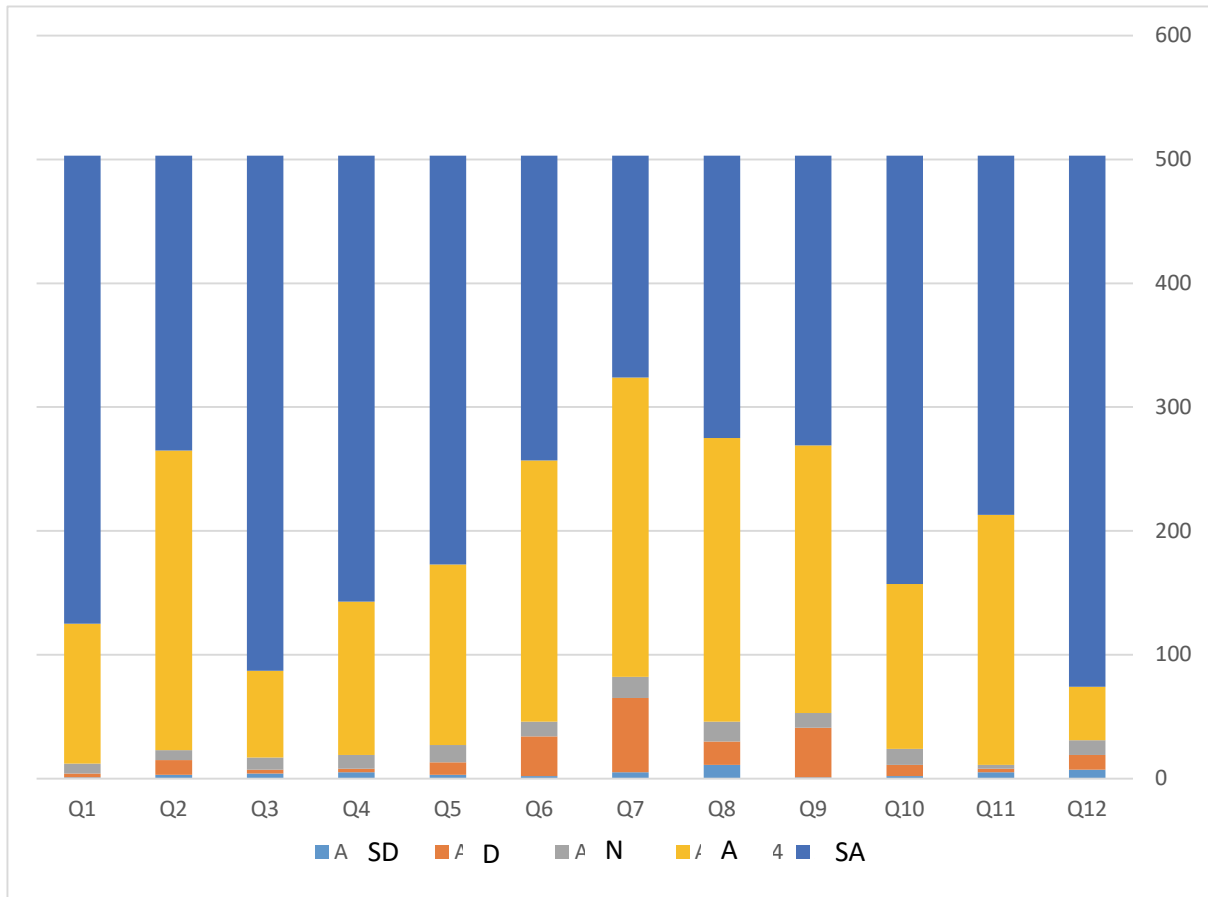
Source: by author

*Figure 4. Chart representing responses to motivation items*

# DISCUSSION OF THE RESULTS

To achieve a sound economic position, Pakistan's economy is reducing its total reliance on agriculture while promoting the manufacturing sector at the same time. Over a period of time, several industries have been established. Among these industries, the pharmaceutical sector plays a prominent role in contributing to a variety of determinants of economic growth. Since the sector is consuming considerable resources, making a value of those resources used depends on the availability of motivated human resources. In this case, there is a dire need for a compatible leadership approach that can serve the purpose of achieving the desired ends. Following Western economies, organizations in Pakistan have been adopting the new approach of transformational leadership while giving up on the conventional transactional leadership approach in recent years. Since the approach is relatively new, and no such contextual study has been undertaken previously, the present study was intended to evaluate the level of transformational leadership in the pharmaceutical companies in Pakistan. An attempt was also made to compare the application of the leadership style by local and multi-national pharmaceutical companies operating in Pakistan, and

how this leadership approach can influence the employees' motivation in those firms.

Findings from the data show that both the local and multi-national pharmaceutical companies have a significant level of transformational leadership with a *T* value of 66.6 and 101.2 for local and multi-national companies respectively. Comparative analysis shows that multi-national companies are more transformational as compared to the local pharmaceutical companies. This is because the multi-national firms mostly originated from the developed economies and these firms have been using the same leadership approach for quite long periods in different geographical contexts. But for the local business entities, the leadership strategy is relatively new and these firms are striving towards the optimal application and utility of the leadership approach.

Taking the whole sample into consideration, findings show that transformational leadership positively and significantly affects the employees' motivation in the pharmaceutical sector of Pakistan. On the basis of academic background, employees with a higher qualification (master degree) were found to be more motivated compared to the employees with lower

qualifications (bachelor degree). The motivation level of the individuals having intermediate (high school) qualifications could not be compared accurately due to the small number of respondents in the sample of the study. Regression analysis shows that the employees in local companies are slightly more motivated compared to the employees in the multi-national firms. There can be a number of reasons for this; one possible reason is that the employees in local companies had experienced a more rigid (transactional) leadership style in the past, and recently bringing a more flexible and adaptive (transformational) leadership approach inside the firms instigated higher motivation in the workforce, another factor may be related to the sample size whereas the sample size for local companies is way larger than the sample size for multi-national enterprises. The difference in sample size is due to a sharp difference in the number of local and multinational pharmaceutical companies in Pakistan i.e. 734 local and 25 multinational firms in the sector. In general, employees, regardless of their company status, showed a very positive response when it comes to motivation. The degree of freedom, empowerment, flexibility, self-esteem, and greater human-centric features associated with the transformational leadership led the employees to respond positively to motivation items on the survey questionnaire.

## CONTRIBUTIONS

The study is unique as it is the first study focusing on transformational leadership and employee motivation to be carried out in the pharmaceutical industry and the country context of Pakistan. The findings of the study make a robust addition to the existing body of literature, making significant theoretical contributions. Furthermore, the practical contributions of the study can be widespread. The study highlighted that the leadership style is effective to result in higher employee motivation, which in turn can bring about positive deliverables like organizational commitment, higher productivity and loyalty among the workers. As transformational leadership is not extended to all sectors and organizations in Pakistan, findings of the study can encourage other organizations in diverse sectors and especially those in the public and manufacturing sectors to replace the conventional leadership styles with the transformational approach which may be helpful to keep their personnel motivated and to achieve the organizational goals in a convenient and cost-effective manner. The present investigation specifically focuses on one branch of the manufacturing sector, its findings can be generalized easily to other branches such as food, beverages, garment and footwear industries. However, its implications for non-manufacturing sectors are difficult to judge, but if the same research approach is used in those sectors, it can bring forth a clearer picture about the efficacy of the transformational approach in the investigated sectors. Furthermore, the economic, political and social environment usually remains ambiguous in developing economies like Pakistan. In such uncertainties, transformational leadership can be productive by providing an upgraded level of flexibility to the organizations and its members to aid in accepting change, bringing about innovations and preventing resource losses.

## CONCLUSION

The investigation highlights the application feasibility of transformational leadership in the pharmaceutical sector of Pakistan in order to keep the workers' pool motivated. A comparative analysis is also used to show if there is a difference in the effects of transformational leadership on employees' motivation between local and multinational enterprises. It was found that the leadership style is almost equally beneficial for local and multinational business entities. As the country is in a transition phase, the industrial sector needs to be stronger, which is possible with a more flexible leadership approach. Among the contemporary leadership approaches, transformational leadership can be practiced in firms having varied contexts. Findings of the study support the extension of transformational leadership to other manufacturing firms in Pakistan that are still practicing the conventional rigid leadership tactics.

## LIMITATIONS

The investigation has a number of limitations. The sample size is small as compared to the total population of employees in the pharmaceutical sector of Pakistan, so there can be difficulties in generalizing the results. An empirical study with a larger sample size could come up with more concrete findings. Similarly, the unit of analysis in this study is limited to the sales representatives of various pharmaceutical companies in Pakistan; future studies can be carried out by including employees with different tasks to get more generalizable results. Furthermore, the study is carried out in a single industry, which is another limitation. A comparative study involving multiple industries would provide a wider range of data about the feasibility of transformational leadership style to boost employee motivation.

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APPENDIX

## Survey Questionnaire

Dear Participants,

Thank you for your interest in participating in our survey. The following questions aim to gather valuable data for our research article "Transformational leadership impact on employee's motivation: a comparative study of national and multinational pharmaceutical companies in Pakistan". Please answer each question to the best of your ability. Your responses will remain anonymous and will be used solely for research purposes.

