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Mato Grosso's Agribusiness

MethodologyinJordanianBanks

Highlights

A Bayesian Network Approach

Influence of Relational Social Capital

Discovering Thoughts, Inventing Future

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The Influence of Relational Social Capital (RSC) on Micro, Small and Medium Enterprises (MSME) Innovation Performance: A Mixed Method Study

By Okechukwu Chiaha

Abstract- This study investigates the influence of relational social capital focusing on trust, norms of cooperation, reciprocity, and identification on innovation performance among Micro, Small, and Medium Enterprises (MSMEs) within Nigeria's textile manufacturing sector. Operating in a resource-limited environment, these MSMEs face unique challenges that make relational social capital a critical asset for sustaining competitive advantage and fostering innovation. Using a mixed-method approach, data was obtained from 564 respondents, we integrate Partial Least Squares Structural Equation Modelling (PLS-SEM) and fuzzy-set Qualitative Comparative Analysis (fsQCA) to capture both linear and configurational effects of relational social capital. Results from PLS-SEM reveal that identification significantly enhances innovation performance, while other elements like trust, norms of cooperation and reciprocity exert varied influences. Further, fsQCA identifies five unique configurations of relational social capital elements contributing to high innovation performance, highlighting the essential role of identification alongside specific relational dynamics.

Keywords: *relational social capital, innovation performance, MSMEs, PLS-SEM, fsQCA.*

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Keywords: relational social capital, innovation performance, MSMEs, PLS-SEM, fsQCA.

I. Introduction

Micro, Small, and Medium Enterprises (MSMEs) play a crucial role in driving economic growth, employment, and innovation, particularly in developing economies. In Nigeria, MSMEs contribute approximately 48% to the national Gross Domestic Product (GDP) and account for over 80% of employment, underscoring their significance in poverty alleviation and economic empowerment (PwC, 2020; World Bank, 2021). These enterprises are not only engines of job creation but also act as catalysts for inclusive economic progress by extending opportunities to both urban and rural areas. Their flexibility enables them to adapt swiftly to changing market conditions, which is essential for resilience and innovation (OECD, 2017; Ayyagari, Demirgüç-Kunt, and Maksimovic, 2014). However, despite their importance, MSMEs especially those in developing countries face significant challenges that constrain their innovation performance and growth. In developing economies like Nigeria, MSMEs encounter obstacles such as limited access to finance, inadequate infrastructure, and weak formal networks for knowledge and resource sharing (Ayyagari et al., 2014; Beck, Demirgüç-Kunt, and Levine, 2005). Access to funding remains one of the most critical issues, as financial institutions often regard MSMEs as high-risk investments due to insufficient collateral and limited financial documentation (Beck and Demirgüç-Kunt, 2006). This lack of financial access restricts MSMEs' ability to invest in innovative practices, which are essential for remaining competitive in a globalised economy (OECD, 2017). Consequently, MSMEs increasingly rely on alternative, non-monetary resources to support their innovation efforts, with social capital emerging as a key resource. Social capital, defined as the network of relationships that provide access to information, resources, and support, plays an essential role in facilitating innovation for MSMEs operating in resource-limited environments (Adler and Kwon, 2002; Putnam, 2000).

Social capital, broadly classified into structural, cognitive, and relational dimensions, is increasingly recognized as a driver of innovation, particularly for MSMEs (Nahapiet and Ghoshal, 1998; Coleman, 1988). Structural social capital refers to the overall configuration of ties within a network, which allows for resource sharing and information flow. For MSMEs, a well-connected network can provide access to non-redundant information, which is critical for identifying market opportunities and accessing diverse perspectives (Burt, 2000; Tsai, 2001). Cognitive social capital encompasses shared values, goals, and understandings within networks, which promote alignment and support collaborative innovation efforts (Chiu et al., 2006; Putnam, 2000). Cognitive alignment reduces friction in collaborative projects, enabling smoother interactions and facilitating reciprocal

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knowledge exchanges essential for innovation (Nahapiet and Ghoshal, 1998; Reagans and McEvily, 2003).

Relational social capital the focus of this study refers to the quality of interpersonal connections within a network, including trust, norms of cooperation, reciprocity, and identification (Coleman, 1988; Granovetter, 1985). Relational social capital shapes the depth and strength of resource-sharing relationships and is particularly relevant for MSMEs in resource-limited settings, where access to formal resources is scarce (Uzzi, 1997; Adler and Kwon, 2002). Trust, a cornerstone of relational social capital, reduces perceived risks and enables MSMEs to engage in open exchanges of knowledge and resources without the need for formalised agreements (Levin and Cross, 2004). In addition, norms of cooperation encourage collective action, facilitating joint problem-solving and resource pooling, which are essential for overcoming individual resource constraints (Coleman, 1988; Moran, 2005). Reciprocity ensures sustained, balanced exchanges within networks, fostering a reliable flow of support and resources that bolsters innovation (Putnam, 2000; Tsai and Ghoshal, 1998). Finally, identification strengthens the network's cohesion by fostering a shared sense of belonging and commitment to collective goals, enhancing cooperation and alignment (Nahapiet and Ghoshal, 1998).

Prior literature on relational social capital and MSME innovation performance is derived from studies conducted in developed economies, where MSMEs typically operate within well-structured institutional frameworks and have access to formal resources (Adler and Kwon, 2002; Beck et al., 2005). The dynamics of relational social capital in developing economies like Nigeria, where MSMEs encounter distinct socio-economic challenges, remain underexplored. For instance, cultural factors in Nigeria may shape norms of obligation and reciprocity differently, influencing how MSMEs interact, share resources, and support each other (Ayyagari, Demirgüç-Kunt, and Maksimovic, 2014). Addressing this contextual gap is essential for understanding how relational social capital operates under the unique conditions faced by resource-constrained MSMEs that rely heavily on informal networks for growth and innovation.

This study seeks to address significant theoretical gaps by examining the configuration-specific and context-dependent effects of relational social capital on MSME innovation performance. While previous research has often treated relational social capital as having a uniform effect on innovation, emerging perspectives suggest these effects are likely configuration-dependent. Specific combinations of relational elements such as trust, norms of cooperation, reciprocity, and identification may interact uniquely to produce varied innovation outcomes (Tsai and Ghoshal, 1998; Ragin, 2008). For example, trust may have a stronger impact on innovation when combined with high reciprocity, while its effect might differ if paired with weaker norms of cooperation. Such configuration-specific studies are rare in MSME literature, especially regarding innovation in developing economies (Ragin, 2008; Granovetter, 1985).

To explore these relationships, this study employs a complementary methodology of Partial Least Squares Structural Equation Modelling (PLS-SEM) and fuzzy-set Qualitative Comparative Analysis (fsQCA). This approach captures the complex, non-linear relationships between relational social capital elements and MSME innovation performance, offering a multifaceted perspective that accounts for the conditional and context-dependent effects of relational social capital in resource-limited MSMEs (Burt, 2005; Granovetter, 1983). Additionally, this research contributes to the underrepresentation of MSMEs in developing economies within the social capital literature by providing empirical evidence from Nigeria, supporting a contextualised understanding of relational social capital's role in driving MSME innovation performance (Levin et al., 2016).

The remainder of this paper is structured as follows: Section 2 presents a literature review together with the hypothesis development. Section 3 details the research methodology. Section 4 present the data analysis and findings of the PLS-SEM. Section 5 present the data analysis and findings of the fsQCA. Section 6 concludes the study by summarising the discussions and conclusion, implications, limitations and future research.

II. Literature Review

a) *Overview of Social Capital Theory*

Social capital theory suggests that relationships and social networks provide valuable resources that individuals and organisations can use to achieve shared goals and mutual benefits. This concept was initially framed by Bourdieu (1986), who viewed social capital as the sum of resources that individuals or groups can access by virtue of their social networks. Social capital was later expanded by Coleman (1988), who emphasised its role in facilitating cooperative action, particularly within communities where formal regulatory systems are weak. Coleman argued that social capital is embedded within social structures, enabling individuals and organisations to collaborate more effectively by reducing transaction costs, fostering trust, and facilitating the flow of information.

Putnam (2000) further developed the concept by focusing on the community level, distinguishing between bonding and bridging social capital. Bonding social capital refers to the strong ties within homogeneous groups, promoting loyalty and trust, while bridging social capital pertains to weaker ties that

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connect diverse groups, enabling the exchange of novel information and perspectives (Putnam, 2000). While bonding capital is crucial for solidarity, bridging capital has been shown to enhance innovation by providing access to a wider array of resources and ideas, particularly valuable for organisations operating in resource-constrained environments (Nahapiet & Ghoshal, 1998; Adler & Kwon, 2002).

Scholars generally categorise social capital into three dimensions structural, cognitive, and relational, each contributing uniquely to network dynamics and outcomes.

Structural social capital refers to the configuration of the network, including the presence and strength of ties between actors (Burt, 2000). Networks with strong structural social capital enable members to access unique resources and non-redundant information, which can foster innovation (Burt, 1992; Tsai, 2001). Burt's theory of "structural holes" highlights how organisations positioned between disconnected groups can leverage their intermediary status to gain access to diverse knowledge, which is particularly relevant for MSMEs seeking to compete in dynamic markets. However, Burt (2005) also warns that an over-reliance on structural social capital can lead to a focus on maintaining advantageous positions rather than engaging in deep, reciprocal exchanges, which can stifle trust and collaboration.

Cognitive social capital encompasses shared goals, values, and languages that facilitate understanding and alignment within networks (Nahapiet & Ghoshal, 1998). When members of a network share similar perspectives and objectives, they can collaborate more smoothly, minimising conflicts and miscommunications (Chiu et al., 2006). Cognitive alignment is particularly beneficial for innovation within MSMEs, as it fosters a shared sense of purpose and reduces the costs associated with coordinating diverse activities (Chumnangoon, Chiralaksanakul, and Chintakananda, 2023). However, a high degree of cognitive social capital may also limit innovation by encouraging conformity and reducing exposure to novel ideas, which can be essential for breakthrough innovations (Levin & Cross, 2004). Therefore, while cognitive alignment supports effective collaboration, it must be balanced with openness to external perspectives to prevent groupthink (Nahapiet & Ghoshal, 1998).

Relational social capital is concerned with the quality of interpersonal relationships within a network, specifically through elements like trust, norms of cooperation, reciprocity, and identification (Coleman, 1988; Granovetter, 1985). Trust plays a foundational role, reducing perceived risks and encouraging open exchanges of knowledge and resources, which are critical for fostering innovation in MSMEs that often operate with limited formal protections (Levin & Cross, 2004; Uzzi, 1997). Trust and cooperation within relational social capital enable organisations to pool resources and collaborate on complex projects, driving innovation while lowering the transaction costs associated with formal contracts (Tsai & Ghoshal, 1998; Moran, 2005). However, while high levels of relational social capital support stability and cohesion, they may also create network insularity, where members become overly reliant on familiar partners and are less likely to seek external perspectives, potentially stifling innovation (Burt, 2005; Garcia-Morales et al., 2014).

