

ANALYSIS OF FACTORS INFLUENCING INTERNATIONAL EXPANSION DECISIONS USING BAYESIAN NETWORKS

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Objetivo do estudo

Analisar os fatores que influenciam as decisões dos gestores em estratégias de expansão internacional e avaliar o impacto do tamanho organizacional, medido pelo número de funcionários, nessas decisões, utilizando o método de Redes Bayesianas.

Relevância/originalidade

Apresenta insights originais ao aplicar Redes Bayesianas para avaliar a influência do tamanho organizacional nas decisões de expansão internacional, oferecendo uma abordagem probabilística que melhora a compreensão da tomada de decisões estratégicas em um contexto global, uma área pouco explorada em pesquisas.

Metodologia/abordagem

As Redes Bayesianas foram construídas usando Python, aplicando algoritmos de clustering para categorizar as empresas por tamanho e interesse em expansão internacional. Dados de eventos de networking em cinco cidades foram padronizados e analisados usando raciocínio diagnóstico.

Principais resultados

O impacto de fatores de interesse, como aquisições e IPOs, varia significativamente dependendo do tamanho organizacional. Empresas pequenas priorizam opções de financiamento alternativas, enquanto grandes empresas favorecem estratégias complexas, como aquisições, devido à maior capacidade financeira e de recursos.

Contribuições teóricas/metodológicas

O trabalho contribui ao demonstrar como as Redes Bayesianas podem modelar relações complexas entre fatores organizacionais e tamanhos, oferecendo insights sobre os impactos variados desses fatores. Destaca a utilidade da simulação para compreender decisões estratégicas em diferentes escalas empresariais.

Contribuições sociais/para a gestão

Ilustramos como diferentes fatores organizacionais e tamanhos influenciam decisões estratégicas, como a expansão internacional, fornecendo orientações baseadas em dados para a adaptação de estratégias com base no tamanho da empresa e em interesses específicos, aprimorando o processo de tomada de decisão.

Palavras-chave: Fatores de influência, Expansão Internacional, Redes Bayesianas, Tamanho organizacional, Funcionários

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Study purpose

This study aims to analyze factors influencing managers' decisions in international expansion strategies and evaluate the impact of organizational size, measured by the number of employees, on these decisions using the Bayesian Networks method.

Relevance / originality

This study contributes original insights by applying Bayesian Networks to assess the influence of organizational size on international expansion decisions, providing a probabilistic approach that enhances understanding of strategic decision-making in a global context, an area underexplored in existing literature.

Methodology / approach

We used a descriptive typological framework for data screening. Bayesian Networks were constructed using Python, applying clustering algorithms to categorize companies by size and interest in international expansion. Data from networking events across five cities were standardized and analyzed using diagnostic reasoning.

Main results

Results revealed that the impact of interest factors, such as acquisitions and IPOs, varies significantly depending on organizational size. Small companies prioritize alternative funding options, while large companies favor complex strategies like acquisitions due to greater financial capacity and resources.

Theoretical / methodological contributions

The work contributes by demonstrating how Bayesian Networks can model complex relationships between organizational factors and sizes, offering insights into the varying impacts of these factors. It highlights the utility of simulation in understanding strategic decisions across different company scales.

Social / management contributions

The work provides practical insights for management by illustrating how different organizational factors and sizes influence strategic decisions like international expansion. It offers data-driven guidance for tailoring strategies based on company size and specific interests, enhancing decision-making and resource allocation.

Keywords: Factors Influencing , International Expansion , Bayesian Networks, Organizational Size, Employees

ANALYSIS OF FACTORS INFLUENCING INTERNATIONAL EXPANSION DECISIONS USING BAYESIAN NETWORKS: THE ROLE OF ORGANIZATIONAL SIZE

1 Introduction

International expansion has become a relevant topic for organizations worldwide, regardless of size or sector. Studying this issue is essential to understand the complex process of internationalization (Silva, Costa & Araújo, 2023). For many companies, the decision to internationalize operations has become crucial for success and survival in the global market. The ability to explore and leverage opportunities in foreign markets is essential for establishing and maintaining a competitive edge over competitors. Understanding how to adapt to the dynamics and demands of international markets allows companies to not only expand their global presence but also strengthen their business strategies and operations (Bolívar et al., 2022). Careful analysis of internationalization methods and strategies embraced by organizations is, therefore, essential for ensuring strength and success in international actions (Hult, Gonzalez-Perez & Lagerström, 2020; Knight & Liesch, 2016).

In the past, organizations focused mainly on producing and selling their products domestically. However, due to the dynamic and increasing global competition, organizations started shifting their focus in the 21st century. To sustain their competitive advantages, they began seeking improvements in product quality, productivity, and customer service. This shift aims to enhance employee performance, as a well-qualified and well-adjusted workforce is essential for achieving these goals (Onojakpor, Tuorila & De Kock, 2022). Continuous improvement and maintaining a competitive edge require having the right people in the right positions (Anwar & Abdullah, 2021). Human capital and the total number of employees are often used as indicators of organizational size in studies by Hashmi et al. (2020); Jean, Kim & Cavusgil, (2020); Onojakpor, Tuorila and De Kock, (2022); and Rienda, Ruiz-Fernández and Carey (2020). These studies highlight the importance of human capital in defining organizational structure.