**Section 1: Demographic Information**

1. What is your age (in years)?

☐18-30

☐31-40

☐41-50

☐51-60

2. What is your gender?

☐Male

☐Female

3. What is your highest level of education?

☐Intermediate (High school)

☐Bachelor degree

☐Master degree

4. What is the status of your organization?

☐Local

☐Multinational

5. How many years of professional experience do you have?

☐1-5

☐6-10

☐11-15

☐16-20

☐ Above 20

**Section 2: Transformational Leadership**

Please rate the following statements based on your opinion using a scale of 1 to 5, where 1 represents "strongly disagree" and 5 represents "strongly agree."

| Q# | Idealized Influence | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1. | In my organization managers urge their subordinates to follow important values and beliefs. | | | | | |
| 2. | In my organization managers demonstrate the importance of mutual trust to overcome problems and difficulties. | | | | | |
| 3. | In my organization managers exceed their self-interests with the goal of achieving a public good. | | | | | |
| 4. | In my organization managers have the ability to persuade their subordinates to increase their enthusiasm for work. | | | | | |
| 5. | In my organization managers focus on the importance of their subordinates having a common understanding of the mission and goals of the organization. | | | | | |
| | **Inspirational Motivation** | | | | | |
| 1. | In my organization managers show confidence in their subordinates by achieving goals. | | | | | |
| 2. | In my organization managers are stirring up the enthusiasm of their subordinates to achieve more than they expected. | | | | | |
| 3. | In my organization managers provide a collective sense of management tasks. | | | | | |
| 4. | In my organization managers are encouraged to invest in new capabilities to the benefit of the organization. | | | | | |
| 5. | In my organization managers are concerned with motivating their subordinates to achieve the vision and mission of the organization. | | | | | |
| | **Intellectual Stimulation** | | | | | |
| 1. | In my organization managers are concerned with developing the intellectual and cognitive abilities of subordinates. | | | | | |
| 2. | In my organization managers encourage their subordinates to discover solutions to the complex problems facing the organization. | | | | | |
| 3. | In my organization managers encourage their subordinates to think unconventional to solve traditional problems. | | | | | |
| 4. | In my organization managers motivate their subordinates to express their ideas with confidence. | | | | | |
| 5. | In my organization managers suggest new ways to get work done. | | | | | |
| | **Individualized Consideration** | | | | | |
| 1. | In my organization managers show personal concern for their subordinates' problems and strive to solve them. | | | | | |
| 2. | In my organization managers listen attentively to the opinions of their subordinates and respect their convictions when they do a good job. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3. | In my organization managers strive to develop the strengths of their subordinates. | | | | | |
| 4. | In my organization managers give enough time to teach their subordinates and train them. | | | | | |
| 5. | In my organization managers express their appreciation to their subordinates. | | | | | |

## Section 3: Employee Motivation

Please rate the following statements based on your opinion using a scale of 1 to 5, where 1 represents "strongly disagree" and 5 represents "strongly agree."

| Q# | Employee Motivation | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 1 | There is provision of fair wage in my organization. | | | | | |
| 2 | There is provision of pay incentives in my organization. | | | | | |
| 3 | My organization ensures communication and cooperation in the working environment. | | | | | |
| 4 | My organization provides opportunity for hierarchical advancement. | | | | | |
| 5 | My organization provides security in the workplace. | | | | | |
| 6 | There is presence of good working conditions in my organization. | | | | | |
| 7 | My organization offers opportunities to advance the field of employee's expertise. | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8 | In my organization need for creative work is addressed. | | | | | |
| 9 | In my organization need for esteem and reputation is addressed. | | | | | |
| 10 | Recognition for work is guaranteed in my organization. | | | | | |
| 11 | In my organization need for competence is addressed. | | | | | |
| 12 | My organization offers opportunities to take responsibilities. | | | | | |

# Digital Solutions and Machine Learning Can Improve Niche Market Reach

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*SUMMARY*

*Digital solutions in marketing can help reach niche markets. Marketers have the greatest opportunity ever to address segments whose needs have not yet been met. Online segmentation techniques allow to better know their characteristics. The aim of this article is to investigate the segmentation and targeting possibilities of the Google Ads system, which helps to explore consumer patterns more deeply. Digital marketing solutions help marketers reach niche markets to maximise the effectiveness of their activities. The goal of this social constructivist research was to find an answer to the question of whether the segmentation and targeting options of the Google Ads advertising system can sufficiently ensure this. To this end, we examined the presence of the "target market category" label in 37 individuals using a face-to-face survey method. The occurrence of the labels and the actual interests often overlapped.*

*Keywords: Segmentation; digital marketing; machine learning; targeting; Google Ads*

*JEL codes: M37*

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## INTRODUCTION

The emergence of Marketing 5.0 with modernization processes has had a significant impact on companies (Kotler et al., 2021), which has led to changes in consumer habits in addition to new technological achievements. This is confirmed by research conducted by GKID (2022), which shows that in 2021 the number of online orders in Hungary reached 68.9 million, which had a value of 1,2 trillion Hungarian forint (HUF). Contrary to expectations, the high number of orders and consumers has further increased market intensity and competition. Today, more than 15,000 online stores are fighting for the attention of consumers (Molnár, 2021), which they try to reach with a variety of marketing tools. Different channels and strategies can be found in digital form. By categorising outbound and inbound techniques, Bleoju et al. (2016) published a comparison table about which they mention that "digital marketing practitioners believe that the distinction between inbound and outbound is actually an artificial and meaningless one. They advocate the idea that no form of marketing fits into either of these artificial concepts and propose an overlap position between inbound and outbound, which they refer to as the grey area" (Bleoju et al., 2016, p. 5525). This idea is valid in the digital context, but inbound marketing techniques offer significant advantages over traditional outbound marketing techniques (Soco Sales Training, 2021), including more accurate measurement and stronger customer engagement, which is an important factor in lead generation (Halligan, 2021). Lead generation is also a high priority in customer acquisition, both marketing- and sales-related (Ehrlich, 2019; Decker, 2021; Sutton, 2021; Keenan, 2022). The importance of efficiency is also underscored by trends in customer acquisition costs: the cost per customer has increased by almost 60% in five years. In contrast, the results of a study of more than 700 companies operating in a subscription model showed that customer acquisition costs have increased by only 30% for those focusing on niche markets (Desai, 2019).

In this paper, we try to answer the following questions:

- How is it possible to target the right consumers in the Google Ads system?
- Which types of machine learning can help companies reach the target audience, and how?

To do so, we use an unconventional qualitative research methodology based on a review of the literature on segmentation and machine learning. This includes Google Ads, which uses tags identified by algorithms

based on predefined product areas and segmentation criteria instead of and in addition to surveys.

# LITERATURE REVIEW

The Digital Marketing Institute (2018) notes that machine learning and marketing go hand in hand these days. Doing one without the other is a mistake no company can afford to make if it wants to remain competitive". According to ECLAC (2016), the strategic pillar of production lies in data and digitised knowledge. Consumer databases and information gathered through automated marketing contribute significantly to the development of the digital economy. Customers' habits can be understood in greater detail as smart devices record users' every move. By analysing this data, it is possible to study the consumer's decision-making process, and based on this information, individual online stores can optimise their offers for everyone. In the field of online marketing, the importance of STP (segmentation, targeting and positioning) has increased. Kotler and Keller (2016, p. 267) state that "identifying and uniquely satisfying the right market segments are often the key to marketing success". In accordance with their theory "effective target marketing requires that marketers:

1. identify and profile distinct groups of buyers who differ in their needs and wants (market segmentation),
2. select one or more market segments to enter (market targeting),
3. for each target segment, establish, communicate, and deliver the right benefit(s) for the company's market offering (market positioning)" (Kotler & Keller, 2016, p. 267).

Customer segmentation is the process of grouping customers based on commonalities (Wang, 2022). The most popular segmentation criteria are geographic, sociodemographic, psychographic and behavioural (Haley, 1984).

It is interesting to note that in the digital marketplace, where we essentially have no personal presence of sellers, we can buy more personalised products and services than in traditional shop sales. An appropriate segmentation technique brings several benefits, such as identifying relevant trends, increasing the effectiveness of marketing activities, making the right decisions about promotions, better understanding the customer experience, and providing relevant products and services (Turkmen, 2022). Segmentation can be used to identify market needs that are not currently being met, and we believe the role of niche marketing has become more important. "For Internet-based companies, and especially those using Big Data tools, these technologies facilitate the development of specific products and services for specific market segments" (ECLAC, 2022, p. 38).

Although Haley (1984) defined the general expectations and targeting options associated with segmentation nearly 40 years ago, the most popular digital marketing ad managers adopted these options at different times and in different ways. Among these most popular ad managers, Google Ads (originally Google Adwords) was the first to use keywords as a setting option for optimal ad placement (Atkinson, 2014). The length of the search term affects consumer behaviour, so the keywords are also suitable for segmentation. In addition, the length of the search term also plays an important role for the company, as the search volume, competition, cost, and conversion rate depend on it (Barysevich, 2021). Earlier, one of the most effective ways to learn about consumers was through keyword research, which engaged both researchers and practitioners in the 2010s. Books such as Ron Jones' *Keyword Intelligence: Keyword Research for Search, Social, and Beyond* (2011) were written at this time. Today, its importance has faded into the background; it is mainly used in search engine optimization. The reason is that the Google Ads advertising platform has reached advertisers' target audiences in nine different ways, from demographic data to remarketing options, between 2000 and 2017. In this research, we will also explore these targeting options, for which we will first explore the knowledge of machine learning techniques and their application in segmentation.

As we mentioned, artificial intelligence (AI) and machine learning techniques help us in many areas, not the least of which is business management. Microsoft Research (2022) identified three themes in its research. Theory, Algorithm, Application in the field of machine learning. AI for science includes the categories of physics, biology, and sustainability; AI for industry contains supply chain applications.

Leonel's (2018) step-by-step infographic helps to understand how machine learning works. Supervised machine learning (SML) starts from categorized, pre-labelled inputs that must be augmented until it is able to separate the data without error, typically using statistical classification or regression calculations. The application areas of SML go beyond our expectations to help replace human activities (Kühl et al., 2022), image recognition (He et al., 2015) and speech recognition (Hinton et al., 2012). Kühl et al. (2022) carried out a study between real humans and SML to find which learns patterns faster. The laboratory study with 44 humans was followed by a study with three different SML algorithms. Their published results showed that the algorithms outperformed human recognition 50% of the time, albeit with slower performance. In their publication, Abdallah et al. (2022) justify the appreciation of machine learning techniques because they can effectively evaluate and identify anomalies that occur between "normal" activities, thus actively contributing to cyber-attack detection. Although in Leonel's (2018) presentation, cyberattack detection falls under the category of

unsupervised machine learning, Abdallah et al. (2022) explain why this is also true for supervised techniques and explain the steps involved, including data collection capabilities. Supervised machine learning algorithms can also be structured in several ways. In the first case, the so-called IDS (intrusion detection system) identifies user actions based on whether they are considered different from usual. However, this requires the prior definition of huge data sets, which is not possible with conventional methods (Belavagi & Muniyal, 2016).

In unsupervised learning, on the other hand, uncategorized, unlabelled inputs are provided, and the algorithm determines the variables based on a criterion that serves as the basis for separation. In this case, clustering and anomaly detection models predominate (Leonel, 2018). Many studies have been conducted on both trends in the academic field, but their practical application also has a great importance. According to Peng et al. (2022), anomaly detection has become an important but difficult target of unsupervised methods due to unbalanced classes and expensive labelling methods. They proposed an extreme machine learning method with mutual estimation to track the anomalies. In their research, they used the dynamic kernel selection

method to perform hierarchical clustering on unsupervised training data to generate clusters. Based on this information, we believe that it is difficult to map the essential difference between segmentation and cyberattack defence, as clustering is a fundamental necessity for both areas. Unsupervised learning is considered by Wang and Biljecki (2022) to be a key element of AI-assisted decision making. Since Unsupervised Machine Learning does not consider semantic relations, it is suitable for recognizing heterogeneous data in texts, images, sounds, or videos (Jain, 2010). According to our interpretation, the connection between Jain (2010) and Smith (1956) lies in the recognition of heterogeneity and its classification according to certain criteria. Moreover, according to El Bouchefry and de Souza (2020), UML itself determines the relevant outputs based on the properties of the data. Fidan and Erkan Yuksel (2022) used the effectiveness of different clustering methods in their study on COVID 19 and Price et al. (2022) in risk management (Song & Heo, 2022).

