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The role of rationality and intuition in creating strategic military documents

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Abstract

Background: Managers can plan strategically based on a rational and/or intuitive approach. In the past, intuition and rationality were seen as opposing approaches, one or the other of which was used. Currently available sources confirm the combination of both approaches as effective, and thus their complementarity.

Purpose: The main goal of the paper is to reveal the characteristics of using intuition and rationality in the process of creating the strategic documents of the Ministry of Defence of the Czech Republic (MoD CR). Further, there are two sub-goals: to analyse the proportions, characteristics and consequences of using the revealed ratio of intuition and rationality in the process mentioned.

Study design/methodology/approach: The general research design is a qualitative paradigm. The data were collected through a semi-structured questionnaire. The sample amounted to 18 authors of strategic documents of the MoD CR. The data were evaluated using the grounded theory method, which defines the procedures of open and axial coding of the text. The arrangement of relationships between the identified data categories was carried out using a paradigmatic model according to grounded theory.

Findings/conclusions: The conclusions confirm the use of a combination of intuition and rationality in the process of creating strategic documents. However, intuition prevails in the ratio of both approaches, which can be the cause of not quite optimal output. Processed strategic documents suffer from some shortcomings (i.e. inconsistency of formal and content aspects, insufficient measurability, objectivity and comparability), which are related to insufficient or incorrect use of exact methods and a systematic approach.

Limitations/future research: The conclusions are valid for the MoD CR, specifically for the process of creating strategic documents. It would be useful to compare them with other types of organizations in the state, public and private sectors. The use of intuition and rationality in other processes of strategic management can be examined and compared with the processes of middle and lower management.

Keywords

Strategic documents, intuition, rationality, military, the Ministry of Defence of the Czech Republic, grounded theory

Introduction

In the initial stages of studying managerial decisions, the primary focus was on perceiving strategic decision-making as a rational, analytical, linear, and systematic process (Cabantous & Gond, 2011). However, there is now growing recognition that conscious and deliberative processes may not always be the dominant factors driving strategic managerial decisions (Salas et al., 2010). Effective strategic decision-making could necessitate the incorporation of both rationality and intuition, and there are cases when rational thinking is insufficient for decision-making (Khatri & Ng, 2000; Katsikopoulos et al., 2022). Instead of a comprehensive analysis, more and more managers are openly acknowledging that they rely on intuition in their decision-making processes and embrace it as an effective approach to important decisions; therefore, intuition does indeed hold a crucial significance in management (Khatri & Ng, 2000; Miller & Ireland, 2005; Elbanna, 2006;

Elbanna & Child, 2007; Akinci & Sadler-Smith, 2019; Crossan & Bedrow, 2003; Woiceshyn, 2009; Kopalle et al., 2023). Klein (2002) emphasizes that even those who claim that they do not rely on intuition do, and have to, without being consciously aware of it.

For this reason, management theorists have been increasingly focusing on the conceptualization of intuition in recent times (e.g. Khatri & Ng, 2000; Sadler-Smith & Shefy, 2004; Dane & Pratt, 2007; Akinci & Sadler-Smith, 2012) and studying its impact on strategic decision-making (Behling & Eckel, 1991; Burke & Miller, 1999; Sadler-Smith & Shefy, 2004; Miller & Ireland, 2005; Sinclair & Ashkanasy, 2005; Dane & Pratt, 2007; Hodgkinson et al., 2009). According to Parikh et al. (1994), intuition is the most important in creating corporate strategy and planning.

Although there has been a recent increase in attention to intuition within management theory, there exists limited research regarding the role of intuition in the context of creating strategic documents.

The research questions of the investigation carried out and presented here are as follows:

1. What is the ratio of using the intuitive and rational approach of the authors in the process of creating strategic documents of the MoD CR?
2. What is the impact of the ratio of intuition and rationality on the output of the process, or the quality of the resulting document?

The essential structure of the study involves a case study of the organisation. The selected organisation is the Ministry of Defence of the Czech Republic (MoD CR). The major scope of authority of the MoD CR is to secure the defence of the Czech Republic, management of the Army of the Czech Republic (ACR) and administration of Military Regions. The organization ensures the planning and implementation of the armed forces enhancement concept, proposes strategic measures for national defence, and establishes collaboration with NATO's allies and other foreign armed forces' defence departments.

Military strategic management encompasses development, training, and deployment of the armed forces, formulation of defence policies, and effective management of material, financial, and human resources. The strategic documents (SDs) of the MoD CR, which are the focus of this study, are formulated in the aforementioned strategic domains.

The MoD CR employs approximately 35,000 employees, 27,000 of which are part of the Czech Armed Forces. With regard to significant changes in the security situation in 2022, the MoD CR clearly intends to further increase the number of military employees in the department.

Strategic documents in the defence department are a tool for the conceptual development of the capabilities of the Ministry of Defence (MoD) and the Army of the Czech Republic (ACR) in the medium and long term (Procházka, 2018).

1. Literature review

1.1. Definition of intuition

Rationality denotes a decision-making mechanism that is analytical, systematic, rule-based, and explicitly structured (Hodgkinson & Healey, 2011). When relying on rationality, managers search and evaluate relevant objective information from all potential sources, and have a preference for employing quantitative tools when evaluating and selecting from various alternatives (Hart, 1992; Grünig et al., 2005). However, there are objective obstacles accepting rationality (Elbanna, 2006; Dean & Sharfman, 1993; Miller, 2008). The organizations might lack the appropriate resources or competencies to collect data and analyse information. Moreover, because of its methodical and well-organized characteristics, rational decision-making can be slow, requiring considerable time and effort. Therefore, it may not always be suitable for addressing the time constraints, intricacies, and uncertainties involved in innovation decision-making (Dane & Pratt, 2007). In such situations, managers tend to rely on an intuitive decision-making process (Dane & Pratt, 2007; Gore & Sadler-Smith, 2011).

In intuitive decision-making, managers do not perform analyses, but their solutions look very mysterious in the way they emerge from their heads (Papulova & Gazova, 2016). Intuition is usually defined as insight that bypasses reasoning or perception of reality resulting in judgments that emerge from swift, subconscious, and comprehensive associations (Dane & Pratt, 2007; Hodgkinson & Healey, 2011; Samba et al., 2022; Frantz, 2000).

Neither the antithesis of rationality nor a haphazard guessing process (Paprika, 2008), intuition is commonly understood as an inexplicable “hunch” or “gut feeling”, as opposed

to explicit, systematic analysis that tells a person what to do (Vaughan, 1979; Elbanna et al., 2013; Elbanna & Fadol, 2016; Miller & Ireland, 2005; Shirley & Langan-Fox, 1996). Managers are unable to clearly articulate or justify the reasons for a particular decision – in essence, they know, but do not know why (Nutt, 1998; Covin et al., 2001; Sinclair & Ashkanasy, 2005; Paprika, 2008). Thus, there are situations, in which an experienced manager will reject a course of action simply because he "feels it's not right", even in situations when all the data available for conscious consideration points in the other direction (Luoma & Martela, 2021). Buchanan & O'Connell (2006) called it "one of the X-factors separating the men from the boys".

Describing intuition may pose challenges, but recognizing it tends to be more straightforward (Sadler-Smith & Shefy, 2004). Some say it is a built-in capacity born with us (Agor, 1997), while some believe that intuition is "simply analysis frozen into habit and into the capacity for rapid response through recognition" (Simon, 1987), thus accentuating its experience-based nature as it is not straightforward and requires years of experience in problem-solving and intimate knowledge of the situation (Simon, 1987; Isenberg, 1991; Eisenhardt & Zbaracki, 1992; Seebo, 1993; Khatri & Ng, 2000; Miller & Ireland, 2005; Dane & Pratt, 2007; Paprika, 2008; Gore & Sadler-Smith, 2011; Duggan, 2013; Ahangaran et al. 2016; Teece, 2018; Giampaoli et al. 2019; Jutidharabongse et al., 2020). Walsh et al. (2022) identify four different categories of intuition: expert, creative, social and temporal. Sadler-Smith & Héliot (2021) adds a fifth type – spiritual intuition.

1.2. Intuition in context

Empirical studies have investigated how particular sets of circumstances shape intuition (e.g. Agor, 1986; Isenberg, 1991; Parikh et al., 1994; Shapiro & Spence, 1997; Khatri & Ng, 2000; Hayashi, 2001; Dayan & Elbanna, 2011; Elbanna & Fadol, 2016) or how intuition influences decision outcomes and organizational performance (e.g. Wally & Baum, 1994; Khatri & Ng, 2000; Covin et al., 2001; Sadler-Smith, 2004).

Decision-makers are shaped by the requirements of the specific situation or task at hand (Wu, 2022; Svenson et al., 2023). There are certain situations in which intuitive decisions may be as good as or even superior to the rational ones (Dane & Pratt, 2007; Hammond et al., 1987; Khatri & Ng, 2000; Schweitzer et al., 2020). According to Leavitt (1975), intuition is perceived as a valuable tool to counteract excessively analytical practices, a concept he termed "analysis paralysis". Intuition is regarded as a potent approach to decision-making, particularly in strategic scenarios where decision-makers grapple with intricate and ambiguous problems (Shapiro & Spence 1997; Clarke & Mackaness 2001; Dane & Pratt, 2007; Elbanna et al., 2013). Henry Mintzberg elucidates that strategic thinking necessitates creativity and synthesis, and intuition is better suited for this purpose than analysis (Mintzberg & Westley, 2001). Studies also suggest that intuition is useful in time pressure and such environments with a dynamic setting, high level of uncertainty and complexity (Agor, 1986; Orasanu & Connolly, 1993; Kuo, 1998; Claxton, 1998; Burke & Miller, 1999; Khatri & Ng, 2000; Miller & Ireland, 2005; Hodgkinson et al., 2009; Malewska & Sajdak, 2014) insofar as they remain familiar and the decision-maker is equipped with a sufficient experiential basis and set of competences, such as decision-making readiness or generating innovative solutions (Hodgkinson et al., 2009; Kahneman & Klein, 2009; Hodgkinson et al., 2009).

In organizational settings, even classical theorists like Carl Jung, Chester Barnard, and Abraham Maslow have acknowledged the significance of intuition (Dane et al., 2012). Nevertheless, the literature has presented inconsistent results regarding the direct impact of intuition on strategic decision outcomes. Various empirical studies have demonstrated a positive correlation between the utilization of intuitive decision-making approaches and improved planning effectiveness or organizational performance (e.g. Songkajorn et al., 2022; Kim et al., 2021; von Diest et al., 2020; Aujirapongpan et al., 2020; Aujirapongpan & Hareebin, 2020). However, there is also empirical evidence indicating no significant relationship between these two variables (Chaston, 2009; Elbanna et al., 2013; Giampaoli et al., 2019). Both intuition and analysis have their strengths and weaknesses (Hallo & Nguyen, 2021). According to Wally & Baum (1994), Khatri & Ng, (2000), Miller & Ireland (2005), Dane & Pratt (2007), Ritchie et al. (2007), Dayan & Elbanna (2011), Kaufmann et al. (2014), Sadler-Smith (2004) or Szanto (2022), the use of intuition can result in good-quality decisions and is generally associated with good results. It is most often attributed to faster decision-making speed (Khatri & Ng, 2000; Hodgkinson & Sadler-

Smith, 2018). On the other hand, managers might make decisions very fast without considering facts and ignoring important details (Elbanna, 2006; Elbanna et al., 2013). Its weakness is also the fact that it can contain subjective views, incorporate several cognitive biases and lack arguments (Khatri & Ng, 2000; Tabesh & Vera, 2020). Moreover, the strategy of relying on intuition is likely to fail in novel or rapidly changing situations (Dane & Pratt, 2007; Woiceshyn, 2009; Kahneman & Klein, 2009). For these reasons, analytic methods need to be used (Korherr et al., 2022). As a result, numerous authors (e.g., David, 2013; Bullini Orlandi & Pierce, 2020; Baldacchino et al., 2023; Manesh et al., 2022) propose that combining intuition with analysis is essential to establish a solid foundation for strategic decisions.

1.3. Empirical research on intuition

Some researchers explored how managers perceive intuition and how they use it across a variety of organizational contexts. According to some scholars, when making decisions, many executives rely on intuition more than formal analysis (e.g., Burke & Miller, 1999). Fields (2000) showcased the regular use of intuition in business practices. Similarly, in Catford's study (1987) involving 57 business professionals, it was evident that intuition was commonly employed as a business tool.

Agor (1986) conducted research on a sample of 200 managers and demonstrated that senior managers exhibited more intuition compared to middle or lower-level managers. Paprika (2008) asserted that entrepreneurs frequently rely on intuition in their decision-making more than executives. In a study of 234 Hungarian companies, Szanto (2022) found evidence suggesting that those better prepared and capable of managing change effectively tended to utilize intuitive decision-making approaches more than those less responsive to change. Sleesman et al. (2022) conducted a study involving 222 Multiteam Systems consisting of United States Air Force Captains, which revealed that leaders with an intuitive leadership style had a positive impact on the performance of multiteam systems operating under high information load conditions. Elbanna et al. (2013) conducted a study confirming a negative relationship between the use of intuition and firm size, indicating that decision-makers in smaller firms rely more on their intuition and personal experience. In a study focused on Slovak companies, Papulova & Gazova (2016) found that intuition was less commonly used and applied as a type of thinking, with a higher preference for it in small and micro companies by 18.72% (compared to large companies at only 2.56%). Moreover, Khatri & Ng (2000) conducted research on a total of 141 physicians, revealing that intuition played an essential role in the strategic process, frequently exhibited by top-level personnel in their strategic decision-making. A total of 18 interviews with Dutch sewer asset managers in a study by Van Riel et al. (2014) demonstrated that intuition was applied to decision-making to ensure the continuity of daily practice. According to a study by Vanlommel et al. (2017), intuitive expertise appeared to be the most important basis for the decision-making of 17 primary school teachers, conducted in Belgium. Also, design professionals often exhibit an inherent and prevalent inclination towards intuitive decision-making when approaching innovation (Michlewski, 2008; Andriopoulos & Lewis, 2009; Stigliani & Ravasi, 2012). Tensions can arise from the contrast between the primarily intuitive approach of design professionals and the rational decision-making commonly embraced by the managers of the companies that employ them (Cabantous & Gond, 2011). Parikh (1991) conducted a significant survey of 13,000 managers worldwide, and their responses attributed 80% of their business success to intuitive decision-making (Buchanan & O'Connell, 2006).

Emmanuel et al. (2010) argue that decision-makers in large UK manufacturing companies, who are experienced executives, incorporate intuition into their strategic investment decision-making practices. In Paprika's study (2008), which examined twenty top-level managers, a combination of analytical and intuitive problem-solving approaches was observed. Some managers in this study preferred to be perceived as rational, while others took pride in relying on their instincts to address specific cases.

Previous studies have attempted to combine intuition and rationality by considering them as distinct decision-making approaches (Dayan & Di Benedetto, 2011; Dayan & Elbanna, 2011; Elbanna & Child, 2007). In academic studies concerning planning and strategic decision-making, there has been a conventional tendency to contrast them, and approach them as alternative, distinct and contradictory decision-making processes (Khandwalla, 1977; Covin et al., 2001; Elbanna, 2010; Calabretta et al., 2017; Kaufmann et al., 2017; Wang et al., 2017; Deligianni et al., 2016; Petrou et al., 2020), assuming that managers are

either rational or intuitive when making strategic decisions (Kolbe et al., 2020; Petrou et al., 2020). However, the dual-process approach has become widely accepted, describing a model of decision-making guided by both rationality and intuition since these quite often complement and interact with each other (Evans, 2008; Hammond, 1996; Kahneman & Frederick, 2005; Kaufmann et al., 2014; Calabretta et al., 2017; Woiceshyn, 2009; Vieira et al., 2020; Troise et al., 2022).

For example, Pondy (1983) noted that rationality and intuition were equal partners, each providing a context in which the other could operate. Similarly, Simon (1987), Agor (1986), Yukl (1994), Kuo (1998), Berry & Broadbent (1987) Lewicki et al. (1988), Barnard (1995), Mintzberg & Westley (2001) or Sadler-Smith (2004) observed that, to be effective, any organization must use both analysis and intuition when creating strategy, switching from one to the other as needed (Thanos, 2022). Relying on intuition or rationality separately will not help managers to implement successful decisions. Hough & Ogilvie (2005), based on a study of 749 managers, as well as Thanos (2022), based on a study of 103 decisions made by service firms in Greece, concluded that managers who simultaneously combine analysis and intuition are more successful than managers who independently use rationality or intuition. Hence, any theory related to strategic decision-making must encompass both rational and intuitive processes (Khatri & Ng, 2000).

According to Agor (1986) and Isenberg (1991), intuition follows the rational process. In this way, the experience and gut instincts of managers act as control mechanisms for the results of rational decision processes, leading to better decision-making. According to Kaufmann et al. (2017), rationality is guided by intuition; thus, using details and data, it checks all important steps before making a decision. According to Dane & Pratt, (2007), intuition both precedes and follows the rational process. In this way, rationality acts as a control mechanism for intuition and vice versa.

2. Methods

The chapter defines the basic characteristics of the research realized, particularly its goal, research sample, applied methods and collection procedures, analyses, and data interpretations.

The goal of the paper is to identify the ratio of rationality and intuition in the process of creating the strategic documents of the MoD CR and to analyse the impact of the revealed ratio on the quality of documents (process outputs). The research questions are defined in the Introduction of the paper.

The chosen research design is qualitative in nature, aiming primarily to uncover new insights and patterns. The researcher identifies topic or questions, collects information from various sources and discovers the answers emerging from information available (Hancock et al., 2021). The qualitative approach is distinguished by its focus on a limited number of cases while gathering a substantial amount of data and associated information. It relies on an inductive approach, often exhibiting relatively low reliability but high validity (Blaikie, 2007; Hendl, 2016).

The purpose of qualitative research is not to test a stated hypothesis, but to explore a new topic and to answer the research questions. Its objective lies in acquiring fresh insights and formulating new theory and understanding. Given the limited number of participants included, the generalization of results to the broader population (statistical generalization) is problematic. Instead, qualitative research relies on analytical generalization, a process involving the extension and generalization of theory. The researcher strives to generalize a particular set of results to a broader theory (Yin, 2019). The new theory is initially valid only for the studied units. It is a new knowledge to be subjected to further investigation or verification of the emerging new theory on a larger sample. This iterative process gradually leads to the confirmation or refutation of the validity of the new theory within the broader context or the entire population.

Various qualitative research methodologies exist - ethnomethodology, ethnography or narrative analysis. For the purpose of the present research, a basic framework suitable for the case study, coupled with selected grounded theory procedures, was employed.

Case studies are characterized by their empirical exploration of a topic, focusing on one specific case that can encompass multiple variables of interest. It looks at the subject in depth and from many angles (Thomas, 2021). The authors used a multiple-case study design, offering greater credibility and persuasiveness of the results compared to a single-case study.

2.1. Data collection

The data collection involved creating a semi-structured questionnaire, followed by conducting

personal interviews with the members of the MoD CR. The questionnaire encompassed a diverse array of questions, but for the purpose of this paper, only the specific questionnaire areas listed below were examined:

1. The ratio and characteristics of using intuition and rationality in the process of creating strategic documents at the MoD CR.
2. The consequences of the revealed ratio of intuition and rationality.

Regarding the mentioned topics, the questionnaire comprises a total of five open-ended questions and two partially closed questions. At first, the questionnaire was presented to two respondents within the so-called pilot studies.

2.2. Sample

For the sampling method, intentional (purposive) sampling was chosen, representing one of the non-probability sampling techniques (Babbie, 2020). In this research, 22 respondents were invited to take part, and 18 of them consented to the personal interviews.

The primary criterion for including a respondent is their involvement in creating strategic documents for the MoD CR. The respondent must have been either a creator or a member of a team actively engaged in creating strategic documents for a certain period within the last ten years.

Among the entire group of 18 respondents, there are 10 civil employees and 8 active military personnel (comprising 2 generals and the remaining being colonels or senior officers). Concerning the duration spent in positions involving creating strategic documents, a total of 13 respondents held such positions for a period ranging from 2 to 10 years, while 4 respondents served in these roles for over 10 years, with the longest tenure being 15 years.

In qualitative research, it is challenging to precisely determine the sample size, that is, the number of respondents (or other data sources) necessary to create a sufficiently comprehensive database and a high-quality theory. The data collection process concludes when theoretical saturation is achieved (Miovský, 2006; Hendl, 2016). This moment occurs when additional cases do not yield new insights but merely confirm the findings from previous cases. Theoretical saturation was attained within the research data when it only repeated (and thus validated) previous discoveries, making any further data collection unnecessary.

2.3. Data processing and analysis

Considering the character of the objective and the specifics of the determined plan, the authors opted to employ the principles of the grounded theory method in handling the data. Grounded theory has two main perspectives, with well-known proponents being Barney Glaser (Glaser & Strauss, 1999) and Anselm Strauss along with Juliet Corbin (Corbin & Strauss, 2015). Although the fundamental perspective is similar, the concept of the coding process differs between the two. In this article, the latter approach (Corbin & Strauss, 2015) is applied.

During the interviews, the data was recorded as written notes and later transformed into a written text. Subsequently, the grounded theory's coding procedures were employed to process and analyse the text. The fundamental principle of the grounded theory involves organising qualitative data through the application of specific text coding approaches:

- Open coding – identification and categorization of concepts, their properties and dimensions of these properties (dimensionalising).
- Axial coding – a process of establishing connections among the primary categories and subcategories using the so-called paradigm model.

The mentioned types of text coding rely on constant comparison, questioning, and identifying similarities and differences. Then the process of dimensionalisation brings an initial idea of the relationships between key concepts – the categories revealed in the qualitative data.

The organization of a considerable amount of qualitative data is primarily achieved through data categorization and subsequent exploration of their interrelationships. The outcome of the grounded theory involves identifying key categories and subcategories of concepts - those that receive significant attention from respondents (high frequency of occurrence) and hold substantial importance. When the text contains sufficient depth, it becomes possible to subdivide the key discovered categories into subcategories.

The key output of the grounded theory is the design of a theory expressed by the paradigmatic model. The model puts the categories and subcategories found into interrelationships by breaking them down into causes, the phenomenon

itself, intervening conditions, strategies of action and consequences of action.

3. Results

The respondents clearly agree that when creating the strategic documents of the MoD CR, intuition and experience is always present. This is how 100% of respondents expressed their opinion.

According to the interviewed respondents, the ratio of intuition and rationality is difficult to estimate; nevertheless, most of them gave some estimate of the ratio.

More than 50 % of respondents agree on the involvement of intuition and experience (most often 50-80 %); the rest is the use of exact methods or rationality. The prevailing importance of intuition can be evidenced by the following statements of the respondents: "Intuition is key"; "Authors are expected to make a qualified estimate"; "In general, there must always be more intuition and experience than exact methods when creating strategic documents".

The findings can be evaluated in more detail as follows. Four respondents declare the involvement of intuition at about 50 %. Eleven interviewees agree on more than 50% involvement of intuition in the process of creating strategic documents compared to rational procedures. Five of these nine respondents estimate the use of intuition at even more than 70 %.

Three respondents out of eighteen report less than 50% involvement of intuition. One of them states about 30-40 % and adds that "expert estimates and a group view are used most, then intuition and exact methods take up the rest". Another respondent mentions minimal involvement of intuition – less than 10 %. This may be due to the fact that the respondent participated in creating strategic documents of the Military Police, i.e. a specific area - as he states, this area is "very bound by legislation, there is no room for greater involvement of intuition, it is necessary to work logically and precisely".

3.1. Factors affecting the ratio of intuition and rationality

Through coding the text (statements of the respondents) according to the grounded theory, the factors influencing the involvement of intuition and exact methods in the process of creating strategic documents were further revealed. The determined ratio depends on the factors listed in Table 1.

Table 1 Factors influencing using intuition/rationality

Experience of the author/s The more experience the author has, the higher the rate of using intuition ("*One intuitively knows how and what to use and what the output should be*"). The level of experience depends on the level of knowledge of the environment (MoD) and experience at all levels of management/command. Another statement can be added to this – "*if intuition is supported by knowledge, experience, then it has its place here [note: in the process of creating strategic documents"].*
Document type Each document has its own goal, required structure, form, and content. The intensity of the authors´ use of rational and intuitive decision-making depends on the specifics of each of them.
A specific part of the document The level of intuition and rationality involved in various parts of a document can differ. The more precise a section needs to be, the more accurate methods should be used. On the other hand, general parts require a higher level of intuitive thinking. For further information, please refer to the section on creating strategic documents below (subchapter 3.3.).
The time horizon, for which the document is created The longer the scope of the document, the more intuition and fewer exact methods are used. This is evidenced, for example, by the following statements: "*Intuition is essential and beneficial for creating the documents with a view of more than 10 years*" or "*For an annual document, the the ratio is 90 % of the exact method and only 10 % of intuition. For a document created for 10 years, the ratio is about 50/50*".
The role of the author in the process of creating strategic documents Different roles of the author (administrator, owner, layman, etc.) influence the representation of intuition and rationality.
The existence of a methodology for creating **strategic documents** With the existence of a methodology or a regulation for processing the task, the share of intuition decreases.