As companies seek international expansion, they are recognizing the significant benefits of hiring people from diverse cultures and backgrounds. This strategy aims to increase diversity and innovation within the organization. Cultural diversity enriches the workplace and contributes to a greater exchange of ideas and perspectives, leading to more creative and efficient solutions. When employees trust each other and recognize the value of different experiences and viewpoints, they tend to be more engaged in their roles, resulting in improved organizational performance (Magnier-Watanabe et al., 2023). However, building and maintaining effective relationships between foreign and domestic employees can be challenging. It requires continuous efforts to promote integration and mutual understanding, as well as overcoming cultural and communication barriers (Murad & Sfhea, 2023).

The Bayesian Networks (BN) method plays a crucial role in supporting decision-making and is widely used across various fields. This method gains prominence with advances in technology and computational tools, facilitating the agile creation of frameworks that consider the interconnection between different variables. A knowledge-based approach allows understanding behaviors through probabilistic results generated by the network. Additionally, the model provides valuable predictions from simulations based on data inferences. By preparing and simulating the network, considering all relevant variables, it is possible to assess a certain level of uncertainty in the results (Silva et al., 2021). The network can create a graphical model that effectively represents the joint probabilities of various variables based on prior information (Heckerman, 2008).

Given the importance of international expansion for organizations, especially those adopting a rapid growth model, and the influence of human capital and organizational size on

strategic changes, using a probabilistic method like Bayesian Networks is essential. Thus, the current study aims to analyze the factors influencing managers' decisions in international expansion strategies and evaluate the impact of organizational size, related to the number of employees, on such decisions using the Bayesian Networks method.

2 Theoretical Framework

2.1 International Expansion

The initiation and progress of international expansion face various internal and external challenges and limitations. Developed countries present specific conditions for organizational internationalization (Mitrašević, Radević & Barišić, 2023). Internationalization occurs when a company's operations expand across national borders (Elumah, 2023). Even highly internationalized companies need to seek new markets for mature products, making market choice crucial for success. Competitive industries are rapidly changing, requiring managers to evaluate and understand these new contexts (Rundh, 2022). International expansion requires more than access; it necessitates mobilizing resources such as information, knowledge, reputation, and tangible assets (Bolívar et al., 2022). Additionally, economic, institutional, political, and sociocultural differences between the host and home countries are critical factors in the decision to internationalize (Elumah, 2023).

As globalization advances and companies succeed in new markets, various factors drive international expansion. Economic factors are primary motivators due to financial implications such as cost reduction, margin increases, and resource maximization, essential in internationalization decisions (Testa et al., 2022). Local geographic resources, educational environment, product demand, fragmentation, complexity, concentration, and the relative size of suppliers and buyers are also considered in expansion. Industry-specific forces are crucial for formulating entry strategies, playing a fundamental role in international expansion (García-Cabrera & García-Soto, 2022; Rundh, 2022). Companies with international ties and a common language can internationalize faster than those without this advantage (Elumah, 2023).

The speed of international expansion hinges on the quantity and quality of resources accessed through alliance networks, which provide a crucial learning mechanism to mitigate risks in market selection, entry modes, and international strategy (Bolívar et al., 2022). García-Cabrera and García-Soto (2022) stress the importance of guarantees such as public resources, state aids, regional funds, and information offices, alongside training opportunities to effectively manage these activities. Fostering a culture conducive to expansive entrepreneurship that aligns with local idiosyncrasies is essential. Pandey (2024) argues that successful international expansion necessitates a comprehensive strategy that aligns with organizational goals and resources, emphasizing management capabilities, top management commitment, and entrepreneurial behavior to navigate global growth complexities. Recent research also highlights the significance of local internationalization ecosystems in the speed and success of international expansion (Costa et al., 2024).

Bhatti et al. (2022) found that Taiwanese and Chinese firms address resource constraints in international expansion primarily through joint ventures and foreign investments, with acquisitions being the most common form of investment. They also noted that US companies can significantly impact Chinese and Taiwanese electronic business networks. Elumah (2023) highlighted that African banks expand internationally mainly via acquisitions and strategic partnerships, driven by client needs, regulations, and access to knowledge. In contrast, Huang et al. (2022) observed that well-governed US firms prefer cross-border mergers and acquisitions over alliances for internationalization, except when integration or costs are major concerns, in which case alliances are favored.

Entrepreneurs are motivated to expand internationally when they perceive business success brings local respect and prestige, is praised and widely covered by the media, and when

successful entrepreneurship is valued in private conversations (García-Cabrera & García-Soto, 2022). Business selection for expansion is more frequent when organizations have greater financial slack, highlighting financial capacity's importance in cross-border expansion (Huang et al., 2022). The commitment of resources abroad is defined as increased allocation of resources to international markets; international business intensity refers to the growing importance of foreign business relative to the overall business; and the breadth of international markets involves the geographic diversification and expansion of international presence (Ferreira, Fernandes & Veiga, 2023; Bolívar et al., 2022).

The basic premise of research on the internationalization of business entities is that all companies are rooted in specific national institutional arrangements or ecosystems (Costa et al., 2024; Mitrašević, Radević & Barišić, 2023). The primary reason for incorporating institutional perspectives into international entrepreneurship research is the lack of adequate theories considering the importance of social context for international entrepreneurial activity (Mitrašević, Radević & Barišić, 2023). The interaction between financial leverage and company size tends to promote a positive relationship with the decision to expand internationally (Huo & Chaudhry, 2020). Human resources are a main determinant of organizational size, and human capital plays a significant role in organizational internationalization (Pandey, 2024). Therefore, understanding the structure and size of organizations concerning their human capital is important.