Social capital's implications for MSMEs are profound, as these businesses often lack the resources to develop independent competitive advantages. For MSMEs, social capital provides access to external resources, markets, and knowledge, compensating for internal limitations and allowing them to innovate and grow (Vu, Binh, and Duong, 2023). Empirical studies indicate that MSMEs with robust social capital can better access financing, form strategic partnerships, and navigate market uncertainties, giving them a competitive edge over isolated firms (Nguyen and Canh, 2021). However, excessive reliance on social capital can be detrimental if it restricts the flow of fresh ideas, as network homogeneity may lead to complacency and limit the firm's ability to adapt to changes (Adler & Kwon, 2002).

While social capital is a valuable asset that enhances MSME innovation and resilience, it requires careful management. Structural social capital offers access to unique resources but may limit deep collaboration. Cognitive social capital facilitates smooth interactions and shared understanding but can hinder creative thinking if overemphasised. Relational social capital promotes trust and reciprocal support but risks network insularity if not balanced with diverse external connections. For MSMEs, achieving an optimal mix of these dimensions is crucial to leveraging social capital effectively for sustained innovation and growth in competitive markets (Vu, Binh, and Duong, 2023; Nguyen and Mort, 2022).

b) Relational Social Capital and MSME Innovation Performance

Relational social capital, with its focus on trust, norms of cooperation, reciprocity, and identification, is essential for driving innovation within MSMEs, especially in resource-limited environments (Adler & Kwon, 2002; Granovetter, 1985). These elements collectively promote collaboration, knowledge sharing, and resource exchange within networks, which enhances MSMEs' innovative capabilities.

Trust facilitates open exchanges by minimising perceived risks and reducing the need for formal agreements, allowing MSMEs to share information freely (Roxas, 2007). Trust-based networks enable MSMEs to access diverse knowledge sources, fostering collaborative and flexible innovation. For instance, Santos,

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Oliveira, and Curado; 2023 found that trust among small businesses facilitated adaptation and responsiveness to market changes, illustrating trust's role in innovation. However, high levels of trust can lead to network insularity, where firms become overly dependent on familiar partners, limiting exposure to new ideas essential for radical innovation (Burt, 2005; Granovetter, 1985).

Norms of Cooperation within relational social capital encourage MSME network members to prioritise collective goals, which supports joint problem-solving and resource pooling (Coleman, 1988; Moran, 2005). In cooperative environments, MSMEs can overcome individual resource limitations by combining expertise and resources, fostering synergies that enhance creativity (Nahapiet & Ghoshal, 1998). In resource-constrained settings, such as developing economies, cooperative norms are particularly valuable, allowing MSMEs to achieve more substantial innovation outcomes together than they could individually (Aldrich & Kim, 2007). However, too much emphasis on cooperation can sometimes suppress individual initiative, potentially reducing the diversity of innovative approaches within the network (Inkpen & Tsang, 2005).

Reciprocity establishes balanced, sustained exchanges within networks, creating an environment where MSMEs can depend on consistent support for innovation (Putnam, 2000). This mutual assistance cycle encourages network members to contribute resources and knowledge with an understanding that support will be reciprocated, enhancing the network's resilience and innovation capacity (Tsai & Ghoshal, 1998). Research indicates that reciprocal exchanges are crucial for MSMEs in resource-limited contexts, providing a reliable source of support that enables continuous innovation (Molm, 2003; Pham et al., 2020). However, reciprocity can sometimes lead to imbalances if some network members contribute more than others, which may strain relationships over time (Molm, 2003).

Identification within relational social capital fosters a shared sense of belonging and loyalty among MSME network members, encouraging them to prioritise the network's collective goals over individual interests (Nahapiet & Ghoshal, 1998). Identification strengthens cohesion, motivating members to support each other's innovation efforts by pooling knowledge and resources more willingly (Tsai & Ghoshal, 1998). In resource-constrained environments, identification helps MSMEs work cohesively toward common objectives, enhancing their ability to innovate collectively. However, excessive identification can lead to over-alignment, where members may overlook external perspectives and limit the diversity needed for breakthrough innovations (Adler & Kwon, 2002; Granovetter, 1985).

c) Hypothesis Development

This study investigates how different components of relational social capital trust, norms of cooperation, reciprocity, and identification contribute to innovation performance within MSMEs. Relational social capital plays a critical role in resource-limited contexts, enabling MSMEs to overcome constraints through collective strategies that drive innovation (Adler & Kwon, 2002; Tsai & Ghoshal, 1998). Each of these components is hypothesised to impact MSME innovation positively by fostering an environment of shared knowledge, cooperation, and mutual support, thus enhancing both incremental and breakthrough innovations.

i. *Trust within Relational Social Capital*

Trust is a foundational aspect of relational social capital, creating a secure environment where network members feel comfortable sharing knowledge and resources without fear of opportunistic behaviour (Coleman, 1988; Levin & Cross, 2004). Trust reduces transaction costs and facilitates open communication, making it particularly valuable for MSMEs that may lack formal protections like patents or legal safeguards (Zahoor and Gerged, 2023). Research by Tsai and Ghoshal (1998) emphasises that trust within a network reduces the perceived risks associated with knowledge sharing, enabling members to draw upon diverse knowledge sources that can lead to creative and innovative solutions. For MSMEs, trust supports collaborative problem-solving and rapid adaptation to changing market conditions, allowing firms to leverage network knowledge for sustained innovation (Santos, Oliveira, and Curado, 2023; Shi, Shepherd, and Schmidts, 2015). Therefore, we hypothesise that trust within relational social capital positively influences MSME innovation performance by fostering a safe and open environment for knowledge exchange.

H1: Trust within Relational Social Capital has a Positive Effect on MSME Innovation by Enabling Safe Knowledge Sharing

ii. *Norms of Cooperation in Relational Social Capital*

Norms of cooperation represent shared expectations within networks that prioritise collective over individual interests, fostering a culture of mutual support (Coleman, 1988; Moran, 2005). In MSMEs, cooperative norms encourage members to pool resources and expertise, creating synergies that help overcome individual limitations and drive innovation (Santos, Oliveira, and Curado, 2023). Studies suggest that cooperative norms in relational social capital allow MSMEs to engage in joint problem-solving and collaborative innovation, especially in contexts where financial and technical resources are limited (Kim and Shim, 2018; Roxas, 2007). Cooperative networks enable MSMEs to tackle complex challenges by accessing a broader base of knowledge and resources, which

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enhances their ability to generate innovative solutions and respond to market demands (Onofrei et al., 2020). Thus, we hypothesise that norms of cooperation within relational social capital positively impact MSME innovation by facilitating collective efforts toward resource pooling and collaborative problem-solving.

H2: Norms of Cooperation in Relational Social Capital Enhance MSME Innovation by Facilitating Resource Pooling and Joint Problem-Solving

iii. *Reciprocity within Relational Social Capital*

Reciprocity within relational social capital is characterised by a balanced exchange of resources, where network members contribute to and receive support from each other over time (Putnam, 2000). This mutual assistance strengthens the network's resilience and encourages ongoing innovation by establishing a reliable flow of resources and knowledge (Molm, 2003; Tsai & Ghoshal, 1998). In MSME networks, reciprocity fosters a supportive environment where firms are motivated to contribute to the collective well-being with the expectation of future support, creating a cycle that reinforces long-term collaboration (Santos, Oliveira, and Curado, 2023; Kim and Shim, 2018). Studies indicate that reciprocal exchanges are crucial for sustaining innovation, as they build trust and reduce the risks associated with collaborative ventures, allowing MSMEs to maintain momentum in their innovation activities (Ganguly, Talukdar, and Chatterjee, 2019; Santos, Oliveira, and Curado, 2023). We hypothesise that reciprocity within relational social capital supports MSME innovation by providing a stable exchange system that enables ongoing resource and knowledge sharing.

H3: Reciprocity within Relational Social Capital Promotes Sustained Innovation by Ensuring a Stable Exchange of Resources

iv. *Identification within Relational Social Capital*

Identification refers to the shared sense of belonging and loyalty within a network, where members view themselves as part of a collective and align their actions with common objectives (Nahapiet & Ghoshal, 1998). In networks, identification fosters a unified identity, strengthening trust and collaboration as members work toward shared goals (Tsai & Ghoshal, 1998). High levels of identification enhance cohesion within the network, motivating members to contribute knowledge and resources that benefit the group as a whole (Adler & Kwon, 2002; Kankanhalli et al, 2015). This alignment is particularly beneficial for innovation, as it reduces conflicts of interest and encourages members to prioritise collective innovation outcomes over individual gains (Granovetter, 1985). Research suggests that identification within a network enhances resource-sharing behaviours and increases members' commitment to collaborative efforts, which are critical for driving MSME innovation (Moran, 2005). Consequently, we hypothesise that identification within relational social capital positively impacts MSME innovation by fostering a collective commitment to shared goals.

H4: Identification within Relational Social Capital Positively Impacts MSME Innovation by Reinforcing Commitment to Collective Goals

III. Methods

a) Data Collection

To test the study's hypotheses, we conducted a cross-sectional survey targeting owners and managers of textile MSMEs across Nigeria's diverse geopolitical regions. Given their broad oversight of business processes, these individuals are positioned to provide reliable insights into how relational social capital affects innovation within their enterprises. The survey was disseminated online, reaching participants via their trade associations, which helped facilitate broad sector participation and ensured a comprehensive regional spread. A stratified random sampling approach was utilised, allowing for a well-rounded sample of 1,000 textile MSMEs across Nigeria. By sampling from different geopolitical zones, this method aimed to capture cultural nuances that could influence relational social capital, thereby bringing diverse regional perspectives into the study (Nahapiet & Ghoshal, 1998). The focus on textile MSMEs is motivated by the sector's pivotal role in Nigeria's economy, its dependency on social networks for resources and market access, and its unique sectoral challenges, including high competition and resource limitations (Ayyagari, Demirgüç-Kunt, & Maksimovic, 2014). Investigating relational social capital in this context provides insight into how elements like trust, cooperation, obligation, reciprocity and identification contribute to fostering the innovation performance of MSMEs across culturally varied environments in Nigeria.