The ideas learned are presented in a summary in Table 1 that contains definitions, practical operation, goals, usage, and problem-solving possibilities.

*Table 1*

*Supervised and Unsupervised Machine Learning comparison*

|  | **Supervised Learning** | **Unsupervised Learning** |
|---|---|---|
| **Definition** | An activity in which the algorithm is taught to separate input data based on given criteria. | An activity in which the system itself finds the differences between input data. |
| **Operation** | Well-defined data is added to the system, and the system only maps the relationship between them. Data expansion continues until the connection is detected. | Operators leave the processing of the data provided to the system so that it can typically map relationships from a larger data set over a longer period, but also be able to make discoveries that the user had not thought of. |
| **Goals** | The "machines" produce not only statistical data, but also forecasts and statements. | The "machines" discover a new, previously unknown pattern and draw conclusions from it. |
| **Usage** | Risk analysis, revenue forecasting. | Recommendation system operation, anomaly mapping. |
| **Problem solving possibilities** | Spam filtering, image recognition, speech recognition. | Audience building, cross-buying mapping. |

Source: Own editing

Among the numerous possible applications of the unsupervised machine learning technique, one of the most important from the marketing point of view is the formation of clusters, which can be interpreted as an essential element of segmentation. Both theorists (van Leeuwen & Koole, 2022) and practitioners (Das, 2020) are engaged in UML methods of data-driven segmentation. In the case of van Leeuwen, the research was conducted in the hospitality industry to create

personalized advertising. Therefore, the authors emphasize the importance of research providing replicable results that can be applied by marketing departments and ultimately help generate profits. Tu et al. (2010) emphasized that segmentation is partly rule-based, which can be considered qualitative, and partly algorithm-based, which can be considered quantitative. Van Leeuwen and Koole (2022) pointed out in their research that without the right target and data input, any

research is doomed to fail. Therefore, they conducted an algorithm-based segmentation of an audience based on 170,000 hotel guests to determine the lifetime value and the channel used for booking and to develop a strategy. Before running the UML algorithm, the number of clusters must be determined, which greatly affects the result. It is interesting to note that Google has outlined in its help which segmentation criteria can be used in the hospitality category and has only specified the use of its own data as the result requirement, unlike, for example, display networks where it has also listed 5 other categories (Google.com, 2022). For example, (Google.com, 2020) identified resellers in the medical market based on their income, number of patients, total number of prescriptions, and years of experience, and then stated that this is just a form of unsupervised machine learning because there are no predefined rules on how to group the data. The step-by-step article by Alzahrani (2021) helps to understand the solution of segmentation with unsupervised machine learning techniques. Consistent with van Leeuwen and Koole's (2022) statement, the first step was to describe the problem in the company, the second step was data exploration, the third step was data preparation, the fourth step was applying the model, and the fifth step was evaluating the results.

An interesting fact to read in on the website Data-flair (2019) is that "Google has declared itself a machine learning-first company." Given this, it is not surprising that Google is using the technology in a variety of services – speech recognition, image recognition, translation, personalized advertising – and in addition the company is also investing resources in the development of healthcare, robotics and quantum computing (Google AI, 2022). However, Google states on its official website that supervised learning offers more opportunities than unsupervised machine learning (Google Developers, 2022). Lawrence (2021) published a detailed guide on how business owners can use the data obtained in the Google Analytics program for segmentation with unsupervised machine learning techniques.

Even after an extensive and thorough search, it is not clear what type of method Google uses to segment consumers. However, based on the information we have, we assume that it uses predefined variables and constantly makes new inputs and refinements to tag consumers with a supervised machine learning technique that is linked to the targeting options of the Google Ads system, using different algorithms. In this, advertisers have several categories at their disposal to optimize the size and composition of their audience. These are as follows:

- Affinity segments: available based on a holistic picture of the consumer, based on their lifestyle, passions and habits.
- Life-events: Along major life milestones, such as a graduation, a move, or a marriage. They

can be used to create a smaller segment because it affects fewer people and less frequently than general interest, but it is usually larger than in-market segments because reaching a milestone can trigger many purchases.

- In-Market Segments: a group of consumers who are considering buying a particular product or service.
- Detailed Demographics: segments based on common characteristics shared by a large portion of the population.
- Custom segments, custom intent segments, and remarketing segments are other methods that are not affected from the perspective of our research.

The full list of Vidhoarder.com (2022), including all segmentation options, reached 4,809 variables. The range of variables included in this study is much smaller. We are looking for the answer among the simpler targeting options to see if they are suitable to reach niche market, and at the same time we are looking for the answer to possible shortcomings in Google tagging. Thomas (2020), the author of Yieldify platform, has defined four categories for segmentation, three of which are compatible with Google's methodology: Demographic, Psychographic, Affinity, Behavioural, In-Market Segments.

In the other sections of our publication, we present the research method, results, and conclusion.

The goal of our analysis is to examine Google's segmentation and targeting options, their accuracy and applicability. Since artificial intelligence and various machine learning systems play a role in this, the paper also draws attention to the extent to which these ensure that the target audience and niche market for the various manufacturers and retailers are reached.

# RESEARCH METHOD

Based on information from theorists and practitioners, we identified the segmentation variables and targeting criteria that sellers of predefined products and services intend to use in our target audience, whose are students at the University of Miskolc, Faculty of Economics. In total, we identified 41 such targeting options. In a face-to-face survey of 37 individuals, we asked the sample to confirm the presence or absence of tags for individuals by looking at Google ad preferences. In this research, respondents had to answer a dichotomous, closed-ended question about whether the area of interest indicated by each label really applies at the moment. We did not use a scaling technique in the survey. We addressed a typical shortcoming of research: the subjectivity of responses. We stated that an AI that tracks consumer activity could provide a more accurate picture than consumer opinion – since it can be interpreted as a form of observation – over many years.

In the second phase of our research, we examined how many of the predefined product and service categories identified had segmentation factors with the potential to create a niche market. In this case, we considered more than 80 interest- and hobby-based targets in Google Ads, as well as additional demographic targets.

# RESULTS

In this section of the study, we present the proportion of the Google tagging system that displayed certain segmentation-related tags for the respondents, and then we also discuss how many segmentation groups can be filtered in the Google advertising system in order to sell a product of our choice

Table 2 contains the best data, sorted by median rate, and the worst, in terms of display ratio, among the 41 criteria examined in the survey, we conducted, as described in the research methodology section. The name can be seen in the "Designation" column, the category in the "Segment Type" column, the appearance rate in the "Appearance Rate" row, and the actual interest/performance ratio in the "Actual Rate" row.

*Table 1*

*Appearance and actual rate of Google Tags on customers' ad settings*

| Additional information | Tags | Segment type | Appearance rate | Actual rate |
|---|---|---|---|---|
| Mostly appeared Google Tag | Age | Demographics | 100% | 100% |
| Mostly appeared Google Tag | Mobile phones | In-market segments | 97.3% | 41% |
| Mostly appeared Google Tag | Love Songs | Affinity | 97.3% | 100% |
| Mostly appeared Google Tag | Material status | Detailed demographics | 97.3% | 100% |
| Mostly appeared Google Tag | Gender | Demographics | 97.3% | 100% |
| Mostly appeared Google Tag | Movie lovers | Affinity | 94.6% | 100% |
| Google tag sorted by median | Starting a business soon | Life events | 68% | 27% |
| Google tag sorted by median | Video games | In-market segments | 54% | 46% |
| Google tag sorted by median | Laptop, Notebook | In-market segments | 51% | 62% |
| Google tag sorted by median | IOS phones | In-market segments | 46% | 62% |
| Google tag sorted by median | Android phones | In-market segments | 38% | 49% |
| Google tag sorted by median | Outdoor recreational equipment | In-market segments | 35% | 24% |
| Least appeared Google Tag | Movie streaming services | In-market segments | 27% | 89% |
| Least appeared Google Tag | Test preparation and tutoring | In-market segments | 24% | 3% |
| Least appeared Google Tag | Perfumes and fragrances | In-market segments | 24% | 65% |
| Least appeared Google Tag | Open online courses | In-market segments | 22% | 5% |
| Least appeared Google Tag | Swimwear | In-market segments | 19% | 8% |
| Least appeared Google Tag | Single | Detailed demographics | 11% | 41% |

Source: Own editing

In our study, we collected data on demographics, detailed demographics, life events, partners, and market segments. As can be seen in Table 2, the appearance rate of the predefined 41 labels used for the segmentation of the target group is very different. The appearance rate of the label reached the maximum rate for age (accuracy was also reasonable, it can narrow consumers into age-based segments), followed by mobiles, music lovers, material status and gender with a frequency of 97.3%. These categories can be interpreted as different criteria that accurately reflect actual interest (or in the case of demographics, accuracy), with the exception of interest

in cell phones, which, unlike the label, covers only 41% of actual interest. In the median of the 41 items the Market Segments category usually appears, showing little difference between the proportion of those with the label and those who are truly interested. An interesting finding is that in the case of IOS and Android devices, the overall real interest of respondents is above 100%, which is because a user has shown interest in both types. As for starting a business, which is the only item listed in the table as a life event, it is significantly overestimated by Google algorithms. Even among correctly labelled users, whose actual intention differs from 68%, only 27% intend to start a business in the next three years. Regarding the release rate of labels, the worst six elements among the university students surveyed mainly refer to the segment within the market. For the use of streaming services and the purchase of perfume, the target market is more difficult to reach with ads based on this information, as it represents a lower percentage than the actual prospects, only 27% and 24%, respectively, for this indicator.

The information collected by Google's machine learning technique appeared in the variables of the different criteria with varying accuracy compared to the actual interest. From this information, practitioners responsible for advertising can conclude that even with the most careful advertising settings the targeting options of the advertising system can easily lead to inaccurate results and reach people outside the target audience.

In Table 3, we looked for the answer to whether the combination of more than 80 segmentation criteria can be considered a suitable solution for creating niche markets, so that companies and entrepreneurs can keep customer acquisition costs lower, in line with modern trends. The table contains 10 predetermined categories of products/services, which are considered goods typically used by the respondents (university students). We examined the segment categories separately (In-Market Segments, Life events, Detailed Demographics, Affinity) and then determined the set of characteristics applicable to the formation of the niche market in an aggregated manner.