2.2 Organization size and human capital

The size of a company is typically defined by the number of employees and budget, representing various organizational components such as available resources, capital, and structure (Hashmi et al., 2020). Company size positively affects technology adoption; larger firms benefit in the initial stages due to resource abundance, though size becomes less relevant later (Costa et al., 2023). The number of employees is vital in HR management and risk management, influencing contingency and quality management factors (Perišić et al., 2023).

Authors such as Onojakpor, Tuorila and De Kock, 2022; Jean et al. (2020), and Rienda, Ruiz-Fernández and Carey (2020) define company size primarily by total employees. A relationship between company size and job satisfaction shows lower satisfaction levels in larger firms due to stricter work conditions (Kacamakovic et al., 2024). While financial capabilities can enhance objective job quality in larger firms, subjective job quality is often lower due to anonymity and rigid structures (Kortmann et al., 2021).

Company size can impact value, making it easier to secure funding. One proxy for company size is employee number (Endri et al., 2020). Hashmi et al. (2020) noted that organization size correlates with financial leverage, diversification, dividend policy, investment policy, and salary levels.

Seroka-Stolka and Fijorek (2020) state that company size is a common control variable in studies on strategic proactivity and stakeholder exposure. Larger firms tend to have more proactive strategic environments due to resource availability and higher visibility (Elia et al., 2020).

Larger organizations expand quickly, demanding additional management levels. They have more suppliers and customers, necessitating decentralized decision-making, which increases employee engagement and efficiency (Anwar & Abdullah, 2021).

A declining workforce in many countries prompts companies to retain and diversify recruitment. Long-term workers are changing companies faster (Magnier-Watanabe et al., 2023). Selection processes significantly impact employee performance, many companies face recruitment and retention challenges, leading to high bankruptcy rates and poor organizational performance due to low motivation and globalization (Anwar & Abdullah, 2021).

Despite stakeholder conflicts, employees are crucial for competitive advantage. Lebanese companies, dubbed "Lebanon's fuel," show weak performance compared to other developing countries, evidenced by worker migration and product/service failures. Effective recruitment and selection increase the likelihood of hiring and retaining satisfied employees, impacting productivity and financial performance (Anwar & Abdullah, 2021).

Elia et al. (2020) analyzed multinational company sizes in emerging markets, noting challenges in retaining staff and competing for skilled workers, as seen in Japan (Magnier-Watanabe et al., 2023) and cross-border competition in Lebanon, Syria, and Iraq (Anwar & Abdullah, 2021). This necessitates theoretical analysis of international expansion relative to company size, defined by human capital quantity.

2.3 International Expansion and Human Capital

Organizations can achieve international expansion by temporarily transferring employees from the domestic market to the host market, eliminating the need for a constant physical presence. Global companies in light services can export personnel due to service inseparability and intangibility, allowing employees to replicate the value chain and transfer knowledge to the host market. Despite high inseparability, global firms initially adopt delivery strategies similar to non-global firms, following their clients but with limited resources for rapid expansion. Some firms choose low-risk entry modes due to swift internationalization (Hult, Gonzalez-Perez & Lagerström, 2020; Knight & Liesch, 2016).

Zheng and Lamond's (2009) study examined organizational variables as predictors of employee turnover in Asian multinationals. Lack of socialization in large multinationals led to higher turnover rates in Asian economies. The study noted increased use of expatriates as supervisors in local subsidiaries to control and implement centralized global strategies. Expatriates' impact on turnover varies by their roles. Multinationals prefer direct control over expatriates rather than informal methods like socialization, which improves with years of overseas operation.

Workforce diversity, integrating domestic and foreign employees, can lead to issues like lack of motivation and poor communication. Trust is crucial in maintaining client relationships. Organizations must manage relations between foreign and domestic employees as diversity can be seen as a source of competitive advantage (Murad & Sfhea, 2023).

Recruiting diverse employees is challenging; HR must ensure experience and organizational fit. As companies expand, including foreign and skilled domestic workers becomes essential, with large firms relying on expatriates for international operations (Murad & Sfhea, 2023). Companies can overcome international expansion limits by integrating into target market networks (Bolívar et al., 2022). Human capital and internationalization balance education and specialization without organizational constraints (Pandey, 2024).

Some countries lack clear incentives for entrepreneurship and business growth due to inexperienced policymaking. Effective regulatory support, including stable incentives and relevant information, aids successful international expansion. Regulatory efficacy varies locally, affecting regional success. Entrepreneurs' perceptions of support depend on information, assistance speed, and training availability from public administration (García-Cabrera & García-Soto, 2022).

Cultural interaction at borders encourages workplace introspection, helping employees understand cultural influences on their perspectives. Positive manager-employee interactions boost engagement and productivity. Employees perform better with good relationships with managers and colleagues. Supporting foreign staff in completing studies increases workforce qualification and loyalty. Helping workers understand their role in the organizational structure and its relevance to global goals is crucial. Aligning experiences with core principles enhances satisfaction, morale, and loyalty in both domestic and foreign locations (Murad & Sfhea, 2023).