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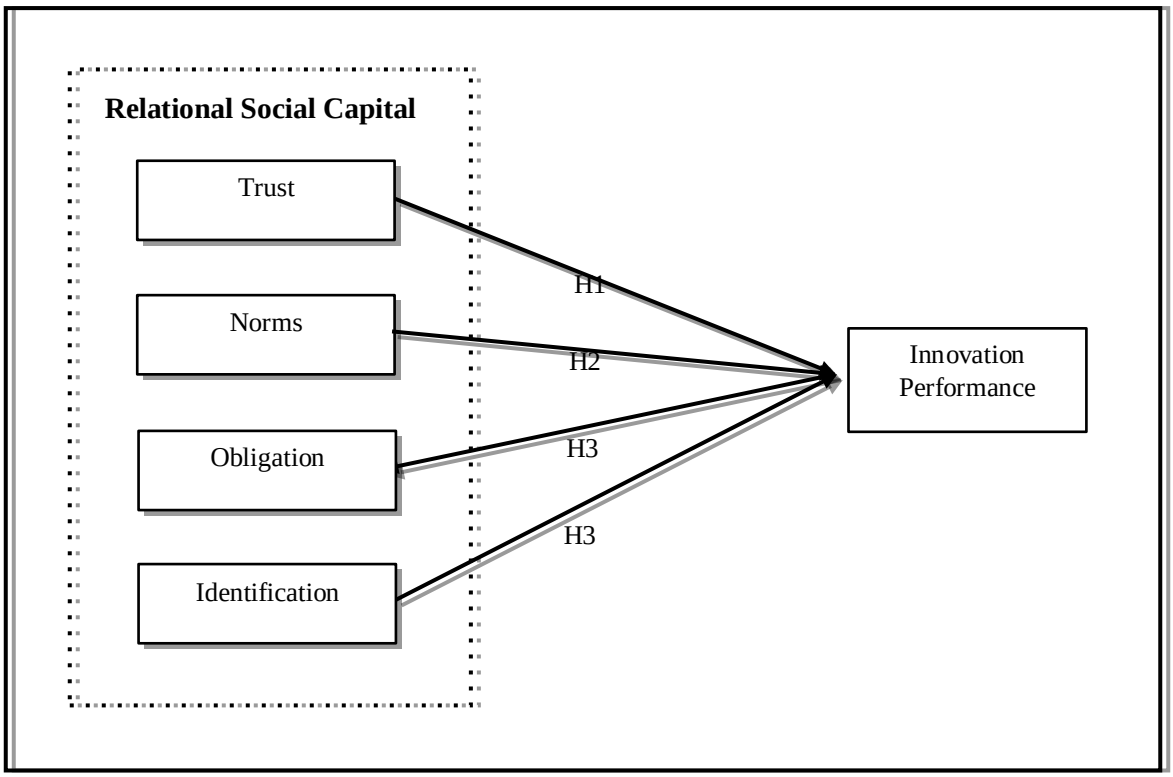


Fig.1: Conceptual Framework

b) Sampling

To measure the constructs in our model, we used previously validated scales with minor adjustments to fit the study context (see appendix 2). Each scale included 7 items, and a 5-point Likert scale was employed, ranging from 1 (strongly disagree) to 5 (strongly agree). Translations and cultural adaptations were done for regional relevance, following Sousa and Rojjanasritat's (2011) committee approach to ensure conceptual clarity across

For data collection, a questionnaire survey approach was used. To evaluate potential non-response bias, we applied the method outlined by Armstrong and Overton (1977), comparing the responses from the earliest 25% of participants with those from the last 25%, using T-tests. Those in the final 25% were respondents who delayed the most in completing the survey after being invited. Since no significant differences were found between these groups, we inferred that non-response bias was unlikely to be a concern. Using G*Power 3.1, we established a minimum sample size through a power test of 0.8 and an effect size of 0.15 (Faul et al., 2007). With a sample size of 384, the study meets this requirement. Table 4 presents the descriptive statistics.

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Table 1: Characteristics of the Sample

Item	Construct	No	%
Gender	Female	307	51.1
	Male	294	48.9
Age	18-25 years	206	34.3
	26 - 35 years	220	36.6
	36 - 45 years	79	13.1
	46 - 55 years	68	11.3
	56 - 65 years	26	4.3
	66 > 70 years	2	0.3
Level of Education	SSCE	100	16.8
	Degree	361	60.5
	Postgraduate	80	13.4
	Others	15	2.5
	Diploma	41	6.9
Business Location	Abia	116	19.3
	Oyo	184	30.6
	Lagos	179	29.8
	Kano	122	20.3
Business Position	Business Owner	414	68.9
	Manager	56	9.3
	Staff	5	0.8
	Others	126	21
Duration of business owner or manager	1-5 years	353	58.7
	6-10 years	147	24.5
	11-20 years	71	11.8
	20 years >	30	5
Number of employees	1-2	240	39.9
	3-9	214	35.6
	10-49	125	20.8
	50-199	22	3.7

c) Data Pre-Processing

A normality test was conducted to confirm the model's compatibility with multivariate analysis requirements. Results from the Kolmogorov-Smirnov (K-S) test indicated that the data did not follow a normal distribution. Thus, PLS-SEM was selected due to its advantages (Hair et al., 2019): (1) suitability for non-normal data, (2) effectiveness with smaller samples, and (3) applicability for exploratory models. Our study aligns with these conditions, and SmartPLS 4.0 was utilised for the analysis.

d) Common Method Variance

As this study relies on self-reported data, common method variance (CMV) was evaluated. Initially, Harman's single-factor test identified six distinct factors, with the first factor accounting for 32% of the variance, under the 50% threshold advised by Podsakoff et al. (2003). Additionally, we conducted a supple-

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mentary analysis using the unmeasured latent method construct (ULMC) following Leong et al. (2020). As shown in Appendix B, Table B2, all method loadings were non-significant for each item, while substantive loadings were significant.

IV. PLS-SEM Results

For empirical analysis, PLS-SEM was employed. According to Hair et al. (2019), this method involves a measurement model for evaluating item reliability and consistency, alongside a structural model for testing convergent and discriminant validity.

a) Measurement Model Evaluation

The measurement model, or outer model, evaluates both reliability and validity. Regarding item reliability, factor loadings ranged from 0.679 to 0.852 (refer to Table 2). Although Hair et al. (2019) recommends a minimum threshold of 0.708 for reliability, loadings above 0.6 are often sufficient in exploratory studies or when construct validity remains robust (Chin, 1998). Each loading was statistically significant at less than 0.001. Table 5 further shows that Cronbach's alpha values exceeded 0.8, composite reliability (CR) was above 0.8, and rho_A values were over 0.7 (Hair et al., 2019), indicating that the reliability standards were met. Convergent validity was assessed via the average variance extracted (AVE), with values between 0.669 and 0.837, surpassing Hair et al.'s (2019) recommended threshold of 0.5. To verify discriminant validity, the Fornell-Larcker criterion and the Heterotrait-monotrait (HTMT) ratio were applied. The square roots of AVEs on the matrix diagonal were greater than the shared variances among variables, affirming sufficient discriminant validity (Fornell & Larcker, 1981)..

According to Hair et al. (2019), model assessment involved examining VIF, R^2, f^2, the Stone-Geisser (Q^2) test, path coefficients, and their significance. The VIF values, ranging from 1.661 to 3.173 (see Table 2), were well below the threshold of 5 (Kock & Lynn, 2012), suggesting no multicollinearity issues. The R^2 values reflect the model's explanatory capacity, with the theoretical model accounting for 32.4% of the variance in innovation performance. The f^2 effect sizes, representing path coefficient redundancy, ranged from 0.000 to 0.182. Predictive accuracy, assessed via the Q^2 value, was found to be 0.305 using blindfolding procedures, indicating moderate predictive power.

i. *Direct Effects Analysis*

The results examining relational social capital's impact on MSME innovation performance reveal diverse outcomes across different dimensions. Trust (TRS) exhibited a positive but non-significant effect on innovation performance ($\beta = 0.094$, $p = 0.177$), suggesting that while trust may support innovation, its influence in this study was not statistically substantial. Norms of cooperation (NOC) had a slight negative effect ($\beta = -0.003$, $p = 0.971$), indicating minimal impact on MSME innovation. Reciprocity (RECP) also showed a minor negative effect on innovation performance ($\beta = -0.007$, $p = 0.917$), implying that expectations of reciprocal support may not significantly foster innovation for MSMEs. However, identification (IDEN) had a pronounced positive impact ($\beta = 0.511$, $p < 0.001$), demonstrating that a strong sense of shared identity and alignment within relational social capital significantly enhances innovation performance. These findings suggest that while trust and reciprocity have limited effects, identification plays a critical role in fostering innovation.

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Table 2: Reliability and Convergent Validity Analysis for Relational Social Capital Variables

Constructs	Items	Factor Loading	rho_c	Cronbach' α	rho_A	AVE	VIF
Trust	TRS1	0.776	0.922	0.902	0.905	0.629	2.028
	TRS2	0.812					2.288
	TRS3	0.8					2.281
	TRS4	0.787					2.163
	TRS5	0.742					1.661
	TRS6	0.803					2.487
	TRS7	0.83					2.538
Norm of Cooperation	NOC1	0.747	0.921	0.9	0.908	0.624	1.809
	NOC2	0.816					2.283
	NOC3	0.796					2.066
	NOC4	0.816					2.329
	NOC5	0.827					2.398
	NOC6	0.744					2.331
	NOC7	0.78					2.419
Reciprocity	RECP1	0.819	0.927	0.909	0.92	0.647	2.322
	RECP2	0.852					2.786
	RECP3	0.816					2.32
	RECP4	0.835					2.507
	RECP5	0.811					2.357
	RECP6	0.755					2.325
	RECP7	0.734					2.249
Identification	IDEN1	0.693	0.899	0.869	0.879	0.56	1.686
	IDEN2	0.8					2.17
	IDEN3	0.69					1.887
	IDEN4	0.744					1.907
	IDEN5	0.823					2.318
	IDEN6	0.794					2.08
	IDEN7	0.679					1.834
Innovation Performance	IP1	0.715	0.953	0.947	0.947	0.593	2.077
	IP2	0.747					2.427
	IP3	0.762					2.309
	IP4	0.821					3.173
	IP5	0.808					2.813
	IP6	0.799					2.883
	IP7	0.791					2.642
	IP8	0.785					2.641
	IP9	0.799					2.756
	IP10	0.764					2.376
	IP11	0.752					2.445
	IP12	0.758					2.428
	IP13	0.764					2.467
	IP14	0.709					2.046

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The evaluation of the measurement model in this study was conducted using the PLS-SEM approach through the SmartPLS 4.0 software application, focusing on assessing the validity and reliability of the variables involved. This process is crucial for ensuring that the measures used accurately reflect the theoretical concepts they are intended to represent.

Table 3: Fornell-Larcker

	IDEN	IP	NOC	RECP	TRS
IDEN	0.748				
IP	0.565	0.77			
NOC	0.702	0.429	0.79		
RECP	0.61	0.367	0.703	0.804	
TRS	0.637	0.415	0.799	0.649	0.793

Note: IDEN-Identification, IP-innovation Performance, NOC-Norms of Cooperation, RECP, -Reciprocity, TRS-Trust

Table 4: Heterotrait-Monotrait Ratio (HTMT)

	IDEN	IP	NOC	RECP	TRS
IDEN					
IP	0.606				
NOC	0.807	0.45			
RECP	0.695	0.381	0.785		
TRS	0.728	0.438	0.883	0.72	

Note: IDEN-Identification, IP-innovation Performance, NOC-Norms of Cooperation, RECP, -Reciprocity, TRS-Trust

In this study, the discriminant validity analysis results are meticulously outlined in Table 2. The table features a correlation matrix in which the diagonal entries represent the square roots of the Average Variance Extracted (AVE) coefficients for each construct. To affirm discriminant validity, the square root of the AVE for any given construct must exceed its highest correlation with any other construct, as posited by Hair et al. (2013). This principle ensures that each construct is sufficiently distinct from the others within the model.