Source: the authors

3.2. Reasons for the predominant representation of intuition

Some of the interviewees mention the reasons for using intuition to a greater extent compared to the use of strategic and decision-making analysis methods:

- Time pressure. The reason for using intuition is primarily the fact that the authors of strategic documents have little free time. As a result of being overwhelmed with other tasks, there is no time left for analytical work; therefore, less time-consuming intuition and past experience are involved.
- The specifics of the field (the MoD) lead to a greater intuitive decision-making. One respondent states the following: "The

management process at the Ministry of Defence is essentially quite intuitive, based more on experience than being strictly exact." Another respondent adds that "Social sciences in general and military management as well – are always more about opinions – something simply cannot be quantified".

- Positive previous experience of the respondent(s) with an intuitive approach.

3.3. Intuition and rationality in the individual stages of creating strategic documents

Further, it has been investigated, in which stages of creating a strategic document intuition and rational approaches are used. It has already been mentioned that intuition has a higher representation in the more general parts of the documents (introduction to the issues, vision setting, etc.). Transparent analytical procedures are used to a greater extent when solving more specific problems.

Four of the eighteen interviewees stated that, in their case, intuition was used continuously during the entire process of creating strategic documents.

Half of the interviewees state that intuition and experience are used especially at the beginning of the process of creating strategic documents, while in the advancing stages, the processing team leans towards methodologically more precise procedures. One of the interviewees, for example, states that "In the first stage of creating a document (what will be done and how) an intuitive approach is used in up to 80 %. Towards the end of the document, it is about 50-60 %. There is a need to use more of a rational approach".

This is confirmed by another, more specific statement – intuition is applied especially in the stages of creating the outline (structure) of the document ("...in the preparation stage, formulating the starting points and basic parameters of the document...") and in the stage of data collection and their analysis. Exact methods are used to a greater extent in the stages of creating variants and determining criteria weights. However, one of the interviewees states that, according to his/her experience, intuition prevails even in the stage of choosing an optimal variant.

One respondent adds to the mentioned area – "What can be measured should be measured and abstract issues should be worked out using experience and intuition."

3.4. Advantages and disadvantages of intuition and rationality

Respondents see the advantages of intuition mainly in saving time. This factor has the highest weight or is most often explicitly declared – it is mentioned in some form by two-thirds of the respondents. Next, the advantages of intuition are listed as well as the disadvantages of rationality - lower costs, lower demands on the authors' competence, and the knowledge of the software.

On the contrary, the negative aspects of intuition are as follows:

- A condition (risk) when incompetent, inexperienced workers make intuitive decisions ("Using intuition fundamentally depends on the abilities of the person who uses it – it cannot be used always and everywhere", "Incompetent people make mistakes when making intuitive decision-making").
- Problems with verifiability of the accuracy of outputs and over-reliance on the status quo ("Less consideration of unknown or less likely and undeveloped ways of solving/reasoning").

The advantages of exact methods are obvious at the theoretical level. Nevertheless, we shall take a look at the practical experience of the authors of strategic documents at the Ministry of Defence and their perception of the benefits and pitfalls of exact procedures in creating strategic documents for the organization. The interviewees declare the following benefits of rational approaches:

- Higher quality of outputs ("A strategic document should not be formed only by intuition, but should be supported by 'hard' facts").
- Support of the argumentation. The higher the degree of use of exact methods and techniques, the more credible the submitted materials are for the contracting authority.
- Higher credibility of the output (in the eyes of the superior authority or approver/s) provides sufficiently convincing results of the analysis.
- The possibility of verifying the results and their modelling.
- Ensuring the consistency of individual documents (Štěpánková, Richter, 2022).
- Higher certainty for authors – "Not everyone is willing to take responsibility for an intuitive decision and rely on it.

Someone prefers to bet on safety by applying some method".

Analogous to the advantages of intuition, the respondents agree that a rational approach, or the application of strategic and decision analysis methods has the following disadvantages:

- Higher costs due to the following disadvantages of exact methods.
- Higher time demands compared to the intuitive approach.
- Higher demands on the authors´ competence and their analytical skills. This results in the risk of incorrect or ineffective application of strategic analysis and decision-making methods or application to a completely inappropriate type of problem. Another mistake is if the methods are used only formally, mechanically, or, on the contrary, their importance is overestimated.
- Higher demands on software and the associated necessary competence of authors to work with relevant software.

3.5. Impacts of lower representation of the rational approach

A significant conclusion of the open coding of data is the low rate of use of strategic and decision-making analysis methods. Exact methods are used here mostly informally or in a modified form (adapted to the needs of the MoD).

The method that is explicitly and informally used most often is a SWOT analysis. Other methods are stakeholder analysis, scenario method, GAP analysis, brainstorming, and data collection methods (mostly informal applications) (Štěpánková & Binková, 2023).

Respondents mainly point to the following shortcomings in the use of methods and data processing:

- Random, unsystematic selection and use of information, data sources, and rational methods.
- The application of strategic analysis methods is highly intuitive and informal.
- Unsystematic selection of appropriate methods, e.g. according to the erudition and experience of authors or contracting authorities (Štěpánková, Richter, 2022).

The authors are largely aware of the utility of exact methods, but they admit their frequent neglect. The reasons for the aforementioned statement, or, more precisely, the barriers to the use of exact methods, are categorized in Table 2.

Table 2 Factors influencing using intuition/rationality

1. Specifics of the organization and strategic document
▪ Inappropriateness of the method for a given document.
▪ The objectives of the document are given by the superior or departmental specifics.
▪ The application of the methods is not required by superior authority.
▪ High specificity of some documents.
2. Specifics of a particular method
▪ The level of complexity of the method
▪ The level of time requirement of the method.
▪ Uncertain data acquisition for the application.
3. Factors related to the personality of the author(s)
▪ Preference for an intuitive approach
▪ Diverse level of competence
▪ Misconception about the purpose of the method
▪ Being overwhelmed by other tasks (Štěpánková & Binková, 2023).

Source: the authors

In addition to the explicit and formally correct use of the methods, the rationality of the authors can also be seen in the modifications of the methods, or adapting them to the needs of the MoD. Even the rejection of some methods due to their irrelevance or the specificity of the MoD can be based on rational reasoning. Nevertheless, the prevailing ratio of intuition appears to be not quite optimal. According to the respondents addressed, the consequences of the absence of a holistic approach are mainly the following:

- Inconsistency and a lack of interconnection of both formal and content aspects of the documents. Inconsistency appears between individual strategic documents of the MoD, between individual versions of the same document, or even between individual parts of the same document.
- Insufficient measurability, objectivity, and comparability of the documents.

The rational approach is, therefore, clearly used to a lesser extent than the intuitive one. Respondents are quite clearly aware of the importance of rationality and perceive the negative consequences of neglecting it. They, therefore, express a relatively high motivation to balance intuition and rationality so that the output (processed documents) is of higher quality and the process of their processing more efficient. The most frequently declared idea is again that a combination of both approaches is necessary and effective *("Objective methods are clearly useful, but the process cannot be done without intuition").*

3.6. Key categories and paradigmatic model

The above-mentioned findings resulted from the open coding of the text according to the grounded theory. This is based on the search for concepts that are key to the investigated phenomenon from the viewpoint of the research question and the subsequent combining of similar concepts into categories and subcategories.

The key categories emerging from respondents' qualitative answers in the questionnaires on the use of intuition/rationality are listed in Table 3.

Table 3 Key categories of using intuition/rationality

1.	A combination of the intuitive and rational approach.
2.	Prevailing application of an intuitive approach over a rational one. Respondents always combine both approaches, but the vast majority of them declare a higher share of intuition compared to rationality.
3.	Factors affecting the ratio of intuition/rationality (the subcategories are: time allowance for processing documents, the experience/knowledge of the authors, specifics of the document, a specific part/stage of the document, time horizon of the document, and the role of the author).
4.	A low rate of using exact methods, or their unsystematic, informal or intuitive applications.
5.	Lower demands of intuition on resources (time, costs, SW, the competence of authors).
6.	he advantages of the rational approach – higher quality of outputs (consistency, systematicity), verifiability of results and higher certainty of authors, but also higher costs.

Source: the authors

Considering the research questions, the central category is "Combining intuition and rationality". This category is subsequently developed through the process of dimensionalisation, i.e. the identification of category properties and their placement on the scale. It is shown in Table 4.

Table 4 Ratio of intuition/rationality based on properties

Property	Range	Corresponding ratio of intuition/rationality
Time allowance	low high	⇨ intuition ⇨ rationality
Experience/knowledge of the field and situation	low high	⇨ intuition ⇨ rationality
Experience/knowledge of exact methods	low high	⇨ intuition ⇨ rationality
Document stage	general specific	⇨ intuition ⇨ rationality
Time horizon of the document	short long	⇨ intuition ⇨ rationality
Existence of methodology	exists doesn´t exist	⇨ intuition ⇨ rationality

Source: the authors

According to the grounded theory, the next step is the so-called axial coding, i.e. searching for the relationships (connections) between the categories found. The goal is to organize the categories and subcategories found into meaningful relationships. In the grounded theory, the so-called Paradigm model (Strauss & Corbin, 1999) is proposed for this purpose, the structure is shown in Figure 1.

Causal conditions → Phenomenon → Context → Intervening conditions → Action and interaction strategies → Consequences

Figure 1 Structure of a paradigmatic model
Source: the authors

The researcher can use all of the classes listed to organize the categories found; however, they may omit some if nothing appeared in the data that could be assigned to a class.

The phase of axial coding is always accompanied by a certain degree of subjectivity. According to Strauss & Corbin (1999), it is quite legitimate that each researcher can generate different structures of interrelationships within the categories of phenomena under investigation.

The key categories and subcategories resulting from the qualitative data of the questionnaire were defined above. Figure 2 shows their structuring into a paradigmatic model and thus the arrangement of relationships between them.

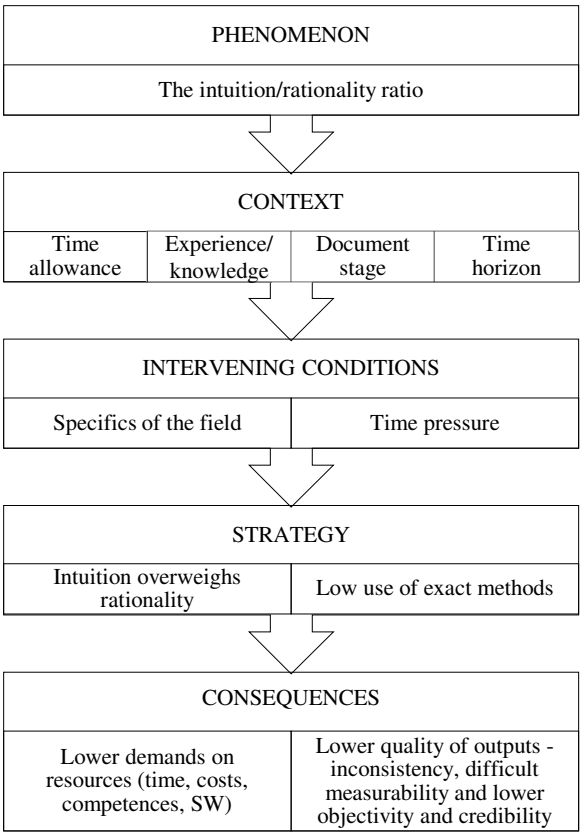

Figure 2 Paradigmatic model – using intuition and rationality
Source: the authors

The paradigmatic model in Figure 2 is a summary of knowledge about the examined phenomenon. Together with the dimensionalisation of the categories (Table 3), it describes the categories and subcategories revealed and the relationships between them.

Conclusion

It follows from the answers of the above-mentioned authors that they perceive it as effective to use a combination of intuitive and rational approach in the process of creating strategic documents. This is in line with many studies that suggest that combining analysis and intuition when creating a strategy leads to effective results (e.g. Barnard, 1995; Mintzberg & Westley, 2001; Sadler-Smith, 2004; Thanos, 2022). However, it is evident that more emphasis is placed on the intuitive approach - the estimates range between 50-80 %, similar to the studies by Burke & Miller (1999), Buchanan & O'Conell (2006), Vanlommel et al. (2017) or Stigliani & Ravasi (2012).

The reason for the prevailing intuitive approach, based on the experience of respondents, is mainly time pressure, the specifics of the field, incompetence of the authors in the area of exact methods, and previous positive experience with the intuitive approach. The reasons mentioned agree with the studies that include their time demands and, therefore, unsuitability in case of time pressure and the frequent incompetence of managers in the area of using exact methods among the most serious obstacles to the application of the rational approach (e.g. Dane & Pratt, 2007; Elbanna, 2006; Dean & Sharfman, 1993; Miller, 2008). The results also agree with the studies that highlight the speed of the decision-making process as one of the advantages of using the intuitive approach (e.g. Hodgkinson & Sadler-Smith, 2018; Khatri & Ng, 2000; Hodgkinson et al., 2009; Miller & Ireland, 2005; Malewska & Sajdak, 2014) and with the studies that perceive the aspect of experience in the field of intuitive decision-making as a key prerequisite for a successful outcome (e. g. Jutidharabongse et al., 2020; Giampaoli et al., 2019; Teece, 2018; Jutidharabongse et al., 2020; Dane & Pratt, 2007; Duggan, 2013; Ahangaran et al., 2016; Paprika, 2008; Gore & Sadler-Smith, 2011).

The factors affecting the ratio of intuition and rationality in the examined sample are the degree of experience of the author(s), the type of a document, a specific part of the document (output), the length of the time period, for which the document is processed, the role of the author and the non-/existence of a methodology for creating strategic documents.

Another important conclusion of open data coding is a low rate of application of strategic and decision-making analysis methods, if need be, the rational approach in the process of creating strategic documents of the MoD CR. Exact methods are used at the MoD CR to a low extent and mostly informally or in a modified form. The consequence is the inconsistency of individual parts of documents as well as individual documents with each other (hierarchical documents or different versions of one document). The results found confirm the results of studies pointing to insufficient or incorrect practical use of strategic analysis methods in the Czech Republic – for example, Straková (2017), revealing that only 40 % of the total number of 456 examined small and medium-sized enterprises in the Czech Republic demonstrate elementary knowledge of strategic analysis methods. Straková & Talíř (2020) reveal in another study that 60 % of the total number of 381 examined enterprises lack awareness of

procedures for development of essential strategic documents such as vision, mission and corporate strategy. The situation is the same abroad (e.g. Novikov, 2018).

The respondents believe that the benefit of the exact method application would be not only a higher consistency of outputs, but also their higher quality, measurability and credibility. Argumentative support, the possibility of verification and comparability of results are also identified as a potential advantage. Many studies in the field of strategic management and managerial decision-making confirm that strategic analysis has a significantly positive impact on the effectiveness of strategic decision-making. This is evidenced both by the studies dealing with strategic management decisions across sectors (e.g. Garbuio et al., 2015) and multinational companies. (e.g. Nwachukwu & Chládková, 2019). For example, Vasilescu (2011) in his paper supports the use of strategic analysis methods at the Ministry of Defence – he states that in today´s changing military environment, intuition is becoming less and less a reliable approach to strategic decision-making.

The listed categories and subcategories were subsequently structured using a paradigmatic model. Interrelationships between categories and subcategories are thus defined.

The central phenomenon is the ratio of intuition and rationality. The context of the phenomenon is determined by influences – time allowance, experience of the authors, document stage, document specifics, and the existence of methodology. The intervening conditions are mainly the specifics of the field and time pressure. The action strategies of the authors (respondents) are the application of a predominantly intuitive approach and the associated lower rate of use of exact methods and their informal or modified application. The consequences of the strategies mentioned are twofold: on the one hand, saving resources (time, costs, demands on competence and software). On the other hand, respondents declare a lower quality of outputs, based on a prevailing intuitive approach (inconsistency, lack of systematism, and lower objectivity).

A combination of intuitive and rational approach appears to be effective. However, the optimal balance or a greater emphasis on rational procedures, according to the data obtained, would generate more efficient work and a higher quality of outputs in the form of high-quality strategic documents of the MoD.

The conclusions of a qualitative investigation are always valid for a given sample and are by their very nature destined for further verification, mainly through quantitative approaches, but also qualitative investigations. The presented conclusions are valid for the MoD CR, specifically for the process of creating conceptual documents of this organization.

It is appropriate to further examine the development of the rate and method of using rational and intuitive approaches at the MoD CR. Specifically, the use of intuition and rationality in other processes of strategic management can be investigated. Further, it would be beneficial to compare the conclusions presented here with the processes of middle and lower management. In a broader context, it would be useful to compare the outputs with other types of organizations in the state, public and private sectors.

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Investigating the effect of consumer xenocentrism on purchase intention for foreign products

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Abstract
Background: Broadly defined as preference for another country rather than your own, xenocentrism in the context of consumer and consumption refers to willingness to purchase foreign products even if there are equivalent domestic products that are similar or even better in quality.
Purpose: The aim of this study is to determine the effect of consumer xenocentrism on Iraq-Kirkukian consumers' purchase intention for Turkish products. In addition, the study also examines the differences between the demographic variables and xenocentrism.
Study design/methodology/approach: To achieve these purposes, a survey was administered to a sampling consisting of 450 individuals selected by using convenient sampling method, and 418 of these surveys were included in the analyses. This sampling consisted of Turkmens, Arabs and Kurds. T-test and ANOVA test were performed to identify the differences between demographic information about the participants and xenocentrism. Factor analysis was done for the scales used in the study, and multiple regression analysis was done later to obtain the effect of consumer xenocentrism on purchase intention for Turkish products.
Findings/conclusions: The results of the study reported a positive and significant effect of consumer xenocentrism on purchase intention for Turkish products. In addition, consumer xenocentrism in Kirkukian consumers did not differ according to gender and ethnic identity.
Limitations/future research: The research was conducted in the city of Kirkuk, Iraq, which was under adverse political and security conditions and face-to-face survey was limited. The results cannot be generalized since Kirkuk has the most diverse ethnic identity in Iraq and is a place where Turkmens live more densely than other cities. Therefore, conducting this research in other countries would yield different results. In particular, examining the structure of consumer xenocentrism in developed economies would provide additional information about the prevalence and impact of xenocentric tendencies in these countries. It is also important to investigate the impact of consumer xenocentrism on other variables such as product decisions, risk perceptions and willingness to pay.

Keywords
Xenocentrism, foreign products, purchase intention, consumption, Kirkukian consumers

Introduction

Xenocentrism is a term derived from the Greek word "xenos" (Gr.: xénos Eng.: ZEE-no;), which literally means "foreign visitor" or "stranger". This notion refers to one's perception of their own culture as inferior to others and preference to appreciate other cultures' elements and customs rather than those of his own culture (Najmaldin, 2020). To illustrate, this phenomenon might be used to explain problems encountered by a tourist or a student who returned from a foreign country after staying there for a few years or months in terms of associating themselves with their own society. In this respect, xenocentrism is not a notion simply confined only to non-material cultures; it is also applicable to material cultures. Xenocentrism might also lead to cultural diffusion, which is a term referring to spread of material and non-material elements of a culture from one culture to another (Najmaldin, 2020; Balabanis & Diamantopoulos, 2016).

In the field of marketing and consumption, xenocentrism is conceptualized as consumer xenocentrism (CX) while explaining insistent willingness to purchase foreign products despite the presence of their high-quality domestic equivalents (Kent & Burnight, 1951; Mueller et al., 2016). Balabanis and Diamantopoulos (2016) define consumer xenocentrism as consumers' beliefs about inferiority of domestic products and their tendency to prefer foreign products as an instrument to improve their social status. Consumer xenocentrism is an actual trendy topic of study dealing with consumer behaviors, purchase intention and factors affecting their willingness to buy domestic and foreign products. The first research focusing on this issue was a theoretical study by Mueller and Broderick (2008), titled "Consumer xenocentrism: an alternative explanation for Foreign product bias". The study dealt with xenocentrism from a socio-psychological point of view and introduced research questions that are critical for international marketing strategy.

Another study carried out by Lawrence (2012) on consumer xenocentrism determined behaviors of consumers adopting global purchasing habits. Within the scope of the study, he developed a consumer xenocentrism scale that measures consumers' willingness to buy foreign products. The results showed that consumers with high level of income have higher xenocentrism tendency when compared to young consumers and consumers with high social status. The related studies using this scale found that Chinese consumers psychologically or sociologically prefer foreign products to domestic ones (Mueller & Broderick, 2008).

Still another study conducted in India examined the effect of country of origin on young consumers' purchasing behavior. According to the findings, foreign products are perceived superior to domestic ones by consumers and they display behaviors reflecting xenocentrism (Kala & Chaubey, 2016). Balabannis and Diamantopoulos (2016) made a two-dimensional conceptualization of consumer xenocentrism: perceived inferiority and social aggrandizement. They also developed a strong measurement tool for xenocentric behaviors displayed by consumers. Another study examined the effect of consumer xenocentrism on ethnocentrism and cosmopolitism, product category, and purchase intention for domestic and foreign original and counterfeit brands according to System Justification Theory. The findings revealed that consumer xenocentrism tendency affects ethnocentrism and cosmopolitism. In addition, the results showed that consumer xenocentrism could not account for consumers' intention to purchase (foreign) counterfeit products (Diamantopoulos et al., 2019). Mueller et al. (2020) determined the validity of the consumer xenocentrism scale adapted to wine consumption in Brazil. Hyun and Lee (2022) aim to evaluate how perceived authenticity of ethnic restaurants interacts with personality traits (ethnocentrism and xenocentrism) to predict behavioral intentions. A total number of 581 valid responses are analyzed via regression analyses. Findings show that both ethnocentrism and xenocentrism have positive impact of perceived authenticity on behavioral intention.

High degree of environmental concern and trust in sustainable producers were found as the antecedents of consumer xenocentrism by Ghaffar et al. (2023) leading to sustainable consumption behavior. Jiang and Christian (2023) proposed a theoretical framework identifying antecedents for the emergence of consumer xenocentrism. Areiza-Padilla and Cervera-Taulet (2023) aim to examine the effect of global and foreign brands, ethnocentrism and xenocentrism related to the consumer. In addition, it evaluates the impacts of xenocentrism, dogmatism and national identity in ethnocentrism. A total number of 778 valid responses collected from developing and developed countries are analyzed via structural equation modeling. Findings demonstrate that

while xenocentrism positively affects the image of global and foreign brands, ethnocentrism does not always negatively affect the image of global and foreign brands. Additionally, while xenocentrism negatively affects the ethnocentrism, national identity and dogmatism have positive impact on ethnocentrism.

It is not always possible to account for prejudices towards foreign products through superior product features and functionality; the reason lying behind these prejudices might also be successful representation of an ideal or value that might be aspired and defined by consumers. The related research also reports that most consumers - especially in developing markets - tend to buy foreign products due to socio-psychological factors such as earning respect. In addition, a biased attitude towards foreign products might reflect association with social and economic ideals criticizing his own national system (Mueller & Broderick, 2008).

This study aims to investigate the effect of consumer xenocentrism on purchase intention of Iraq-Kirkukian consumers for Turkish products. The conceptual framework of the study and hypothesis development are structured in the first part. Sampling, scales of the study and data analysis are presented in the second section. While results are presented in the third part, the discussion and conclusion comprise the remaining two sections.

1. Background and hypothesis

1.1. The effect of consumer xenocentrism on purchase intention

The study conducted by Dachs-Wiesinger (2018) with Austrian consumers reported that consumer xenocentrism positively affects foreign product purchase intention. Similarly, Diamantopoulos et.al. (2019) carried out a study with Russian consumers and found that consumer xenocentrism positively affects original foreign product purchase intention and negatively affects domestic product purchase intention. The research by Rettanai Kannan (2020) also revealed that consumer xenocentrism positively affects original foreign product purchase intention and negatively affects domestic product purchase intention. Another study conducted in Iran reported a negative and significant effect on purchase intention for Iranian products (Sheikhepoor et al., 2020).