Internationalization attracts companies to foreign markets, hiring local labor for market access, understanding, and relationships. Yet, specialized expatriates are needed for foreign operations. Combining expatriates and locals diversifies the workforce, attracting creative talent globally (Murad & Sfhea, 2023). Elia et al. (2020) observed that advanced internationalization stages, including mergers and acquisitions, reduce liability if organizations retain employees, locations, and key stakeholders.

3 Method

The data screening stages used a descriptive typological framework. The Bayesian Network construction and execution stage utilized an applied typology (Nasir & Sukmawati, 2023). A Bayesian Network formalizes this concept by representing variables through a directed acyclic graph, incorporating both qualitative and quantitative aspects. The qualitative part consists of a structure with nodes representing variables, either discrete or continuous, and directed arcs indicating causal or influence relationships. If a directed arc connects variables A and B, A is the parent or ancestor node of B, while B is the child or successor node of A. The study employed diagnostic reasoning for Bayesian Networks to observe current results in the parent variable based on simulations in the child variable. Discrete data is crucial for performing diagnostic reasoning, enabling parameter learning that results in a finite state matrix (Kyrimi et al., 2021; Xie et al., 2021).

The quantitative part comprises network parameters, including a set of conditional probability functions associated with each node. These functions are captured by probabilistic classification and represent the conditional probability distribution of each node, given its parent nodes. Furthermore, integrating these functions with machine learning algorithms enhances predictive model accuracy. This combination allows for refined and adaptive modelling of relationships between variables. The subjects of interest, driven by the reasoning employed, can be addressed qualitatively, focusing on meaning rather than merely expanding probabilistic connections. This allows for more robust and comprehensive data analysis, contributing to better evidence-based decisions. Hence, practical applications of these models can be extended to various fields, such as healthcare, economics, management, and engineering, increasing the utility and applicability of probabilistic networks (Kyrimi et al., 2021).

The research sample was selected from digital companies that participated through networking invitations and business meetings, aimed at discussing how to maintain rapid growth and enhance performance. Data includes records from events in Amsterdam, Berlin, London, New York, and Paris. Analyzed organizations had to meet specific criteria, including a digitally enabled business model, a minimum growth rate of 20% over three consecutive years, and exclusive participation of founders and/or CEOs with primary equity stakes or high management positions. Additionally, the geographic diversity of events helped capture a variety of perspectives and practices from different markets (Costa et al., 2023).

The study utilized two DataFrame fields: "Number of Employees," providing information on the number of workers in each organization, and "Interested in," covering the managers' preferences regarding International Expansion and other interests such as exits and acquisitions, building and managing an effective board, balancing growth and profit, growth through acquisitions, other venture capital options (debt, venture debt, and private equity), pre-IPO planning, and none of the above (Silva, Costa & Araújo, 2023). After a careful examination of the DataFrame, adjustments were needed in the "Number of Employees" field to standardize the number of workers into specific groups, facilitating better data interpretation and analysis. However, the database already partially organized these groupings. Table 1 presents the sample size and the groupings.

Table 1

Research Population and Sample

No. of workers							
0 to 25	Year	2016	2017	2018	2019	2020	Total
	No. of interviewees	0	28	46	33	18	125
26 to 50	Year	2016	2017	2018	2019	2020	Total
	No. of interviewees	96	85	95	60	14	350
51 to 100	Year	2016	2017	2018	2019	2020	Total
	No. of interviewees	88	97	150	121	26	482
101 to 250	Year	2016	2017	2018	2019	2020	Total
	No. of interviewees	40	77	122	97	30	366
251 to 500	Year	2016	2017	2018	2019	2020	Total
	No. of interviewees	0	20	26	23	5	74
More than 500	Year	2016	2017	2018	2019	2020	Total
	No. of interviewees	0	10	20	11	4	45
Total	Year	2016	2017	2018	2019	2020	Total
	No. of interviewees	224	317	459	345	97	1442

It was possible to extract information from 1,442 respondents within the research population of 1,578 records in the DataFrame. Among the remaining 136 records, 27 respondents entered "confidential," 43 respondents filled in with "200+," preventing classification into one of the groups. In the remaining 66 records, the "Number of Employees" field was left blank. Examining the DataFrame, it became evident that the records were not organized in a probabilistic structure, the standard format for constructing Bayesian Networks. Consequently, it was necessary to standardize the data. For this, Equation 1, as recommended by Nobre et al. (2023), was used to establish a structured grouping of the records.

$$PG_{RB} = \frac{EG_{RB}}{TG_{RB}} \quad (1)$$

PG_{RB} represents the desired standardization in the node (variable) grouping of the network. EG_{RB} refers to the raw record in the DataFrame (not standardized). TG_{RB} represents the total sum of non-standardized records within a specific area of interest. The equation used in this study incorporates each record's participation within its respective area of interest, ensuring that the sum of all records within a specific group equals 1 (Nobre et al., 2023). To standardize the data and facilitate the construction of the Bayesian Network, the entire database was standardized using Python 3.8 and the Anaconda Spyder 4.1.5 platform. To create the first node of the network, named "International Expansion," a clustering algorithm was employed, relating the variable "Number of Employees" with the "Interested in" field indicating companies' interest in "International Expansion." This approach allowed the classification and standardization of each group of companies according to the number of employees and their interest in expanding their business to other countries. The results shown in Figure 1 provide essential information for constructing and analyzing the Bayesian Network.