The data presented in Table 4.16 unequivocally demonstrate that for all constructs, the square roots of the AVEs are indeed greater than the corresponding off-diagonal coefficients in both rows and columns of the matrix. This finding firmly establishes the discriminant validity of the constructs, indicating that each construct uniquely captures the phenomenon it is intended to represent, based on their parameter estimates and statistical significance.

Having established the validity and reliability of the constructs through the measurement model, it is imperative to also scrutinise the structural model as a whole. However, prior to delving into the structural model, a critical reassessment of the proposed theoretical framework was conducted. This reassessment was necessitated by modifications made during the confirmatory factor analysis phase, which involved the elimination of certain items. Despite these deletions, it is important to note that no constructs were removed from the model. This decision was based on the criterion that at least two indicators remained to represent each construct adequately, thereby preserving the integrity and coherence of the theoretical framework (Hair et al., 2012). The revised theoretical model of the study is visually depicted in Figure 4.1, showcasing the adjustments made to accommodate the findings from the confirmatory factor analysis and ensure a robust and valid representation of the constructs within the structural model.

Table 5: Overview of Hypothesis Testing Outcomes

Hypothesis	Path coefficient	Standard deviation	T statistics	2.50%	97.50%	P values	Result
IDEN -> IP	0.511	0.060	8.473	0.396	0.630	0.000	Accepted
NOC -> IP	-0.003	0.076	0.037	-0.154	0.146	0.971	Rejected
RECP -> IP	-0.007	0.066	0.104	-0.131	0.124	0.917	Rejected
TRS -> IP	0.094	0.070	1.352	-0.044	0.228	0.177	Rejected

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According to the results, 32.5% of the variance in SMEs innovation performance can be explained by Trust, Norms of cooperation, Reciprocity and Identification (Figure 7).

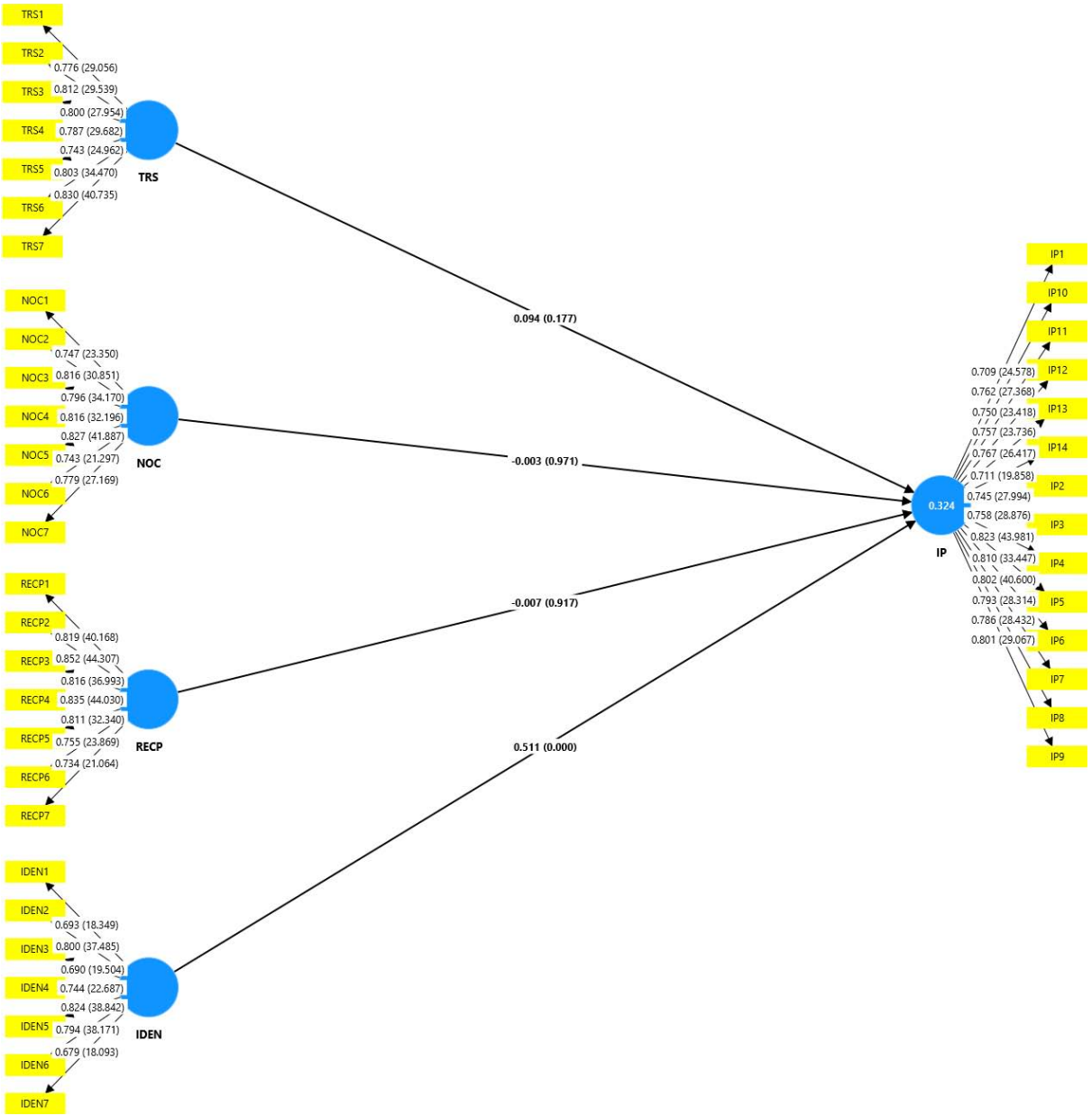


Fig. 2: Path Coefficient Analysis

V. FSQCA Results

This section details the findings of the fsQCA analysis, focusing on necessary and sufficient conditions for achieving high innovation performance (IP) in MSMEs through components of relational social capital such as trust (TRS), norms of cooperation (NOC), reciprocity (REC), and identification (IDEN). Using a consistency threshold of 0.90 to determine necessity, as suggested by Ragin (2008), we identify configurations that jointly contribute to high IP outcomes. The fsQCA analysis reveals insights into the complex interplay between relational social capital dimensions, highlighting the configurational nature of conditions necessary and sufficient for high innovation.

a) Calibrating Variables

To convert our causal conditions measured on five-point Likert scales into a fuzzy set scale, we first calculated the average scores for each variable, then determined the percentiles of these averages. Specifically, the full membership threshold was set at the value encompassing 95% of the average scores (fuzzy score = 0.95). The crossover point was set at the median, covering 50% of the average scores (fuzzy score = 0.5). The threshold for full non-membership was

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defined as the value covering the lowest 5% of the average scores (fuzzy score = 0.05).

b) Analysis of Necessary Conditions

To identify whether individual relational social capital elements were necessary for achieving high IP, we examined each condition's consistency score, where a score above 0.90 indicates necessity (Ragin, 2008; Schneider & Wagemann, 2010). Table 1 presents the results of the necessary condition analysis.

Table 5: Summary of Analysis of Necessary Conditions

Condition	Consistency	Coverage
TRS	0.861943	0.976491
NOC	0.887297	0.970939
REC	0.869104	0.973059
IDEN	0.923725	0.971591

As shown in Table 5, identification (IDEN) is the only condition with a consistency score exceeding 0.90, indicating it as a necessary condition for high innovation performance. This finding aligns with prior studies suggesting that a strong sense of identification is crucial for effective collaboration and knowledge sharing in MSME networks, which in turn fosters innovation (Fiss, 2011; Schneider et al., 2010). Identification may facilitate trust and commitment within MSMEs, particularly in resource-constrained environments, as it reinforces members' alignment toward common goals (Granovetter, 1985; Adler & Kwon, 2002). The absence of necessity in other conditions suggests that while trust, norms of cooperation, and reciprocity are important, they alone are insufficient to consistently drive high innovation performance without the presence of identification.

c) Sufficient Configurations of Relational Social Capital

The intermediate solution in fsQCA identifies configurations of relational social capital elements that are sufficient to achieve high IP. These configurations reflect the principle of equifinality, indicating that multiple causal paths can lead to the same outcome, a hallmark of configurational approaches (Ragin, 2008; Fiss, 2011). Table 2 summarises the sufficient configurations derived from the fsQCA analysis.

Table 6: Configurations of fsQCA Intermediate Solution for High Innovation Performance

Paths	TRS	NOC	REC	IDEN	Raw Coverage	Consistency
~TRS * ~NOC * ~REC	○	○	○	⊗	0.236973	0.972811
TRS * NOC * ~REC	⊗	⊗	○	⊗	0.290818	1.000000
TRS * NOC * IDEN	⊗	⊗	○	⊗	0.828311	0.987818
~TRS * ~REC * IDEN	○	○	○	⊗	0.260864	0.997369
NOC * ~REC * IDEN	○	⊗	○	⊗	0.290001	0.997633

Notes: ● = presence of condition; ○ = absence of condition; ⊗ = presence of key condition in path.

The findings reveal five unique configurations that contribute to high IP, underscoring the complex, non-linear relationships among relational social capital elements (Fiss, 2011). For example, in the second configuration (TRS * NOC * ~REC * IDEN), the presence of trust, norms of cooperation, and identification, combined with the absence of reciprocity, consistently leads to high IP with a perfect consistency score of 1.000. This pathway suggests that while reciprocity is generally positive, in some cases, its

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absence may streamline interactions and reduce potential conflicts or misunderstandings, facilitating innovation in contexts where consistent cooperation and identification are strongly emphasised (Schneider et al., 2010; Ragin, 2008).

Additionally, the third configuration (TRS * NOC * IDEN) illustrates that when trust, norms of cooperation, and identification are all present, high IP is achieved, highlighting the cumulative impact of these elements on innovation performance. This finding aligns with previous literature that underscores the importance of trust and shared norms in enabling cooperative behaviour and joint problem-solving in MSMEs (Tsai & Ghoshal, 1998; Granovetter, 1985). The overall solution coverage and consistency scores of 0.818 and 0.895, respectively, indicate that these configurations collectively explain a substantial proportion of high innovation performance cases, affirming the robustness of the model. High coverage suggests that the identified configurations encompass a wide range of cases, while high consistency reflects the reliability of these paths in consistently producing the desired outcome (Schneider & Wagemann, 2010; Woodside, 2013). This configurational approach underscores the importance of relational social capital's collective dynamics in driving innovation performance, as opposed to single isolated factors (Fiss, 2011; Ragin, 2008).