A similar study carried out in Iran also revealed that consumer xenocentrism had a significant effect on foreign product purchase intention (Ghafourian et al., 2021). Rojas-Méndez and Chapa (2019) also concluded that high levels of xenocentrism result in higher willingness to purchase foreign products and low levels of xenocentrism leads to higher tendency to purchase domestic products. Camacho et al. (2020) found that consumer xenocentrism has a positive effect on willingness to purchase imported products. In a study conducted with Colombian consumers, Camacho et al. (2020), measured direct and indirect relationship between consumer xenocentrism and foreign product purchase intention. The authors suggested that consumer xenocentrism has a positive direct effect on imported product purchase intention, perceived product quality and product evaluation (Camacho et al., 2020). According to Pham and Nguyen (2020) consumer cosmopolitanism and xenocentrism have positive impact on consumers' purchase intention toward foreign products. Nguyen and Pham (2021) found that cosmopolitanism and xenocentrism attitudes positively affect consumer preference for foreign products in terms of Vietnamese consumers. Besides patriotism, wordmindedness, and materialism are stated as antecedents of consumer ethnocentrism, cosmopolitanism, and xenocentrism, respectively.

According to the results of the study made by Mahmoud et al. (2023), all other factors (country of origin, self-confidence, self-esteem) except country image and interpersonal influence positively affect consumer intention to purchase foreign products. Zhang and Zhang (2023) proposed a hypothesis model related to Chinese consumer xenocentrism in electronics industry by utilizing structural equation modeling.

Accordingly, the following hypothesis has been formed:

H_1: Consumer xenocentrism has an effect on willingness to purchase foreign products.

1.2. Consumer xenocentrism and demographic variables

It is acknowledged that demographic variables serve as a significant factor in decision making processes of consumers (Batra et al., 2000; Belk, 2000). The related studies often dealt with a variety of variables affecting attitude towards foreign products such as age, economic differences and urban and rural differences. The related studies revealed that young consumers display more xenocentric behaviors than elderly consumers,

(Batra et al., 2000) which is an indication of freedom of young people as defined by Kent and Burnight (1951). In their study conducted with Chinese consumers, Mueller et al. (2016) aimed to explain their willingness to purchase foreign products even when domestic products are better in terms of quality and price. The findings showed that consumers with a high-income level, young consumers and those with a high social status have higher levels of consumer xenocentrism.

Thus, it is quite possible that there is a positive correlation between income and xenocentrism (Kisawike, 2015). The studies revealed that consumers with high levels of income bought foreign products more (Belk, 2000). In other words, consumers with a high income are more xenocentric in preferring foreign products. However, some researchers suggest that individuals do not have to be in high-level income group in order to purchase expensive foreign products since those in the high-level income group sometimes purchase relatively less expensive foreign products or counterfeit products (Kisawike, 2015). Similarly, the findings regarding the impacts of urban and rural differences showed that consumers living in cities were more xenocentric than those living in rural areas. The reason lying behind this situation is that people living in urban areas are exposed to foreign products more than people living in rural areas and they are more familiar with these products. For instance, consumers living in cities in India purchase foreign products to enhance their prestige when compared to those living in rural areas (Mueller & Broderick, 2008).

In their study aiming to analyze the effect of country origin of a product on purchase intention of young Indian consumers, Kala and Chaubey (2016) examined consumer ethnocentrism and consumer xenocentrism. The study also found that young Indian consumers perceived foreign products superior to domestic products and were more xenocentric (Kala & Chaubey, 2016).

According to the results of the study made by Arora et al. (2019) while low power distance, individualist, and masculine cultures show strong and positive relationships between consumer xenocentrism and negative electronic word-of-mouth; high power distance, collectivist, and less masculine (or feminine) cultures show positive relationships between xenocentrism and positive electronic word-of-mouth.

Sheikhepoor et al. (2020) examined consumer xenocentrism and consumer purchasing behaviors for Iranian products. The study reported a low level of xenocentrism among Iranian consumers for beverages. The studies also found that there was a significant difference between consumer xenocentrism levels and age and marital status; however, they reported the lack of a significant difference between consumer xenocentrism and gender, income and educational background (Sheikhepoor et al., 2020).

Ethnic identity is a label adopted by groups degraded to minority status. It has a political content as well as social one; however, ethnic identity often involves a political content rather than social one when the basic reference points taken by this minority groups are cultural, political, lingual and religious. Foreign products are sometimes used by some groups to highlight their ethnic identity against a national one. The following hypotheses can be formulated in order to determine differentiations between consumer xenocentrism and demographic variables:

H_{2a} : Xenocentrism tendencies differ according to gender in terms of “brand trust for Turkish brands”

H_{2aa} : Xenocentrism tendencies differ according to gender in terms of “feeling proud of Turkish brands”

H_{2b} : Xenocentrism tendencies differ according to ethnic identity in terms of “brand trust for Turkish brands”

H_{2bb} : Xenocentrism tendencies differ according to ethnic identity in terms of “feeling proud of Turkish brands”

H_{2c} : Xenocentrism tendencies differ according to age groups in terms of “brand trust for Turkish brands”

H_{2cc} : Xenocentrism tendencies differ according to age groups in terms of “feeling proud of Turkish brands”

H_{2d} : Xenocentrism tendencies differ according to income levels in terms of “brand trust for Turkish brands”

H_{2dd} : Xenocentrism tendencies differ according to income levels in terms of “feeling proud of Turkish brands”

H_{2e} : Xenocentrism tendencies differ according to educational background in terms of “brand trust for Turkish brands”

H_{2ee} : Xenocentrism tendencies differ according to educational background in terms of “feeling proud of Turkish brands”

2. Materials and Methods

2.1. Sampling

The participants of the study were determined by using convenient sampling method. Turkmens, Arabs and Kurds who are older than 18 years old and live in Kirkuk, a city located in northern Iraq, were the population of the study. There are mainly two ethnic groups involved in the study. The first group consists of Turkmens and the participants in the second group are non-Turkmen, namely Arabs and Kurds. In fact, that the number of Turkmens, Arabic and Kurdish people living in Kirkuk are supposedly equal. The reason lying behind the absence of accurate data is that not a census had been carried out in the city for a long time. Also, the reason why there were more Turkmens among the participants is that the Kirkuk residents with Arabic and Kurdish ethnic origin were reluctant to participate in the study when they saw the phrase "Turkish products" in the survey. Although censuses were occasionally conducted in the country; the estimated population of Kirkuk was taken as 1.600.000 in the present study since no census was carried out in the city since 1997. The data related to the study were obtained via a survey. A total of 450 participants responded to the survey; however, 418 of them were included in the analyses due to missing or wrong information in some replies.

The participants were analyzed in terms of their ethnic identity, age, income level and educational background. Accordingly, 35% of them were male and 64.6% female. In addition, 65.6% of the participants were Turkmens and 25.6% Arabs and 8.9 % Kurds. As for the age variable, 33% of the participants were in 18-25 age group, 48.3% in 26-35, 12.4% in 36-45, 3.6% in 46-55, and 2.6% of them were 56 years old and older. In addition, 2.9% of the participants were primary school graduates, 9.1% high school, 22% of them graduated from associate degree programs, 79.4% undergraduate programs and 8.6% from graduate programs. Finally, the data regarding income levels were analyzed under four different categories: low income (0-121,000 ID), low-mid (122,000-560,000 ID), mid–high (561,000-960,000 ID) and high (961,000 ID and above).

2.2. Scales of the study

Xenocentrism tendencies of Kirkukian consumers were measured by using C-XENSCALE, which was developed by Lawrence (2012) and later revised based on the principles of System Justification Theory proposed by Balabanis and Diamantopoulos (2016) in accordance with C-XEN structure (Diamantopoulos et al., 2019; Balabanis & Diamantopoulos, 2016).

The study was piloted by administering the survey to 30 people in Iraq-Kirkuk. The surveys were given to these people face-to-face and collected back within a 10-day period. The obtained data were then analyzed to determine whether the scale was suitable for a larger sampling. According to the results of the reliability analysis, the item "There are few domestic products that are as high quality as Turkish products" was removed from Consumer Xenocentrism Scale (Diamantopoulos et al., 2019; Balabanis & Diamantopoulos, 2016). The scale was finalized after the detailed analysis. It was prepared both in Turkish and Arabic and administered online. The Cronbach Alpha coefficient of the consumer xenocentrism scale was calculated as (α)=0,87 and the Cronbach Alpha coefficient of purchase intention scale as (α)=0,88.

2.3. Data analysis

The collected data were analyzed by using SPSS 25 software at 95% degree of confidence. T-test and ANOVA test were performed to determine the correlations between demographic variables and xenocentrism. Factor analysis was done for the scales used in the study and multiple regression analysis was made to explore the effect of consumer xenocentrism on purchase intention for Turkish products.

3. Results

3.1. Factor analysis for consumer xenocentrism

The factor analysis performed for consumer xenocentrism revealed a KMO value of 0.89, which suggests that the sampling was suitable for factor analysis (KMO>0,5). In Barlett globality test, x^2 value was calculated as 1841,48 and it was statistically significant ($p<0,05$). Therefore, the data were suitable for factor analysis according to the results of KMO and Barlett test.

Table 1 presents the results of the factor analysis for consumer xenocentrism. Xenocentrism scale has two factors. The first one is called "Trust in Turkish Brands" and consists of 5 items whose factor loads vary between 0.85 and 0.69. This factor explains 37.20 of the variance and

its reliability coefficient is 0.69. The second factor is "Feeling proud of Turkish products", which consists of 4 items whose factor loads range between 0.79 and 0.74. This factor accounts for 28.73% of the total variance and has a reliability coefficient of 0.86.

Table 1 Exploratory factor analysis for consumer xenocentrism

	Factors Loads
Factor1: Trust in Turkish Brands Explained Variance: 37.20%; eigen value: 4.64; Alpha α:0,86	
I trust Turkish companies more than domestic ones since they are more experienced and have more resources.	0,85
I trust Turkish products more than domestic ones.	0,82
Turkish products perform better than domestic ones in most of the product categories.	0,81
I prefer to buy Turkish products.	0,81
I cannot think of a domestic brand that is as good as Turkish ones.	0,69
Factor2: Feeling proud of Turkish brands Explained Variance: 28.73%; eigen value: 1.28; Alpha α:0,80	
Those who buy a domestic product are recognized by others less.	0,79
I feel more modern when I buy Turkish products, I buy foreign products to stand out among other people.	0,78
I prefer Turkish products to domestic ones since most of the people I know buy Turkish products.	0,76
Buying Turkish products boosts my self-esteem	0,74
Total Explained Variance: 65%; Cronbach Alpha value: α:0,86	

Source: the authors

3.2. Factor analysis on purchase intention for Turkish products

The factor analysis performed for purchase intention for Turkish products revealed a KMO value of 0.70, which indicates that the sampling was suitable for factor analysis (KMO>0,5). In Barlett globality test, x^2 value was found to be 769.52 and statistically significant (p<0,05). Therefore, the data were suitable for the factor analysis according to the results of KMO and Barlett test.

Table 2 Exploratory factor analysis for intention to buy Turkish products

	Factor Loads
Factor1: Intention to buy Turkish products Explained Variance: %81.44; eigen value: 2.44; Alpha α:0,88	
I prefer to buy Turkish products	0,93
I consider buying Turkish products	0,92
It is highly possible that I buy Turkish products.	0,85

Source: the authors

Table 2 displays the results of the factor analysis performed for purchase intention for Turkish products. The scale has one factor, which consists of 3 items whose factor loads vary between 0.85 and 0.93. The factor explains %81.44 of the total variance and its reliability coefficient is 0.88.

3.3. The Effect of consumer xenocentrism on purchase intention for Turkish products

Multiple regression analysis was performed to analyze the effect of consumer xenocentrism on purchase intention for Turkish products. The regression analysis assumptions were tested prior to the analysis. The correlation coefficients between the variables were examined in order to test the presence or absence of multicollinearity. Correlations with a value of 0.80 or higher indicate the presence of multicollinearity (Kalaycı, 2010). In the present study, the correlation coefficients between the variables ranged between 0.47 (Trust in Turkish brands) and 0.48 (Feeling proud of Turkish brands). The correlation coefficients were lower than 0.80. Tolerance and VIF values were also examined while evaluating multicollinearity, which were calculated as 0.66 and 1.50 respectively. A VIF value higher than 10 indicates a multicollinearity; therefore, it was concluded that there was not a multicollinearity in the present study. In addition, Durbin Watson statistics were utilized to determine the autocorrelation value, which was calculated as 1.94. A DW value ranging between 1.5 and 2.5 shows the presence of autocorrelation. Therefore, the value calculated for this study indicates the lack of autocorrelation.

Table 3 The effect of consumer xenocentrism on purchase intention for Turkish products

	Dependent Variable Purchase intention for Turkish Products					
Independent Variables	Std β	t	p	R	R^2	F
Factor1: Trust in Turkish Products	0,59	13,64	0,01**	0,68	0,47	186,72**
Factor2: Feeling proud of Turkish Products	0,14	3,28	0,01**			
Constant		10,25	0,01**			

∗p < 0,05; ∗∗p < 0,01

Source: the authors

According to the results of the regression analysis, the obtained values (F = 186,72; p < 0,01) show that the effect of consumer xenocentrism on purchase intention for Turkish products is significant (H_1 hypothesis). The factors of

consumer xenocentrism explain 47% of the dependent variable "Purchase intention for Turkish products". When we examine the standardized beta (β) values regarding regression, we can conclude that "Trust in Foreign (Turkish) products" factor (β = 0,59; p < 0,01) and "Feeling proud of foreign (Turkish) products" factor (β = 0,14; p < 0,01) influence purchase intention for Turkish products.

3.4. Differences in consumer xenocentrism according to participants' demographic features

3.4.1. Differences in consumer Xenocentrism according to gender variable

T-test was performed to determine whether consumer xenocentrism factors differ according to gender, and the results were displayed in Table 4.

Table 4 Differences in consumer xenocentrism according to gender variable

Factors	Gender	n	Mean	df	t	p
Factor 1: Trust in Turkish Products	Male	148	3,62	416	0,40	0,68
	Female	270	3,58			
Factor 2: Feeling Proud in Turkish Products	Male	148	3,08	416	2,88	0,01**
	Female	270	2,80			

∗p < 0,05; ∗∗p < 0,01

Source: the authors

According to Table 4, there is not a significant difference (t=0,40; p=0,68) between gender and "Trust in Turkish Products", which is a factor of consumer xenocentrism. However, gender significantly differs according to the factor "Feeling proud of Turkish products" (t=2,88; p=0,01**). Thus, H_{2a} hypothesis was rejected while H_{2aa} hypothesis was accepted. The findings regarding "feeling proud of Turkish products" revealed that males who buy Turkish products feel proud of with Turkish products more than females.

3.4.2. Differences in consumer xenocentrism according to the participants' ethnic identities

The researchers used t-tests in order to determine whether consumer xenocentrism factors differ according to participants' ethnical background. The results of the analysis are presented in Table 5 below.

Table 5 Differences in consumer xenocentrism according to ethnic identity

Factors	Ethnic Identity	n	Mean	df	t	p
Factor1: Trust in Turkish products	Turkmen	274	3,82	416	8,29	0,01**
	Non-Turkmen	144	3,15			
Factor2: Feeling Proud in Turkish products	Turkmen	274	3,10	416	6,32	0,01**
	Non-Turkmen	144	3,50			

∗p < 0,05; ∗∗p < 0,01

Source: the authors

As shown in Table 5, the factors "Trust in Turkish brands" (t=4,95, p=0,01**) and "Feeling proud of Turkish brands" (t=4,95, p=0,01**) differ significantly according to ethnic identity. Thus, H_{2b} and H_{2bb} hypotheses are accepted. As for the differences between the ethnic identities, the study revealed that Turkmens trust and feel proud of Turkish brands more than the participants in the other ethnic group.

3.4.3. Differences in Consumer Xenocentrism According to Age Groups of the Participants

ANOVA analysis was done in order to determine whether consumer xenocentrism factors differ according to age groups.

Table 6 Differences in consumer xenocentrism according to age groups

Factors	Age Groups	n	Mean	df	F	p
Factor1: Trust for Turkish Products	18-25	138	3,49	4	1,56	0,18
	26-35	202	3,59			
	36-45	52	3,78			
	46-55	15	3,81			
	56 +	11	3,82			
Factor2: Feeling Proud of Turkish Products	18-25	138	2,81	4	0,62	0,64
	26-35	202	2,90			
	36-45	52	2,98			
	46-55	15	3,08			
	56 +	11	3,11			

∗p < 0,05; ∗∗p < 0,01

Source: the authors

As seen in Table 6, there is a not a significant difference between age groups and "Trust in Turkish products" (F=1.56, p=0.18) and "Feeling proud of Turkish products" (F=0.62, p=0.64). Therefore, H_{2c} and H_{2cc} hypotheses are rejected.

3.4.4. Differences in consumer xenocentrism according to participants' income levels

ANOVA Test was performed in order to determine whether consumer xenocentrism factors differ according to participants' income levels of the. The results are displayed in Table 7 below.

Table 7 Differences in consumer xenocentrism according to income levels

Factors	Income levels	n	Means	df	F	p
Factor1: Trust in Turkish products	0-120.000 ID	104	3,48	3	1,88	0,13
	121.000-560.000ID	123	3,55			
	561.000-960.000 ID	129	3,73			
	961.000 ID and above	61	3,57			
Factor2: Feeling proud of Turkish products	0-120.000 ID	104	3,01	3	1,98	0,11
	121.000-560.000ID	123	2,74			
	561.000-960.000 ID	129	2,98			
	961.000 ID and above	61	2,83			

∗p < 0,05; ∗∗p < 0,01

Source: the authors

Table 7 indicates the absence of a significant difference between income levels and the factors "Trust in Turkish products" (F=1,88 p=0,13) and "Feeling proud of Turkish products" (F=1.98, p=0.11). Accordingly, hypotheses H_{1d} and H_{1dd} were rejected, which signifies that consumer xenocentrism do not differ between income levels.

3.4.5. Differences in consumer xenocentrism according to participants' educational background

ANOVA Test was done in order to determine whether consumer xenocentrism factors differ according to participants' educational backgrounds. Table 8 below presents the results.

Table 8 Differences in consumer xenocentrism according to educational background

Factors	Education Levels	n	n	df	F	p
Factor1: Trust for Turkish products	Primary school	12	3,58	3	1,16	0,91
	High school	38	3,60			
	University	332	3,58			
	Graduate degree programs	36	3,69			
Factor2: Feeling proud of Turkish products	Primary school	12	2,91	3	0,05	0,98
	High school	38	2,92			
	University	332	2,89			
	Graduate degree programs	36	2,95			

∗p < 0,05; ∗∗p < 0,01

Source: the authors

According to Table 8, "trust for Turkish products" (F=1,16 p=0,91) and "feeling proud of Turkish products" (F=0,05, p=0,98) do not significantly differ according to educational backgrounds of participants. Therefore, H_{1e} and H_{1ee} hypotheses were rejected. In other words, consumer xenocentrism do not differ between educational backgrounds.

4. Discussion

There are a lot of factors affecting xenocentrism such as social status, modernity, reverse purchasing behavior, ethnical identity, collectivism, individualism and demographic features of consumers. The present study examines the effect of consumer xenocentrism on purchase intention for Turkish products and how consumer xenocentrism differs according to demographic variables. The factor analysis done for consumer xenocentrism scale revealed a two-factor structure: trust for Turkish products and feeling proud of Turkish products, which is also consistent with the results of the similar studies (Diamantopoulos et al. 2019; Balabanis & Diamantopoulos, 2016). The study reported a positive and significant effect of consumer xenocentrism on purchase intention for Turkish products. This finding is supported by the studies concluding a positive effect of consumer xenocentrism and purchase intention for foreign products (Diamantopoulos et al. 2019; Dachs-Wiesinger, 2018; Rettanai Kannan, 2020; Camacho et al., 2020).

In addition, consumer xenocentrism differed according to gender; males were more xenocentric than females. In addition, men felt proud of Turkish brands more than women. This finding is supported by similar studies; indeed, they reported a higher xenocentric tendency – foreign product bias- in male-oriented or male-focused cultures or societies.

Another significant finding regarding demographic variables is that consumer xenocentrism differed according to ethnic identity. It was found that Turkmen consumers are more xenocentric than Arabic and Kurdish ones. This finding is consistent with the statement "idealizing cultures, values and countries of their own ancestors and justifying their behaviors" as specified in the study by Kent and Burnight (2002). It is clear that Turkmens preferred to buy Turkish products and more xenocentric than non-Turkmen consumers because they see Turkey as their mainland and speak the same language and adopt the same culture and values. On the other hand, Arabic and Kurdish consumers were less xenocentric than Turkmens in their purchase intention for Turkish products although they sometimes use them, which is believed to be due to historical, political and socio-economic reasons. Indeed, there is still an ongoing and long-lasting hatred among Arabs and Kurds towards Turks and

Turkey reacted against the Kurds' attempts to found their independent state. Thus, they do not like, even hate, Turks although they use Turkish products. According to some researchers, it might be assumed that individuals living in societies experiencing economic, social and political constraints will be more xenocentric (Mueller & Broderick, 2008).

The present study did not reveal a difference according to age variable. This finding contradicts with that of the study by Batra et al., (2000), which stated that young consumers are more xenocentric than elderly ones. According to Kent and Burnight (2002), the reason for this tendency is the attempts of young people to voice their freedom. Similarly, consumer xenocentrism did not differ according to income level, which is not consistent with the findings of similar studies. These studies reported a positive correlation between xenocentrism and income level and those with a high income (rich people) have a higher tendency to be xenocentric (Kisawike, 2015).

The average income in Kirkuk is between 3400-4000 ID, which is considered as low income in Iraq economic standards. Although Kirkuk houses 4% of total world oil reserve, insufficient employment opportunities and young population unemployment, absence of international companies and private business enterprises in the city, and unstable political conditions might be among the reasons of this low-income level. Some studies reported that consumers with low income display a higher tendency for xenocentrism. Consumer xenocentrism did not differ according to educational background. In conclusion, consumer xenocentrism had a significant effect on purchase intention and differed according to demographic variables due to high volume of trade between two countries. This finding might be valuable and guiding for the entrepreneurs of both countries. The results of the present study might play a role in market segmentation of such a market involving consumers with different ethnic identities.

5. Conclusion

Although xenocentrism was introduced to sociology literature by Kent and Burnight (1951), it was regarded as a relatively new issue in marketing literature. Despite the increase in the number of studies on this issue as of 2008, field studies are still insufficient in number when the richness and comprehensive content of the literature on consumer behaviors are considered (Balabanis & Diamantopoulos, 2016; Rojas-Méndez & Chapa, 2019). Therefore, this study is expected to contribute to the literature with its invaluable data. In addition, the study is significant since it is one of the few studies aiming to determine which variables and factors affect purchase intentions.

The most challenging constraints in this study were time and financial ones. The researchers could not make use of some sources effectively while determining the participants since there was limited time, the study was not supported financially and the study was conducted in Kirkuk which has the most ethnic identity in

Iraq and is a place where Turkmens live more densely than other cities Iraq, so the results cannot be generalized and conducting this research in other countries will yield different results. For future studies, examining the structure of consumer xenocentrism in developed economies would provide additional information about the prevalence and impact of xenocentric tendencies in these countries. Additionally, it can be investigated the impact of consumer xenocentrism on other variables such as product decisions, risk perceptions and willingness to pay.

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Global minds, local impact: exploring the effect of foreign directors on corporate R&D expenditure

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Abstract

Background: In the contemporary business environment, corporate research and development (R&D) expenditure is pivotal for fostering technological innovation and advancing technological progress. While much research has focused on the influence of boards of directors on corporate innovation, the role of foreign directors in shaping corporate R&D expenditure, particularly in developing countries, remains underexplored.

Purpose: The aim of this paper is to investigate the pivotal role of foreign directors in corporate R&D expenditure within Chinese listed manufacturing firms. It also provides micro-level evidence of the economic consequences of foreign directors, considering heterogeneity across property rights, industry, regional dimensions, and board positions.

Study design/methodology/approach: This study utilizes the largest and most detailed dataset of Chinese listed manufacturing firms in the CSMAR database, offering comprehensive proxy variables. The sample encompasses 18,273 observations from 2008 to 2021. Multivariate regression models, employing static two-way fixed effects models with clustered robust standard errors and dynamic generalized method of moment (GMM) models, were established to investigate the relationship between foreign directors and corporate R&D expenditure. Sensitivity tests involve the substitution of dependent and core explanatory variables. Moreover, heterogeneity test and situational analysis are conducted.

Findings/conclusions: The results confirmed a significant augmentation in corporate R&D expenditure attributable to foreign directors. Heterogeneity analysis reveals that the positive impact of foreign directors on R&D expenditure is more pronounced in private-owned enterprises, high-tech industries, and economically developed regions of China. Situational analysis further confirms that foreign independent directors are the main driving force behind this effect.

Limitations/future research: This research is confined to a single-country and single-industry sample, without a comprehensive consideration of the individual traits of foreign directors. Future research avenues could involve cross-national comparisons and a more nuanced categorization of foreign directors.