*Table 2*

*Google Ads targeting possibilities to reach niche segments of university students*

| | In-Market Segments | Life events | Detailed Demographics | Affinity | Niche segment targeting |
|---|---|---|---|---|---|
| **Premium laptops** | 1 | 2 | 2 | 3 | 8 |
| **Premium mobile phones** | 1 | 2 | 2 | 3 | 8 |
| **Premium perfumes** | 1 | 2 | 2 | 1 | 6 |
| **Sports equipments** | 1 | 2 | 2 | 1 | 6 |
| **Vehicles** | 1 | 2 | 2 | 1 | 6 |
| **Online classes** | 2 | 2 | 2 | 1 | 7 |
| **Music streaming** | 3 | 2 | 2 | 2 | 8 |
| **Video streaming** | 2 | 2 | 2 | 2 | 8 |
| **Cosmetic services (like beauty salons)** | 1 | 2 | 2 | 1 | 6 |
| **Restaurants and their services** | 1 | 2 | 2 | 1 | 6 |

Source: Own editing

As can be seen in Table 3, the number of attributes belonging to each product and service criterion varies between 1-3. By setting different criteria variables in the Google Ads system, the niche market belonging to the specified categories can have 6-8 attributes when creating an individual target group.

# CONCLUSIONS

Marketers are under increasing pressure to make their sales activities as efficient as possible. One way to do this is to sell to consumer segments whose needs are not being met in the marketplace. Niche marketing is the solution to this problem and helps create a loyal customer base. The resurgence of segmentation has been ushered by online marketing, as Big Data and AI can be used to learn more about consumer habits. With the application of machine learning, targeting, reaching, and identifying niche markets has become attainable.

In our study, we examined the various labels of the Google Ads system. We did qualitative research where, instead of a consumer survey, we focused on the presence or absence of labels in Google's advertising settings, which are also freely available for consumers to view. In addition to display rate, we also used consumer survey data to provide some accuracy in the labelling methodology used by Google Ads. Ratings in the six most typical categories, the middle six categories sorted by median, and the six most atypical categories vary widely, and actual interest matches measured data does not match well with the Google Ads labels. This is likely due to shortcomings on the user side of the ad settings. Examining a larger sample and including more tags may provide a more accurate picture of effectiveness. The second phase of our study is based on

the four segmentation categories mentioned in the literature review, namely in-market segments, affinity, detailed demographics, and life events. Among these variables, we explored how many options can be applied to narrow down the target audience for products and services that are typically of interest to the target audience (here, university students). Normally, their number is between 6-8, which of course can be further optimized by Google's additional factors not included in the research. The comparative analysis of the two tables can again be interpreted as a suggestion for practitioners to get an optimal picture of the category to set up ad targeting.

Limitations of the research:

- The number of respondents is relatively low; only 37 people were included in the qualitative research.
- The attributes asked during the research only contained the most characteristic features of the target group, so the majority of labels were not affected.
- The research can only be used when setting up the individual target audience and only affected the In-Market Segments, Life events, Detailed Demographics and Affinity factors. Additional targeting optimization options were not included in the research, such as remarketing options, use of keywords, etc.

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# Technology and Strategy: Towards Strategic Techno-Management

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*SUMMARY*

*Although technology is as old as humanity and technological issues can be traced in several disciplines and their development, the strategic level of managing technology is a relatively new area. The ever-accelerating changes in science, economy, and society require adaptive competencies. A company must gain gradually knowledge from systematically monitoring and developing its technology. The aim is to give an overview of the key concepts of exploiting the strategic opportunities of techno-management. There is conceptual diversity in the literature, and information and communication technology dominate recent publications; strategic techno-management deserves a general approach.*
*Keywords: techno-management; techno-strategy; strategic techno-management*
*JEL codes: L19; O32*
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## INTRODUCTION

Technology has an imprint on any age. New technologies in agriculture and later in the textile industry expanded life chances. The assembly line created by József Galamb offered an explosive development of mass production, first in the automotive industry. Chemical engineering technologies have changed the world since the 1920s. Computers offered mass data processing and automation from the 1950s. Information and communication technologies are now embedded in our lives. Although it has not often been highlighted in history, managing technologies has an important role; technologies must be considered an enabler supporting efforts to meet the customers' needs.

Nowadays, technology is often used as a buzzword for plans or actions, and information technology is presumed when the term is used. However, technology has a broader meaning that allows a systemic approach to matching challenges and solutions. The even more agile business and social environment of the 21st century requires rethinking management tools. Industry factors and the external environment can cause significant pressure on industries to change technology (Onufrey & Bergek, 2021). Among others, achieving success requires managing technology and human aspects

together (Kollman & Dobrovič, 2022). We believe that the emergence of strategic management has established a framework for business thinking. The resource-based strategic theories emphasize capabilities, which can be interpreted as a focus on technologies, and the appreciation of dynamic capabilities justifies the applicability in the agile environment. However, incorporating technological aspects into strategies and their exploitation to gain or maintain a competitive advantage requires re-learning strategic capabilities and breaking organizational barriers. According to the technology-intensive Industry 4.0 implementations, failures in achieving strategic goals and improving competitiveness usually can be traced back to internal causes (Ramadan et al., 2022). Among appropriate conditions, strategic technology management can be expected to offer a potential solution for managing ambiguity, complexity, and business dynamics caused by technology (Sahlman, 2010). The study aims to give a comprehensive overview of how techno-management can serve corporate competitiveness through strategic applications. The results are based on a literature review.

# TECHNOLOGY

The Greek word „τεχνη" (techne) means the practical ability to create something. „λογος" (logos) refers to human knowledge and causality. Together, these mean the sum of skills, the ability to do things, and the knowledge that underpins them (Szakály, 2002). Sikander (2011) defines technology as types and patterns of activity, equipment and material, and knowledge or experience to perform tasks. Porter (1998) notes that every value activity embodies technology in the form of know-how, procedures, or technology embodied in process equipment. Steele (1989) distinguished product and process (manufacturing) technologies based on the professional content and purpose of the technology. Pataki (2005) focused on the substantive content of technologies, delimiting:

- core technologies: that are an essential element or component of products and services;
- additional technologies: to increase the utility and functional value of products and services;
- peripheral technologies: that add value to the products or services for the target market segment.

The THIO model (Figure 1) offers a general approach that describes technology as a synergic system of four components: technoware, humanware, inforware and orgware (Pataki, 1999; Szakály, 2002). THIO can demonstrate the contribution of existing technologies in a company (Siregar et al., 2016). Depending on the purpose, the different definitions of technology emphasize one or more THIO elements.
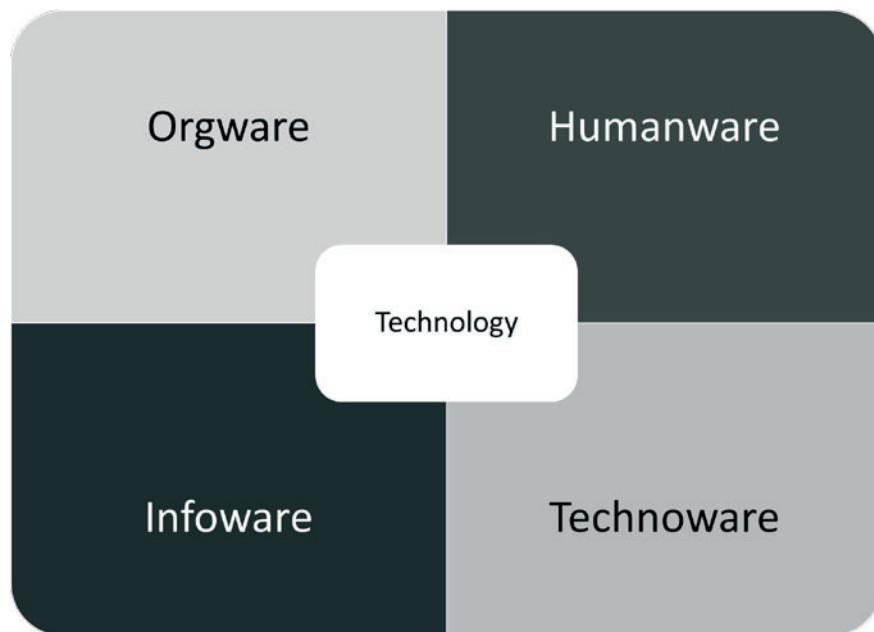


Source: based on Deutsch et al., 2019

*Figure 1. THIO model*

Technoware is the tangible form of technology. It includes the machines, equipment, tools, factories, and other items that are necessary for the transformation processes of companies. Accordingly, technology can be understood as hardware, as tangible tools, as man-made things that both enhance people's existing capabilities and enable them to perform tasks that they would not be able to perform – qualitatively or quantitatively – without them (van Wyk, 1999).

Orgware (or organware) is essential to the transformation processes of companies, embodying technology in an institutionalized form. It includes processes, systems, networks, allocations, etc. They are

needed because the hardware needs to be invented, designed, developed, manufactured and enabled for use. In other words, this is the soft side (software), i.e., the knowledge, know-how, skills, practices, and other non-physical means needed to produce and use the hardware properly (Schön, 1967; Ayres, 1994; Lowe, 1995; Rogers, 1995).

Inforware refers to the information supply and support of the transformation process, including the elements of the technology in the form of documentation, such as specifications, plans, blueprints, diagrammes and descriptions.

Humanware covers the people-related elements of technology, encompassing all the skills, abilities and competencies that drive the transformation processes of enterprises.

# TECHNO-MANAGEMENT

There are several approaches to the relationship between technology and management (Nagy-Borsy, 2018). 'Technology management', in the narrowest interpretation, refers to methods and practices that support the development and use of technology within an organization (Zuckerman, 2002; Pelser, 2014). Based on the innovation-centred approach of Friedman et al. (2008) and Shane (2009), technology management refers to the embedding and use of innovation within an organization, and technology management is characterized by the relationship of the company's activities to innovation.

According to Szakály (2002), technology management links the professional, scientific and management domains, while Pataki (2005) defines it as cross-functional activity of putting technology at the service of the effective and efficient operation of the organization.

The concept 'Management of Technology' means managing technology-intensive business activities (Braun, 1998; Pilkington et al., 2006). It assumes that the need for managing technologies is common in all companies, just the company-level focus is unique, and a flexible and resilient understanding of the concept is suggested. The main characteristics of technology management can be summarized as follows:

- In the narrow sense, technology management refers to the methods that can be used to improve available technologies or to acquire and integrate technologies that are not available.
- In the broader sense, technology management is understood as a cross-functional activity within the enterprise, an integrated framework of activities designed to enable the organization to use and exploit available technology effectively and to facilitate technological improvements.
- As a functional area, technology management is linked to the innovation activities of companies and has a strategic orientation, supporting and defining the formulation and implementation of corporate and business strategies.
- In the case of technology-intensive developments and projects, technology management supports the management of the project portfolio (from a technology perspective) and the efficient implementation of projects.