Figure 1

Standardization algorithm for the number of employees grouped by International Expansion

Algorithm	Action description
<code>import pandas as pd</code>	➡ Software library used in the Python language for data analysis and manipulation.
<code>caminho_planilha= "dataframe.xlsx"</code>	➡ Path to the DataFrame with records in .xlsx spreadsheet format. Note that this path will only work if both files (algorithm and logs) are in the same folder.

<code>df = pd.read_excel(caminho_da planilha)</code>	➔ Load information into the DataFrame using the pandas library.
<code>def obter_ocorrencias (dataframe, interesse, empregados): return len (dataframe[(dataframe["Interested in"].str.contains(interesse)) & (dataframe["NumberofEmployees"].str.contains(empregados))])</code>	➔ Definition of the function that will return the records meeting the specified interest based on the grouping of the number of employees.
<code>def calcular_percentuais(fatores): total_valores = sum(fatores.values()) percentuais = {variavel: (valor / total_valores) * 100 for variavel, valor in fatores.items()} return percentuais</code>	➔ Definition of the function that will calculate and return the percentage of factors meeting the pre-established criteria. This involves computing Equation 1.
<code>empregados_interesse = ['0-25', '26-50', '51-100', '101-250', '251-500', '500+']</code>	➔ Assignment of groupings with the number of employees.
<code>IEEmployees = {f'IE{empregados}': obter_ocorrencias(df, "International Expansion", empregados) for empregados in empregados_interesse }</code>	➔ Assignment of the factor of interest, in this case 'International Expansion,' to the grouping with the number of employees. Execute the 'obter_ocorrencias' function.
<code>percentuais = calcular_percentuais(IEEmployees)</code>	➔ Calculate the percentage for each of the groupings with the number of employees. Execute the 'calcular_percentuais' function based on the assignment in IEEmployees.
<code>for variavel, percentual in percentuais.items(): print(f"{variavel}: {percentual:.2f}%")</code>	➔ "Print the results regarding the participation of each grouping (number of employees). The total should correspond to 100%, which is a base requirement for the creation of the node in the Bayesian Network.
<code>print(IEEmployees)</code>	➔ Print the specific number of responses for each grouping (Number of Employees) that shows interest in International Expansion.

In order to complement the Bayesian Network with a new node, named "Factors of Interest," a second algorithm will be employed. In addition to the initial analysis that grouped "Number of Employees" and "International Expansion," this algorithm will expand the analysis to encompass all other factors of interest present in the "Interested in" field of the DataFrame. Among these factors are exits and acquisitions, building and managing an effective board, balancing growth and profitability, growth through acquisitions, other venture capital options: debt, venture debt, and private equity, pre-IPO planning, and none of the above. Figure 2 presents a detailed diagram of the steps of this algorithm, providing a comprehensive view of the process and allowing a deeper understanding of the relationships between the different factors of interest.

Figure 2.

Standardization algorithm for the number of employees, grouping International Expansion with each of the factors of interest

Algorithm	Action description
<code>import pandas as pd</code>	➔ Software library used in the Python language for data analysis and manipulation.

<pre> caminho_planilha= "dataframe.xlsx" df = pd.read_excel(caminho_da planilha) def obter_ocorrencias(df, interesse, empregados): return len(df[(df["Interested in"].str.contains("International Expansion")) & df["Interested in"].str.contains(interesse) & (df["Number of Employees"].str.contains(empregados))]) def calcular_percentuais(fatores): total_valores = sum(fatores.values()) percentuais = {variavel: (valor / total_valores) * 100 for variavel, valor in fatores.items()} return percentuais empregados_interesse = ['0-25', '26-50', '51-100', '101-250', '251-500', '500+'] for empregados in empregados_interesse: fatores = { f'{empregados}_Exits Aquisitions': obter_ocorrencias(df, "Exits and Aquisitions", empregados), f'{empregados}_Building MEB': obter_ocorrencias(df, "Building and managing an effective board", empregados), f'{empregados}_Balancing GvsP': obter_ocorrencias(df, "Balancing growth vs profit", empregados), f'{empregados}_Growth Acquisitions': obter_ocorrencias(df, "Growth through acquisitions", empregados), f'{empregados}_Other options': obter_ocorrencias(df, "Other options to venture capital: debt, venture debt & private equity", empregados), f'{empregados}_Pre IPO': obter_ocorrencias(df, "Pre IPO planning", empregados), f'{empregados}_None above': obter_ocorrencias(df, "None of the above", empregados) } percentuais = calcular_percentuais(fatores) for variavel, percentual in percentuais.items(): print(f'{variavel}: {percentual:.2f}%") print(fatores) </pre>	<ul style="list-style-type: none"> ➔ Path to the file with records in .xlsx spreadsheet format. Note that this path will only work if both files (algorithm and logs) are in the same folder. ➔ Load information into the DataFrame using the pandas library. ➔ Definition of the function that will return records meeting the specific interest 'International Expansion!' based on the number of workers and other factors of interest . ➔ Definition of the function that will calculate and return the percentage of factors meeting the pre-established criteria. This will involve calculating Equation 1. ➔ Assignment of groupings with the number of employees. ➔ Assignment of the factor of interest, in this case 'International Expansion,' to both the grouping with the number of employees and each of the remaining factors of interest, presented one by one. Execute the 'obter_ocorrencias' function. ➔ Calculate the percentage for each grouping of the number of employees. Execute the 'calcular_percentuais' function based on the assignment of factors. ➔ Print the results regarding the participation of each grouping (Number of employees) for each factor of interest. The total for each grouping should correspond to 100%, a prerequisite for the creation of the node in the network.
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	Print the specific number of responses for each gender (Male or Female) showing interest in both International Expansion and each of the factors of interest.
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After executing the algorithms, the standardization results were obtained. The first algorithm, which grouped companies by size and interest in international expansion, generated the data presented in Table 2. This data will be used to build the Bayesian Network.