Keywords

Foreign directors, corporate R&D expenditure, corporate governance, agency theory, developing countries

Introduction

Corporate research and development (R&D) expenditures play a critical role in the process of transforming new technologies into innovative outcomes, consequently attracting increasing attention in the academic literature (e.g., Domazet et al., 2023; Pu & Zulkafli, 2024; Schot & Steinmueller, 2018; Sharma et al., 2022). Strategies concerning R&D expenditure are often intertwined with the board of directors, who are entrusted with the responsibility of protecting shareholder interests and returns (Ali et al., 2021; Xia et al., 2023). The presence of foreign directors among these board members has rarely ignited discussions within the field of firms' innovation

strategies. While some financial economists have confirmed that the inclusion of foreign directors in board governance structures can be an effective governance tool with the potential to promote patent output and reshape the competitive landscape of firms (e.g., Prencipe et al., 2022; Tao et al., 2022; Xiang & Yi, 2022), the extent to which foreign directors, with their unique backgrounds, perspectives, and experiences, stimulate R&D expenditure remains a relatively understudied issue in the field of R&D strategy.

Indeed, the decisions and monitoring exercised by the board of directors play a key role in determining the success or failure of innovation strategies (Balsmeier et al., 2014; Chen et al., 2016; Shui et al., 2022). This is mainly because innovation activities in most cases require long-term commitments and have a high failure rate (Xiang & Yi, 2022; Xie et al., 2022). Such complexity can lead to managerial conservatism (Jun & Wang, 2018) and potentially hinder investment in R&D projects, as managers may prefer to allocate resources to short-term projects that promise more immediate returns (Chen et al., 2016; Sharma et al., 2022; Xiang & Yi, 2022). Therefore, the monitoring role of the board of directors should be emphasised to mitigate managerial self-interested behaviour.

In contrast to local directors, foreign directors are more independent from the firm's managers. Due to this greater independence, foreign directors have a better vantage point for monitoring managers, which is beneficial for ensuring that R&D resources are well allocated (Masulis et al., 2012; Xiang & Yi, 2022). Therefore, this paper argues that foreign directors can significantly monitor a firm's R&D decisions. Previous research has suggested that foreign directors may not significantly contribute to R&D investment (e.g., Attia et al., 2020). However, our findings are inconsistent with the prior literature. As far as we are concerned, this may arise from the following factors:

(1) Data quality. Previous research has been constrained by regional limitations, and the majority of studies were conducted before 2010. The information on R&D investment was fragmented and not uniformly reported at the national level, making it difficult for these researchers to obtain both accurate and complete data.

(2) Method heterogeneity. Prior studies failed to address potential problems arising from firm-specific characteristics over time. Additionally, the presence of heteroscedasticity and serial correlation issues in panel data often affect the validity of their results.

(3) Differences in the institutional environment. Divergences in institutional environments between developing and developed countries have significant implications for a firm's talent acquisition strategies, resource availability, and intellectual property landscape in the context of innovation (Balsmeier et al., 2014; Donbesuur et al., 2020; Masulis et al., 2012). In short, the conclusions drawn from previous studies conducted with developed countries as samples may not be applicable to developing nations. These factors collectively shape a firm's strategic tendency and ability to invest in innovation in different institutional environments.

To address the limitations above, our research sample primarily focuses on publicly listed manufacturing firms in China. As of 2022, China has maintained its position as the world's leading manufacturer for 13 consecutive years (Pu & Zulkafli, 2024). The rich dataset available in this industry can provide valuable insights into how R&D strategies drive innovation trends. Additionally, since the Chinese government-initiated policies such as the "Thousand Talents Plan" in 2008 to attract foreign talent, the manufacturing sector has emerged as a key area for attracting foreign managerial talent to drive innovation and technological advancement (Lin & Guan, 2023; Yuan & Wen, 2018).

Using R&D data from publicly listed manufacturing firms in China spanning from 2008 to 2021 and employing multiple estimation techniques (static panel data estimation and dynamic GMM estimation), our study reveals a significant positive relationship between the presence and proportion of foreign directors and corporate R&D expenditure. Heterogeneity analysis indicates that the facilitating role of foreign directors is particularly pronounced in private-owned enterprises, high-tech industries, and developed regions of China. Situational analysis further confirms that foreign independent directors are the main driving force behind this effect. These findings underscore the critical role of foreign directors in driving corporate R&D strategies.

Our paper provides several contributions. First, given the limited academic attention to the involvement of foreign directors in corporate decision-making (Florackis & Sainani, 2018), this study provides theoretical support within the

context of the corporate governance literature from an agency theory perspective. Second, by adopting static and dynamic model estimation techniques that focus on the personal characteristics of foreign directors, this study further substantiates the determinants of a firm's R&D investment effort. This empirical evidence sheds light on the question of which board composition is more conducive to innovation activities Third, the heterogeneity effects of foreign directors in boosting corporate R&D strategies underscores a valuable implication for policymakers, as it supports the shift towards an innovation-centred economy through improved corporate governance mechanisms and an innovative institutional environment.

The structure of the paper is as follows: Section 1 reviews the theory and develops the hypotheses. Section 2 explains the data sources and methods used. Section 3 presents the empirical findings. The concluding section provides a summary following a discussion of the results.

1. Literature review and hypotheses

1.1. Agency theory

Agency theory is one of the most important theories in corporate governance (Eisenhardt, 1989; Fama & Jensen, 1983; Farooq et al., 2022). The theory emphasises that agents may not always serve the best interests of the principal, especially in situations of information asymmetry and potential conflicts of interest with the principal (Balsmeier et al., 2014; Fama & Jensen, 1983; Xiang & Yi, 2022). This could lead to managers pursuing their interests at the expense of shareholders (Du et al., 2017; Eisenhardt, 1989; Farooq et al., 2022).

Indeed, corporate governance often requires the involvement of the board of directors. According to Palia and Lichtenberg (1999), information asymmetry can lead self-interested managers to shirk their responsibilities or use firm resources for their benefit, such as seeking excessive compensation and personal consumption. The monitoring role of the board serves as a mechanism to mitigate agency problems between shareholders and managers (Chen et al., 2016; Eisenhardt, 1989; Jun & Wang, 2018). The directors' independence and expertise enable it to assess the long-term potential value of innovation projects, rather than focusing solely on short-term returns (Farooq et al., 2022; Xiang & Yi, 2022; Xie et al., 2022). More important is the board monitoring the managerial execution of decisions and resource allocation; this monitoring function helps to reduce managerial conservatism and promote investment in innovation activities (Fama & Jensen, 1983; Jun & Wang, 2018; Sharma et al., 2022).

1.2. Determinants of corporate R&D expenditure

Existing research indicates that R&D expenditure serves as a driver for corporate innovation, technological collaboration, and economic growth (Ahmad & Zheng, 2022; Boeing et al., 2022). In response to the changing landscape of business competition, firms strive to develop new inventions and enhance competitiveness, thereby generating substantial profits from innovative activities (Farida & Setiawan, 2022). However, in the realm of daily operational management, various factors including firm assets, firm age, financial leverage, board size, industry concentration, return on equity, and Tobin's Q, exert influences on R&D expenditure.

Previous studies have shown that firms with larger asset bases often possess stronger financial capabilities to allocate resources towards R&D activities (Choi et al., 2021). Drawing from the resource dependency perspective, firms endowed with abundant resources are deemed better positioned to invest in innovation and technological advancement (Ahmad et al., 2024). Simultaneously, younger firms, characterized by higher levels of entrepreneurial spirit and risk propensity, tend to allocate a greater proportion of resources to R&D activities compared to their more mature counterparts (Zhou et al., 2023). Concerns regarding debt servicing and financial risk may impose constraints on firms with higher levels of financial leverage when seeking external financing for R&D projects. Consequently, such firms may exhibit lower R&D expenditure compared to those with lower leverage ratios (O'Connell et al., 2022).

Moreover, larger board sizes are associated with greater diversity of expertise and perspectives, facilitating strategic decision-making regarding R&D investments (Muhammad et al., 2024). Firms operating in industries with higher concentrations may face lesser competitive pressures for innovation, resulting in lower R&D expenditure. Conversely, firms in highly competitive industries may prioritize R&D investments as a means to differentiate themselves and gain competitive advantages (Du et al., 2022). Meanwhile, higher return on equity levels suggests greater financial capacity to allocate resources

towards R&D activities (Tömöri et al., 2022). Firms with higher Tobin's Q ratios are inclined towards investing in R&D activities to enhance intangible assets, increase market value, and maintain competitiveness (Vithessonthi & Racela, 2016).

1.3. Foreign directors and corporate R&D expenditure

Empirical research on the relationship between foreign directors and corporate R&D expenditure is relatively scarce and has focused on developed countries within the European Union. Attia et al. (2020) used a sample of 120 firms listed on the French stock exchange from 2002 to 2013 and reached a negative conclusion, which suggests a significant negative impact of foreign directors on R&D expenditure. However, the results highlight the limitations of using small sample data to examine the relationship between foreign directors and corporate R&D expenditure.

In explaining the relationship between foreign directors and corporate R&D expenditure, this study uses agency theory since one of the main roles of the board of directors is to monitor managers (Fama & Jensen, 1983; Farooq et al., 2022). Agency theory emphasises that the board of directors is an effective mechanism for constraining managerial opportunism and addressing agency problems between managers and shareholders (Eisenhardt, 1989; Masulis et al., 2012). On the one hand, independence of foreign directors can reduce managerial discretion and thus prevent managerial manipulation of R&D investments. Asymmetric information causes increased costs associated with transactions, which leads to issues of moral hazards and asymmetric information. These issues can significantly decrease the effectiveness of R&D capital allocation (Chen et al., 2016; Jun & Wang, 2018). Compared to local directors, foreign directors have much weaker social networks that enhance their independence and, in turn, their ability to improve the efficiency of board monitoring, thereby reducing managerial discretion and avoiding underinvestment in R&D expenditure (Balsmeier et al., 2014; Jun & Wang, 2018).

On the other hand, heterogeneity of foreign directors can more effectively mitigate agency problems in R&D activities. Some research has indicated that foreign directors are more likely to exhibit heterogeneity in terms of background and experience (Castro et al., 2009; Farooq et al., 2022). The monitoring role of the board is enhanced by director heterogeneity, and agency conflicts are reduced because diverse backgrounds and experiences are more likely to question management's decisions, which homogeneous boards may not possess (Balsmeier et al., 2014; Jun & Wang, 2018; Masulis et al., 2012).

In summary, the above argument has led to the following hypothesis:

H1: There is a positive relationship between foreign directors and corporate R&D expenditure.

2. Data and methodology

2.1. Data sources

Considering data quality, all the data used in this study are sourced from the China Stock Market and Accounting Research (CSMAR) database, which includes items such as R&D expenditure, directors' nationalities, and other pertinent financial information. The CSMAR database is a well-known repository in the field of economic and financial data, renowned for its extensive coverage and credibility within the context of Chinese financial markets.

Furthermore, our dataset encompasses manufacturing firms listed on the Shenzhen and Shanghai stock exchanges from 2008 to 2021. This selection is based on the dominance of manufacturing firms within this database, offering comprehensive and abundant information. To ensure the reliability of our analysis, drawing on previous research (e.g., Xiang & Yi, 2022; Zhang et al. 2020), the study conducted several preprocessing procedures. First, "special treatment" firms, defined as those that suffered continuous losses for two consecutive years and thus faced delisting risks, were excluded from the dataset to avoid the influence of extraordinary financial conditions. Second, observations with missing data were systematically removed to mitigate the potential impact of missing values. Third, to further reduce the influence of extreme values, a winsorisation process was applied to all continuous variables at the 1st and 99th percentiles. Finally, this process of rigorous data preparation resulted in a total sample of 18273 firm-year observations.

Table 1 Variable definitions and measurements

	Measurements	References
Panel A: Dependent variables		
Corporate R&D expenditure (CRDE and CRDE_alter)	CRDE is the R&D input divided by business revenue. CRDE_alter is the R&D input divided by assets.	(Sunder et al., 2017; Zhang et al., 2020)
Panel B: Independent Variables		
Foreign directors (FD1, FD2, and FD3)	FD1 is the percentage of foreign directors divided by the total number of board members. FD2 is a dummy variable that takes the value of 1 for the presence of a foreign director on the board and 0 otherwise. FD3 is the number of foreign directors on the board.	(Du et al., 2017; Yuan & Wen, 2018)
Panel C: Control variables		
Firm age (FA)	The natural logarithm of the number of years since the firm's establishment plus one.	(Liu & Lv, 2022)
Firm size (FS)	The logarithm of total assets.	(Ding et al., 2022)
Financial leverage (LEV)	The total debts of a firm divided by total assets.	(Yuan & Wen, 2018)
Board size (BS)	The natural logarithm of total number of board members.	(McGuinness et al., 2017)
Market concentration (HHI)	Measured by the Herfindahl-Hirschman Index (HHI), reflects the degree of market competitiveness within an industry.	(Wu et al., 2018)
Return on equity (ROE)	The ratio of net Income divided by average shareholders' equity.	(Shan et al., 2023)
Tobin's Q (TQ)	The ratio of the market value of a firm's assets to their replacement cost.	(Hou & Li, 2022)

Source: the authors

2.2. Variable measurement

The dependent variable of this study was corporate R&D expenditure (CRDE and CRDE_alter). Its measurement uses research and development investment information from the CSMAR database as the measurement source for R&D expenditure. Following past studies (e.g., Morbey 1989; Sunder et al. 2017; Zhang et al. 2020), the measure of corporate R&D expenditure (CRDE), is R&D input divided by business revenue. The second measure is CRDE_alter, which is R&D input divided by assets. It should be emphasized that the second indicator serves as a measure of corporate R&D expenditure for robustness checks.

The independent variable of our focus is foreign directors (FD1, FD2, and FD3). Following the approach of Du et al. (2017) and Yuan and Wen (2018), this study uses a ratio variable (FD1), a dummy variable (FD2), and a number variable (FD3) to explore the role of foreign directors. Specifically, FD1 is the percentage of foreign directors divided by the total number of board members, FD2 is a dummy variable that takes the value of 1 for the presence of a foreign director on the board and 0 otherwise, and FD3 is the number of foreign directors on the board.

Regarding control variables, following previous studies (e.g., Ding et al., 2022; Liu & Lv, 2022; McGuinness et al., 2017; Yuan & Wen, 2018), this study controls for a set of variables that may be biased towards R&D expenditure, such as firm size (FS), firm age (FA), financial leverage (LEV), board size (BS), market concentration (HHI), return on equity (ROE), and Tobin's Q (TQ). Additionally, this research also controls for the impact of firm and year factors to capture firm and year fixed effects. Table 1 presents the definitions and measurements of all variables used in this study.

2.3. Estimation techniques

To mitigate potential endogeneity concerns, this research employs both static panel data estimation and dynamic panel data estimation. Specifically, a two-way fixed effects model is adopted for the static panel data analysis. This selection is motivated by two crucial factors. First, the two-way fixed-effects model effectively captures both firm-specific and time-specific effects, thus providing a robust framework for identifying causal relationships between influencing factors and corporate innovation investment. Second, the F test and Hausman test both reject the null hypothesis of the validity of the pooled ordinary least squares (POLS) and random effects (RE) model estimates, indicating that the fixed effects (FE) model is appropriate for the primary analysis and further heterogeneity testing.

Furthermore, as there may be reverse causality and the potential presence of unobservable variables affecting the relationship between foreign directors and corporate R&D expenditure,

some endogeneity issues are expected. The dynamic generalized method of moments (GMM) model, which depends on instrumental variables, is an effective method for addressing endogeneity concerns of reverse causality and omitted variables (Arellano & Bond, 1991; Blundell & Bond, 1998). Consequently, this study also uses a two-step system GMM panel data estimation, known for its improved estimation efficiency, to estimate the relationship between foreign directors and corporate R&D expenditure. The basic empirical model used in the two-way fixed effects Model (1) and dynamic innovation investment Model (2) are as follows:

$$CRDE_{i,t} = \alpha_0 + \alpha_1 FD_{i,t} + \alpha_2 FS_{i,t} + \alpha_3 FA_{i,t} + \alpha_4 LEV_{i,t} + \alpha_5 ROA_{i,t} + \alpha_6 BS_{i,t} + \alpha_7 HHI_{i,t} + \alpha_8 ROE_{i,t} + \alpha_9 TQ_{i,t} + Year + Firm + \varepsilon$$

Model (1)

$$CRDE_{i,t} = \alpha_0 + \alpha_1 CRDE_{i,t-1} + \alpha_2 FD_{i,t} + \alpha_3 FS_{i,t} + \alpha_4 FA_{i,t} + \alpha_5 LEV_{i,t} + \alpha_6 ROA_{i,t} + \alpha_7 BS_{i,t} + \alpha_8 HHI_{i,t} + \alpha_9 ROE_{i,t} + \alpha_{10} TQ_{i,t} + Year + Firm + \varepsilon$$

Model (2)

where α_0 denotes the intercept, and $\alpha_1 - \alpha_{10}$ are the coefficients to be estimated. This study added dummy variables that control for year and firm fixed effects (Year and Firm), ε is the error term, i denotes the cross-sectional dimension for firms, and t denotes the time series dimension. The definitions of all key variables are given in Table 1.

3. Empirical results

3.1. Descriptive statistics

Table 2 presents the descriptive statistics of the number of observations; and the mean, minimum and maximum values of the main variables of our sampled firms from 2008 to 2021. According to Table 2, the mean (standard deviation) value of corporate R&D expenditure (CRDE and CRDE_alter) are 0.0433 (0.0387) and 0.0231 (0.0178) respectively. The mean value of the first indicator, foreign directors (FD1) is 0.0174 with a standard deviation of 0.0571, suggesting that the presence of foreign directors varies from firm to firm. The second measure of foreign directors (FD2) is a dummy variable, and its mean (standard deviation) value is 0.1043 (0.3056). The average and standard deviation of the third foreign directors (FD3) measurement are 0.1600 and 0.5781, respectively. In terms of the control variable, the firms in our sample have an average firm size of 22.0298, firm age of 2.8370, financial leverage of 3.7024, board size of 2.1198, market concentration of 0.1570, return on equity of 0.0796, and Tobin's Q of 2.1041.

Table 2 Descriptive statistics

	Observations	Mean	Std.Dev	Min	Max
CRDE	18273	0.0433	0.0387	0.0000	0.2950
CRDE_alter	18273	0.0231	0.0178	0.0000	0.1207
FD1	18273	0.0174	0.0571	0.0000	0.3333
FD2	18273	0.1043	0.3056	0.0000	1.0000
FD3	18273	0.1600	0.5781	0.0000	10.0000
FS	18273	22.0298	1.1520	19.5394	25.8518
FA	18273	2.8370	0.3495	0.6931	4.1589
LEV	18273	3.7024	3.1617	1.2221	35.3616
BS	18273	2.1198	0.1884	1.6094	2.7081
HHI	18273	0.1570	0.1069	0.0144	0.5950
ROE	18273	0.0796	0.1013	-0.5532	0.4500
TQ	18034	2.1040	1.2650	0.8481	9.8236

Source: the authors' calculation based on the CSMAR database.

3.2. Correlation and variance inflation factor analysis

Table 3 shows Pearson's correlation coefficients for the main variables. The preliminary correlation among variables in which the value of the correlation coefficient of foreign directors (FD1), financial leverage (LEV), and Tobin's Q (TQ) has a positive relationship with corporate R&D expenditure (CRDE), while firm size (FS), board size (BS), market concentration (HHI), and return on equity (ROE) has an adverse effect on CII. In addition, firm age (FA) was not found to have a significant association with CRDE.

To further investigate the presence of multicollinearity, this study calculates the variance inflation factor (VIF) for the main variables. The largest VIF is 1.38, which is well below the rule of thumb cut-off of 10.00 for multiple regression models (Akinwande et al. 2015). Therefore, it is improbable that there is a major issue of multicollinearity in our models.

Table 3 Pearson correlation and variance inflation factor

	CRDE	FD1	FS	FA	LEV	BS	HHI	ROE	TQ	VIF
CRDE	1.000									-
FD1	0.091***	1.000								1.01
FS	-0.158***	0.047***	1.000							1.38
FA	-0.003	-0.017**	0.209***	1.000						1.09
LEV	0.226***	0.030***	-0.359***	-0.123***	1.000					1.18
BS	-0.131***	0.000	0.225***	-0.016**	-0.098***	1.000				1.07
HHI	-0.101***	0.050***	0.107***	-0.129***	0.020***	-0.029***	1.000			1.06
ROE	-0.079***	0.027***	0.121***	-0.047***	0.064***	0.051***	0.139***	1.000		1.12
TQ	0.212***	0.057***	-0.254***	0.006	0.199***	-0.095***	-0.039***	0.214***	1.000	1.17

Notes: This table presents Pearson correlation coefficients for the key variables and as defined in Table 1. VIF denotes the variance inflation factor.

Source: the authors' calculation based on the CSMAR database

3.3. Static panel data estimations

As our empirical estimation relies on panel data, it may introduce potential biases of heteroskedasticity and autocorrelation, thereby decreasing the validity and reliability of our findings. Following the approaches of Abadie et al. (2022) and Thompson (2011), this research uses firm-level clustered robust standard error estimators to address these concerns.

Table 4 reports the regression analysis outputs of model (1), column (1) includes corporate R&D expenditure (CRDE), the first ratio measure of foreign directors (FD1), control variables, year-fixed effects, and firm-fixed effects. The coefficient of foreign directors (FD1) is 0.0246 (t=2.64), which is significantly positive at the 1% level. Additionally, column (2) of Table 4 shows the regression results of the second measure of foreign directors' variable (FD2) on CRDE; the coefficient on FD2 is 0.0043 (t=2.99) and significant at the 1% level. This indicates that foreign directors promote R&D expenditure, both statistically and economically.

Table 4 The Impact of foreign directors on corporate R&D expenditure in static panel data estimations

	CRDE	
	(1)	(2)
FD1	0.0246***	
	(2.64)	
FD2		0.0043***
		(2.99)
FS	0.0012	0.0012
	(1.04)	(1.02)
FA	-0.0074*	-0.0072*
	(-1.73)	(-1.69)
LEV	0.0005***	0.0005***
	(3.11)	(3.12)
BS	0.0043**	0.0040*
	(2.08)	(1.94)
HHI	0.0120**	0.0125**
	(1.97)	(2.06)
ROE	-0.0326***	-0.0326***
	(-11.27)	(-11.25)
TQ	0.0002	0.0002
	(0.67)	(0.64)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Observations	18034	18034
P-value of F test	0.0000	0.0000
P-value of Hausman test	0.0000	0.0000
Adj. R^2	0.186	0.186

Notes: Parentheses report the t values of firm--clustered robust standard errors. The signs *, ** and *** indicate a significance level of 10%, 5% and 1% respectively. All variables are defined as shown in Table 1.

Source: the authors' calculation based on the CSMAR database.

In terms of control variables, the results are generally consistent with prior studies. Consistent with Attia et al. (2020), financial leverage (LEV), board size (BS), and market concentration (HHI) are positively and significantly related to CRDE, suggesting that firms with higher financial leverage, board size, and market concentration have better R&D investment levels. However, return on assets (ROE) and firm age (FA) are significantly and negatively related to CRDE. This demonstrates that firms with better financial performance and older firms lack the incentives to promote R&D investment levels.

Overall, H1 is supported by the positive and significant coefficients on two measures of foreign directors in static panel data regressions with corporate R&D expenditure.

3.4. Dynamic panel data estimations

Considering omitted variables and reverse causation may affect the relationship between foreign directors and corporate R&D expenditure. The use of a two-step system generalized method of moments (GMM) approach for estimation can mitigate the bias caused by the endogeneity issue due to omitted variables and reverse causation (Chinoda & Kwenda 2019). This approach provides a consistent parameter estimation by using instruments that can be obtained from the orthogonal condition between the variables and the disturbance lag variables.

Table 5 reports the results of dynamic corporate R&D expenditure (CRDE) models using a two-step system GMM panel data estimations. The diagnostic tests, which are acceptable for models (1) to (2), show that the null hypothesis of no first-order serial correlation (AR1) was rejected, but the null hypothesis of no second-order serial correlation (AR2) was accepted. The Hansen test for instrument overlap was not rejected at standard significance levels. The number of instrumental variables is smaller than the number of individual firms. This means that our instruments are effective and well-specified. In columns (1) to (2), there is a significant positive relationship between lagged CRDE and current CRDE, indicating that previous R&D expenditure affect current corporate R&D expenditure, which confirms that corporate R&D expenditure are a dynamic process.