In summary, the fsQCA results support the notion that relational social capital influences MSME innovation performance through various combinations of conditions, highlighting the need for tailored strategies that consider specific relational configurations. These findings align with the complementary PLS-SEM results, which identified identification as a significant predictor of innovation performance. Together, both analyses provide a comprehensive understanding of how relational social capital components contribute to MSME innovation within a resource-limited, emerging market context.

VI. Discussions and Conclusion, Implications, and Limitations

a) *Discussions and Conclusion*

This study explored the impact of relational social capital, specifically trust, norms of cooperation, reciprocity, and identification on the innovation performance (IP) of MSMEs. By applying both Partial Least Squares Structural Equation Modelling (PLS-SEM) and fuzzy-set Qualitative Comparative Analysis (fsQCA), we aimed to provide a comprehensive view of how these relational dimensions contribute to innovation. The integration of these two methods allows us to validate findings from different perspectives: PLS-SEM identifies significant pathways in a linear context, while fsQCA highlights non-linear, configurational relationships that contribute to high IP in complex, resource-constrained environments like Nigeria.

In the PLS-SEM analysis, identification was found to be a significant predictor of IP in MSMEs, demonstrating that a strong sense of alignment with organisational goals and a shared identity can drive innovation. This result aligns with prior literature suggesting that employees' commitment to collective goals encourages resource sharing and collaborative problem-solving (Levin & Cross, 2004; Tsai & Ghoshal, 1998). However, other relational elements trust, norms of cooperation, and reciprocity did not exhibit statistically significant direct effects on IP. This may suggest that, while important, these factors alone do not directly drive innovation but may require specific combinations to be effective.

The fsQCA results complement and extend these findings by identifying five unique configurations that lead to high IP, illustrating the importance of relational elements working in concert. For instance, one configuration showed that the presence of trust, norms of cooperation, and identification, coupled with the absence of reciprocity, is sufficient to achieve high IP. This implies that while reciprocity is generally valuable, its absence in certain configurations may reduce complexity in interactions, fostering a more streamlined approach to innovation (Ragin, 2008; Schneider et al., 2010). Another configuration demonstrated that the combination of trust, norms of cooperation, and identification alone was sufficient to achieve high IP, emphasising that these elements together create a collaborative culture that supports innovation (Granovetter, 1985; Tsai & Ghoshal, 1998). The overall solution coverage and consistency for the fsQCA analysis were 0.818 and 0.895, respectively, indicating that the identified configurations collectively account for a substantial portion of high IP cases. High coverage suggests that these configurations apply to a broad range of cases, while high consistency indicates that these paths reliably lead to the desired outcome (Schneider & Wagemann, 2012; Woodside, 2013). This configurational approach highlights the nuanced ways in which relational social capital elements combine to influence innovation, aligning with previous calls for non-linear analyses in social capital research (Fiss, 2011; Ragin, 2008).

b) *Theoretical Implications*

This study contributes to social capital theory by demonstrating that relational social capital's influence on IP is both context-dependent and configuration-specific. Traditional linear models, such as those applied in PLS-SEM, provide a valuable overview but may overlook the complex interdependencies between relational factors. By incorporating fsQCA, our study supports the notion that relational elements must work in specific combinations to foster innovation effectively. This aligns

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with Fiss's (2011) configurational theory, which posits that specific conditions only lead to desired outcomes when combined in particular ways.

Our findings emphasise the importance of identification as a central driver of innovation within MSMEs, suggesting that alignment with organisational goals and a sense of shared purpose are crucial in resource-limited settings (Coleman, 1988). The role of identification as a core condition in multiple high-IP configurations highlights its significance in relational social capital, adding nuance to existing theories that primarily focus on trust or cooperation as standalone factors (Nahapiet & Ghoshal, 1998; Granovetter, 1985). This study thus contributes to a more refined understanding of relational social capital by illustrating how different configurations can either enable or hinder innovation.

c) Practical Implications

For managers, these findings suggest that fostering relational social capital requires a balanced approach that considers the specific relational needs of their organisation. Given the central role of identification in our high-IP configurations, managers should cultivate a strong sense of organisational identity and shared goals among employees, as this can significantly enhance innovation outcomes (Levin & Cross, 2004). However, our results also indicate that reciprocity, while valuable, may sometimes complicate relational dynamics, suggesting that managers should carefully assess whether reciprocal relationships are essential or if streamlined interactions are more beneficial in certain contexts.

Additionally, managers should recognize that trust and cooperation are valuable but may need to be coupled with strong identification to drive innovation effectively. Developing initiatives that build trust and cooperation while reinforcing shared goals could foster a collaborative culture that supports innovation. These insights provide actionable guidelines for MSME managers in resource-limited settings, enabling them to strategically leverage relational social capital to improve their innovation capabilities.

d) Limitations and Future Research

This study has several limitations that provide directions for future research. First, our analysis was limited to the relational dimension of social capital, focusing on a specific subset of MSMEs in Nigeria. Future studies could explore how other social capital dimensions, such as structural and cognitive, interact with relational factors to influence IP. Additionally, while our study utilised both PLS-SEM and fsQCA, future research could apply other non-linear methods or longitudinal designs to capture dynamic relationships over time, particularly as relational networks evolve (Schneider & Wagemann, 2012).

Authorship Contribution Statement

Okechukwu Emmanuel Chiaha: Original draft preparation, methodology, formal analysis, conceptual framework, data curation, investigation, and review and editing of the manuscript.

Adekunle Ogunsade: Supervision, conceptual development, validation, and review and editing of the manuscript.

Oluwasoye Mafimisebi: Supervision, conceptual framework, validation, and manuscript review and editing.

Declaration of Competing Interest

The authors confirm that there are no known financial or personal conflicts of interest that could have influenced the research presented in this paper.

Data Availability: This will be made available on request.

Appendix A: Questionnaire items: Structural Social Capital

Code	*Trust/Trustworthiness*: *(WeiZheng 2010; Chow and Chan 2008; Hau et al. 2013; Santos et al, 2020)*
TRS1	I can count on other businesses in my trade when in need.
TRS2	I trust other businesses in my trade.
TRS3	I believe other businesses in my trade are honest.
TRS4	It's easy for me to rely on other businesses in my trade.
TRS5	I am confident in the businesses in my trade.
TRS6	Other businesses in my trade usually keep their promises.
TRS7	I feel safe doing business with others in my trade.
	Norms of Cooperation: *(Kankanhalli et al, 2015: Santos et al, 2020)*
NOC1	Businesses in my trade help each other a lot.

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NOC2	I work well together with other businesses in my trade.
NOC3	I often share tools and ideas with others in my trade.
NOC4	It's normal for me to team up with other businesses in my trade.
NOC5	I often work with other businesses on big projects.
NOC6	In my trade, businesses often come together to solve problems.
NOC7	Businesses in my trade usually support each other to do well.
	Reciprocity: *(Kankanhalli et al, 2015: Santos et al, 2020)*
RECP1	When I help others in my trade, they usually help me back.
RECP2	Giving help and getting help in return is normal in my business.
RECP3	It's common for businesses in my trade to help each other out.
RECP4	If I share something with others, I usually get help in return.
RECP5	I do favours for others, and they do favours for me too.
RECP6	If I do something good for another business, I expect they will do the same for me.
RECP7	In my trade, helping someone means they will probably help me later
	Identification: *(Kankanhalli et al, 2015)*
IDEN1	I am happy to be a part of this trade.
IDEN2	This trade is like a big family to me.
IDEN3	I have the same business goals as others in this trade.
IDEN4	I feel a strong connection with the people in my trade.
IDEN5	Being a part of this trade matters a lot to me.
IDEN6	I am proud to work with others in this trade.
IDEN7	We all seem to be working towards the same goals in this trade.
	Product Innovation: Manuela et al., 2020, Kim et al (2017), Atuahene-Gima (2005), Subramaniam and Youndt (2005), Jansen et al. (2006), Herrmann et al. (2007), Valle and Vázquez-Bustelo (2009)
PRIN1	I often create new kinds of textile materials and products that my customers like.
PRIN2	I make changes to my textile materials and products so they have something special that customers can't find anywhere else.
PRIN3	When customers ask for something different, I change my textile materials and products to give them what they want.
PRIN4	I'm always thinking of new kinds of textile materials and products to offer to my customers.
PRIN5	What my customers tell me often leads me to make my textile materials and products better.
PRIN6	I look for special designs that will make my textiles different from others.
PRIN7	I often make my textile materials and products in ways that are simpler for my customers to wear or use and look better.
	Process Innovation: Huergo and Jaumandreu (2004), Reichstein and Salter (2006), Jansen et al. (2006), Martinez-Costa and Martinez-Lorente (2008), Akgüna et al. (2009), Aliasghar et al. (2020)
PSIN1	Using new machines, methods, or tools in my business makes my work quicker, and easier.
PSIN2	I always try to find new ways to make the textile materials and products that customers like.
PSIN3	I regularly search for new machines or tools that help me weave faster and spend less.
PSIN4	I have made changes in my textile materials and product-making process that help me work faster and reduce costs.

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PSIN5	I look for new patterns, dyes, or weaving methods to make my textile material and product stand out.
PSIN6	I have updated the way I package my textile materials and products to protect them better and make them more attractive to customers.
PSIN7	I find ways to reduce costs without lowering the quality of my textile materials and products.

Appendix

TRSAV	NOCAV	RECAV	IDENAV	number	IPAV	cases	raw consist.	PRI consist.	SYM consist
1	1	0	1	6	1		1	1	1
0	0	0	1	2	1		1	1	1
1	1	0	0	1	1		1	1	1
0	1	0	1	1	1		0.99727	0.991192	1
1	1	1	1	322	1		0.990734	0.987707	0.99771
0	0	0	0	4	1		0.969478	0.871291	0.883101

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Improving Nursing Night Shifts: The Importance of Low Light and Proper Breaks

By Boris BARD

Abstract- The article explores the physiological importance of circadian rhythms, regulated by hormones like melatonin and cortisol, and reviews studies demonstrating the benefits of dim lighting and structured naps during shifts. Evidence from international research, such as a Brazilian study on nap duration, highlights the optimal 2.1–3-hour nap window for recovery and performance. However, Ontario hospitals often rely on informal "tacit agreements" for breaks, lacking formal policies or proper facilities to support restorative rest.

The article calls for action by Accreditation Canada and hospital councils to adopt evidence-based policies. Recommendations include dimming night time lighting to protect circadian rhythms and formalizing extended, supported break periods. Cost-effective solutions like dimmers, table lamps, and improved nap spaces are proposed to enhance nurse well-being and patient outcomes.

Keywords: *nurses, working conditions, night shifts, circadian rhythm, melatonin, cortisol, ambient lighting, rest breaks, sleep deprivation, shift work sleep disorder (SWSD), mental health, healthcare policies, evidence-based practices, accreditation canada, napping facilities, lighting hazards, ontario hospitals. staff well-being, patient safety, managerial practices.*

GJMBR-A Classification: *JEL: I12, J81*



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I. Free Nurses from Ideologically Driven Harsh Working Conditions

This article reviews evidence on two key components of nursing night shifts (and other professional night shifts): exposure to ambient light and staff breaks.