Table 2
Number of Employees and International Expansion

Number of employees	Sample	International Expansion Option	Participation Percentage per Option
0 to 25	125	50	6,98%
26 to 50	350	185	25,84%
51 to 100	482	245	34,22%
101 to 250	366	175	24,44%
251 to 500	74	23	3,21%
More than 500	45	38	5,31%
Total	1442	716	100%

The second algorithm grouped the data by company size, interest in international expansion, and other relevant factors, using codes to simplify the analysis: Exits and Acquisitions (EA), Building and Managing an Effective Board (BMEB), Balancing Growth vs. Profitability (BGP), Growth Through Acquisitions (GTA), Other Venture Capital Options: Debt, Venture Debt, and Private Equity (OO), Pre-IPO Planning (PIPO), and None of the Above (NA). The result of the algorithm's execution is displayed in Table 3.

Table 3
Number of Employees, International Expansion, and Factors of Interest

No. of employees	Interest factor	Sample	Option per Factor and per International Expansion	Participation Percentage per Option
0 à 25	EA	125	20	16,67%
	BMEB	125	31	25,83%
	BGP	125	28	23,33%
	GTA	125	14	11,67%
	OO	125	19	15,83%
	PIPO	125	8	6,67%
	NA	125	0	0,00%
	Total	125	120	100%
26 à 50	EA	350	79	19,22%
	BMEB	350	88	21,41%
	BGP	350	91	22,14%
	GTA	350	72	17,52%
	OO	350	53	12,90%
	PIPO	350	27	6,57%
	NA	350	1	0,24%
	Total	350	411	100%
51 à 100	EA	482	94	15,96%
	BMEB	482	132	22,41%
	BGP	482	133	22,58%
	GTA	482	115	19,52%
	OO	482	73	12,39%
	PIPO	482	41	6,96%

	NA	482	1	0,18%
	Total	482	589	100%
101 à 250	EA	366	75	16,78%
	BMEB	366	89	19,91%
	BGP	366	96	21,48%
	GTA	366	98	21,92%
	OO	366	53	11,86%
	PIPO	366	36	8,05%
	NA	366	0	0,00%
	Total	366	447	100%
251 à 500	EA	74	11	16,92%
	BMEB	74	9	13,85%
	BGP	74	11	16,92%
	GTA	74	17	26,15%
	OO	74	7	10,77%
	PIPO	74	10	15,39%
	NA	74	0	0,00%
	Total	74	65	100%
Mais de 500	EA	45	15	14,85%
	BMEB	45	16	15,84%
	BGP	45	19	18,82%
	GTA	45	26	25,74%
	OO	45	12	11,88%
	PIPO	45	13	12,87%
	NA	45	0	0,00%
	Total	45	101	100%
Total		1442	1733	100%

Tables 2 and 3 present results that require careful interpretation. Table 3 contains a larger number of observations due to the non-exclusive nature of the factors of interest. For example, a respondent might express interest in both international expansion and balancing growth and profitability. It is important to note that, although there are multiple factors of interest, the number of choices for each individual factor does not exceed the number of companies that selected international expansion in each size group. This relationship is observed, for instance, in the grouping with between 51 and 100 employees, where out of the 245 choosing international expansion, 133 chose balancing growth and profitability (BGP).

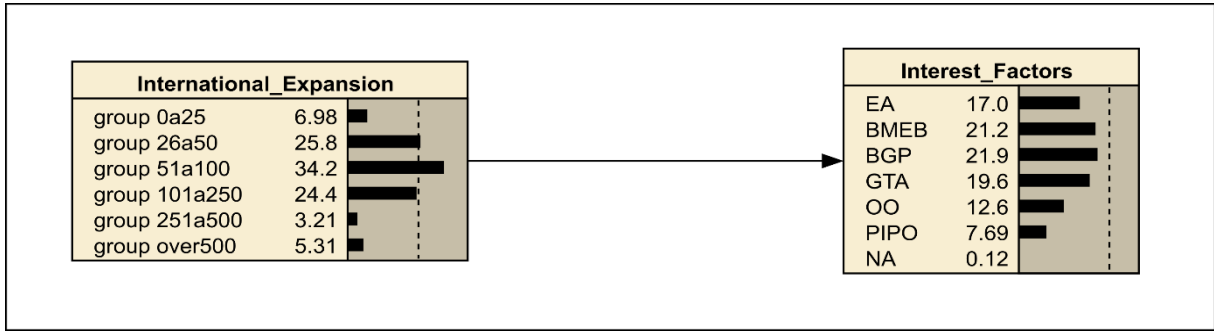
The data analysis revealed interesting patterns regarding the relationships between the investigated factors. To model these relationships accurately, the software Netica was used. The ability to directly input the tabulated data obtained from the previous algorithms made the modelling process more efficient.