Table 5 The impact of foreign directors on corporate R&D expenditure in dynamic panel data estimations

	CRDE	
	(1)	(2)
FD1	0.0506***	
	(2.64)	
FD2		0.0036**
		(2.07)
Lagged CRDE	0.6855***	0.7382***
	(18.24)	(16.27)
FS	-0.0115**	-0.0058*
	(-2.24)	(-1.77)
FA	0.0019	-0.0031*
	(0.07)	(-1.93)
LEV	0.0007**	0.0003
	(2.31)	(1.34)
BS	0.0906***	0.0061
	(2.84)	(1.59)
HHI	-0.0909	-0.0515
	(-1.29)	(-0.75)
ROE	-0.0601***	0.0068
	(-8.94)	(0.17)
TQ	0.0043***	-0.0003
	(3.69)	(-0.25)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Observations	15644	15644
Number of firms	2052	2052
Number of instruments	52	47
P-value of AR (1)	0	0
P-value of AR (2)	0.290	0.642
P-value of Hansen test	0.212	0.415

Notes: Corresponding robust z-values are reported in parentheses. The signs *, ** and *** indicated a significance level of 10%, 5% and 1% respectively. All variables are defined as shown in Table 1.

Source: the authors' calculation based on the CSMAR database.

Columns (1) to (2) of Table 5 display the dynamic GMM panel data regression results that tested our hypothesis; column (1) based on the first ratio indicator of foreign directors (FD1), gives the results of regressing FD1 on CRDE. The positive coefficient of 0.0506 is significantly positive at the 1% level, which suggests that FD1 can enhance CRDE. In addition, the use of the second dummy foreign directors (FD2) indicator in column (2) also has a positive and significant effect on CRDE (α=0.0036, $p<0.05$). Hence, these results show that foreign directors have a positive impact on corporate R&D expenditure in dynamic panel data estimations. This finding is consistent with hypothesis (H1) of our study.

3.5. Additional sensitivity test

In this section, we conducted two sensitivity tests on the baseline specifications of Model (1) and Model (2). The purpose was to mitigate potential spurious relationships arising from measurement errors in the core explanatory and dependent variables.

(1) Substitution of explanatory variable: In the baseline regressions, we utilized the proportion of foreign directors (FD1) and a dummy variable (FD2) as proxies for the presence of foreign directors. An inherent concern is that the proportion of foreign directors on the board may not solely depend on the number of foreign directors but also all board members. Additionally, dummy variables may not precisely capture the specific quantity of foreign directors. Drawing from the approach proposed by Yuan and Wen (2018), we directly employed the actual number of foreign directors on the board as a sensitivity check proxy for foreign directors. Regression results in columns (1) and (3) of Table 6 demonstrate that foreign directors are significantly positive at the 5% or 1% level, indicating that the variation in the foreign director measure did not significantly undermine the study's conclusions.

(2) Substitution of dependent variable: The primary regression models of this study utilize the ratio of R&D expenditure to business revenue as a measure of firms' R&D expenditure. This measurement approach helps balance the impact of differing business revenue levels across firms to some extent. Considering that innovation activities are long-term, continuous, and high-risk processes, introducing uncertainty into firms' strategic innovation choices, this method addresses the challenge of evaluating innovation. Inspired by studies by Gu (2016) and Sunder et al. (2017) regarding R&D expenditure indicators, we further employed an alternative variable (CEDE_alter), which represents R&D input divided by assets. Subsequently, we re-estimated Model (1) and Model (2). Regression results in columns (2) and (4) of Table 6 show that the foreign director indicator (FD3) remains significantly positively associated at the 10% and 5% levels, respectively, providing additional support for the conclusions of this study.

Table 6 Additional sensitivity test

	FE			GMM	
	CRDE	CRDE_alter		CRDE	CRDE_alter
	(1)	(2)		(3)	(4)
FD3	0.0025**	0.0010*		0.0021***	0.0014**
	(2.47)	(1.91)		(1.96)	(2.01)
Lagged CRDE				0.7523***	
				(15.76)	
Lagged CRDE_alter					0.8929***
					(16.99)
Controls	Yes	Yes		Yes	Yes
Year FE	Yes	Yes		Yes	Yes
Firm FE	Yes	Yes		Yes	Yes
Adj. R^2	0.187	0.215			
Observations	18034	18034		15644	15644
Number of Firms				2052	2052
Number of Instruments				43	32
P-value of AR (1)				0	0
P-value of AR (2)				0.636	0.717
P-value of Hansen test				0.987	0.403

Notes: Parentheses report the t values of firm--clustered robust standard errors (columns 1 and 2) / robust z-values (columns 3 and 4). The signs *, ** and *** indicated a significance level of 10%, 5% and 1% respectively. All variables are defined as shown in Table 1.

Source: the authors' calculation based on the CSMAR database.

3.6. Heterogeneity test

Foreign directors play a crucial governance role in corporate R&D activities. This study confirms the positive influence of foreign directors on corporate R&D expenditure. However, further exploration is needed to examine some internal and external characteristics of firms to determine whether other factors may affect the outcomes of foreign directors in influencing R&D expenditure. Specifically, this paper conducts heterogeneity tests from three perspectives.

Table 7 SOEs Vs POEs

	CRDE				
	SOEs			POEs	
	(1)	(2)		(3)	(4)
FD1	-0.0137			0.0323***	
	(-1.05)			(3.06)	
FD2		-0.0007			0.0058***
		(-0.33)			(3.25)
Controls	Yes	Yes		Yes	Yes
Year FE	Yes	Yes		Yes	Yes
Firm FE	Yes	Yes		Yes	Yes
Observations	5267	5267		12476	12476
Adj. R^2	0.310	0.310		0.141	0.141

Notes: Parentheses report the t values of firm--clustered robust standard errors. The signs *, ** and *** indicated a significance level of 10%, 5% and 1% respectively. All variables are defined as shown in Table 1.

Source: the authors' calculation based on the CSMAR database.

(1) Heterogeneity of property rights. State-owned enterprises (SOEs) and private-owned enterprises (POEs) may exhibit significant differences in governance structure and strategic decision-making (Lu et al., 2024; Luo et al., 2016). SOEs are typically subject to direct government supervision and intervention, with their decisions potentially influenced by political considerations and short-term economic growth targets (Yang et al., 2024). Conversely, facing greater market competition due to relatively limited resources, POEs are likely to have a stronger motivation for investing in innovation activities (Zhang et al., 2024). Additionally, the role of foreign directors in governance may vary between SOEs and private enterprises. In SOEs of China, directors and senior managers are often bureaucratic appointments by the government, serving political goals and strategic intentions, potentially diminishing the efforts of foreign directors in driving innovation investment (Liao et al., 2024; Zhang et al., 2023). However, in POEs, pursuing long-term performance maximization due to ownership characteristics (Battilana et al., 2022), we anticipate that the impact of foreign directors may be more pronounced.

The results in Table 7 indicate that foreign directors (FD1 and FD2) do not facilitate increased R&D expenditure in SOEs, but both FD1 and FD2 show a significant positive correlation at the 1% level in POEs. Consequently, the influence of foreign directors on R&D activities is heterogeneous due to equity differences, with foreign directors positively affecting corporate R&D expenditure, and this effect is observed exclusively in POEs.

Table 8 High-tech vs non-high tech

	CRDE				
	High-Tech			Non-High Tech	
	(1)	(2)		(3)	(4)
FD1	0.0259**			0.0066	
	(2.37)			(0.76)	
FD2		0.0048***			0.0009
		(2.74)			(0.67)
Controls	Yes	Yes		Yes	Yes
Year FE	Yes	Yes		Yes	Yes
Firm FE	Yes	Yes		Yes	Yes
Observations	13957	13957		4077	4077
Adj. R^2	0.193	0.194		0.176	0.176

Notes: Parentheses report the t values of firm--clustered robust standard errors. The signs *, ** and *** indicated a significance level of 10%, 5% and 1% respectively. All variables are defined as shown in Table 1.

Source: the authors' calculation based on the CSMAR database.

(2) Industry heterogeneity. In the context of different industries, the role of foreign directors in influencing corporate R&D expenditure may vary. We classified the samples into high-tech and non-high-tech industries based on the "Classification Catalogue of High-tech Industries" released by the National Bureau of Statistics of China. Typically, high-tech industries are more knowledge-intensive, relying on highly specialized technical and scientific knowledge (Zhang et al., 2021). Moreover, these industries often face intense global competition, resulting in a more urgent demand for innovation (Liu et al., 2014; Rađenović et al., 2023). In such an environment, foreign directors may find it easier to comprehend and advocate for R&D investment in innovative activities due to their deeper understanding of global technological trends and best practices. Conversely, in non-high-tech industries, these factors might be relatively weaker, and firms may prioritize stable production and market share over long-term innovation investments (Zhang et al., 2021). Consequently, we anticipate that the role of foreign directors in R&D expenditure may not be as prominent in non-high-tech industries as in high-tech industries.

The results presented in Table 8 indicate that foreign directors (FD1 and FD2) do not promote R&D expenditure in non-high-tech industries, as shown in columns (3) and (4). The regression results for foreign directors in high-tech industries, as depicted in columns (1) and (2), reveal significantly positive coefficients at the 5% or 1% significance level, indicating that foreign directors only stimulate R&D expenditure in high-tech industries. This confirmation is grounded in the impact of industry heterogeneity.

(3) Regional heterogeneity. China exhibits spatial heterogeneity in its economic development across provinces. In developed regions, firms may have easier access to advanced technological resources and innovation support due to the generally more developed technological infrastructure, research and development institutions, and higher education facilities (Li & North, 2017). In such circumstances, foreign directors may need to pay more attention to innovation strategies and global market trends to better propel firms into R&D expenditure in developed regions. On the contrary, in less developed regions, firms may face challenges such as insufficient infrastructure, immature markets, and inadequate technological support (Rodríguez-Pose et al., 2021). In this environment, the monitoring role of foreign directors may struggle to overcome the adverse effects of institutional environments.

Previous research has indicated that China's eastern regions are the most economically developed (Wu et al., 2019). We conducted a subsample analysis based on whether the spatial geographic location of the sampled provinces is in the eastern region, defining it as developed, and others as less developed. The results in Table 8 demonstrate that the promoting effect of foreign directors (FD1 and FD2) on corporate R&D expenditure is only significant in developed regions, as indicated in columns (1) and (2). This further substantiates the validity of our inference as mentioned earlier.

Table 9 Developed regions vs less developed regions

	CRDE			
	Developed Regions		Less Developed Regions	
	(1)	(2)	(3)	(4)
FD1	0.0262***		0.0178	
	(2.79)		(0.74)	
FD2		0.0047***		0.0034
		(3.05)		(0.94)
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	12807	12807	5227	5227
Adj. R^2	0.175	0.175	0.214	0.214

Notes: Parentheses report the t values of firm--clustered robust standard errors. The signs *, ** and *** indicated a significance level of 10%, 5% and 1% respectively. All variables are defined as shown in Table 1.

Source: The authors' calculation based on the CSMAR database

3.7. Situational analysis

To explore whether the involvement of foreign directors in different roles affects firms' R&D expenditure, we further examine situations where foreign individuals serve as independent directors (FID) and non-independent directors (non-FID). Typically, independent directors are presumed to

prioritize the overall interests of the firm and shareholders, thus favouring investments in future growth, including R&D (Muhammad et al., 2024; Shi et al., 2023). Conversely, non-independent directors may lean more towards their interests or those of the management team, potentially favouring short-term profit investments over the high-risk, long-term nature of R&D expenditure (Li et al., 2023). For instance, although foreign chairpersons are board members, their role may be influenced by the short-term profit expectations of shareholders, investors, and the market, leading them to allocate funds to short-term projects to meet market demands and expectations, potentially avoiding the long-term investment and risks associated with R&D projects (Tan et al., 2022). Additionally, foreign managing directors, serving both as board members and CEOs of the management team, may have incentive structures that prioritize short-term performance metrics, such as stock price performance and financial results, over long-term R&D strategic goals (Belderbos et al., 2020; Eklund, 2022; Li et al., 2023), which could influence their decisions regarding R&D investment.

The results in columns (1) and (2) of Table 10 indicate that when foreign board members serve as independent directors (FID), their impact on CRDE is statistically significant and positive (α=0.0055; p-value<0.05). Conversely, foreign non-independent directors (non-FID) do not yield statistically significant. Furthermore, when non-FID are further divided into foreign chairpersons (FC) and foreign managing directors (FMD), the coefficients remain statistically insignificant, confirming our hypothesis.

Table 10 Situational analysis

	CRDE			
	(1)	(2)	(3)	(4)
FID	0.0055**			
	(2.20)			
Non-FID		0.0023		
		(1.17)		
FC			-0.0004	
			(-0.01)	
FMD				0.0026
				(0.65)
Controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N	18034	18034	18034	18034
Adj. R^2	0.186	0.185	0.185	0.185

Notes: Parentheses report the t values of firm--clustered robust standard errors. The signs *, ** and *** indicated a significance level of 10%, 5% and 1% respectively.

Source: the authors' calculation based on the CSMAR database

Discussion and conclusion

From the perspective of board governance, this research fills the gap in an understudied area that bridges two distinct streams of literature: foreign directors and R&D investment. Our research findings align with the predictions of agency theory, indicating a positive correlation between foreign directors and corporate R&D expenditure. The enhanced independence and diverse experiences of foreign directors may provide them with a better ability to monitor managers' continuous resource allocation to R&D activities, thereby increasing corporate R&D expenditure.

Previous research has argued that the capacity for cultural diversity possessed by foreign directors is not crucial for innovation R&D activities and may even have a significant negative impact (Attia et al., 2020). However, this result largely overlooks issues related to data quality, method heterogeneity, and differences in institutional environments. To mitigate these concerns, this paper uses a comprehensive dataset from the CSMAR database with the most extensive records and the largest number of sample firms in Chinese listed firms, covering the period from 2008 to 2021. Moreover, the paper re-examines the impact of foreign directors on R&D expenditure in the world's largest developing economies using static two-way fixed effects models with clustered robust standard errors, dynamic GMM models, and additional sensitivity tests. The conclusion of this study suggests that within the context of developing countries with less robust corporate governance mechanisms and institutional environments, the presence of foreign directors appears to enhance the level of firms in R&D investment. One possible explanation is the strong

connection between domestic directors and firm executives, which may influence the board's supervisory functions (Balsmeier et al., 2014; Liu & Lv, 2022; Masulis et al., 2012). Foreign directors with weaker external connections and diverse backgrounds seem to offer effective monitoring for board governance, which is a pivotal factor in corporate R&D activities (Du et al., 2017; Fabrizio & Richard, 2015; Tao et al., 2022; Xia et al., 2023). It is noteworthy that the relationship between foreign directors and R&D expenditure exhibits heterogeneity at the levels of property rights, industry, and geographical location. Specifically, the enhancing effect of foreign directors on R&D expenditure is more pronounced in private-owned enterprises, high-tech industries, and samples from developed regions. Moreover, our results further confirm that foreign independent directors are the main driving force behind this effect.

The contribution of this study can be summarized in two dimensions. Theoretically, the economic consequences of foreign directors have garnered widespread attention in academia. This paper empirically examines the impact of foreign directors on corporate R&D expenditure, enriching the literature on the financial effects of board governance. Meanwhile, grounded in the perspective of agency theory, it also provides a new viewpoint to enhance our understanding of board roles in mitigating agency conflicts in R&D activities.

This research also holds policy implications. Firstly, as the world's largest emerging economy, China strategically promotes the introduction of foreign talent as a key innovation driver. In 2008, China even launched the "Thousand Talents Program," emphasizing the importance of attracting foreign expertise. The irreversible trend of economic globalization, especially in developing countries, underscores the pivotal role of foreign talent. In this context, state-owned enterprises should recognize the effectiveness of foreign directors in driving R&D investments, prompting adjustments to their innovation investment policies. For non-high-tech industry firms and those located in underdeveloped regions, a focus on the governance role of foreign directors in R&D activities is crucial for gaining a competitive edge in this era of innovation-driven economic development. Lastly, the heterogeneity effects of foreign directors offer insights for the governments of developing countries. Policymakers should formulate differentiated policies for the introduction of foreign talent and create an institutional environment more conducive to innovation. This effort aims to exert a more positive impact on the innovative investments of state-owned enterprises, non-high-tech industry firms, and firms located in less developed regions.

Nevertheless, this study has its limitations, but it also points the way for future research. On the one hand, the paper acknowledges that our research has a certain level of external validity as it does not delve into other industry-specific characteristics. As the sample sizes for other industries listed in China are relatively small, the sample of the paper is based on Chinese listed manufacturing firms. Future research should also examine the universality across other industries and countries. On the other hand, foreign directors, when considered together with their educational backgrounds and experiences, may exert unique and complex influences on corporate R&D investment. It has been observed that diverse educational backgrounds and experiences often influence directors' investment preferences and levels of risk-taking (Masulis et al., 2012; Prencipe et al., 2022; Xiang & Yi, 2022). Future research could further explore this dimension.

To conclude, this paper addresses a largely overlooked question of whether foreign directors affect corporate R&D expenditure. The findings suggest that concerning the presence and proportion of foreign directors, this unique nationality attribute often leads to greater R&D expenditure. Through our research findings, we hope to stimulate and enrich the academic conversation on how foreign directors impact various dimensions of innovation activities.

Declarations

Availability of data and materials

The datasets used during the current study are available from the corresponding author on reasonable request.

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Managerial conflict of interests effects on duopoly market structure

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Abstract

Background: Principal-agent problem has been discussed intensively in the recent decade, but this specific case has not yet been analyzed in this manner; one of two companies in Cournot duopoly employs a manager who has a partial ownership of the second company, but without executive power in that company. This kind of conflict of interest changes the market game since the overlapping makes it difficult to determine how many actual players there are on the market, which is crucial to understanding what is about to happen with prices and quantities.

Purpose: This paper will determine which agent's share in the other company becomes a problem for the principal of the first company and how a change in the share affects market price, both companies' quantities and profits, and finally how a duopoly grows closer to a monopoly since the number of players is no longer integer.

Study design/methodology/approach: The manager of the first company is paid in that company's share in profit. As a partial owner of the other company, this manager also receives ownership revenue. Thus the manager (agent) tries to maximize his own revenue which consists of the share in both companies. The agent's actions in the first company are aimed to maximize his own profit instead of the principal's profit.

Findings/conclusions: The higher the agent's share in the competitive company, the greater the agent's reward has to be in terms of the share in the profit of the first company. Additionally, it also increases the prices, decreases the quantities, turning duopoly into a non-integer oligopoly, the closer to monopoly the higher the agent's share is in the competitive company.

Limitations/future research: The assumed Cournot game should also be transformed into a game where players do not act simultaneously. Therefore, a Stackelberg oligopoly analysis could bring a novel view of this specific interaction.

Keywords

Principal-agent problem, conflict of interest, Cournot duopoly, non-integer number of players, monopoly

Introduction

According to the agency theory, one party (the principal) delegates work to another party (the agent) (Daily et al., 2003; Shapiro, 2005; Bosse & Phillips, 2016). The application of the theory has been widespread, including economics (Cooper, 1949, 1951; Ross, 1973), management (Barnard, 1938; Eisenhardt, 1985, 1988; Kosnik & Bettenhausen, 1992, Zhang et al., 2022; Matinheikki, 2022), finance (Jensen & Meckling, 1976, Fama, 1980, Forster et al., 2025), politics (Mitnick, 1982, 1990; Hammond & Knott, 1996, Kiser & Tong, 1992, Al-Faryan, 2024), and sociology (Eccles, 1985; White, 1985; Shapiro, 1987, Davis et al., 2021). The principal–agent problem refers to the conflict in interests that arises when one party (the agent) takes actions on behalf

of another party (the principal) (Eisenhardt, 1985). In practice, agency problem arises when the agent (e.g. manager) fails to act in the interest of the principal (e.g. owner) (Williamson, 1975; Arrow, 1984). Berle and Means (1932) conclude that the enforcement of the corporate law in the early 1930s in the U.S. allowed managers to be able to manage the resources of companies to their own advantage. Fama and Jensen, (1983) show that separation of ownership and control lead to the information asymmetry.

The purpose of this paper is to provide a mathematical model for conflicts of interest in a Cournot type duopoly, in which the principal-agent problem has quantitative effects both on the principal's agent and co-owners. After the introduction, the first part of the paper presents the theoretical background of the principal-agent conflict of interest. The second part presents a model which introduces the agency problem in canonical duopoly. It is followed with the Results and Discussion section which employs the comparative static analysis of the market quantity, price and companies' profit reaction to the change in the agent's share in competitive company, with algebraic analysis and numerical simulations. Conclusion summarizes the main findings and sheds a light on the possible future studies.

1. Theoretical background

The paper offers the extension of the model initially presented in Vrankić et al. (2022). The theoretical background of the principal-agent conflict of interest has been well-rounded and little break-through came up since the turn of the century (Vrankić et al., 2022).

Jensen and Meckling (1976) define an agency relationship as a contract between one or more parties (principals) and another party (agents), entrusting them with the responsibility of allocating resources on their behalf. If both parties are motivated by maximizing their own wealth, there is good reason to believe that agents will not always act in the best interests of the principal. As a result, the agency problem arises when the interests of the principal and agent conflict, and/or when the principal finds it difficult to verify the actions of the agent (Eisenhardt, 1989). In this situation, the agent is free to pursue his/her own interests in order to benefit from its position (Noreen, 1988; Cohen et. al, 2007). It is also possible for agents to exploit information asymmetry to take (hidden) actions in order to benefit themselves at the expense of the principal (Holmstrom, 1979; Panda & Leepsa, 2017). In order to prevent divergence of interests, the principal may establish an appropriate incentive program (Jensen, 1994; Laffont & Martimort, 2009) or incur oversight costs in order to prevent unwanted agent behavior (Donaldson and Davis, 1991; Bonazzi & Islam, 2007). Accordingly, it is impossible for the agent to make optimal decisions without incurring costs (both for the agent and the principal). According to Jensen and Meckling (1976), agency costs include monitoring costs, bonding costs, and residual losses.

It is argued that the agency theory fails to capture both sides of the relationship (i.e. the relationship between the principal and the agent), therefore failing to provide insight into the potential problem of the principal exploiting the agents (Shapiro, 2008). A key component of Perrow's stewardship theory is the rejection of the assumption that agents are work-averse, self-interested utility maximizers. In spite of this, he acknowledges that there are certain situations that are more likely to result in the emergence of agency problems.

Two lines of research have been conducted on the agency problem: positivist theory (Jensen & Smith, 2000) and principal-agent theory (Eisenhardt, 1989). In positivist theory, conflicting goals are identified and governance mechanisms are described to limit the agent's selfish behavior; it is less mathematical and focuses almost exclusively on the special case of large, public corporations (Jensen & Meckling, 1976; Fama, 1980; Fama & Jensen, 1983). Principal-agent research provides a rather general understanding of agency relationships (i.e. it impacts a variety of agency relationships such as client-lawyer, writer-publisher, owner-manager, etc.). A logical deduction and mathematical proof are followed by the specification of assumptions (e.g. Demski & Feltham, 1978). By developing a mathematical model for the special case of an agency relationship between the owner of a company and its manager who owns shares in another company in the same industry, this paper attempts to bridge the two streams. It is assumed that the market is Cournot duopoly (non-cooperative companies producing a homogeneous product and bringing their decisions simultaneously). Because it analyzes a special case with a high risk of agency problem occurrence (i.e. the stewardship theory's premise will not hold), it does not contradict the alternative view of principal-agent problem (Donaldson & Davis, 1991). Furthermore, the present research provides

empirical evidence regarding the impact of agency problems on principal wealth (Crutchley & Hansen, 1989, Tosi Jr., & Gomez-Mejia, 1989, Lafontaine, 1992, Davidson III et al., 2004). A limited number of studies have investigated the broader social and institutional effects of agency problems. In the opinion of Hill and Jones (1992), an area that remains relatively unexplored is the capacity of agency theory to explain the nature of the contractual relationships between a firm's stakeholders (e.g. employees, customers, suppliers, creditors, communities, and the general public). In the meantime, this topic "grew cold" and few studies have recently focused on the application of principal-agent problem, but almost none have addressed oligopoly (Chen et al., 2022). It is the intention of this paper to fill this gap in the literature by developing a theoretical model to illustrate how agency theory directly negatively impacts company performance and the wealth of its owners, as well as indirectly negatively affecting consumers and the general public's interests since principal-agent problem in oligopoly is a gamechanger and this paper aims to prove it.

2. Models

One side of the story refers to the agency problem. The other is the plain Cournot duopoly. The overlapping of these two aspects shall provide the grounds for the analyses required to achieve the paper's goals.