Today, some hospitals impose working conditions on nurses that reflect similar struggles. For instance, certain mental health facilities in Ontario enforce a "Zero Restraint Policy," presenting it as a progressive approach but, in reality, pushing staff into physical altercations with patients. [1] Another troubling example is the insistence on 24/7 bright lighting in nursing stations under the appearance of an "open-for-business" concept. This approach treats nursing stations like 24-hour fast-food outlets, aimed at waking up and attracting uninteresting "customers". The constant bright lighting disrupts the nurses' and patients' natural body clocks.

Furthermore, the lack of appropriate spaces for naps during breaks represents unnecessary cruelty. In most mental health departments across Ontario, nurses' break areas are inadequately equipped for genuine rest. Nurses working 12-hour shifts often cannot access suitable spaces for short, restorative naps, leaving them physically and mentally drained. These conditions compromise their ability to provide safe, effective care.

Such rules lack a basis in evidence or science. Instead, they seem ideologically motivated, often to achieve goals unrelated to patient care. Some managers may enforce these practices to project an image of "strong leadership," relying on unnecessary cruelty to boost their reputation. These are a clear example of ideology-driven regulations replacing evidence-based practices.

II. Circadian Rhythm, Melatonin, Cortisol, and Body Temperature

The circadian rhythm is the body's natural clock, aligning alertness and sleepiness with the 24-hour light-dark cycle. Two hormones, melatonin and cortisol, play central roles in this process.

Melatonin increases in response to darkness, starting around 9–10 p.m., peaking at 3–4 a.m., and declining between 7–9 a.m. It remains undetectable during daylight hours. [2] Body temperature follows a similar pattern, peaking in the evening and dropping to its lowest point between 2–4 a.m., then gradually rising before waking. This evening temperature drop helps prepare the body for sleep. [3] Nurses often feel cold during this time and may need extra layers to stay warm.

Cortisol, produced by the adrenal glands, follows an opposite pattern. It rises before waking and falls in the late evening, remaining low throughout the night. Cortisol plays a key role in regulating immunity, pain, concentration, stress response, blood pressure, blood sugar, mood, bone health, and memory. [4]

Human biology has led many hospitals to design environments that support patients' circadian rhythms, such as dimming lights in hallways and nursing stations at night. However, some hospitals disregard these practices, maintaining full lighting in areas like hallways and nursing stations, which disrupts the natural rhythms of staff and patients.

III. Lighting During Night Shifts – Health and Performance

Most mental health departments allow some separation between the darkness of patient rooms and the brighter hallways. However, bright lights in nursing

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stations disrupt melatonin production and circadian rhythms for both staff and patients. Frequent staff movement, such as hourly checks or, worse, the outdated practice of 15–30-minute patient checks still used in some places [5], exacerbates this issue by introducing light and noise into patient rooms, further compromising recovery.

Studies reveal that light decreases norepinephrine and acetylcholine while increasing cortisol, serotonin, GABA, and dopamine. While light is a powerful tool, using it unnaturally outside therapeutic goals can have severe consequences.

Research shows that nurses' sleepiness levels peak around 5:00 a.m. [6]. To address this, some suggest using bright light during night shifts. This approach suppresses melatonin production and increases cortisol levels. However, it may negatively impact the well-being of both patients and staff.

Proponents argue that keeping nurses alert with bright lights is more important than preserving circadian rhythms. This is despite the long-term risks associated with Shift Work Sleep Disorder (SWSD). SWSD is further aggravated by rotating schedules, such as Ontario's common "two-day, two-night, five-days-off" model. It can result in poor concentration, headaches, fatigue, errors, substance use disorders, irritability, and mood disturbances. [7]

A 2018 ICU study revealed that while bright light improved alertness, it also caused an increase in nursing errors. [8]

On the other hand, a 2022 study in a 430-bed hospital in Japan examined sleepiness and multiple performance parameters. Unlike the ICU study, it found that darkness did not impair nurses' work performance. Instead, *maintaining dark work environments protected staff health, reduced turnover, and ensured patient safety.* The study showed that bright lights (300 lux or more) suppress melatonin within 1–2 hours, while even 120 lux has similar effects with prolonged exposure. [9] The study's hospital continues to implement dark environments, and some other facilities are beginning to adopt this approach.

To the writer's knowledge, lighting at or below 120 lux-specifically designed to preserve patient recovery and staff health- has not yet been implemented in Ontario hospitals. Instead, despite clear evidence, many facilities still use excessive lighting.

In science, as in science, nothing is black and white. A small yet interesting study from Taiwan, using a control group, found that nurses exposed to bright light (7,000 to 10,000 lux) for more than 30 minutes during the early part of their night shift experienced reduced sleepiness. This is not surprising.

What is noteworthy, however, is that the study demonstrated that nurses who used sunglasses and avoided sunlight during the day could prevent symptoms associated with SWSD. Although the study focused on slightly different symptoms- such as the Insomnia Severity Index and Hospital Anxiety and Depression Scale- there is overlap, making the findings worth considering. [10]

Thus, it might be possible to trick nurses' circadian rhythms and avoid negative health consequences even during rotating shifts. Yet, achieving this regimen would require strict daytime adaptations, such as wearing sunglasses and creating dark environments, which are challenging to implement. Furthermore, this approach does not protect patients' circadian rhythms from disruption. Therefore, this solution seems highly impractical.

IV. Breaks

What strategies can be implemented, beyond dimmed ambient lighting, to help nurses maintain low levels of sleepiness, reduce the risk of mistakes, and enhance their ability to provide safe and high-quality patient care effectively?

The Joint Commission, a nonprofit organization that accredits healthcare organizations in the United States, offers clear guidance: *"The only way to counteract the severe consequences of sleepiness is to sleep"* (pg. 2). It emphasizes napping as a practical and integral part of a comprehensive fatigue management plan. [11] Similarly, Accreditation Canada, which accredits healthcare organizations in Canada, has an equivalent role in promoting best practices for healthcare environments.

A significant study in Rio de Janeiro, Brazil, surveyed 1,940 nurses from 18 public hospitals between 2010 and 2011. The research evaluated the adverse outcomes of 12-hour night shifts, such as sleepiness, reduced performance, and increased risk of injuries or occupational accidents. The study analyzed the impact of napping during shifts on nurses' ability to recover and maintain job performance, as well as the effects on their overall health and quality of life. Work naps were defined as sleep periods equal to or less than 50% of a person's regular sleep duration.

The research discovered that female nurses, who formed the majority of the participants, often lacked sufficient recovery time during the day due to family and household responsibilities. While nurses were allowed to sleep during breaks, about half reported not sleeping at all, while the other half slept between 2.1 and 3 hours. Interestingly, those who napped for 2.1 to 3 hours demonstrated significantly better recovery rates than those who slept for less than 2.1 hours, and even slightly better those who slept for more than 3 hours. This "golden window" of 2.1 to 3 hours proved crucial for balancing personal recovery and maintaining job performance.

To facilitate breaks, nurses in Rio de Janeiro often divided into two groups, covering each other from

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midnight to 3:00 a.m. and 3:00 a.m. to 6:00 a.m. Although this practice was based on a "tacit agreement" with management rather than formal regulations, the study found that many hospitals lacked appropriate facilities to support restorative naps.

The Main Conclusion of this Study is Clear: If hospitals aim to achieve high-quality nursing care, they must regulate 2.1- to 3-hour napping breaks and establish proper facilities for these naps. [12]

Another finding of this research is its ability to humanize nurses, moving beyond seeing them as a "workforce" and recognizing them as individuals. For instance, one can imagine *Rosalie*, a mother of two young children aged 5 and 7, with nine years of nursing experience. During an exhausting 12-hour night shift, Rosalie is tasked with facilitating several patient transfers in and out of her acute care department while managing multiple calls from the shift manager regarding delays. The constant bright light in her nursing station elevates her cortisol levels, further impairing her already restless and fatigued thinking. At 5:00 a.m., she misreads a doctor's order and administers the wrong medication to a patient. On her way home, she runs a red light but narrowly avoids an accident. Exhausted and shaken, she arrives home but still must get her children ready for school, meet an air conditioning technician, and squeeze in an hour or two of sleep before starting the cycle again for her next night shift. How would Rosalie function on her next shift at 5:00 a.m.? Would you want to be her patient at that time?

The United States Centers for Disease Control and Prevention (CDC) explicitly *recommends "a night-shift nap of 2 to 3 hours" for nurses to maintain alertness during 12- to 16-hour night shifts* and to function effectively during subsequent day shifts. [13]

A 2013 Canadian study explored obstacles to regulating nursing sleep breaks. The study surveyed 47 acute care nurse managers across Canada, many of whom had personal experience with night shifts. Most managers recognized the adverse effects of sleep deprivation on staff and patients, including fatigue-related incidents. While the majority supported regulated sleep breaks, they anticipated resistance from upper management. Some concerns included staff coverage during breaks, potential inattention to patients, inadequate emergency response, and difficulty waking up after breaks. [14]

Remarkably, earlier research conducted by the same group of investigators found little evidence to support these concerns. Frontline nurses were observed to take breaks responsibly, ensuring that experienced staff remained on duty and that team leaders assessed patient needs before allowing anyone to rest. In practice, breaks were often impossible, and all emergencies were appropriately managed. [15]

V. Situation in Ontario

There is no research in Ontario comparable to the Brazilian study described above. Based on the writer's 21 years of full-time nursing experience across six different Ontario hospitals, as well as familiarity with others, Ontario nurses share a similar arrangement to those in Rio de Janeiro. They also work mostly 12-hour shifts with 1.5 hours of official breaks but, similarly to Rio, have 2.5 to 3.5 hours of "tacit agreement" nap breaks, depending on the hospital. These breaks are often taken in various locations- such as storage rooms, offices, or change rooms - typically insufficiently equipped for napping.

Typically, the charge nurse on the shift organizes these breaks based on an informal sense of fairness and adjusts them according to patient conditions. Staff are often called back from breaks, when necessary, usually for emergencies such as codes, high-acuity situations, or significant patient movement.

Occasionally, *a "manager from hell",* as nurses describe them, appears in hospitals. These managers tend to micromanage, often monitoring breaks closely and enforcing the official 1.5-hour limit, disrupting the established tacit agreement. In response, some staff leave for other jobs, while others remain, suffering quietly. They are often aware that such managers rarely last long in their roles.

Micromanagement significantly decreases motivation, increases non-care-related tasks, drastically reduces the time available for patient care, and often triggers a cascade of issues, including lateral violence among nurses.

Ultimately, these conditions can lead to medical errors, adverse patient events, fatalities, and damage to the hospital's reputation in the public eye. In the end, such developments typically result in the dismissal of the manager and sometimes the director. Experienced nurses familiar with this cycle often choose to wait it out, hoping that the next manager, appointed after an unfortunate event, will be more reasonable and allow them to exercise their professional judgment in the best interests of their patients while providing support for their work.