A review of techno-management functions allows a more practical interpretation of the content. Table 1 summarizes major models in the field. Most of the models follow a similar logic. Jemala (2012) presented company-level tasks with three main functions: identification, implementation, and commercialization. The model is a simplified version of Gregory's (1995) approach. An exception is a model by Cleland and Bursic (1991), which links the functions to the phases of the strategic technology management system life cycle, with a focus on technology integration.

*Table 1*
*The function of techno-management and strategic techno-management*

| Gregory (1995) | Rush et al. (2007) | Arasti & Karamipour (2003) | Cleland & Bursic (1991) | Kropsu-Vehkapera et al. (2009) | Pelser (2014) | Jemala (2012) |
|---|---|---|---|---|---|---|
| Identification | Awareness | Identification | Creation | Technology strategy | Technology awareness | Identification |
| Selection | Search | Selection | Monitoring | Technology development and utilization | Technology acquisition | Implementation |
| Acquisition | Core competence | Acquisition | Assessment | Information and knowledge management | Technology and product planning | Commercialization |
| Exploitation | Strategy | Exploitation | Transfer | Technology acquisition and transfer | R&D organization and management | |
| Protection | Assess/selection | | Acceptance | Technology forecasting | R&D investment | |
| | Acquire | | Utilization | Product development | Manufacturing and | |

| | | | | process technology | |
|---|---|---|---|---|---|
| | Implementation | | Maturity | Life cycle management | |
| | Learning | | Decline | Commercialization | |
| | Linkages | | | Production process management | |

Source: based on Deutsch et al., 2019

The need to take a comprehensive approach to techno-management can be served by the identification of key activities along the functions. Based on Cetindamar et al. (2016), the key activities are as follows:

- Technology identification: identifying technological opportunities involves the process and means of monitoring external and internal environmental changes that support the acquisition and maintenance of competitive advantage.
- Technology selection: addresses strategic issues at the enterprise level and their relationship to technology strategy, which also requires strategic objectives and priorities at the business unit level.
- Technology acquisition: the determination of how a company or business acquires technologies of value to it, i.e., whether the organization develops them itself, develops them jointly with other organizations, or purchases technologies to gain and maintain a competitive advantage.
- Technology exploitation: involves the effective transfer, deployment, absorption, operation within the organization, and ultimately, commercialization of technology. Exploitation processes naturally include incremental improvements, process adjustments and marketing activities.
- Technology protection: covers the formal processes and tools that ensure the protection of a company's intellectual property, including the knowledge and expertise embedded in its products and processes.
- Learning: the knowledge gained from the implementation of a company's or enterprise's technological activities and projects and from feedback from the external environment to improve those activities.

# STRATEGY AND TECHNOLOGY STRATEGY

The term strategy covers the long-term goals set by the company and the possible ways and means to achieve them, with the intention of environmental adaptation (Bartek-Lesi et al., 2007; Balaton & Tari, 2014). In each era, the strategy has been the proper response to market and other environmental challenges with the right tools and approach. As the environment has become more complex (the development of the information society, advances in computing and ICT, the environment, and the growing importance of social responsibility), the range of strategic approaches and tools has expanded.

Strategic planning and strategic management have a broad literature tracing its evolution from financial and long-term planning to strategic issues (Barakonyi, 2000). Porter (1996) defined strategy as a competitive position, "deliberately choosing a different set of activities to deliver a unique mix of value". Mintzberg et al. (1998) summarized five approaches; the strategy can be interpreted as follows:
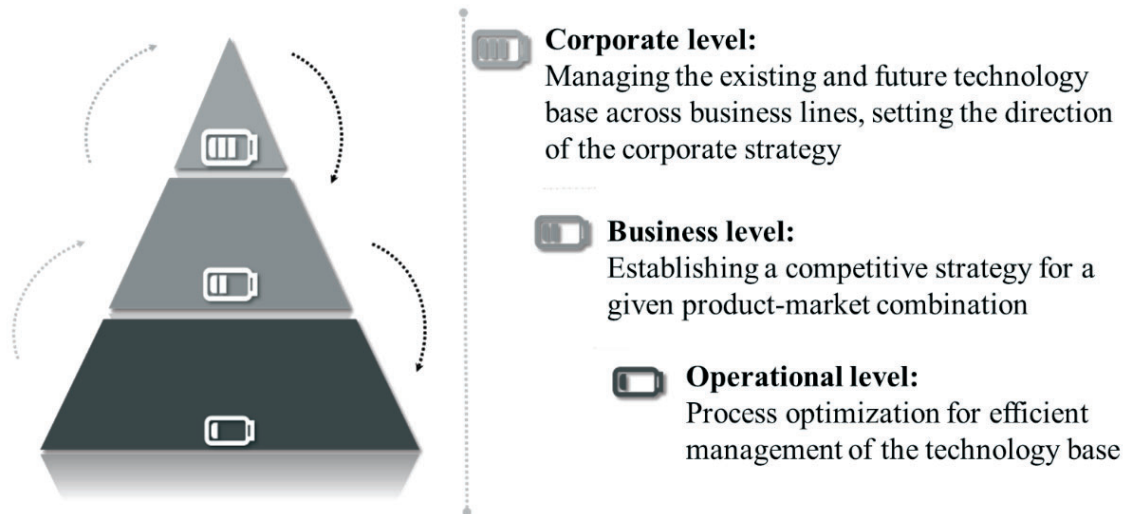
- Plan: direction, a guide or course of action into the future;
- Pattern: consistency in behaviour over time;
- Perspective: the fundamental way of doing things;
- Position: locating particular products in particular markets;
- Ploy: a specific manoeuvre intended to outwit an opponent or competitor.

Three interacting levels of strategy have been distinguished (Mészáros, 2005; Chikán, 2021):

- Corporate strategy: the company's vision, mission, objectives, and the series of strategic actions needed to achieve them. Its main task is to determine the areas and markets in which the company should operate and the means to move in these strategic directions.
- Business (unit) strategy: the business strategy sets out the position to be achieved in the sector or market in question, in line with the corporate strategy, and the specific competitive strategies required to achieve these objectives in the relevant product-market configurations. If the company is present in only one business sector, the corporate strategy is the same as the business strategy.
- Functional strategy: these define the objectives and the means of achieving them in each functional area (finance, marketing, R&D, production, etc.) in line with the corporate and business strategies. The purpose of functional strategies is to ensure the efficient use of resources (optimal operation of the function), continuous innovation, and the development of capabilities that support the company's competitive advantage.

Sukri and Yusoff (2021) approach technology strategy as a long-term plan that leads companies to utilize the committed resources toward technology in order to provide manufacturing companies with a competitive edge. It seems obvious to handle techno-strategy as functional, but this would be an oversimplification. Techno-management and techno-strategy must be managed on each level of strategy (Figure 2). The role of technology is presented as a key factor in Porter's (1998) concept. A chapter deals with technological change and technological strategy, in which it is highlighted that technology impacts the conditions of industrial competition and creates the corporate basis for competitive strategies, as well as rethinking the value chain.



**Corporate level:**
Managing the existing and future technology base across business lines, setting the direction of the corporate strategy

**Business level:**
Establishing a competitive strategy for a given product-market combination

**Operational level:**
Process optimization for efficient management of the technology base

Source: based on Deutsch et al., 2019

*Figure 2. Levels of techno-strategy*

The primary goals of corporate-level technology strategy are as follows (see also Arasti et al., 2017):

- Ensure the development of company-wide principles and policies for strategic technology management and the company-wide coherence of technology strategy implementation;
- Support the company's growth by developing and sharing core technology capabilities and selecting tools;
- Ensure consistency between technology strategy objectives in various time horizons;
- Align the company's business and technology portfolio;
- Ensure company-wide protection of intellectual property rights;
- Enforce the way and principles of technology sharing within the company;
- Define the priorities and methods for resource allocation within the company to implement the technology strategy;
- Provide support activities relevant to each function of strategic technology management.

In contrast, strategic business unit-level technology strategy provides answers to the following questions (Skilbeck & Cruickshank, 1997; Jemala, 2012):

- How can the firm or company gain or maintain a competitive advantage in each product-market combination through technology?
- How can the technological base of the firm or company support the competitive strategy it is pursuing or intends to pursue?
- How can strategic technological goals and objectives be pursued for a business unit?
- What technological changes can be expected in the given product-market combination?

Of course, technology strategy has a functional role as well. It deals with operational tasks, namely:

- Translating strategic technological decisions into concrete projects and actions;
- Supporting the technology base for business processes;
- Allocation and use of technological resources;
- Optimizing internal processes and systems;
- Operating monitoring and control processes for technology management (Skilbeck & Cruickshank, 1997; Jemala, 2012).
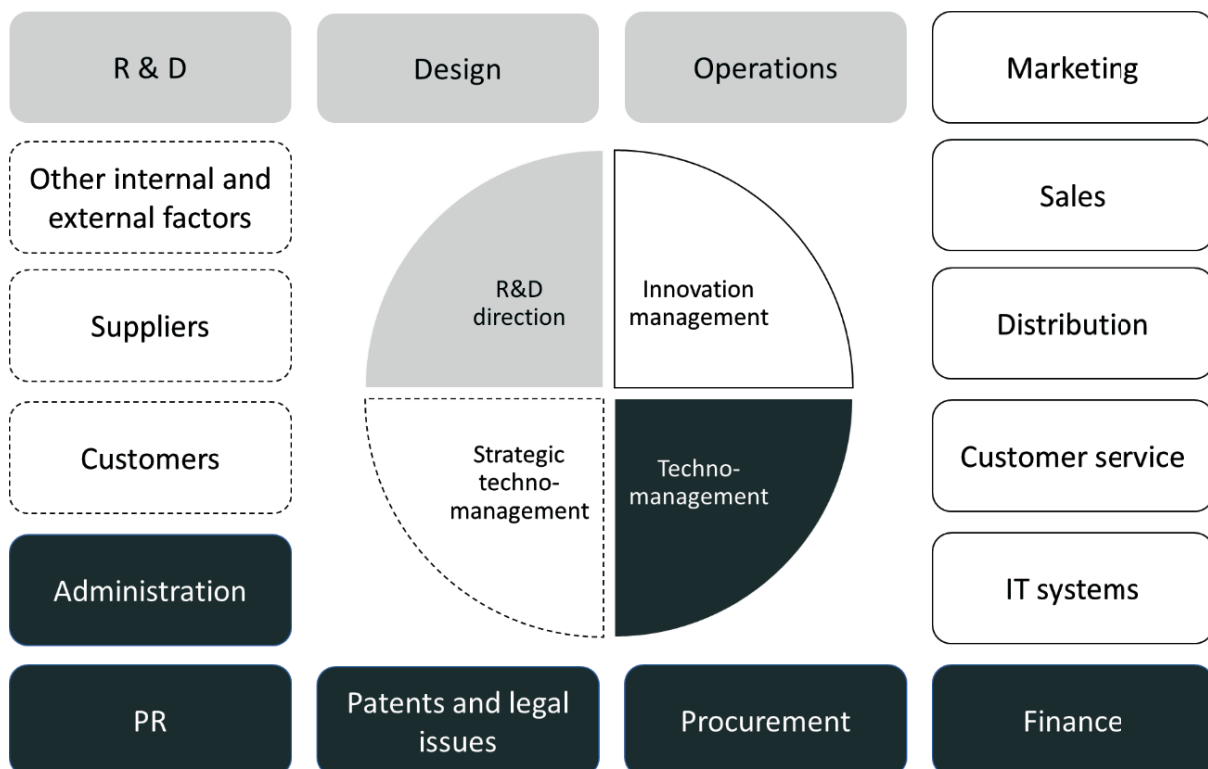
# TOWARDS STRATEGIC TECHNO-MANAGEMENT