2.1. Basic Cournot oligopoly model

In the Cournot duopoly model, each company announces its own profit-maximizing production level based on the production level of its competitor. There is no incentive for two companies to change their production level at the same time in Cournot equilibrium, which is one of the basic characteristics of Nash equilibrium too. Their production plans are announced simultaneously with the production of homogeneous products. Using standardized prices to simplify calculations, and maintain the explanatory power of the model, their joint quantity produced affects the price with the following relationship:

$$\boldsymbol{p = 1 - Y = 1 - y_1 - y_2} \quad (1)$$

where y_1 and y_2 are nonnegative quantities produced by these two companies. The second simplification, which allowed for price standardization, is that there is no cost assumption, which does not reduce the model's explanatory power.

$$\max_{y_1} \boldsymbol{\pi_1 = p y_1} \quad \& \quad \max_{y_2} \pi_2 = p y_2 \quad (2)$$

When maximizing profit ($\frac{\partial \pi_1}{\partial y_1} = 0$ & $\frac{\partial \pi_2}{\partial y_2} = 0$) the following reaction curves are obtained:

$$y_1 = \frac{1}{2} - \frac{1}{2} y_2 \quad \& \quad y_2 = \frac{1}{2} - \frac{1}{2} y_1 \quad (3)$$

Their intercept provides Cournot-Nash equilibrium where quantities account for 1/3 of the perfectly competitive market coverage, 2/3 in total:

$$y_1^C = y_2^C = \frac{1}{3}, Y^C = \frac{2}{3} \quad (4)$$

Price in the basic Cournot model is $p^C = 1 - \frac{2}{3} = \frac{1}{3}$ and profits, which are equal to revenues under the zero cost assumption, are equal to the quantities multiplied with price:

$$\pi_1^C = \pi_2^C = \frac{1}{3} \cdot \frac{1}{3} = \frac{1}{9}, \pi = \frac{2}{9} \quad (5)$$

2.2. Modified Cournot duopoly model

The main idea of this paper is based on a specific situation where the Principal (owner of the Company 1) employs the Agent (minor shareholder of the competitive Company 2, but without executive power in that company) as the manager of Company 1 with full executive power. It is also assumed that he pays the Agent with the share in total profit of the Company 1, ϑ_1. The Agent owns ϑ_2 part of the Company 2 ($\vartheta_2 < 50\%$, since he has a non-controlling share).

This kind of the overlapping causes a conflict of interests since the Agent's income consists of both labor income (from Company 1, L) and the capital income (from Company 2, R):

$$\boldsymbol{V = L + R = \vartheta_1 \Pi_1 + \vartheta_2 \Pi_2} \quad (6)$$

Thus, the manager's goal is inconsistent with the owner's goal, which creates an agent-principal problem, where the agent acquires yield from both parties. Depending on the shares of companies' profits, $\boldsymbol{\vartheta_1}$ and $\boldsymbol{\vartheta_2}$, the Agent's goal would be more or less coherent with the principal's goal, maximizing their own income. Since the Agent has executive power only in the Company 1, as long as $\boldsymbol{\vartheta_2 < 0.5}$, the decision variable remains $\boldsymbol{y_1}$ only (otherwise, he would achieve executive power in both companies which would instantly lead to creation of a specific kind of a split monopoly, but

not cartel). Therefore, the Agent tries to maximize his own revenues, *V*:

$$\max_{y_1} \boldsymbol{V = \vartheta_1 \Pi_1 + \vartheta_2 \Pi_2} \quad (7)$$

$$\max_{y_1} \boldsymbol{V = \vartheta_1 p y_1 + \vartheta_2 p y_2} \quad (8)$$

$$\max_{y_1} \boldsymbol{V = p(\vartheta_1 y_1 + \vartheta_2 y_2)} \quad (9)$$

$$\frac{\partial V}{\partial y_1} = \mathbf{0} \quad (10)$$

$$\frac{\partial p}{\partial y_1}(\vartheta_1 y_1 + \vartheta_2 y_2) + p\vartheta_1 = 0$$

$$\vartheta_1 - 2\vartheta_1 y_1 - (\vartheta_1 + \vartheta_2) y_2 = 0$$

$$\Rightarrow \boldsymbol{y_1 = \frac{1}{2} - \frac{\vartheta_1 + \vartheta_2}{2\vartheta_1} y_2} \quad (11)$$

where (11) is the Company 1's reaction curve. Note that, since the Agent has all the executive power in Company 1, company 1's reaction curve is deducted from the Agent's profit function, not its own. In contrast, Company 2 makes its own decisions and has its own profit maximizing reaction:

$$\max_{y_2} \boldsymbol{\Pi_2 = p y_2 = (1 - y_1 - y_2) y_2} \quad (12)$$

$$\frac{\partial \Pi_2}{\partial y_2} = \mathbf{1 - y_1 - 2y_2 = 0} \quad (13)$$

$$\Rightarrow \boldsymbol{y_2 = \frac{1}{2} - \frac{1}{2} y_1} \quad (14)$$

where (14) is the Company 2's reaction curve. The intercept of the two reaction curves (11 & 14) provides the market equilibrium in Cournot model with conflict of interest (point C):

$$\boldsymbol{y_1^{CC} = \frac{\vartheta_1 - \vartheta_2}{3\vartheta_1 - \vartheta_2}}; \quad \boldsymbol{y_2^{CC} = \frac{\vartheta_1}{3\vartheta_1 - \vartheta_2}}; \quad \boldsymbol{Y^{CC} = \frac{2\vartheta_1 - \vartheta_2}{3\vartheta_1 - \vartheta_2}} \quad (15)$$

Stubbing (15) into demand provides the market price:

$$\boldsymbol{p = \frac{\vartheta_1}{3\vartheta_1 - \vartheta_2}} \quad (16)$$

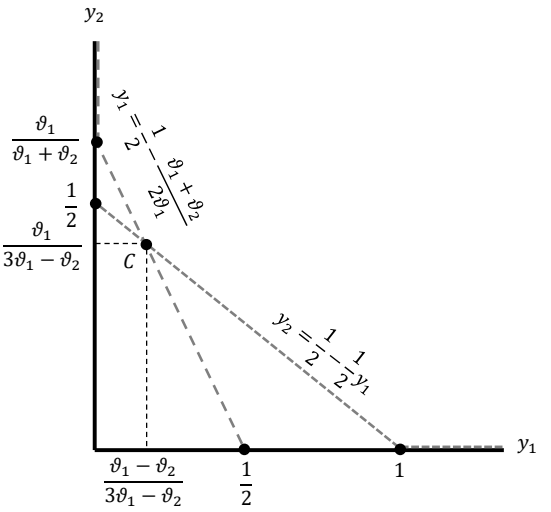

Figure 1 Cournot model in case of Agent's conflict of interests
Source: the authors

Profits of these two companies are:

$$\pi_1 = \frac{1}{9} - \frac{\vartheta_2(3\vartheta_1 + \vartheta_2)}{9(3\vartheta_1 - \vartheta_2)^2} \quad (17)$$

$$\pi_2 = \left[\frac{1}{3} + \frac{\vartheta_2}{3(3\vartheta_1 - \vartheta_2)}\right]^2 \quad (18)$$

$$\pi = \frac{2}{9} + \frac{\vartheta_2(3\vartheta_1 - 2\vartheta_2)}{9(3\vartheta_1 - \vartheta_2)^2} \quad (19)$$

2.3. Relation between Basic and Modified Cournot duopoly model

Market quantities, price and profits in the modified model can be rearranged as follows:

$$\boldsymbol{y_1^{CC} = \frac{\vartheta_1 - \vartheta_2}{3\vartheta_1 - \vartheta_2} = \frac{1}{3} - \frac{2\vartheta_2}{3(3\vartheta_1 - \vartheta_2)} < \frac{1}{3} = y_1^C} \quad (20)$$

$$\boldsymbol{y_2^{CC} = \frac{\vartheta_1}{3\vartheta_1 - \vartheta_2} = \frac{1}{3} + \frac{\vartheta_2}{3(3\vartheta_1 - \vartheta_2)} > \frac{1}{3} = y_2^C} \quad (21)$$

$$\boldsymbol{Y^{CC} = \frac{2\vartheta_1 - \vartheta_2}{3\vartheta_1 - \vartheta_2} = \frac{2}{3} - \frac{\vartheta_2}{3(3\vartheta_1 - \vartheta_2)} < \frac{2}{3} = Y^C} \quad (22)$$

$$\boldsymbol{p^{CC} = \frac{\vartheta_1}{3\vartheta_1 - \vartheta_2} = \frac{1}{3} + \frac{\vartheta_2}{3(3\vartheta_1 - \vartheta_2)} > \frac{1}{3} = p^C} \quad (23)$$

$$\pi_1^{CC} = \frac{1}{9} - \frac{\vartheta_2(3\vartheta_1 + \vartheta_2)}{9(3\vartheta_1 - \vartheta_2)^2} < \frac{1}{9} = \pi_1^C \quad (24)$$

$$\pi_2^{CC} = \left[\frac{1}{3} + \frac{\vartheta_2}{3(3\vartheta_1 - \vartheta_2)}\right]^2 > \frac{1}{9} = \pi_2^C \quad (25)$$

$$\pi^{CC} = \frac{2}{9} + \frac{\vartheta_2(3\vartheta_1 - 2\vartheta_2)}{9(3\vartheta_1 - \vartheta_2)^2} > \frac{2}{9} = \pi^C \quad (26)$$

It is proven that in this model Principal's company 1 produces less and earns less when the Agent has the conflict of interests; competitive company, where the Agent has the share, produces more and earns more; prices soar above the basic Cournot level of prices and the overall profit on the market is also above the overall Cournot profit without conflict of interest, showing a negative effect of the conflict on consumers and competition.

Market saturation in the Cournot oligopoly model can also be analyzed by the number of companies in the oligopolistic market. Fundamental microeconomic theory provides the information that the overall produced quantity on the Cournot oligopoly market (Y^C) with n companies is equal to $Y^C = \frac{n}{n+1} Y^{PC}$, where Y^{PC} is the perfectly competitive quantity. In the example presented in (1), Y^{PC} turns out to be equal to 1. Therefore, each total quantity of production in Table 1 could provide an equivalent of the market participants:

$$Y = \frac{n}{n+1} \Rightarrow n = \frac{Y}{1-Y} \quad (27)$$

It enables numeric comparison between the basic and the conflicted Cournot duopoly for any chosen Company 2 share ϑ_2 (Table 1).

Table 1 Conflict of interests and the equivalent number of market players

ϑ_2	0	.05	.25	.50	.75
Y^{CC}	0.667	0.630	0.590	0.500	0.500
n	2.000	1.703	1.441	1.000	1.000

Source: the authors

Notice that for the values of $\vartheta_2 \geq 0.5$ Company 1 is eliminated and Company 2 becomes a monopolist. Also notice that the quantity produced, which can be expressed through the number of participants on the market, gradually falls as ϑ_2 increases, showing that the larger the Agent's share in Company 2, the lower the equivalent number of participants is, corroborating the previous statements that the rise in the conflict of interests discourages competition. It in turn proves that the real monopolistic power lies in the overlapping ownership which is the cause of the agency problem in this case.

3. Results and Discussion

The owner of Company 1 (Principal) is left with the rest of the profit, Z, after he paid the Agent (manager):

$$\max_{\vartheta_1} Z = (1-\vartheta_1)\Pi_1 = \frac{(1-\vartheta_1)\vartheta_1(\vartheta_1-\vartheta_2)}{(3\vartheta_1-\vartheta_2)^2} \quad (28)$$

Principal then wants to find out the profit share ϑ_1 which maximizes his own profit for a given level of ϑ_2 he cannot control:

$$\max_{\vartheta_1} Z = \frac{(1-\vartheta_1)\vartheta_1(\vartheta_1-\vartheta_2)}{(3\vartheta_1-\vartheta_2)^2} \quad (29)$$

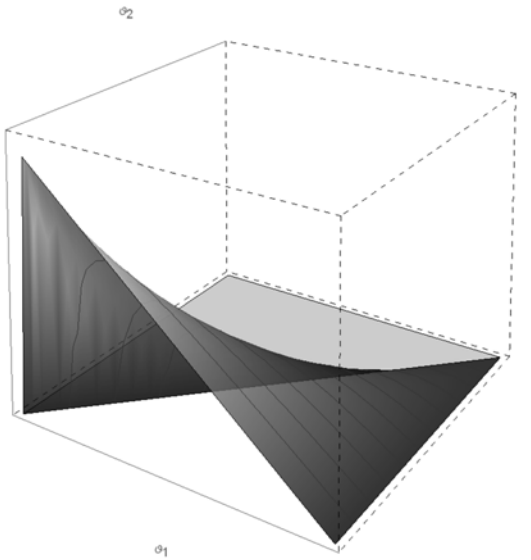

Figure 2 Principal's profit function Z
Source: the authors

Remember that $\boldsymbol{\vartheta_1 \epsilon [0,1]}$ by definition refers to the Figure 1; one notices that if $\frac{\vartheta_1}{\vartheta_1+\vartheta_2} \leq \frac{1}{2}$ then the Agent decides not to produce and competitive company 2 becomes a monopolist $(\boldsymbol{y_2^M = \frac{1}{2}})$.

As a result, the Principal must provide the following in order to maintain its position on the market:

$$\frac{\vartheta_1}{\vartheta_1+\vartheta_2} > \frac{1}{2} \Rightarrow \boldsymbol{\vartheta_1 > \vartheta_2} \quad (30)$$

Secondly, one has to discuss the closed set $\boldsymbol{\vartheta_2 \epsilon [0,1]}$ since when $\boldsymbol{\vartheta_2 = 1}$ then it is impossible that share $\boldsymbol{\vartheta_1}$ exceeds the value of $\boldsymbol{\vartheta_2}$ making Z = 0. Therefore the optimum share of profit rewarded to the Agent has to be found at $\boldsymbol{\vartheta_1 \epsilon \langle \vartheta_2, 1 \rangle}$, where by definition $\boldsymbol{\vartheta_2 < \frac{1}{2}}$.

$$\frac{dZ}{d\vartheta_1} = \frac{-3{\vartheta_1}^3+3\vartheta_2{\vartheta_1}^2+\vartheta_2(1-2\vartheta_2)\vartheta_1+{\vartheta_2}^2}{(3\vartheta_1-\vartheta_2)^3} = 0 \quad (31)$$

The expression (31) can be solved as the cubic equation:

$$\boldsymbol{-3{\vartheta_1^*}^3 + 3\vartheta_2{\vartheta_1^*}^2 + \vartheta_2(1-2\vartheta_2)\vartheta_1^* + {\vartheta_2}^2 = 0} \quad (32)$$

Therefore a solution will be $\boldsymbol{\vartheta_1^* = \vartheta_1(\vartheta_2)}$ and can be obtained by solving a cubic equation for each given value of $\boldsymbol{\vartheta_2}$. That solution will provide relation between the Agent's ownership of the company 2 and the profit share as a reward from the Principal for managing Company 1. That result will, in turn, provide relation between $\boldsymbol{\vartheta_2}$ and the share in the Company 1's profit, individual production levels, total profits of the companies and the market price. The following sensitivity analyses will provide answers to these questions.

3.1. Effects of ϑ_2 change on Agent's reward

This section will provide the exact algebraic relation between the Agent's share in Company 2 and their profit share in Company 1. The answer to that question lies in solution of (32):

Its differentiation with respect to $\boldsymbol{\vartheta_2}$ gives:

$$\boldsymbol{\left[9{\vartheta_1^*}^2 - 6\vartheta_2\vartheta_1^* - \vartheta_2(1-2\vartheta_2)\right]\frac{d\vartheta_1^*}{d\vartheta_2} - 3{\vartheta_1^*}^2 - 2\vartheta_2 - \vartheta_1^*(1-4\vartheta_2) = 0} \quad (33)$$

Now $\boldsymbol{\frac{d\vartheta_1^*}{d\vartheta_2}}$ can be obtained, and the resulting fraction simplified as A/B:

$$\boldsymbol{\frac{d\vartheta_1^*}{d\vartheta_2} = \frac{3{\vartheta_1^*}^2+2\vartheta_2+\vartheta_1^*(1-4\vartheta_2)}{9{\vartheta_1^*}^2-6\vartheta_2\vartheta_1^*-\vartheta_2(1-2\vartheta_2)} = \frac{A}{B}} \quad (34)$$

The next step is to determine the sign of A. Multiplying A with $\boldsymbol{\vartheta_1^*}$ provides:

$$\boldsymbol{A\vartheta_1^* = 3{\vartheta_1^*}^3 + 2\vartheta_2\vartheta_1^* + {\vartheta_1^*}^2(1-4\vartheta_2)} \quad (35)$$

Now express $\boldsymbol{3{\vartheta_1^*}^3}$ from (24) and replace the bolded part of (27) to obtain:

$$A\vartheta_1^* = (1-\vartheta_2){\vartheta_1^*}^2 + \vartheta_2(3-2\vartheta_2)\vartheta_1^* + {\vartheta_2}^2 > 0 \quad (36)$$

(36) is obviously positive, due to the assumptions about $\boldsymbol{\vartheta_2}$ and the sign of the square. Next step is determination of the B sign:

$$B = 9\vartheta_1^{*^2} - 6\vartheta_2\vartheta_1^* - \vartheta_2(1-2\vartheta_2) \quad (37)$$

After multiplication of (29) with ϑ_1^* one obtains:

$$B\vartheta_1^* = 9\vartheta_1{}^3(\vartheta_2) - 6\vartheta_2\vartheta_1^{*^2} - \boldsymbol{\vartheta_2(1-2\vartheta_2)\vartheta_1^*} \quad (38)$$

Now expressing $\vartheta_2(1-2\vartheta_2)\vartheta_1^*$ from (32) and replacing the bolded part of (38):

$$B\vartheta_1^* = 3\vartheta_1^{*^2}(2\vartheta_1^* - \vartheta_2) + \vartheta_2{}^2 > 0 \quad (39)$$

Knowing (30), (39) cannot be anything but positive. By dividing $A\vartheta_1^*$ and $B\vartheta_1^*$ one obtains (40) which is identical to (34):

$$\frac{d\vartheta_1^*}{d\vartheta_2} = \frac{A\vartheta_1^*}{B\vartheta_1^*} = \frac{A}{B} > 0 \quad (40)$$

This finding proves that the Principal's optimal reward for the Agent increases as the Agent's profit share in the competitive company rises, keeping in mind that the rewarded share should be greater than the Agent's share in the competitive company (expression 30).

3.2. Effects of ϑ_2 change on output, profits and price

In Chapter 1.3 the relation between basic and conflicted duopoly for different $\boldsymbol{\vartheta_2}$ is shown, but no sensitivity analysis has been conducted so far. Observing the equations (20) through (26), for the optimal value $\boldsymbol{\vartheta_1^*}$, one notices that variation of the common factor:

$$\boldsymbol{f(\vartheta_2) = \frac{\vartheta_2}{3\vartheta_1^* - \vartheta_2} = D} \quad (41)$$

is the only factor that affects the change in all but $\boldsymbol{\pi_2^{CC}}$ and $\boldsymbol{\pi^{CC}}$. Therefore first step is to determine dynamics of (41):

$$\boldsymbol{f'(\vartheta_2) = \frac{3\vartheta_1^* - \vartheta_2 - \vartheta_2\left(3\frac{d\vartheta_1^*}{d\vartheta_2} - 1\right)}{3\vartheta_1^* - \vartheta_2} = \frac{3\left(\vartheta_1^* - \vartheta_2\frac{d\vartheta_1^*}{d\vartheta_2}\right)}{(3\vartheta_1^* - \vartheta_2)^2}} \quad (42)$$

In order to determine the sign of the bolded expression in (42) one has to make the following transformations:

$$\boldsymbol{C = \vartheta_1^* - \vartheta_2\frac{d\vartheta_1^*}{d\vartheta_2}} \quad (43)$$

Now replace $\frac{d\vartheta_1^*}{d\vartheta_2}$ with (34). Using algebraic transformations the following expression is obtained:

$$\boldsymbol{C = \frac{\vartheta_2(\vartheta_1^* + \vartheta_2)}{9\vartheta_1^{*^2} - 6\vartheta_2\vartheta_1^* - \vartheta_2(1-2\vartheta_2)}} \quad (44)$$

Note that denominator is B (37) which is positive, while numerator is clearly positive:

$$\boldsymbol{C = \frac{\vartheta_2(\vartheta_1^* + \vartheta_2)}{B} > 0} \quad (45)$$

Going back to the expressions (20) to (23) & (25) it is obvious that as $\boldsymbol{\vartheta_2}$ increases, C is positive causing $\boldsymbol{y_1^{CC}}$ to fall, $\boldsymbol{y_2^{CC}}$ to rise, $\boldsymbol{y^{CC}}$ to fall, $\mathbf{p^{CC}}$ to rise and $\boldsymbol{\pi_2^{CC}}$ to rise.

By multiplying the 2nd part of the expression (24) with $\frac{3\vartheta_1^* - \vartheta_2}{3\vartheta_1^* - \vartheta_2}$ (24) can be rewritten as (46) and apply the known fact from (45):

$$\pi_1^{CC} = \frac{1}{9} - \frac{1}{9}\cdot\frac{\vartheta_2}{3\vartheta_1^* - \vartheta_2}\cdot\frac{3\vartheta_1^* - \vartheta_2}{3\vartheta_1^* - \vartheta_2}$$

$$\pi_1^{CC} = \frac{1}{9} - \frac{1}{9}\cdot\frac{\vartheta_2}{3\vartheta_1^* - \vartheta_2}\left(1 + 2\frac{\vartheta_2}{3\vartheta_1^* - \vartheta_2}\right) > 0 \quad (46)$$

The same transformation can be applied to (26); By multiplying the 2nd part of the expression with $\frac{3\vartheta_1^* - \vartheta_2}{3\vartheta_1^* - \vartheta_2}$ (26) can be rewritten as (47):

$$\pi^{CC} = \frac{2}{9} + \frac{1}{9}\cdot\frac{\vartheta_2}{3\vartheta_1^* - \vartheta_2}\cdot\frac{3\vartheta_1^* - \vartheta_2}{3\vartheta_1^* - \vartheta_2}$$

$$\pi^{CC} = \frac{2}{9} + \frac{1}{9}\cdot\frac{\vartheta_2}{3\vartheta_1^* - \vartheta_2}\left(1 - \frac{\vartheta_2}{3\vartheta_1 - \vartheta_2}\right) \quad (47)$$

It is necessary to determine dynamics of the second part of the expression, which can be rewritten as $D(1-D)$ when (41) is applied. Graph of this equation is a parabola which increases for $D < 0.5$. However, due to the fact that $\boldsymbol{\vartheta_1 > \vartheta_2}$ (30), D always fulfills that requirement, concluding that (47) increases as ϑ_2 increases.

These findings bring to conclusion that as the conflict of interest increases, measured with the Agent's share in Company 2, the market shows tendencies towards monopoly: the overall quantity produced diminishes, prices soar as well as the Company 2 and the total market profit, while Company 1 gradually declines and disappears when $\boldsymbol{\vartheta_2}$ reaches 0.5.

3.3. Numeric analysis

The following table contains numeric simulation of the effects of different Agent's shares in Company 2 on the overall market quantities, profits and price.

Table 2 Simulation of the effects of different Agent's shares in Company 2

ϑ_2	0.05	0.25	0.50	0.75	Basic Cournot model
ϑ_1^*	0,168	0,447	0,68	0,859	
y_1^{CC}	0,26	0,181	0,117	0,06	0,333
y_2^{CC}	0,37	0,41	0,442	0,47	0,333
Y^{CC}	0,63	0,59	0,558	0,53	0,667
p^{CC}	0,37	0,41	0,442	0,47	0,333
π_1^{CC}	0,096	0,074	0,052	0,028	0,111
π_2^{CC}	0,137	0,168	0,195	0,221	0,111
π^{CC}	0,233	0,242	0,247	0,249	0,222

Source: the authors

$\boldsymbol{\vartheta_2}$ values are randomly picked, $\boldsymbol{\vartheta_1^*}$ is solved by solving (32) for the given $\boldsymbol{\vartheta_2}$ and the rest of the

values are obtained by stubbing the ϑ_1^* and ϑ_2 into (20) – (26). Z function for the scenarios given in the Table 2, as well as the $\vartheta_2 = 0$ scenario (linear Z function), is given in the Figure 3.