The examples of lighting and breaks discussed in this article are just two of many unscientific practices in our hospitals that create inefficiencies, put staff at risk, and compromise patient recovery. The best way to prevent this is to ensure that every policy is directly connected to tangible patient and staff outcomes. This approach will ensure that only science-based policies prevail.

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VI. Call for Action

a) Recommendation to Accreditation Canada

To ensure the best patient care and experience, Accreditation Canada should include the following Required Organizational Practices (ROPs) as criteria for granting hospital accreditation:

1. *Circadian Rhythm-Adaptable Patient and Staff Areas*

Patient and staff areas should be designed to align with circadian rhythms. Lighting should be dimmed to below 120 lux, ensuring safety through environmental modifications such as specialized floor lighting. Every effort should be made to reduce light exposure overnight: all unnecessary screens must be turned off, and staff should use backlit keyboards where possible. If staff require stronger lighting for patient care or to manage their drowsiness, proper separation should be established between intense light areas and other spaces in the department. Overnight lighting should be treated as a hazard.

- *New ROP:* Minimization of light hazards during night time.

2. *Extended and Supported Breaks for Nurses*

Hospitals must increase nurses' breaks from the current official 1.5 hours to 2.5 or 3 hours, making the existing "tacit agreement" an official policy. These extended breaks should be paid for and supported by providing quiet, dark, and comfortable spaces for napping.

- *New ROP:* A hospital ensures the provision of at least 2.5 hours of nursing breaks in an appropriate environment for napping.

b) Recommendation to Hospital Councils under the Excellent Care for All Act

The evidence-based principles of the *Excellent Care for All Act* require the minimization of light exposure for both staff and patients, as well as a minimum of 2.5 hours of nursing breaks in appropriate environments. It would be a violation of corporate responsibility to implement ideologically driven policies harmful to patients and staff while ignoring clear evidence supporting health and well-being. Achieving these changes requires little to no additional resources.

1. *Maintaining Existing Practices*

If a hospital cannot formalize a new collective agreement granting nurses 2.5-hour night breaks, it can still maintain the existing tacit agreement through informal communication. Hospitals should also identify and avoid hiring or retaining "managers from hell" who micromanage staff, disrupting these informal but practical arrangements. Simple reviews and improvements to potential napping spaces can also lead to significant benefits.

2. *Implementing Cost-Effective Solutions*

Hospitals can adopt simple, inexpensive solutions to minimize overnight lighting, such as table lamps and dimmers.

V. Conclusion

Hospitals should prioritize the real people they treat and employ, addressing their genuine biological needs. Let science- not ideology- guide hospital policies and practices.

Final Statement: The only truly effective way to remain a productive staff member around 5:00 am while protecting both staff and patient circadian rhythms is to keep lighting as dim as possible and either have just completed a powerful nap break or be in the middle of one.

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Effective Strategies for Implementing Agile Methodology in Jordanian Banks

By Abdal Hafeth Saleh Alaraj

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Keywords: *agile methodology, banking sector, jordan, digital transformation, change management, agile strategies, leadership, cultural change.*

GJMBR-A Classification: *LCC: HG1615.3*



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Keywords: agile methodology, banking sector, jordan, digital transformation, change management, agile strategies, leadership, cultural change.

I. Introduction

a) Defining Agile Methodology and its Importance

The process of Agile methodology uses an iterative method for project and software development to achieve flexibility alongside customer-driven satisfaction (Agile Alliance, 2001). Software development projects first used Agile as a framework for productivity and response speed improvements but it became an industry-standard framework in banking and financial services and other sectors. The banking sector finds Agile methodologies especially relevant thanks to the accelerating need for market changes and regulatory changes and technological enhancements (Brühl, 2022). Project management techniques differ from Agile since the latter uses continuous adaptation through repetitive cycles alongside multi-professional team engagements. The underlying principles of organizations drive operational effectiveness while enabling product creation and enable rapid adjustments to continuously changing customer demands (McKinsey & Company 2021). Agile benefits banks operating in regulated competitive markets by streamlining their processes and minimizing the total development time (Masood, 2017).

The sector of banking in Jordan conducts digital transformation because of enhanced technology and shifting consumer patterns and stricter supervisory requirements. Agile management methodologies face major challenges during their implementation in Jordanian banks because of resistance to change and their established hierarchical organization and outdated technological limits (Brühl, 2022). A planned Agile deployment solution stands necessary due to Jordanian banking sector-specific requirements that demand best practice applications and strategic measures specifically designed for this domain. The implementation of Agile methodologies allows Jordanian banks to create financial products centered around customers while improving their services along with their ability to anticipate regulatory changes (Beerbaum, 2020). The Agile framework enables team members from IT to operations and risk management to customer service to collaborate which builds widespread improvement initiatives and fresh concepts (Tengstrand et al., 2021). This research investigates proven Agile implementation approaches to help Jordanian banks obtain important methods and perspectives that direct their digital transformation effectiveness.

b) Research Objectives

This study seeks to:

1. Focuses on discovering optimal techniques to use Agile methodologies within Jordanian banking institutions.
2. Assess the leadership position as a facilitator of Agile transformation.
3. Evaluating both technological infrastructure and structural necessities for establishing Agile successfully.
4. Developed recommendations to help institutions overcome the challenges that stand in the way of Agile implementation.

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II. Theoretical Framework

a) Fundamentals of Agile Methodology

The Agile methodology provides a flexible system for managing projects and developing software that builds teams and delivers solutions with customer needs in focus. The original software industry focus of Agile methodology has now expanded to serve finance and banking sectors due to its capability for operational efficiency enhancement as well as faster innovation and improved market demand responsiveness. The Agile Manifesto created in 2001 established the methodology through its fundamental four principles which guide the overall framework.

The principle requires human involvement to achieve positive project results in order to succeed. Traditional banking systems work with strict organizational hierarchies that create slower decision times and less innovation. The Agile approach promotes active banking communication and interconnected workforces that solve problems swiftly thus delivering fast market response capabilities. The authors Ahmed and Elali (2021) argue that Agile methodology enables direct stakeholder participation so banks avoid bureaucratic delays.

Functional solutions at agile organizations take precedence over heavy documentation efforts because agile methods emphasize swift development coupled with continuous enhancement of functional solutions. Banking activities depend on documentation especially for regulatory needs but Agile methods enhance efficiency through better distribution of focus on customer value delivery. Automated reporting tools play a key role when financial institutions adopt Agile because these tools allow organizations to keep documentation current without delaying development according to Brühl (2022).

Agile methodologies insist on ongoing customer participation from beginning to end during project development. Customer preferences often shift away from traditional bank service agreements because they work with predefined contracts and rigid specifications. Agile methodology helps banks conduct repetitive product development cycles from customer feedback to enhance satisfaction levels among consumers. The application of Agile frameworks by banks according to McKinsey & Company (2021) leads to better customer satisfaction because they can more quickly respond to changing client demands.

A distinguishing feature of Agile methods over traditional project planning has its focus on adaptable systems because Agile framework do not promote rigid planning. Financial institutions need to handle changing regulations as well as economic markets and technological developments in their operational environment. The Agile frameworks Scrum and Kanban allow banks to change their strategic approaches by responding to these outside forces. Santhanam and Suresh (2023) confirm that Agile methodologies strengthen bank resilience so they can rapidly shift in changing market conditions.

b) Agile Applications in Various Sectors

The original software development-designed Agile methodology keeps growing as an industry-specific methodology because of its proven flexibility and productivity benefits. Agile has proven its success by being successfully applied to healthcare and manufacturing industry and banking which shows how it adapts well to different domains.

The healthcare industry has progressively implemented Agile technologies to deliver enhanced medical services while optimizing management systems together with applying agile approaches to medical research initiatives. Hospitals together with pharmaceutical companies utilize Scrum along with Kanban Agile frameworks to bring medical staff closer to IT teams for improved data handling and rapid medical technology integration and enhanced patient service quality. According to Berkani Causse and Thomas (2019) Agile transformation in healthcare institutions enables repeated problem-solving and rapid changes to adhere to regulations thus serving as an essential healthcare delivery tool.

The manufacturing industry uses Agile techniques to optimize their production system thus decreasing waste and boosting productivity. The principles behind Lean manufacturing that focus on continuous improvement and efficiency reduction match the Agile methodologiesframework. The implementation of Agile principles in manufacturing operations generates better supply chain functionality together with shorter times needed to develop new products through controlled studies. The research by Alzoubi, Alshurideh, Akour, and Al Kurdi (2022) demonstrates that Agile practices create superior process quality outcomes which enhances manufacturing firm efficiency and lowers operational costs.

Agile methodologies in banking and financial industries deliver essential transformation which enables successful market reaction to changing conditions and enhances risk control and customer service quality. Traditional banking models face challenges with dynamic consumer needs because they maintain extensive paperwork systems within rigid banking structures. Through Scrum, Kanban and SAFe (Scaled Agile Framework) financial institutions obtain faster ways to develop innovative products while effectively meeting evolving market needs. A Brazilian commercial bank received detailed evaluation from Borba, Jorge, and Pereira (2018) who reported that Agile methodologies strengthened internal team relations and boosted project speed and customer contentment. The implementation of Agile techniques in German banking

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institutions produces operational flexibility as documented by Brühl (2022) while creating a program of innovation according to his study. Alshawabkeh (2023) analyzed how business intelligence capabilities in Jordanian banks promote strategic agility through Agile integration which boosts operational decisions and efficiency rates.

The Agile methodology demonstrates significant value in drives operational improvement along with innovation development and satisfaction enhancement across these business sectors. The main advantages of deploying Agile solutions consist of:

1. Agile provides organizations with the ability to quickly respond to market condition changes as well as regulatory needs and shifting customer requirements.
2. Agile implements collaboration practices which unite different departments to eliminate organizational silos to increase communication effectiveness.
3. Agile development principles enable businesses to build products in successive cycles which shortens the delivery time for new products and services.
4. Through its methodology Agile organizations gain superior risk management by monitoring feedback to make databases that reduce dangers throughout repeated adjustments.

III. Research Methodology

The analysis of the Agile methodology utilization of Jordanian banks had employed a mixed-method approach that includes both quantitative and qualitative data collection techniques. This includes the usage of instruments for collecting data through surveys, conducting background interviews, and performing statistical interpretation for the major problems and solutions found. The research issued formal surveys to staff employees of different Jordanian banks in order to assess the level of adoption, challenges, and effectiveness of Agile methodologies. The surveys were directed to a range of staff positions in the bank including managers, IT experts, project coordinators, and Agile practitioners.

a) Sample Description

A total of 300 surveys were distributed, with 50 responses received from employees representing different levels and departments within Jordanian banks. The sample composition is detailed in Table 1.