Similar to the understanding of techno-management, there are competing approaches and definitions of the strategic aspects of tech management in the literature. 'Technology strategy' and 'Strategic technology management' or 'Strategic management of technology' may be referred to as synonymous by some authors, while others make serious differentiations. Moreover, technology strategy can be part of corporate strategy or the related competencies in the field. Szakály (2008) gives a synthesis, as techno-strategy is the corporate activity of creating, searching for, disseminating, and adopting technologies with a strategic orientation.

Although techno-management and techno-strategy are about technology, it is to note that these are different concepts. Technology management focuses on developing and managing technological resources and capabilities within the company and integrates them according to the operational objectives. Techno-strategy manages technologies and innovations within the company and those to be sourced from outside,

according to the corporate strategy, with a strong external orientation.

Sahlman (2010) and Sikander (2011) give a broad interpretation of strategic technology management. Strategic management of technology is "planning, organizing, leading and controlling of technological activities, interacting with company's skills to apply knowledge, structures, resources, and socio-economic environment. The goal is contributing to formulation and execution of the company's basic, long-term goals and objectives, and adoption of courses of action and the allocation of resources necessary for those goals" (Sahlman, 2010, p. 45). According to Sikander (2011), strategic technology management means developing a company's technology strategies and then evolving methods to implement and manage them, including implementation and management tasks. Technology policy is mentioned as the integration of technology strategy and technology management. Strategic technology management is therefore concerned with how to integrate technology strategy and its management into the strategic thinking, high-level planning, and management processes of the company.

The options and areas involved in managing technology are illustrated by Gaynor (1996) with an overview of the phases (Figure 3).



Source: based on Gaynor, 1995; Deutsch et al., 2019

*Figure 3. Stages in the evolution of technology management in practice*

# Towards practical implications: Competitive strategies and technology

Porter's generic strategies describe the basis on which a company can gain a competitive advantage over its competitors by "outperforming" them (Balaton & Tari, 2014). The source of the advantage may be lower cost (cost-leadership) or the development of characteristics that are distinct from others (differentiation). The target within an industry may be broad or concentrated on a specific customer segment (focused). The related tasks of product and process technology are summarized in Table 2.

# Techno-strategic options

It may seem that the benefits of a techno-strategy are only available to a narrow group of companies, the market, and technology leaders. Indeed, such companies are at the forefront of developing and deploying new products and processes. Their results are spectacular and dictate the future, but they are not exclusively the economy. The competitive advantage of follower companies can come from lower product prices, learning from the experience of the frontrunners, and lower research and development costs. In a differentiated competitive strategy, benefits and savings can be achieved by focusing on product variations. Buzás (2002) provides an overview based on Mytelka (1999) of the characteristics of leaders, early and late followers (Table 3), which can be used as a map for interested companies

*Table 2*
*Product and process technology and the generic strategies*

|  | **Product technological change** | **Process technological change** |
|---|---|---|
| **Cost leadership** | Product development to reduce product cost by lowering material content, facilitating ease of manufacture, simplify logistical requirements, etc. | Learning curve process improvement to reduce material usage or lower labour input. Process development to enhance economies of scale |
| **Differentiation** | Product development to enhance product quality, features, deliverability or switching costs | Process development to support high tolerances, greater quality control, more reliable scheduling, faster response time to orders, and other dimensions that raise buyer value |
| **Cost focus** | Product development to design in only enough performance for the target segment's needs | Process development to tune the value chain to a segment's needs in order to lower the cost of serving the segment |
| **Differentiation focus** | Product design to meet the needs of a particular segment better than broadly-targeted competitors | Process development to tune the value chain to segment needs in order to raise buyer value |

Source: Porter, 1998, p. 178

*Table 3*
*Innovation strategies (Mytelka, 1999:20)*

|  | Front runners | Quick followers | Latecomers |
|---|---|---|---|
| **Innovation strategy** | Get ahead | Keep-up | Catch-up |
| **Capabilities** |  |  |  |
|  | New combinations of generic technologies Pushing back the frontiers of knowledge | Introduction of variety Improvement in quality Reduction in costs incremental change | Problem-solving innovation (attention to "know-why", learning to learn) Improvements in productivity and machinery maintenance Imitation Adaptation |
| **Critical Knowledge Inputs** |  |  |  |
|  | Scientific research and scaling up of laboratory models. Linking of R&D and marketing within the firm. | Engineering, testing, design, and marketing: linking design and production within the firm. | Engineering and management capabilities: feedback from the production process, product scanning, and adaptation capabilities. |
| **Policy Objectives** |  |  |  |
|  | In-house research, technology development R&D networking | Technology development R&D networking | Technology transfer, diffusion, demonstration, training |
| **Useful Partnership Linkages** |  |  |  |
|  | Windowing through a broad array of long–term R&D collaborative projects with research institutions, users & materials suppliers | To university engineering faculties, consultancy firms, design centres, technology institutes, users | To apprenticeship programs, productivity centres, clients, equipment suppliers, and intermediaries |

Source: Mytelka, 1999, p. 20

# CONCLUDING REMARKS

Technology and techno-management is not a novel invention; it belongs to the normal functioning of a company or organization. Evidence of this is that technology appears regularly in the literature. However, based on the screening of the recent sources, it can be concluded that direct attention to technology management and strategic relations has been less focused in the 2020s than earlier. Industry 4.0 relations, supply chain extensions, and information and communication tools applications receive prominent attention. A recent book by Cowan (2023) is entitled *Introduction to Technology Management*, but digitalization relations are discussed. We believe that managing technology requires a more general approach that allows the adjustment of strategies and actions to the changing environment regardless of the issues of digitalization.

Challenges can be derived from the features of the environment, especially the dynamics of its change. A turbulent and agile business and social environment leads to appreciating the value of dealing with technology. The exploitation of the possibilities requires special competencies. Several models are available; competitive advantages depend on an appropriate combination and redesigning of them. This paper has offered a comprehensive overview of the terminology and the related models, offering an industry-independent map for future adopters.

Two issues must be noted when dealing with technology at a managerial level. First, it is a broad and fundamental area that needs attention in every company. Second, the conceptual diversity of the subject makes it difficult to get to grips with. A company must gain knowledge gradually from systematically monitoring and developing its technology. The necessary steps and tools should be chosen by factors such as the maturity of the company, the information needs of its managers and the specificities of the industry.

Techno-management and techno-strategy can be best captured by their functions, since these allow a practical approach and a link to the processes. Putting together technology management functions and tools is a corporate-level task. Literature supports this with grouping and tool orchestration but cannot replace individual implementation.

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# Logistic Regression or Neural Network? Which Provides Better Results for Retail Loans?

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SUMMARY

*While there is extensive literature on the prediction of corporate bankruptcies, there is little literature on the classification of retail borrowers. This is also true in Hungary. Recognising who is at risk of becoming a bad debtor is not easy. There are several ways to analyse the data, which may yield different results. In this paper, my aim is to predict the default of household loans using logistic regression and neural networks. The question is, which method produces the better results? The analyses show that the neural network model produced the best and most favourable results. The accuracy of the best method was found to be 81.5%.*
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## INTRODUCTION

For both corporate and retail lending, it is important for financial institutions to lend to customers with a low risk of non-repayment. Although institutions have their own credit assessment process, they still may not properly select the customers for whom it is appropriate to provide credit.

While there is a great deal of literature on the prediction of corporate bankruptcies, there the classification of retail borrowers has received little attention. In the case of the corporate sector, it has been observed that the range of analytical tools used has steadily increased with the development of methodological possibilities and IT, from the initial univariate analyses to the present day models using neural networks.

This is also true in Hungary, where there is not much scientific work on this topic. Despite the fact that the last crisis was not so long ago, in recent years lending has really taken off, with many people taking out loans as if there were no tomorrow. Recognising potential bad debtors is not easy. We can use different methods, and sometimes the results are not the same.

The aim of my research is to investigate the default of household loans using methods based on multivariate statistical procedures. The different methods and models can help to identify the factors that contribute to someone becoming a defaulting debtor, and to determine which multivariate statistical methods produce the best results.

## INTERNATIONAL BANKRUPTCY MODELS: LITERATURE REVIEW

Bankruptcy forecasting research does not yet have a 100-year history. The first attempts were made in the 1930s, but the models in use today only appeared in the 1960s. In the period up to the present day, models and methods have changed a lot, which is also due to advances in analytical capabilities and information technology.

In fact, the initial 'models'' were not really models at all: researchers were looking for indicators for which there was a significant difference between bankrupt and surviving companies, comparing these indicators and trying to establish various correlations.

The first univariate analysis was conducted by Beaver. He included 158 companies in his analysis, with equal proportions of bankrupt and surviving companies. His method allowed him to categorise companies with 90% classification accuracy. The disadvantage of the method is that it is a univariate model, so the categorisation is based on a single indicator; if different indicators result in different classifications, the method cannot handle this. This is one of the reasons why this method has not been widely used (Beaver, 1966; Virág, 2004).