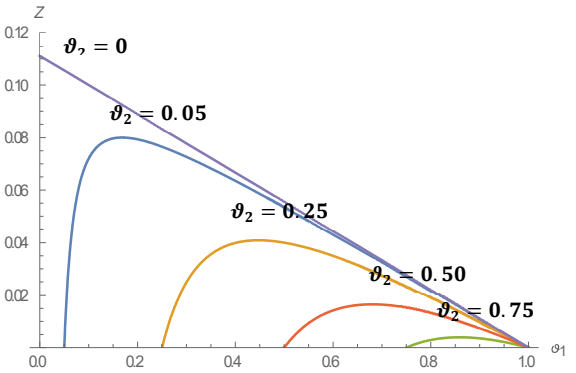

Figure 3 Principal's layer curves of the profit function Z for different values of ϑ_2
Source: the authors

Figure 3 shows that the larger the Agent's share in the competitive company, the greater the ϑ_1 share that the Principal has to give to the Agent, and the maximum payoff of the owner (Z) depletes gradually as ϑ_2 increases. Note that Figure 3 maps vertical cuts of the Z function shown on Figure 2.

Conclusion

This paper analyzes a basic Cournot duopoly model with standardized prices and zero costs. It was proposed that the agent of company 1 (Agent) is rewarded with a share of profits by the company's owner (Principal). A share of the other company is owned by the Agent, but without executive power. The purpose of this study was to demonstrate how the conflict of interests increases as the Agent's share of the other company increases. Principal's profit function is positive only when he rewards the Agent with a greater share than the Agent's share in the other company, but depletes as that share increases. Using comparative statics, it is shown that these two shares are positively correlated. Also, it has been shown that as the Agent's share in the competitive company increases, the market gradually becomes monopolized, as the overall quantity produced decreases. As the market price increases, the profits of both the competitive company and the agent also increase, while the company they run is gradually choked by the Agent, depleting its profits and reducing its production as a result. Consequently, the greater the conflict of interest, the lower the consumer's welfare and the lower the level of competitiveness.

The paper presents a novel method of measuring competitiveness by relating the market coverage to the equivalent number of companies in an oligopoly, demonstrating that the conflict of interests is the same as if the number of companies were not integer. Future studies will focus on generalizing the analysis to more participants, not only two.

Declarations

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Consumerisation of IT – intersection of development streams of business and personal IT

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Abstract
Background: In the age of IT consumerisation, private owned IT artifacts are increasingly used for business purposes. Management's approval is not required, but various approaches are used to create effective management strategies.
Purpose: The historical development trends of business and personal ICT are examined in the paper to understand their intersection - IT consumerisation.
Study design/methodology/approach: The paper provides a preliminary research assessment. The informative outcomes drawn from diverse perspectives and the comprehensive nature of 'gray literature' should serve as guidance for the direction, adjustments, and modifications of future research.
Findings/conclusions: A number of technological and market factors have led to the consumerisation of IT. As a spinout from business IT, personal IT has had a feedback effect on it: the proliferation of computers and mobile devices on the consumer market, combined with affordable Internet-related resources, not only changed personal IT usage patterns, but also redefined the expectations that users have for enterprise software. In order to create an effective IT consumerisation management strategy, it is imperative to understand them.
Limitations/future research: The paper is a starting point for future empirical research in the field of IT consumerisation, and as such, may be amended according to new knowledge that is obtained subsequently.

Keywords
Business IT, personal IT, IT consumerism, history of business IT, history of personal computing

Introduction

The first steps in the development of business IT are fascinating when viewed in the context of their time. Business IT was the privilege of large organizations in the 1950s. It is a result of complex and financially challenging requirements for operability, as well as high levels of required technical education for computer system users. Even so, optimism regarding computer technology's further development prevailed despite all this. Technical and technological developments over the past 70 years have often exceeded expectations expressed many decades ago (Freiberger & Swaine, n.d.). However, it is unlikely that anyone in the era of vacuum tubes and transistors would have predicted that IT would cause such a source of frustration as contemporary literature reveals: enterprise IT consumers today are dissatisfied with insufficient performance and

technological obsolescence of their business IT artefacts, unintuitive user interfaces, fragmentation/non-integration of business applications, etc. Personal IT devices (such as smartphones, laptops, tablets, etc.) play a significant role in shaping such attitudes. As a result, their use - often described as pleasant, intuitive, simple, and personalized - enables mobility, independence, and instant access to shareable, personalized information. Users acquire the necessary technical skills and knowledge easily, intuitively, *during* (and not necessarily *before*) using personal IT devices. Therefore, it comes as no surprise that business IT is also subject to these demands. Users often turn to personal IT devices when these requirements are not met. This trend is called the consumerisation of IT (CoIT). In spite of the fact that it is no longer considered to be nascent, many companies are still not addressing it adequately or even at all.

The general premises in the paper are that "roots" have an important role to play in determining the trajectory of development, making decisions, setting goals, and creating opportunities. Therefore, we believe that, among other things, being informed about CoIT's creation history, which is the focus of the study, is *conditio sine qua non* to determining an appropriate CoIT management strategy. Due to the well-known and widely disseminated history of information technology, only the level of detail necessary to highlight those development milestones that led to the intersection of business and personal IT, thus shaping the technological landscape of today's workplaces, will be covered in the paper.

1. The course of development of business computers

The following section describes the development process of business computers through the decades, as well as the key milestones that paved the way for the emergence of personal IT.

1. The development of computing for war. Most 1940s to 1950s computers were located in universities and used technology (vacuum tubes) and knowledge that were used in wartime. For instance, Great Britain built the first electronic computer in 1943, Colossus, to crack Nazi codes. Two years later, the Harvard Mark I was constructed in the USA and used for ballistic calculations, while ENIAC was used for hydrogen bomb calculations (Freiberger & Swaine, n.d.). The SAGE computer system developed in 1958 was used to detect incoming Soviet missiles (Taylor, n.d.). Programming was a privilege of a few elite, highly educated specialists who wrote software in machine and assembly languages.

2. The emergence of business computers. The first business computers were built using transistor technology. Although the number of computers increased and their performance improved, computers remained few in number, under-performing, and difficult to handle without specialized knowledge. The idea that ordinary, non-tech savvy users will use them was therefore unfounded (Alfredo, 2017). Computer manufacturers believed that professional computer operators would be the only ones who would use them (Freiberger & Swaine, n.d.). Data processing was made easier with the first corporate mainframe, the UNIVAC. It was initially used by the government, military and academia (Freiberger & Swaine, n.d.), until General Electric became its first private sector customer in 1954 as an attempt to reduce costs through automation (Fruhlinger, 2018). Every computer science text book mentions UNIVAC, but it is also interesting to point out the LEO 1, run in 1951, which was used to compute the costs of ingredients in a British chain of hotels and restaurants (Fruhlinger, 2018). The progress of computing during this period can be attributed to the development of high-level programming languages (FORTRAN, ALGOL, COBOL) and single-stream batch processing operating systems (Craviero), such as the General Motors Operating System developed for IBM701 (OSdata.com, 2010), General Motors GM-NAA I/O developed for IBM704, and Manchester University Atlas Supervisor, which is the first modern operating system with the idea of virtual memory (Evren, 2022).

3. Laying the groundwork for general purpose computing. Time-sharing systems were developed from the 1960s to the 1970s. New programming languages and operating systems appeared, which are still known today in their modern incarnations (e.g. BASIC, UNIX). The arrival of minicomputers resulted in their use in scientific laboratories and businesses. Typical examples include PDP-8 built in 1965, and IBM System 360. The advent of integrated circuits and high-level programming languages paved the way for desktop computers. As a result, computers grew faster, more efficient and more reliable, while their dimensions and prices were reduced (Freiberger & Swaine, n.d.). A prediction made by the American engineer and businessman, Gordon Moore, in 1965 became known as Moore's Law, stating that

computer power (more precisely, processor speed, i.e., the number of elements on an integrated circuit) would double approximately every 18-24 months with the price steadily declining due to the exponential miniaturization of electronics (Rotman, 2020) (Shalf, 2020). As a result, Moor argues, component prices are inversely proportional to their number, with a constant decrease in size and an increase in computer speed. In the same year, Moor also predicted the appearance of personal computers, portable communication equipment, electronic watches, self-driving cars, etc. (Moore, 1965). Every time Moore's Law has been predicted to become obsolete, the predictions have been proven wrong. According to the next prediction of this type, Moore's law will be obsolete in 2025 because existing chip manufacturing technologies will have reached their limits at that time (Figure 1) (Shalf, 2020).

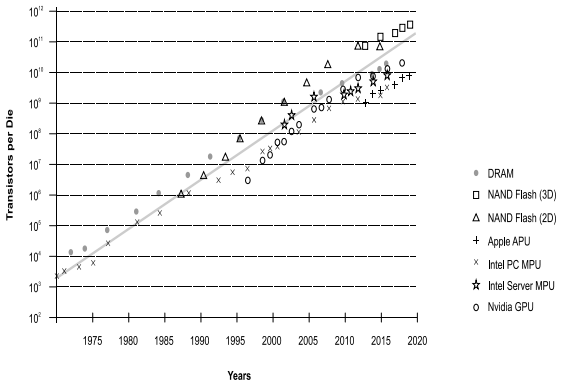

Figure 1 Transistor Count Trends
Source: IC Insights, 2020

4. The emergence of business software. Microprocessors were introduced between the 1970s and the 1980s, which, according to Moore's law, led to a significant reduction in the size and price of computers, as well as a rapid increase in their power, resulting in many corporations using them for inventory management, reports and payrolls (Alfredo, 2017). INTEL produced the 4004 chip in 1971 - the first commercially produced microprocessor for use in simple business systems: calculators, cash registers, ATMs, etc. (TechTarget contributor, 2012). During 1977, the General Ledger program was created as the first, compared to today's standards, serious business software, followed by the Electric pencil word processor program, and two years later VisiCalc, which was the first tool to perform tabular calculations (spreadsheets) (Freiberger & Swaine, n.d.), succeeded by Lotus 1-2-3 (1980), Multiplan (1982) and Excel (1985). Using these computers, non-procedural programming languages were developed that were easily mastered by users without a technical background. "One computer - many users" described the wave of computer development up to the 1980s, when one business computer was used by several people in a company.

5. IT companies are starting to take an interest in the consumer market. This interest was sparked by IBM's first personal computer with an open architecture, which allowed other companies to manufacture not only components for IBM computers, but also entire clones (Freiberger & Swaine, n.d.), which will be discussed in Section 2**.**

6. IT companies shifted their focus from the business market to the personal computer market following the burst of the dot-com bubble. Between 1998 and 2000, the value of shares of IT companies increased dramatically as a result of the popularity of the Internet and computing, which took on an increasingly important role in people's lives, as well as the development of e-business, investments in IT and e-business companies (Geier, 2015). A large number of young firms went public and achieved high stock market valuations, creating the illusion that anyone with a good idea can get rich quickly using the Internet and IT. The Internet boom prompted investors to invest in technology companies without considering the usual metrics of profitability. In 2000, however, most tech stocks had lost up to 75% of their value, causing the bubble to burst and resulting in losses of $1.75 trillion (McCullough, 2018). Quarterly losses for many companies ranged from 10 to 30 million dollars (Geier, 2015). The effects of the dotcom mania went beyond the United States, as the recession affected the entire world. Business consumers' demand for IT equipment dropped - Silicon Valley alone lost 200,000 jobs as a result. Due to such circumstances, the IT industry shifted its focus from business to consumer IT market niche (McCullough, 2018).

7. Internet maturity and low-cost Internet resources were enabled by the remaining optical infrastructure. After the dot-com bubble had burst, the remaining optical fibre Internet infrastructure with significant bandwidth enabled new, low-cost Internet services, which, among other things, became the basis for IT consumerisation. The global network of optical fibres extends over 400 million kilometres today

(Sivers, 2021), a significant part of which is at the bottom of the ocean (Cooper, 2022). AT&T and Version took advantage of high bandwidth after the dot-com bubble burst to offer Internet services to consumers. A significant future growth in communication needs was also taken into consideration when laying optical cables, so additional, so-called "dark fibres" were installed, which remain unused and, according to National Geographic, account for approximately 90% of all optical fibres in America (Plouffe, 2017).

2. The course of development of personal computing

As mentioned earlier, in the 1980s, the technological prerequisites were present for IT to expand from the business to the personal sphere. With the advent of gaming computers and general purpose computers, users were able to acquire a higher level of digital literacy from the comfort of their own home. Through the Internet, users had access to information, online communication, social interactions, and entertainment, and the mobile and smart phone enabled access to the digital world while they were on the go. The following paragraph is the overview of personal IT development by decades, highlighting important milestones that shaped personal IT users into what Prensky called "digital natives" (Prensky, 2001).

1. Gaming computers and the declining price of computers. The popularity of computers was greatly influenced by gaming computers. Thus, every-day information technology became accessible to consumers who were not tech-savvy. The leading companies were Apple, Commodore, Tandy and Atari (Press, 2022). Games such as text adventure or role-playing made ordinary users aware they can operate a computer (Taylor, n.d.), and computers were no longer just a tool for business, but also for entertainment. This is illustrated by the Guinness Book of Records listing for Commodore 64 (a gaming computer released in 1982) as the best-selling computer model of all time (about 30 million units sold in 5 years) (Caplan & Lowe).

2. The emergence of the Internet and open architecture led to mass production of personal computers. From 1980 to 1990, computers became mass-produced. In 1981, IBM introduced the IBM PC to the market with the Microsoft MS-DOS operating system. The IBM PC was built on an open architecture, so other manufacturers could manufacture compatible components or even produce complete clones. The possibility offered was widely accepted. The very next year, Compaq Computer Corporation introduced a computer compatible with IBM PC. PC users outnumbered mainframe users in 1984 as a result of the mass demand for personal computers (Sanger, 1984). As a result of these events, personal computing emerged, which can be summed up by the expression "1 user - 1 computer".

3. The Internet left the military and academic sphere in 1983, 14 years after its creation, and became available to ordinary users. Basing his estimates on data from the period 1983-2019, Nielsen determined that high-end users' connection speed grows by 50% per year (Figure 2) (Nielsen, 2019). There has been an increase in Internet connection speeds from 300 bps in the mid-80s to more than 350 Mbps today. Personal devices have become more attractive platforms for communication, entertainment, and multimedia consumption as a result of this growth, which has enabled faster interconnection of users, instant loading and playback of content as well as the development of new applications.

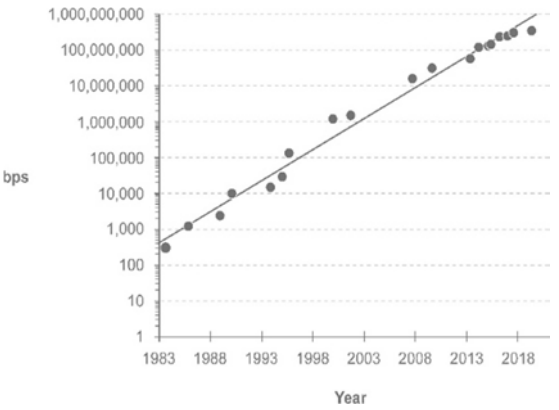

Figure 2 High-end user's connection speed 1983-2018
Source: Nielsen, 2019

4. Graphical user interface made computers easier to use. During the early 1980s, milestones were set in the field of operating systems. The Lisa computer was launched in 1983 by Apple, which introduced a new way to interact with users through graphical user interface (GUI) and graphical icons instead of command lines (Freiberger & Swaine, n.d.). In the following year, Apple introduced the first desktop computer with a screen, mouse, and user interface - Macintosh (Press, 2022). The process of interacting with ICT was simplified and made more intuitive through the use of buttons (icons) rather than complex text commands, thus improving accessibility and interactivity. The GUI also enabled multitasking,

meaning that users could simultaneously perform multiple tasks using multiple work windows. During the 1980s and 1990s, the Microsoft vs Apple saga began (both operating systems were conceptually based on Xerox GUIs) (Dormehl, 2023).

5. WWW. The World Wide Web, a system of links between pages created by users, made the Internet a public medium for communications in 1991 (Freiberger & Swaine, n.d.). With the Mosaic browser, (Science Media Museum, 2020), the Internet became a universal source of information accessible to a large portion of the population thanks to the modest means required to access and create websites. Figure 3 shows the growth of Internet users.

Figure 3 Growth of the Internet from 1995 (millions of users)
Source: adjusted according to Internet World Stats, 2021

The Netscape Navigator browser was released in 1994 (Science Media Museum, 2020) and since then the number of websites has grown exponentially (Armstrong, 2021) (Figure 4). In 1998, when Google was founded, there were about 2.4 million websites, while in 1994, when Yahoo was founded, only 3,000 websites existed; Facebook was launched in 2004 as one of 51.6 million websites, and six years later Instagram was launched with over 200 million. There were 1.83 billion websites in January 2021 (Ahlgren, 2021), and today there are over 1.97 billion.

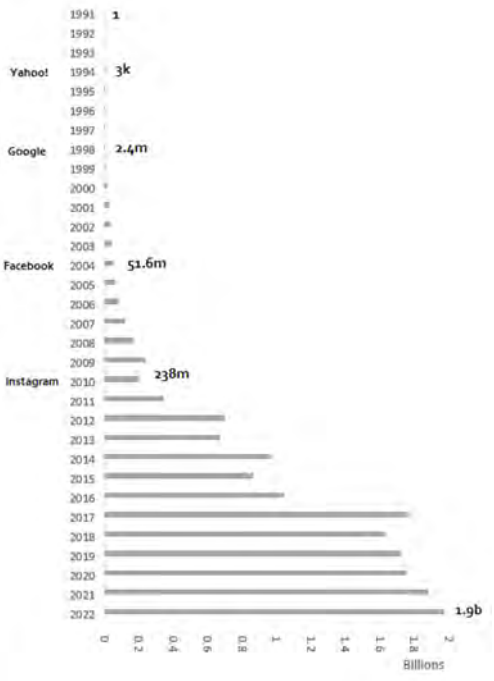

Figure 4 Number of web sites (1995-2022)
Source: Armstrong, 2021

6. The emergence of cloud technology. As personal computing and the Internet have proliferated, the demand for digital storage space (photos, videos, etc.) has risen significantly. The so-called cloud proved to be a good solution for personal storage (Mar, Law, & Chin, 2015). It is easy to use (Iansiti & Richards, 2012), easy to administer (Kiryakova, Angelova, & Yordanova, 2015), and has a low learning curve (Farah, 2010). Therefore, users like the fact that they can securely store their images, videos, documents, etc. and access them from any device they choose. Although cloud is primarily about data storage, it is also about enabling distribution of software as a service (SaaS) that allows users to access various applications via the Internet rather than installing them locally (Bawab, 2014), which will be discussed in detail in the following sections. Apparently, the cloud is also useful for business: it facilitates file sharing and collaboration among colleagues, joint work on files and projects, and access to current information, all without requiring sophisticated technical expertise from the user. Data showing the growth of the cloud use supports some analysts' predictions that personal clouds will replace personal computers in the future (Alamoudi & Alamoudi, 2016) (Figure 5).

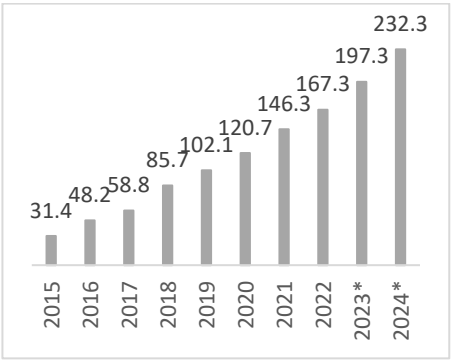

Figure 5 Public Cloud Application Services/Software as a Service (SaaS) Consumption by End Users Worldwide 2015 to 2024 (2023 and 2024 are projections)
Source: Vailshery, 2023

7. Mobile and smart phone market development. The development of mobile devices, especially smartphones, is important for the consumerisation of IT. Having access to these devices enabled users to have a mobile phone and take advantage of advanced technological capabilities and multipurpose functionality which, in addition to making phone calls, also provides: sending texts, taking photos, recording videos, surfing the Internet, listening to music, playing games, etc. Figure 6 shows the growth of mobile subscribers, and Figure 7 shows the number of smartphones sold worldwide.

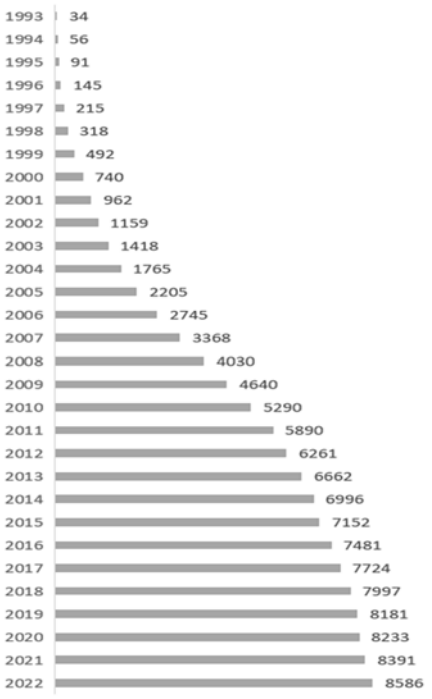

Figure 6 Number of mobile subscriptions worldwide 1993-2022 in millions of units
Source: Petroc, 2023

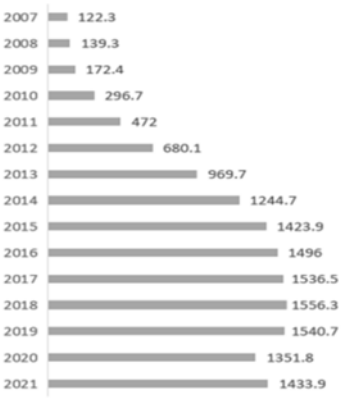

Figure 7 Number of smartphones sold worldwide 2007-2021 in millions of units
Source: Laricchia, 2022

Some kind of milestone devices were Nokia 9210 Communicator, one of the first internet-enabled mobile phone on the market in 2000 and iPhone as one of the first smartphones in 2007. A year later, HTC Dream was released, running Android, today's leading mobile operating system. Telecommunications and ICT services are becoming more affordable worldwide, as on average, mobile service prices are steadily decreasing (Measuring Digital Development: ICT Price Trends 2019), resulting in a rise in mobile users (Figure 8) (Laricchia, 2022)**.** Mobile device prices are declining, as illustrated by the following example: Motorola DynaTAC costing $3,995 was the first mobile phone to appear on the consumer market in 1983. Mobile phone prices in the USA are more than five times lower in 2023, at $718, and devices for the consumer market are less expensive than those for corporations (Laricchia, 2023).

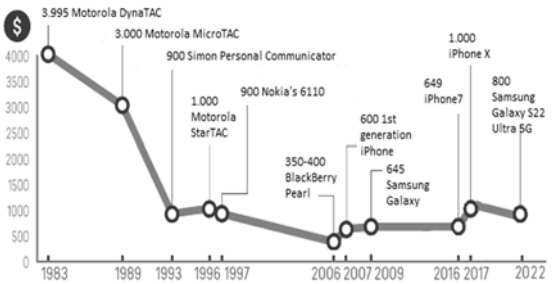

Figure 8. Mobile device prices from 1983 to 2022 in America
Source: adjusted according to Statista, 2021

In the 1990s, users signed long-term contracts for subsidizing the purchase of mobile phones, so the true price of the phone was hidden in the monthly fees, resulting in the decline of the price of mobile phones for the consumer market. As a

result of abandoning this practice and using increasingly expensive parts in the production of phones, in recent years we have seen prices rise once again (Kastrenakes, 2019). Mobile phone makers today are building phones with respectable computational performance while allowing users to stay connected on the go (Lill, 2017). By connecting the phone to a monitor, keyboard, and mouse, some manufacturers have gone further, allowing it to be used as a computer, which could result in fewer laptop sales (Wong, 2019).

Thus, it is not surprising that the sale of PCs has decreased as a result of the increased sales of mobile devices, especially smartphones. Figure 9 shows that mobile, desktop, and tablet have 55.4%, 41.96%, and 2.64% market shares worldwide, respectively, according to StatCounter GlobalStats (StatCounter Globalstat, 2021).

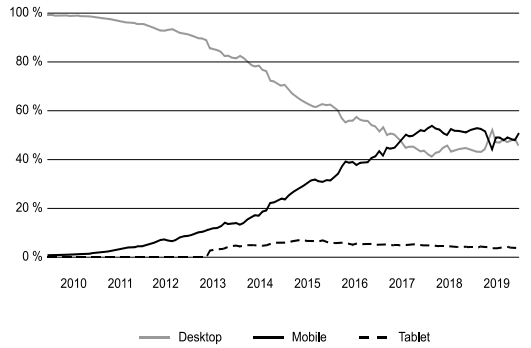

Figure 9 Desktop vs Mobile vs. Tablet Market Share Worldwide
Source: StatCounter Globalstat, 2021

Furthermore, the mobility of these devices has revolutionized the way people use IT in addition to their multipurpose functionality. Furthermore, smartphones have made it easier to download and use numerous applications and social networks, allowing users to customize their devices to suit their specific needs, entertainment, communication, and daily activities. When users become accustomed to user-friendly interfaces, mobility, and practicality that personal IT provides them, they begin to resist business IT that is not like the one they use every day.