4 Result Analysis and Discussion

After constructing the network, simulations are essential for in-depth analysis. The Bayesian Network, through diagnostic reasoning, allows for exploring future scenarios and simulating possible pathways (Kyrimi et al., 2021; Xie et al., 2021). Figure 3, generated in Netica, illustrates the network constructed based on the tabulated data for the two nodes.

Figura 3.

Bayesian Network: International Expansion and Interest Factors



The Bayesian Network consists of two connected nodes: "International_Expansion," the parent node, which groups employees into categories based on the minimum (N°_{min}) and maximum (N°_{max}) number of employees per group, represented by "group_ $N^{\circ}_{min}N^{\circ}_{max}$." The child node, "Interest_Factors," includes the other factors of interest identified by their codes. The link between these two nodes results in a total of 48 conditional probabilities.

Analyzing Figure 3, it is observed that the category "None of the Above" (NA) has a very low frequency, representing only 0.12% of the data. Due to this low probability, it is concluded that this option does not significantly influence the results of the simulations. Consequently, the NA category will be excluded from the network's future analyses. Figure 4 presents simulations that demonstrate how different factors may influence the network.

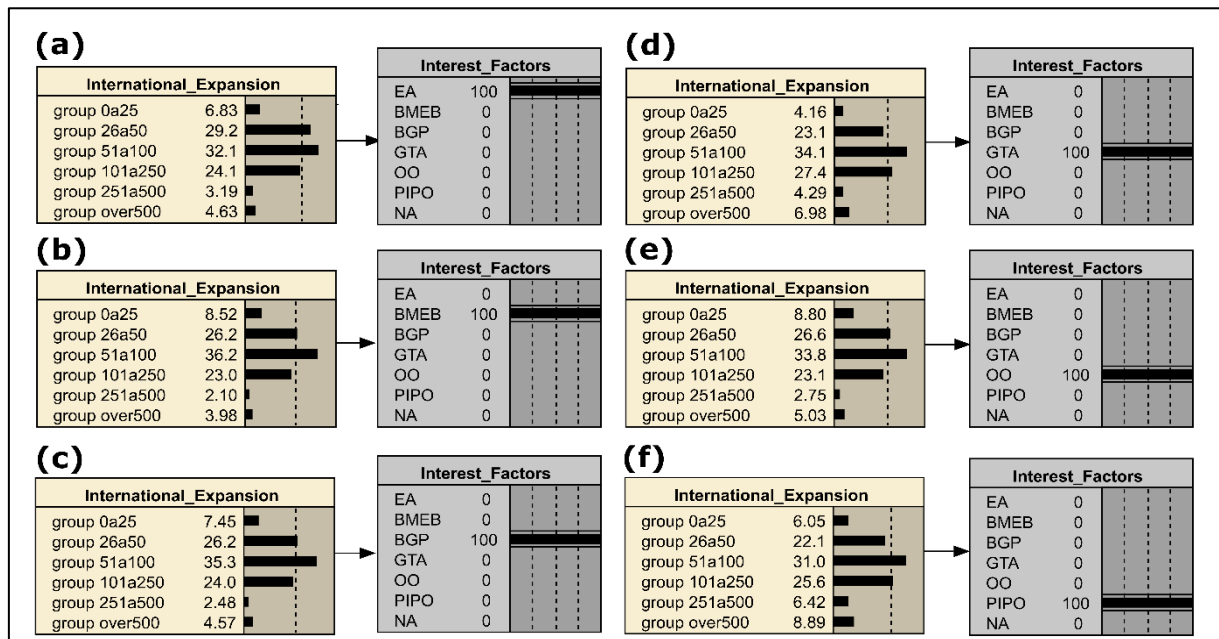


Figure 4
 Simulation with triggers on the factors of interest in the Bayesian Network.

Activating the "Exits and Acquisitions" (EA) parameter at 100% (Figure 4a) produced distinct results across different organizational sizes compared to the baseline (Figure 3). Companies with 26 to 50 employees showed a significant increase in interest (from 25.8% to 29.2%), while those with over 500 employees experienced a decrease (from 5.31% to 4.63%). These results suggest that the impact of the EA factor varies with organizational size. This variation aligns with Huang et al. (2022), who found that alliances may be more advantageous than acquisitions for certain types of organizations, especially when facing integration challenges or high costs.

Analyzing the simulation where the "Building and Managing an Effective Board" (BMEB) factor was maximized (Figure 4b) shows a distinct impact across different organizational sizes. Companies with over 500 employees saw a decrease in BMEB interest (from 5.31% to 3.98%), while smaller ones (up to 25 employees) showed an increase (from 6.98% to 8.52%). These results suggest that the BMEB factor's impact decreases with organizational size. Anwar & Abdullah (2021) highlight the importance of management systems for organizational outcomes.

The simulation in Figure 4(c), with a 100% increase in "Balancing Growth vs. Profitability" (BGP), reveals a differentiated response among organizational sizes. Companies with 51 to 100 employees showed an increase in BGP interest (from 34.2% to 35.3%), while larger ones (above 250 employees) showed a decrease, with groups of 251 to 500 (from 3.21% to 2.48%) and over 500 employees (from 5.31% to 4.57%). This suggests that BGP has a greater impact on medium-sized companies, possibly due to the need to balance growth and profitability. Pandey (2024) supports this view, emphasizing the importance of aligning international strategy with organizational resources and capabilities.