The first real model was created by Altman, who built his model on five financial indicators that could predict insolvency with 95% confidence. A few years later, an extended seven-variable model was developed based on this model (Altman, 1968; Virág, 2004). Deakin also used discriminant analysis to predict bankruptcy. He used a sample with 34 cases to test his results. The model had a classification accuracy of 97% (Deakin, 1972). Blum's 1974 model also had a classification accuracy of over 90% (Blum, 1974). Altman's extended version of his five-variable model was developed in 1977, and the new model used a larger sample of 111 cases, with 58 surviving companies. (Altman et al., 1977)

Altman's models were not representative, and the sample included roughly equal proportions of surviving and failing firms. Ohlson conducted the first survey to be considered representative. Ohlson was also the first to use logistic regression in bankruptcy prediction models. The sample he studied included 2163 companies, of which 4.85% went bankrupt. If the P-value in the model exceeds 0.038, the company is considered to be at risk of bankruptcy. The model has an accuracy of approximately 83% (Ohlson, 1980).

The next novelty was the emergence of recursive partitioning algorithms and dates back to the mid-1980s. Among the first adopters of this method were Altman, Frydman and Kao. The classification accuracy of the model was 94%, but there was a significant difference in the correct categorisation between surviving and failed firms (Frydman et al., 1985)

The next big step was the emergence of neural networks, which dates back to the 1990s. The first application of neural networks can be attributed to Odom and Sharda. Their model was based on the variables used by Altman in 1968. The sample consisted of 129 companies. For the training sample, the classification was perfect, thus outperforming the results obtained by discriminant analysis. For the test sample, the classification accuracy of 82% significantly exceeded the results obtained by discriminant analysis (Odom & Sharda, 1990)

Tam and Kiang's analyses were carried out for banks, with the neural network performing best over a one-year time horizon, but logistic regression performing best over a two-year time horizon (Virág & Kristóf, 2005). Coats and Fant compared the performance of discriminant analysis with a neural network and came to similar conclusions. In the second half of the 1990s, Olmeda and Fernandez processed data from Spanish banks. Their research was carried out using all the models mentioned above, of which the neural network proved to be the best, with a classification accuracy of 82.4% (Olmeda & Fernandez, 1997). Zhang et al. (1999) compared the neural network with logistic regression. The former achieved a classification accuracy of 88.2% and the latter 78.6%.

Overall, it can be concluded that, among the different methods of analysis, neural networks have basically produced the best results.

# METHODS OF PREDICTING BANKRUPTCY

For bankruptcy forecasting, the following methods are widely used:

- discriminant analysis
- logistic regression
- decision tree
- neural network

For this study I used logistic regression and neural network.

## Logistic regression

In logistic regression, the goal is to classify observation units into predefined groups of dependent variables. In this case, the dependent variable has two categories, so I applied binomial logistic regression. In logistic regression, the analysis is based on the 'odds', which determine the probability of the default. The odds can be expressed by the following formula:

$$odds_x = \frac{P_x}{1 - P_x}.$$

In the logistic regression, we assume that the logarithm of the odds can be defined as a linear function of the independent variables, which can be written as follows:

$$\ln(odds_x) = logit(P_x) = \beta_0 + \beta_1 x_1 + \ldots + \beta_p x_p.$$

The other central element of the analysis is the so-called cut point value. This value can be chosen arbitrarily, but it is important to keep in mind that the losses resulting from a false classification are kept to a minimum (Hajdu, 2003, 2018; Sajtos & Mitev, 2007; Malhotra, 2008; Varga & Szilágyi, 2011).

## Neural network

The best performing computer today is still the human brain. Neurons, information-processing units, help to perform tasks. "Neural networks, or more precisely artificial neural networks, are information processing paradigms inspired by the highly interconnected parallel processing structures and processes of the mammalian brain. In essence, neural networks are mathematical models that operate on the basis of certain information processing principles of biological nervous systems and are therefore capable of adaptive learning." (Ketskeméty et al., 2011, p. 394).

In my analyses, I used the Multi-Layer Perceptron (MLP) method, which extends the simple perceptron with hidden layers that are placed between the input and output layers, improving learning performance. Information can flow between the layers with and without feedback. The best known is the back propagation network, where the error propagates backwards, continuously shaping the weights (Ketskeméty et al., 2011).

Neural networks have several advantages:

- they can handle nonlinearity;
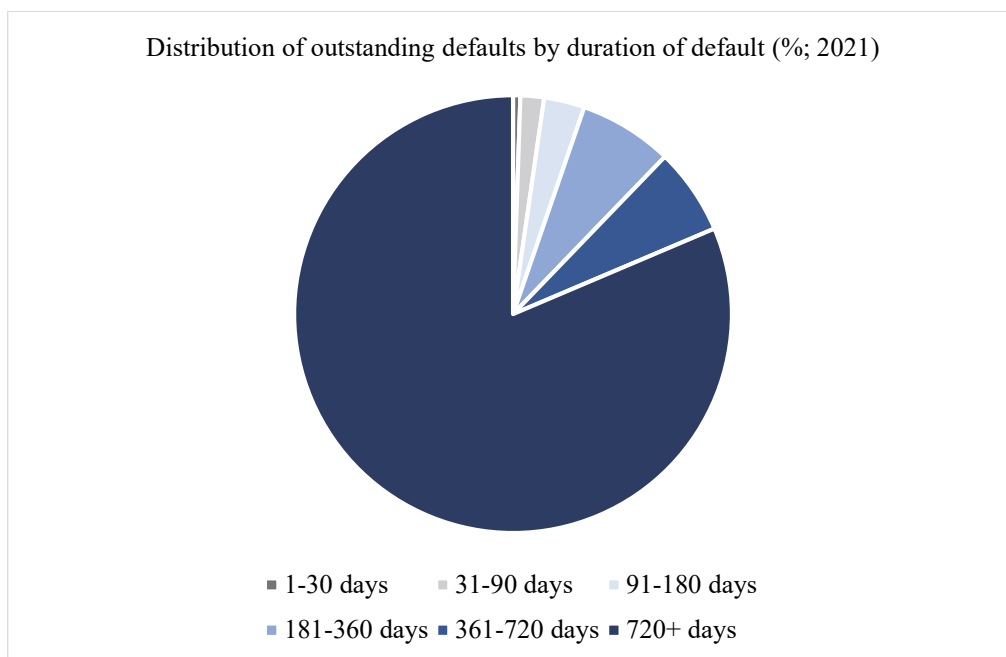- they have no problem with missing data;
- they can handle large numbers of variables and elements (Kristóf, 2002).

To evaluate and compare the models, I used the classification matrix, ROC curve and Gini coefficient. For the AUC value calculated from the ROC curve, if the value is around 80–90%, it is considered to be outstanding. Also for the Gini coefficient, a value between 80–90% indicates a very good predictive model.

# DATABASE AND RESULTS

In Hungary, information on household creditors is kept by the Central Credit Information System, or KHR, which helps banks to share information on creditors, assist in credit assessment and reduce the risk of over-indebtedness. The KHR maintains a so-called complete list, i.e., customers who meet their obligations on time are also included in the register.

The trend in defaults for 2021 shows that the number of defaults steadily decreased over the year, with the number of outstanding debts falling by 13.9% from January to December. The trend in outstanding debts has also been influenced by legislative changes, such as the gradual reduction of the moratorium on repayments.



Distribution of outstanding defaults by duration of default (%; 2021)

- 1-30 days
- 31-90 days
- 91-180 days
- 181-360 days
- 361-720 days
- 720+ days

Source: Own editing based on KHR data

*Figure 1. Distribution of outstanding defaults by duration of default*

Figure 1 shows the distribution of outstanding default by duration. In terms of duration of defaults, 12.21% of the outstanding defaults have been outstanding for up to one year, 6.4% for less than 720 days and a significant proportion, 81.39%, for more than almost 2 years (KHR Annual Information, 2021).

The necessary database for the analyses was provided by BISZ Zrt. The data were extracted on 30 September 2021, so the database contains the persons registered on that date. A unit in the database represents one loan transaction, so there may be persons in the database who are listed more than once with different loan transactions. Overall, on that date, the register contained 10,767,452 credit transactions and 21 variables. In addition to the original variables, I added more variables to the database. The original variables are:

- Anonymous identifier of the consumer
- Type of the consumer
- Age of the consumer (in 2021)
- Gender of the consumer
- Distorted agreement identifier
- Type of agreement
- Status of agreement
- Date of the agreement
- Expiry date of the agreement
- Amount and currency of the agreement
- Amount and currency of principal debt outstanding
- Information on regular repayments (amount and currency)
- Amount and currency of the default
- Status of the default
- Date the default occurred
- Date the default was terminated
- Residence of consumer (on the district level of the country)

Added variables are:

- Default (yes or no)
- Loan maturity (difference between the date and expiry date of the agreement; in months)
- Repayment amount as a percentage of agreement amount (repayment amount/amount of agreement)
- Age of the consumer at the time of borrowing the loan

For the analysis the relevant variables are the default, gender, loan maturity, age of the consumer at the time of borrowing the loan, and repayment amount as a percentage of agreement amount.

Before starting the analyses, the first step was to clean the database and narrow it down to the research objectives; after that I had 2,887,470 cases in the database. For the analysis I used 2 database with 500 cases. For the sampling I used a random numbers generator. For the first sample, I used simple random sampling. This is a type of representative sampling. For the second sample, I also used random sampling, but in this case the proportion of performing and non-performing loans is the same. The second sample type is a good and applied practice in this area.

## Empirical research

Recent methods used for bankruptcy prediction include logistic regression and neural networks. I assume that these methods can be used to predict with high accuracy which customers or loan transactions will default.

**I classified as default the loan transaction that had a default amount.**

To support this statement, I constructed classification models using logistic regression and neural network. To perform the analysis, I used the database provided by KHR and to validate the results, I divided the sample into a training and a test part. The training sample included 70% of the cases.

## Logistic regression

First, I performed a logistic regression analysis on the first sample. For the variable selection I used the Backward method. Of the available explanatory variables, only the ratio of the repayment to the agreement amount was found to be significant. The Omnibus test (p<0.001) and the Hosmer and Lemeshow goodness-of-fit test (p=0.212) showed a reliable model with a good fit. The categorisation (Table 2) of good-performing loans is much more likely to be correct. This may be due to the predominance of good-performing loans in the sample, i.e., the sample composition is unfavourable for analysis. The solution can be using the second sample.

I repeated the analysis again, this time on the second sample. The Omnibus test (p<0.001) and the Hosmer and Lemeshow goodness-of-fit test (p=0.105) showed a reliable model with a good fit. The variable that was found to be significant in the previous case was also found to be significant in this case (p<0.001), and the model was extended to include loan maturity (p<0.001) as shown in Table 1.