8. The development of Web 2.0 and pervasive computing. The miniaturization of hardware, embodied mostly in the proliferation of smartphones and laptops, has contributed to the realization of the idea of pervasive computing, integrating IT into everyday life (Mahadev, 2001), as mentioned in (Sakal & Matković, 2016). Since the 2000s, pervasive computing, a new IT era, has been on the rise, characterized by the use of interconnected computerized equipment anywhere and at any time (Figure 10).

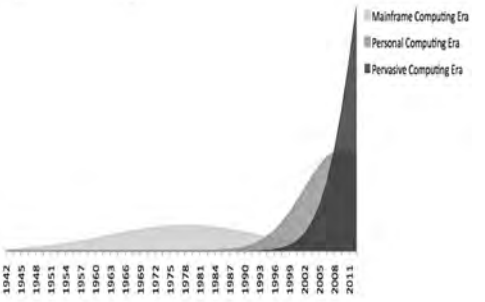

Figure 10 Three eras of computing
Source: Muller, Alt, & Michelis, 2011

The development of Web 2.0 took place a year before the dot-com bubble burst. This term includes various applications and websites such as social networks, blogs, wikis, etc., which allow users not only to consume content, but also to generate and share it online with their devices. Social networks, one of the key factors of IT consumerisation since their creation (Sen, 2012), are rapidly increasing their number of users. Using Facebook as an example (Ortiz-Ospina, 2019), we see that it had 1 million users in 2004, but it had approximately 2.9 billion users by 2021 (Number of monthly active Facebook users worldwide as of 2nd quarter 2021 , 2021), which is similar to many other social networks' rapid growth (Ortiz-Ospina, 2019). Using social networks has transformed how people consume content, communicate, get information, and actively participate in the digital world. Following specific groups, brands, and people allows them to adapt the content they are exposed to according to their preferences and needs, thus creating a unique digital identity. Consumption of personalized content is becoming an integral part of everyday life, so personalizing IT is now also necessary in business.

9. Marketing aimed at consumerism and product obsolescence. Technological progress has enabled a large number of users to improve their digital literacy, but marketing, consumerism, and product obsolescence also need to be discussed. As consumerism has heavily influenced new generations, they attach importance to trying new products and following trends, so they apply the same behaviour to IT. Marketing creates a perception of value, thus creating a need for a technological product. Apart from advertisements that aim to trigger people's status consciousness, the consumerisation of IT is also fuelled by functional and psychological product obsolescence

to manipulate consumption. This is demonstrated in the market by designing inferior items that are quickly worn out, discarded and replaced at an increasing rate, which creates a need for new items to be owned. Consumerist culture is also promoted that encourages status consciousness and the need to own the latest product, even if the old one is still functional. Since 2000, this trend of faster consumption and obsolescence of products has been relevant in the field of ICT. For example, Apple launched 3 new phones on the market in 2016, while Samsung launched 31 products (Peng, 2019).

10. Workforce evolution and changing IT needs in the workplace. Due to lower hardware prices and the proliferation of mobile applications and social media that users heavily utilize in their private lives via wireless and broadband networks (Sadiku, Foreman, & Musa, 2018), their ability to master systems of comparable complexity to those in companies has increased (Köffer, Ortbach, Junglas, Niehaves, & Harris, 2015). "Digital natives" are a new generation of users (Mallmann, Vargas, Carlos, & Maçada, 2019), whose expectations and work practices have changed significantly (Petrović, 2022) compared with previous generations, the so-called "digital immigrants" (Gregory, Kaganer, Henfridsson, & Ruch, 2018). They have advanced collaboration skills (Sakal, Raković, Seres, & Vuković, 2019), a habit of being constantly connected through social networks (Weiß & Lei, 2012) and a desire to work remotely (Köffer, Ortbach, & Björn, 2014). According to some research, 68% of millennials are more likely to be interested in an employer if the possibility of working remotely is offered (Wong, 2019). The new generation (Millennials and Generation Z) employees expect to use their own devices and applications, and if companies do not cater to their requests, they will not hesitate to use them despite the bans, if it facilitates or speeds up their work. The research shows that 80% of workers use SaaS applications at work without IT department approval, and 67% of teams introduce their own collaboration tools (Scott, 2020). Moreover, new generation employees want to be flexible, not tied to the place of employment, and want IT services to be upgraded so they can be constantly accessible on their private mobile devices (Sakal, Raković, Seres, & Vuković, 2019) and have the possibility of a compressed work week and flexible working hours (Kim, 2018). They have different definitions of success and an outward-looking perspective in which they interact with a wide network of communities outside the company they work for (Brack & Kip, 2012). It is extremely important for them to have autonomy in their work arrangements (Kim, 2018), to have an opportunity to grow and earn more (Mayerova & Hyžova, 2020) and to have interesting work tasks (Mastrolia & Willits, 2013).

3. Intersection of development streams of business and personal technology

Figure 11 represents two parallel streams of business and personal computing development since the 1940s. The direction of IT flow from one stream of computing to another is indicated by arrows.

Since the late 1970s and early 1980s, personal computing had evolved as a separate stream of technological development from business computing. Thereafter came the mass production and sale of gaming computers, personal computers and compatible devices, which intensified after the dot-com bubble burst and the massive reorientation of IT companies towards consumers. In the 1990s, companies began developing GUIs to facilitate user interaction with computers, and at the same time, the Internet, Web 2.0, developed, and cloud computing was born which facilitated and accelerated the mass adoption of computer technology. Increasing numbers of people were using computers every day to communicate and share data, images, and videos over the Internet. During the development of technology, the price of computers and compatible devices decreased, which made them even more accessible to the masses. During the same period, computers also became more reliable, fast, and efficient, and as the generation passed, they became smaller and smaller, until they became palm-sized devices. Interaction via UI became by default intuitive, easy, fun, enabling personalized and mobile access to digital content (Figure 12). Business IT was subjected to similar demands. Business IT, however, differs from what is expected: users' experience was not its primary concern, but rather cost-effective business process support. Despite the rapid development of computing devices in the consumer market, the pace of development of business computers did not keep pace, resulting in workplaces using devices/software with model/version numbers lower than the ones of personal devices.

Consequently, between 2000 and 2010, users started bringing their own devices into the

workplace and using them for business purposes, or asked companies to let them use better devices. Companies had different reactions to this influx of personal IT into the business domain. Some companies implemented a "wait and see" strategy, completely ignoring the consumerisation of IT happening to them. Other companies recognized the importance of customizing business IT to new generations of employees and enabling them to use their own devices (Yevseyeva et al., 2014), (Managing IT Consumerization, 2014) through BYOD (Bring Your Own Device) programs or through financing the purchase of desired devices (D'Arcy, 2011). They thus found themselves in a "consumerisation catch" in which they were compelled to deal with employees' demands for new IT in the workplace or employees will inevitably use their own devices (Petrović, 2022). The companies that refused to meet these employees' demands were either abandoned or employees found a way to use their own devices. Therefore, the consumerization of IT has redefined employee-company relationships (Niehaves, Köffer, & Ortbach, 2012) fundamentally transforming how IT is managed as employees now decide on business IT (Petrović, 2022).

Supporting the use of personal devices for business purposes can provide companies with some advantages, such as: reducing costs, improving processes, increasing flexibility, productivity and innovation of employees, their greater independence and satisfaction, better cooperation between employees and better connections with clients and business partners. In refusing to support it, companies risk making new generations unwilling to work for them and receiving a bad reputation. On the other hand, by accepting the consumerisation of IT, a company also accepts potential risks, such as: employee privacy issues, data security concerns, inconsistent business processes, more complex system due to the large number of heterogeneous devices it must support, etc. (Petrović, 2022). In order to select the optimal strategy, it is essential to comprehend the chances and threats as well as the reasons behind employees' desire to work from their own devices, as partially illustrated in this paper.

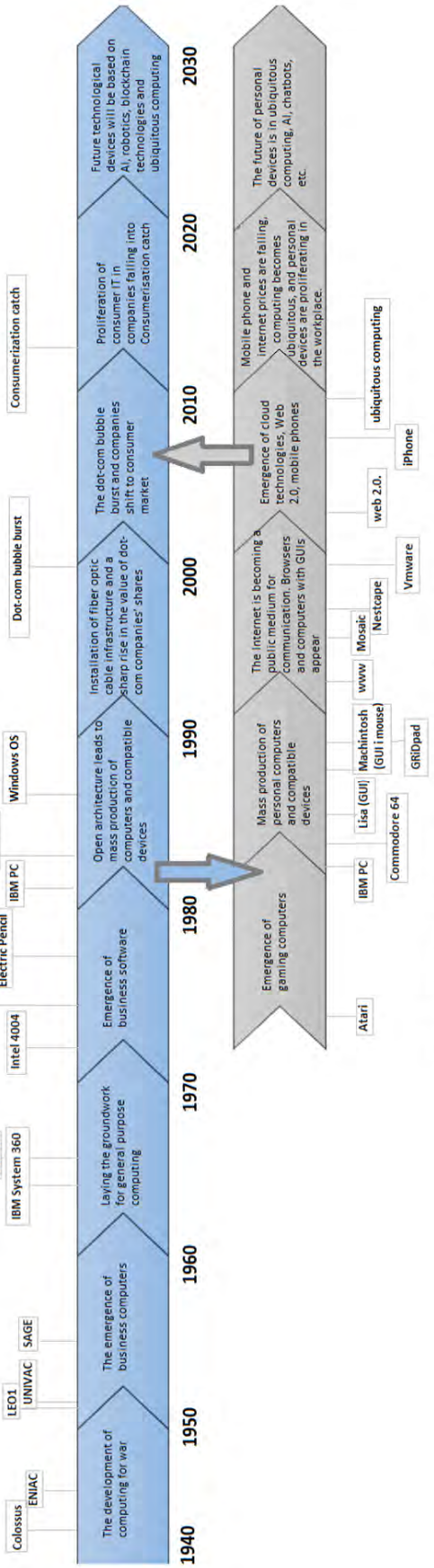

Figure 11 Flows of development of business and personal computing
Source: the authors

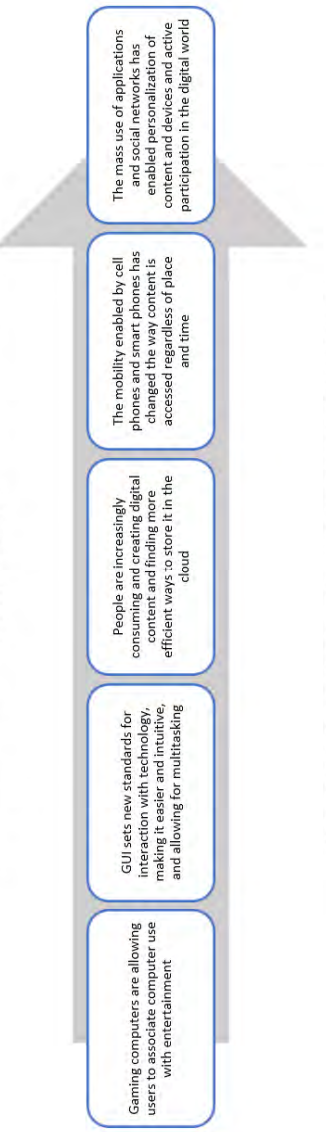

Figure 12 The evolution of the user experience of technology
Source: the authors

Several market and technological factors have contributed to the consumerisation of IT. The development of personal IT as a spin-out from business IT took place in parallel, until personal IT began to flow into the business world. Their historical development background is helpful not only for identifying the factors that led to the emergence of IT consumerism, but also for identifying what users expect from future technological solutions, based on their criticism of current IT systems in businesses. IT consumption in the future will be shaped by ubiquitous computing, faster IT development, as well as the continued growth and complexity of consumer needs for greater mobility and personalization of IT devices and applications. There is a realistic expectation that the further development of both personal and business IT will accelerate exponentially in the near future and make technologies like Web 3.0, Internet of Things, artificial intelligence, machine learning, blockchain, mass automation and robotization a common, everyday occurrence (Freiberger & Swaine, n.d.), (Ebling, 2016), (Nishitha, 2019). The above factors will, naturally, affect how the human factor implements work: staff augmentation and freelancing are also experiencing a certain increase. Research on the freelance market – Fiverr and Upwork (Payset Perspective, 2022) shows that over 80% of medium and large business owners surveyed rely on freelancers and that 56% of respondents who are not freelancers will become so in the future. Statista confirms these findings, predicting 16 million more such workers in America by 2027 (Payset Perspective, 2022). Remote employees and freelancers are the driving force for the consumerisation of IT, i.e. the adoption of BYOD policies (NordLayer, 2023). Therefore, companies will need to empower their employees, giving them the ability to make use of their own devices, which they will provide adequately (Novitović, n.d.), bringing them financial and operational benefits (Adlum, 2023).

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Figures should be centered. All figures must have captions. The title of figures should appear immediately below the figure. The title of the figure should follow the figure number. Figures should not be wider than the margins of the paper. Figures will not be redrawn by the publisher. Figures should be high-quality grayscale graphics (please, do not use colors): vector drawings (with text converted to curves) or 300 dpi bitmaps.

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> Ljubojević, T.K. (1998). Ljubojević, T.K. (2000a). Ljubojević, T.K. (2000b). Ljubojević, T.K., & Dimitrijević, N.N. (1994).

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Authors must be listed by their last names, followed by initials. Publication year must be written in parentheses, followed by a full stop. Title of the article must be in sentences case: only the first word and proper nouns in the title are capitalized. The periodical title must be in title case, followed by the volume number, which is also italicized:

> Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. *Title of Periodical, volume number* (issue number), pages.

➲ **Journal article, one author, paginated by issue.**

Journals paginated by issue begin with page 1 in every issue, so that the issue number is indicated in parentheses after the
volume. The parentheses and issue numbers are not italicized, e.g.

> Seliverstova, Y. (2021). Workforce diversity management: A systematic literature review. *Strategic Management*, *26*(2), 3–11. https://doi.org/10.5937/StraMan2102003S

➲ **Journal article, one author, paginated by volume.**

Journals paginated by volume begin with page 1 in issue 1, and continue page numbering in issue 2 where issue 1 ended, e.g.

> Perić, O. (2006). Bridging the gap: Complex adaptive knowledge management. *Strategic Management, 14*, 654–668.

➲ **Journal article, two authors, paginated by issue.**

Dakić, S., & Mijić, K. (2020). Regression analysis of the impact of internal factors on return on assets: A case of meat processing enterprises in Serbia. *Strategic Management*, *25*(1), 29–34. https://doi.org/10.5937/StraMan2001029D

➲ **Journal article, two authors, paginated by volume.**

Ljubojević, K., & Dimitrijević, M. (2007). Choosing your CRM strategy. *Strategic Management, 15*, 333-349.

➲ **Journal article, three to six authors, paginated by issue.**

Marić, S., Uzelac, O., & Strugar-Jelača, M. (2019). Ownership structure as a measure of corporate performance. *Strategic Management*, *24*(4), 28–37. https://doi.org/10.5937/StraMan1904028M

➲ **Journal article, three to six authors, paginated by volume.**

Boškov, T., Ljubojević, K., & Tanasijević, V. (2005). A new approach to CRM. *Strategic Management, 13*, 300-310.

➲ **Journal article, more than six authors, paginated by issue.**

Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., et al. (2005). Putting the user at the center of software testing activity. *Management Information Systems, 3*(1), 99-106.

➲ **Journal article, more than six authors, paginated by volume.**

Strakić, F., Mirković, D., Boškov, T., Ljubojević, K., Tanasijević, V., Dimitrijević, M., et al. (2003). Metadata in data warehouse. *Strategic Management, 11*, 122-132.

➲ **Magazine article.**

Strakić, F. (2005, October 15). Remembering users with cookies. *IT Review*, *130*, 20-21.

➲ **Newsletter article with author.**

Dimitrijević, M. (2009, September). MySql server, writing library files. *Computing News, 57,* 10-12.

➲ **Newsletter article without author.**

VBScript with active server pages. (2009, September). *Computing News,57,* 21-22.

B. BOOKS, BROCHURES, BOOK CHAPTERS, ENCYCLOPEDIA ENTRIES, AND BOOK REVIEWS

Basic format for books

Author, A. A. (Year of publication). *Title of work: Capital letter also for subtitle*. Publisher.

- **Book, one author.**

  Ljubojević, K. (2005). *Prototyping the interface design*. Faculty of Economics in Subotica.

- **Book, one author, new edition**

  Dimitrijević, M. (2007). *Customer relationship management* (6th ed.). Faculty of Economics in Subotica.

- **Book, two authors.**

  Ljubojević, K., Dimitrijević, M. (2007). *The enterprise knowledge portal and its architecture*. Faculty of Economics in Subotica.

- **Book, three to six authors.**

  Ljubojević, K., Dimitrijević, M., Mirković, D., Tanasijević, V., & Perić, O. (2006). *Importance of software testing*. Faculty of Economics in Subotica.

- **Book, more than six authors.**

  Mirković, D., Tanasijević, V., Perić, O., Jovanov, N., Boškov, T., Strakić, F., et al. (2007). *Supply chain management*. Faculty of Economics in Subotica.

- **Book, no author or editor.**

  Web user interface (10th ed.). (2003). Faculty of Economics.

- **Group, corporate, or government author.**

  Statistical office of the Republic of Serbia. (1978). *Statistical abstract of the Republic of Serbia.* Ministry of community and social services.

- **Edited book.**

  Dimitrijević, M., & Tanasijević, V. (Eds.). (2004). *Data warehouse architecture*. Faculty of Economics.

- **Chapter in an edited book.**

  Repa, V. (2019). Deriving Key Performance Indicators from Business Process Model. In M. Pańkowska & K. Sandkuhl (Eds.), *Perspectives in Business Informatics Research. BIR 2019. Lecture Notes in Business Information Processing, vol 365.* (pp. 148–162). Springer. https://doi.org/10.1007/978-3-030-31143-8_11

➲ **Encyclopedia entry.**

Mirković, D. (2006). History and the world of mathematicians. In *The new mathematics encyclopedia* (Vol. 56, pp. 23-45). Faculty of Economics.

C. UNPUBLISHED WORKS

➲ **Paper presented at a meeting or a conference.**

Ljubojević, K., Tanasijević, V., Dimitrijević, M. (2003). *Designing a web form without tables*. Paper presented at the annual meeting of the Serbian computer alliance, Beograd.

➲ **Paper or manuscript.**

Boškov, T., Strakić, F., Ljubojević, K., Dimitrijević, M., & Perić, O. (2007. May). *First steps in visual basic for applications*. Unpublished paper, Faculty of Economics Subotica, Subotica.

➲ **Doctoral dissertation.**

Strakić, F. (2000). *Managing network services: Managing DNS servers*. Unpublished doctoral dissertation, Faculty of Economics Subotica.

➲ **Master's thesis.**

Dimitrijević, M. (2003). *Structural modeling: Class and object diagrams*. Unpublished master's thesis, Faculty of Economics Subotica.

D. ELECTRONIC MEDIA

The same guidelines apply for online articles as for printed articles. All the information that the online host makes available must be listed, including an issue number in parentheses:

Author, A. A., & Author, B. B. (Publication date). Title of article. *Title of Online Periodical, volume number* (issue number if available). https://www.anyaddress.com/full/url/

➲ **Article in an internet-only journal**

Tanasijević, V. (2003, March). Putting the user at the center of software testing activity. *Strategic Management*, *8* (4). https://www.ef.uns.ac.rs/sm2024

➲ **Document from an organization**

Faculty of Economics. (2008, March 5). *A new approach to CRM*. https://www.ef.uns.ac.rs/papers/acrm.html

➲ **Article from an online periodical with DOI assigned.**

Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems*, 2 (2), 45-54. https://doi.org/10.5937/StraMan213302003S

➲ **Article from an online periodical without DOI assigned.**

Online journal articles without a DOI require a URL.

Author, A. A., & Author, B. B. (Publication date). Title of article. *Title of Journal, volume number*. https://www.anyaddress.com/full/url/

Jovanov, N., & Boškov, T. A PHP project test-driven end to end. *Management Information Systems*, 2 (2), 45-54. https://www.ef.uns.ac.rs/mis/TestDriven.html

REFERENCE QUOTATIONS IN THE TEXT

➲ **Quotations**

If a work is directly quoted from, then the author, year of publication and the page reference (preceded by “p.”) must be included. The quotation is introduced with an introductory phrase including the author’s last name followed by publication date in parentheses.

According to Mirković (2001, p. 201), “The use of data warehouses may be limited, especially if they contain confidential data”.

Mirković (2001, p. 201), found that “the use of data warehouses may be limited”. What unexpected impact does this have on the range of availability?

If the author is not named in the introductory phrase, the author's last name, publication year, and the page number in parentheses must be placed at the end of the quotation, e.g.

He stated, “The use of data warehouses may be limited,” but he did not fully explain the possible impact (Mirković, 2001, p. 201).

➲ **Summary or paraphrase**

According to Mirković (1991, p. 201), limitations on the use of databases can be external and software-based, or temporary and even discretion-based.

Limitations on the use of databases can be external and software-based, or temporary and even discretion-based (Mirković, 1991, p. 201).

➲ **One author**

Boškov (2005) compared the access range…

In an early study of access range (Boškov, 2005), it was found...

➲ When there are **two authors**, both names are always cited:

Another study (Mirković & Boškov, 2006) concluded that…

➲ If there are **three or more authors** the abbreviation "et al." (Latin for "and others") is employed in APA in-text citations when referencing works with three or more authors. The format is to include only the first author's last name, followed by "et al.," a comma, and the year of publication. For instance, (Dakic et al., 2024) would be used as an example.

➲ **Unknown author**

If the work does not have an author, the source is cited by its title in the introductory phrase, or the first 1-2 words are placed in the parentheses. Book and report titles must be italicized or underlined, while titles of articles and chapters are placed in quotation marks:

A similar survey was conducted on a number of organizations employing database managers (Limiting database access, 2005).

If work (such as a newspaper editorial) has no author, the first few words of the title are cited, followed by the year: (The Objectives of Access Delegation, 2007)

Note: In the rare cases when the word "Anonymous" is used for the author, it is treated as the author's name (Anonymous, 2008). The name Anonymous must then be used as the author in the reference list.

➲ **Organization as an Author**

If the author is an organization or a government agency, the organization must be mentioned in the introductory phrase or in the parenthetical citation the first time the source is cited:

According to the Statistical Office of the Republic of Serbia (1978), …

Also, the full name of corporate authors must be listed in the first reference, with an abbreviation in brackets. The abbreviated name will then be used for subsequent references:
The overview is limited to towns with 10,000 inhabitants and up (Statistical Office of the Republic of Serbia [SORS], 1978).

The list does not include schools that were listed as closed down in the previous statistical overview (SORS, 1978).

➲ When citing **more than one reference from the same author**: (Bezjak, 1999, 2002)

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(Griffith, 2002a, 2002b, 2004)

➲ **Two or more works in the same parentheses**

When two or more manuscripts are cited parenthetically, they must be cited in the same order as they appear in the reference list, separated by a semicolon.

(Bezjak, 1999; Griffith, 2004)

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If two or more sources used in the submission were published by the same author in the same year, the entries in the reference list must be ordered using lower-case letters (a, b, c…) with the year. Lower-case letters will also be used with the year in the in-text citation as well:

Survey results published in Theissen (2004a) show that…

➲ To **credit an author for discovering a work** when you have not read the original:

Bergson's research (as cited in Mirković & Boškov, 2006)…

Here, Mirković & Boškov (2006) will appear in the reference list, while Bergson will not.

➲ When **citing more than one author**, the authors must be listed alphabetically:

(Britten, 2001; Sturlasson, 2002; Wasserwandt, 1997)

➲ When there is **no publication date**: (Hessenberg, n.d.)

➲ **Page numbers must always be given for quotations**:

(Mirković & Boškov, 2006, p.12)

Mirković & Boškov (2006, p. 12) propose the approach by which "the initial viewpoint…

➲ **Referring to a specific part of a work**:

(Theissen, 2004a, chap. 3) (Keaton, 1997, pp. 85-94)

➲ **Personal communications, including interviews, letters, memos, e-mails, and telephone conversations**, are cited as below. (These are *not* included in the reference list.)

(K. Ljubojević, personal communication, May 5, 2008).

FOOTNOTES AND ENDNOTES

A few footnotes may be necessary when elaborating on an issue raised in the text, adding something that is in indirect connection, or providing supplementary technical information. Footnotes and endnotes are numbered with superscript Arabic numerals at the end of the sentence, like this.1 Endnotes begin on a separate page, after the end of the text. However, *Strategic Management* **does not recommend the use of footnotes or endnotes.**

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