When analyzing the simulation where the "Growth Through Acquisitions" (GTA) factor was maximized (Figure 4d), an inverse relationship between company size and interest in GTA was observed. Small organizations (up to 100 employees) showed a decrease in interest in GTA (e.g., the group of up to 25 employees decreased from 6.98% to 4.16%), while large companies (over 100 employees) showed a significant increase (e.g., the group with over 500 employees increased from 5.31% to 6.98%). This difference can be attributed to the greater financial capacity of large companies, making them more capable of making acquisitions. Elumah (2023) supports this interpretation by showing that large African banks actively used acquisitions as a growth strategy.

Comparing the simulation where the "Other Venture Capital Options: Debt, Venture Debt, and Private Equity" (OO) factor was maximized (Figure 4e) with the initial situation (Figure 3) shows an inverse relationship between company size and interest in OO. Small companies (up to 50 employees) saw a significant increase in interest in OO (e.g., companies with up to 25 employees increased from 6.98% to 8.80%), while larger organizations showed a decrease. This difference may be explained by the lower financial capacity of smaller companies, driving them to seek alternative funding sources for their internationalization activities. Endri et al. (2020) support this view, highlighting that larger companies have access to a broader range of financing options, both internal and external.

Analyzing the simulation where the "Pre-IPO Planning" (PIPO) factor was maximized (Figure 4f) shows an inverse relationship between company size and interest in PIPO. Micro and small companies (up to 100 employees) showed a decrease in PIPO interest, while large companies showed a significant increase. This difference can be explained by the greater complexity and demands of the IPO process, which can be more challenging for smaller companies. Huo & Chaudhry (2020) reinforce this interpretation, noting that financial leverage and company size are important factors in international expansion decisions, including going public, as larger companies tend to have better management capacity and access to resources.

5 Final Considerations

The aim of this study was to analyze factors influencing managerial decisions in international expansion strategy and assess the impact of organizational size, related to the number of employees, on such decisions using Bayesian Networks. The simulation method used allowed for a granular analysis of various scenarios shaping internationalization decisions. By segmenting organizations by size, significant nuances in perceptions of each influencing factor were identified. This detailed approach revealed that elements such as access to venture capital, pre-IPO planning, and corporate governance structure have proportionally distinct

impacts on companies of different scales, uncovering the underlying mechanisms of internationalization strategies adopted by each segment.

The data analysis shows a strong link between company size and its internationalization strategies. The study found that interest in factors like exits and acquisitions, building an effective board, and other venture capital options varies significantly with company size. Small firms showed greater interest in exits and acquisitions and alternative capital sources, suggesting a pursuit of rapid growth and financial flexibility. Conversely, large companies tend to place less importance on these factors, possibly due to a more established investor base and greater internal resource generation capacity. Medium-sized firms, on the other hand, showed a particular interest in balancing growth and profitability, seeking an effective board to guide their strategic decisions.

The study also revealed that while large companies accelerate their expansion plans, focusing on acquisitions and preparations for IPOs, small and medium-sized enterprises show more moderate interest in these factors. This divergence likely stems from differences in financial capabilities. Large corporations, with greater purchasing power, can strategically pursue acquisitions, accelerating growth. Smaller firms, with more limited resources, face greater challenges with the IPO process, which requires complexity, planning, and preparation that may be harder to achieve. Moreover, the bureaucracy and stringent regulatory requirements associated with IPOs can be an even greater obstacle for smaller companies with fewer resources to dedicate to these issues.

This study aims to address significant gaps in the literature on international expansion by investigating the determinants of internationalization decisions in rapidly growing firms. Unlike previous studies that focused on specific sectors, such as Elumah (2023) on banks, Anwar & Abdullah (2021) on Lebanon, Endri et al. (2020) on Indonesia, and Huo & Chaudhry (2020) on China, or specific entry modes like Huang et al. (2022) on acquisitions or alliances, this research adopts a broader approach, considering a variety of factors influencing internationalization decisions across different company sizes and sectors. Furthermore, while studies like Pandey (2024) explored strategic entrepreneurship in the context of international expansion, this research differs by analyzing the moderating role of organizational size in these processes. By doing so, the study contributes to a deeper understanding of the complexities involved in the internationalization decisions of growing firms.

Despite its contributions, the study has several limitations. First, the sample was restricted to fast-growing organizations participating in events in Amsterdam, Berlin, London, New York, and Paris. While this involves diversity from five countries, it may limit the generalizability of the results, as organizational behavior and management practices may vary in different regions, especially in Eastern and emerging countries. Additionally, the study faced data set limitations. Although it recorded 1,442 respondents out of 1,578 records (approximately 91.38% of the total), there were 136 missing records (about 8.62% of the data). Even though this is a small percentage, these 8.62% could moderately alter some perceptions of influence factors in internationalization. The study also limited employee numbers to six group classifications, which may have impacted results and representation of each employee group. Future research using alternative data sets from diverse locations, along with quantitative and/or qualitative studies considering different employee groupings, could provide more insights to corroborate or challenge the study's conclusions. Additionally, exploring alternative modeling approaches, distinct from Bayesian Networks, using the same data set could validate, complement, and/or refute the contributions of this investigation.

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