*Table 1*

*Significant variables in the logistic regression models*

| Type of the sample | | Variable | Wald | Sig. | Exp(B) |
|---|---|---|---|---|---|
| I | Test | the ratio of the repayment to the agreement amount | 13.249 | <0.001 | 1.025 |
| | Training | the ratio of the repayment to the agreement amount | 49.181 | <0.001 | 1.030 |
| II | Test | the ratio of the repayment to the agreement amount | 17.529 | <0.001 | 1.031 |
| | | loan maturity | 8.190 | <0.001 | 0.977 |
| | Training | the ratio of the repayment to the agreement amount | 29.528 | <0.001 | 1.051 |
| | | loan maturity | 9.418 | <0.001 | 0.982 |

Source: SPSS output, own editing

The question is, which model is better? I think it is a complex issue. If we look at classification accuracy only (Table 2), the first one is better. However, it should be taken into account that the new sample composition has had a positive effect on the categorisation of non-performing loans, which can be considered as a more favourable result for the analysis. Based on this, the second model is the better.

*Table 2*

*Classification tables*

| Sample type | Observed | | Predicted | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Default | | Percentage Correct | Default | | Percentage Correct |
| | | | 0 | 1 | | 0 | 1 | |
| Test | Default | 0 | 141 | 1 | 99.3 | 60 | 27 | 69.0 |
| | | 1 | 4 | 4 | 50.0 | 16 | 60 | 78.9 |
| | Overall Percentage | | | | 96.7 | | | 73.6 |
| Training | Default | 0 | 315 | 8 | 97.5 | 143 | 20 | 87.7 |
| | | 1 | 14 | 13 | 48.1 | 36 | 138 | 79.3 |
| | Overall Percentage | | | | 93.7 | | | 83.4 |
| | | | a. The cut value is 0.3 | | | a. The cut value is 0.4 | | |

Source: SPSS output, own editing

The model equation can be written in the following form:

$$Y = \ln(odds_x) = 0.021 + 1.051x_1 + 0.982x_2$$

after transformation

$$P_{(default)} = \frac{e^{0.021+1.051x_1+0.982x_2}}{1 + e^{0.021+1.051x_1+0.982x_2}},$$

where

$x_1$: the ratio of the repayment to the agreement amount

$x_2$: loan maturity.

## Neural network

In the case of neural networks, I chose the Multi-Layer Perceptron (MLP) option, which is widely used in bankruptcy prediction. The neural network does not have any preconditions, but there is a risk of over-learning. All of the available variables can be included in the analysis. The algorithm chose the ratio of the repayment to the agreement amount as the most important explanatory variable. The resulting model has a high classification accuracy, with 6.7% of loan transactions misclassified in the case of the training part and 3.2% in the case of the testing part.

I encountered the same problem as in logistic regression. In the classification matrix (Table 3), we can see that the sensitivity value is lower than the specificity value, so the analysis achieves higher accuracy for the classification of good-performing loans. A solution could be the same as in the logistic regression, using a sample with (approximately) equal proportions of performing and non-performing loans.
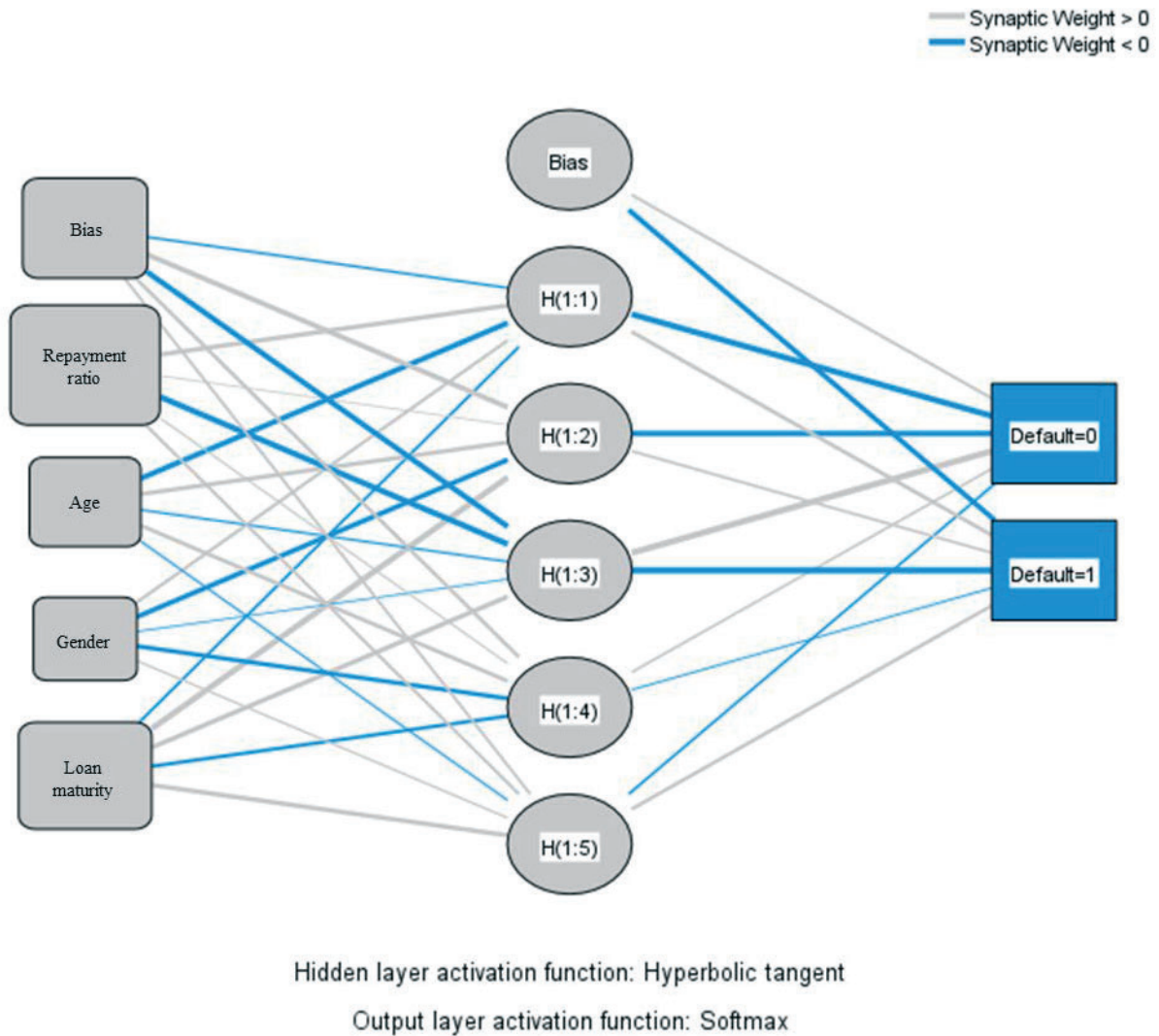
*Table 3*

*Classification table of the neural network model*

| Sample type | Observed | Predicted | | |
|---|---|---|---|---|
| | | 0 | 1 | Percent Correct |
| Training | 0 | 307 | 9 | 97.2% |
| | 1 | 14 | 12 | 46.2% |
| | Overall Percent | 93.9% | 6.1% | 93.3% |
| Test | 0 | 149 | 0 | 100.0% |
| | 1 | 5 | 4 | 44.4% |
| | Overall Percent | 97.5% | 2.5% | 96.8% |

Source: SPSS output, own editing

The second sample produced the neural network shown in Figure 2:



Hidden layer activation function: Hyperbolic tangent

Output layer activation function: Softmax

Source: SPSS output, own editing

*Figure 2. Neural network model*

The Algorithm chose the ratio of repayment to the agreement amount as the most important explanatory variable. Based on the normalised importance of the variables, the hierarchy of the variables is:

- Repayment ratio: 100.0%
- Loan maturity: 66.9%
- Age: 23.0%
- Gender: 7.7%

The resulting model has a high classification accuracy. Although the overall accuracy of the classification has decreased, as can be seen in Table 4, the specificity and sensitivity are approaching each other and the classification of non-performing loans has improved significantly.

*Table 4*

*Classification table of the neural network mode*

| Sample Type | Observed | Predicted | | |
|---|---|---|---|---|
| | | 0 | 1 | Percent Correct |
| Training | 0 | 163 | 14 | 92.1% |
| | 1 | 53 | 132 | 71.4% |
| | Overall Percent | 59.7% | 40.3% | 81.5% |
| Test | 0 | 73 | 0 | 100.0% |
| | 1 | 19 | 46 | 70.8% |
| | Overall Percent | 66.7% | 33.3% | 86.2% |

Source: SPSS output, own editing

Based on this, I think that the second model is the better, and the new sample has a positive effect on the categorisation of non-performing loans.

# COMPARISON OF RESULTS, CONCLUSION

I based the models on four explanatory variables, and Table 5 summarises which explanatory variables were found to be significant by the different methods.

*Table 5:*

*Summary of variables used by classification models*

| Name of the variable | Logistic regression | | Neural network | |
|---|---|---|---|---|
| | I | II | I | II |
| ratio of repayment | X | X | X | X |
| loan maturity | | X | X | X |
| age | | | X | X |
| gender | | | X | X |

Source: Own editing

Based on the above, it can be concluded that the most significant of the data recorded by the KHR in terms of loan defaults is the ratio of the repayment to the agreement amount.

It can be concluded that the chosen methods can be successfully applied to predict defaults. The accuracy of the classification of the models was high, but there was a significant difference in the classification of each group when the first sample was used. I therefore carried out the analyses on the second sample, where the proportion of performing and non-performing loans is the same. This had a positive effect on the research aim. I also evaluated and compared the models using the AUC value and the Gini coefficient.

*Table 6*

*Evaluation of the models*

| Method & sample | Accuracy (%) | | | AUC (%) | Gini (%) |
|---|---|---|---|---|---|
| | 0 | 1 | Σ | | |
| Logistic regression I | 97.5 | 48.1 | 93.7 | 87.7 | 75.4 |
| Logistic regression II | 87.7 | 79.3 | 83.4 | 91.2 | 82.4 |
| Neural network I | 97.2 | 46.2 | 93.3 | 90.8 | 81.6 |
| Neural network II | 92.1 | 71.4 | 81.5 | 92.5 | 85.0 |

Source: SPSS output, own editing

For the AUC value, a value between 80–90% is considered to be outstanding. In the Table 6 we can see that all models have AUC values significantly above 80%. A similar conclusion can be drawn for the Gini coefficient, where a value above 70% indicates a very strong model. On the basis of classification accuracy, the first logistic regression model is considered to be the best, but on the other two evaluation criteria, the second neural network model is better.

From an application and interpretation point of view, logistic regression is a simpler option, and its performance is barely inferior to that of neural networks, so the best two models are the second logistic regression and the second neural network model.

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    +
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- ♦ Journal of Economic Literature (JEL) codes
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- ♦ Literature review
- ♦ Materials and/or methods
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