Table 1: Participant Demographics

Characteristic	Percentage (%)
Managers	60%
IT Specialists	24%
Customer Service	10%
Other Banking Roles	6%

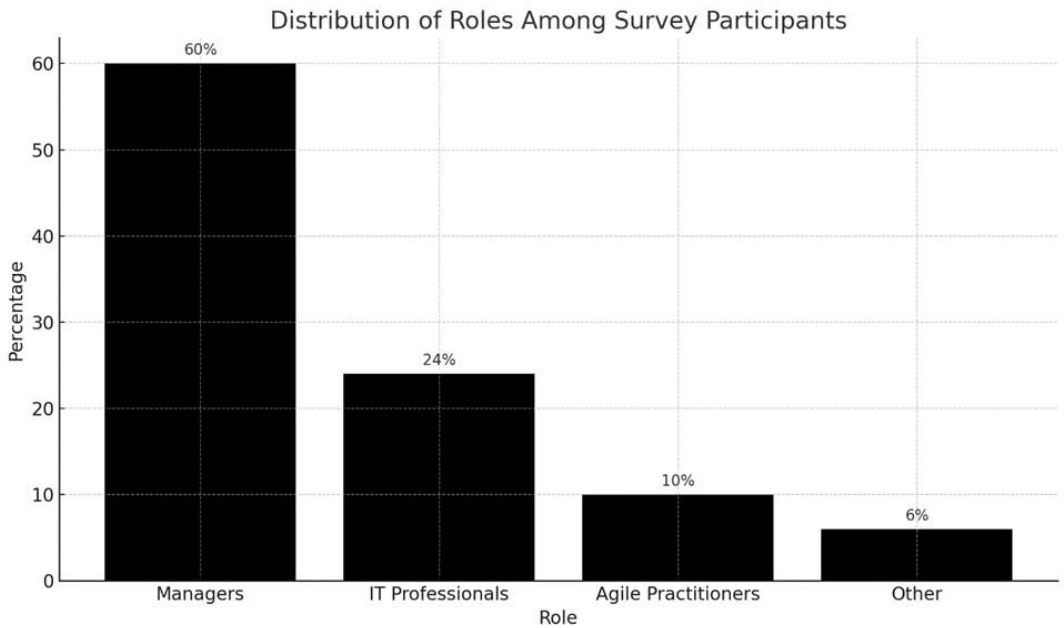


Fig. 1: Participant Demographics

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Additionally, respondents' experience with Agile methodologies varied, with 40% having prior Agile exposure, while 60% were either new to Agile or had limited exposure.

In addition to the survey results, 10 in-depth interviews were carried out with Agile specialists, top bank executives, and IT Heads, among other major respondents. These interviews were designed to understand the implementation challenges and success factors of Agile in the Jordanian banking industry.

Table 2: Key Themes from Qualitative Interviews

Theme	Percentage
Resistance to Change	75%
Need for Agile Training	50%
Integration with Legacy Systems	45%
Importance of Leadership Support	45%

b) Data Analysis Approaches

Two types of analysis were used to approach the data collected: Statistical and thematic analysis were combined to examine the data collected:

1. *Predictive Analysis:* Descriptive statistics and regression modeling were used to analyze the relationships among Key Performance Indicators KPIs representing the success of Agile adoption and independent variables, like the leadership support and training also other organizational cultural aspects.
2. *Qualitative Data Analysis:* A thematic analysis was performed which ensued in identifying patterns and common themes addressed throughout the interview and therefore secured triangulation with the survey data.

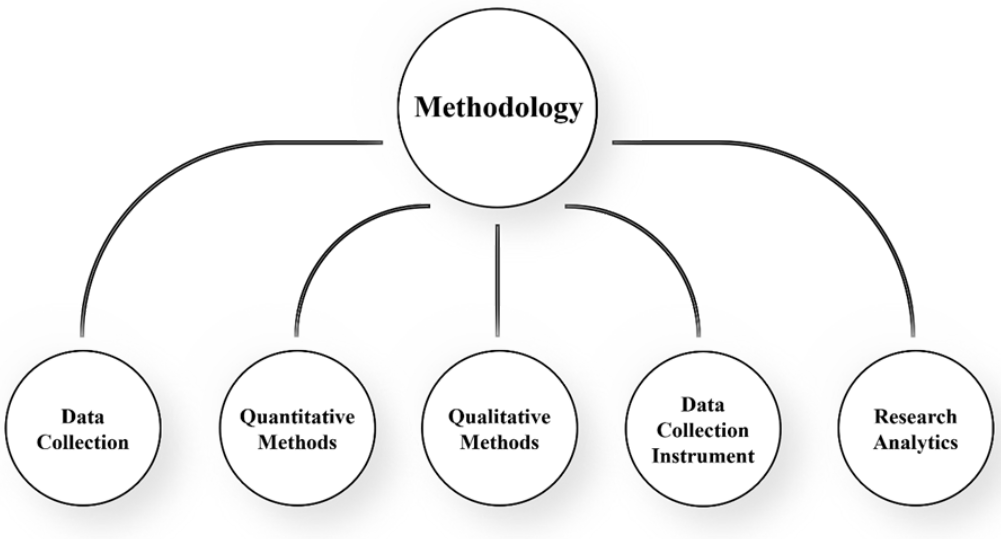


Fig. 2: Metthodology

c) Effective Strategies for Implementing Agile in Jordanian Banks

i. *Role of Leadership in Supporting Agile Transformation*

Banking institutions need strong leadership support to successfully implement Agile methodologies for their operations. The successful implementation of Agile principles requires senior executives to show full support and hands-on involvement to develop an agile environment. The implementation of Agile transformation necessitates executives to build decentralized collaborative leadership while providing strategic direction to teams that make operational choices.

The implementation of Agile practices in Jordanian banks depends heavily on the level of engagement from bank executives according to interview and survey results. Participation of senior managers in Agile ceremonies alongside training initiatives led their employees to show stronger acceptance and motivation regarding Agile practices in banks. Agile initiatives guided by bank leaders resulted in better inter-team work and decreased reluctance to change while achieving better business goal alignment with Agile processes.

The essential role of leadership in Agile transformation includes allocating enough resources along with training funds and technological investments.

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Leaders need to allocate resources which grant team's access to Agile tools in addition to Agile frameworks along with opportunities for professional development. A safe psychological work environment that lets team members try out new Agile procedures leads to higher success rates of transformation initiatives.

ii. *Enhancing Organizational Culture for Digital Transformation*

For Agile transformation success to develop within an organization it requires structural changes that affect the core cultural elements of the business. Acquiring Agile success proves difficult for traditional banks because they maintain strict hierarchical operational systems. Financial institutions should establish an organizational culture based on flexibility and collaboration alongside innovation practices.

Survey results show that cultural resistance stands as a main barrier to Agile implementation for 40% of Jordanian bank staff members. Teams used to receiving hierarchical order from above experience difficulty learning to work with self-management teams under continuous iterative cycles. The solution requires banks to execute specific change management strategies such as Agile awareness trainings and leadership coaching and employee incentive programs for agile involvement. Additionally the adoption of cross-functional teams forms a necessary part of cultural transformation.

Integrated diverse team abilities alongside multiple viewpoints produce high-performing agile teams in such conditions. There is evidence from Jordanian bank Agile practitioners showing that instituting cross-functional teams leads to better performance and faster product delivery and a continuous learning environment.

iii. *Providing Intensive Employee Training Programs*

The effective implementation of Agile depends on holistic training initiatives that both close knowledge gaps and provide banking professionals with the essential skills pointed out below. A study showed that insufficient training stood as the leading barrier to Agile implementation among half the participants. Agile training programs should teach Scrum and Kanban frameworks as well as teach JIRA and Trello tools together with Agile methods specific to banking fields.

Following are the Best practices which must be Adopted during Agile Training:

1. The Agile Foundations Training builds organizational knowledge of Agile principles along with methodologies for employees while specifically addressing team members who perform project management duties.
2. Specific training sessions cater to Scrum Masters and Product Owners and Agile teams for developing their role understanding while maintaining their functional responsibilities.
3. Training Sessions About Agile Tools and Techniques Include Practical Workshops for Agile Planning Software and Instruction on Sprint Planning and Implementing Operations Continuously.

Agile maturity sustainability requires banks to establish a formal training strategy starting with basic education then moving into unique classes for managerial staff and inter-department workers. The continuous development of Agile competencies will be supported through mentoring and Agile coaching as well as a system for continuous learning.

d) Implementing a Gradual Adoption Model

A step-by-step framework for Agile method-logy implementation proves more suitable than immediate wholesale upgrades within banking institutions. The sequential adoption model lets banks find implement-tation obstacles while perfecting Agile processes before their widespread organizational use.

Survey results showed that banking institutions experienced more successful Agile implementation by using pilot programs which led to minimal employee and management resistance during the transition. Pilot programs help teams fight Agile practice implement-tation while obtaining feedback until they can optimize their strategies for large-scale deployment.

e) Research Findings and Analysis

The success of Agile transformation in Jordanian banks depends heavily on leadership backing combined with ongoing training and phased implementation according to data analysis from qualitative and quantitative sources. Survey results displayed that banks which maintained leadership commitment alongside formal training received better results in Agile application than those establishing neither of these directions. Banks achieved better implementation results from Agile methods when they migrated to Agile in measured phases rather than making fast broad changes.

Agile practitioners from Jordanian banks specified the essential position of leaders in creating Agile work environments during their interviews. The involvement of leaders in Agile ceremonies together with training initiatives spread the methodology throughout the entire organizational structure. Interview participants identified that Agile implementation proved better when banks received adequate support from leadership through proper funding for Agile training and by promoting teamwork among different departments.

The provision of continuous training sessions together with workshops emerged as a crucial element which led to Agile project success. The training programs provided essential Agile instruction together

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with role-specific training for Scrum Master and Product Owner positions as well as hands-on activities which reproduced banking situations. Through this approach employees gained both knowledge of Agile methodologies and developed assurance in their practical utilization.

Numerous Jordanian banks have executed Agile methodologies which resulted in remarkable advancements across efficiency enhancement and both customer satisfaction improvement and faster product development speed. These bank case studies show the best Agile transformation methods together with typical elements needed for success.

A large commercial bank operating in Jordan chose to implement Agile principles in its IT department along with its digital banking business units. Staff at the bank used Scrum frameworks to advance software development along with product innovation thus speeding up digital banking solution delivery. The personnel noted improved interdepartmental teamwork and faster customer service responsiveness as well as better problem resolution capacity.

Agile methods found implementation success when a mid-sized Jordanian bank adopted them in its customer service operations. The bank applied the Kanban principles to handle customer inquiries and complaints which cut down their response time by 30% alongside doubling customer satisfaction measures. Transformation success at this bank depended heavily on their leadership team that both added Agile principles into their cultural framework while providing ongoing learning possibilities for staff members.

IV. Conclusion and Recommendations

The study findings demonstrate that financial institutions require five essential aspects to achieve successful Agile adoption.

Leadership commitment functions as a basic necessary element. By maintaining ongoing engagement with senior leaders financial institutions establish Agile cultural norms for their organization while getting necessary resources to execute Agile implementation. Successful bank implementation of Agile requires cultural adaptation that transforms bank organizational culture into principles including collaboration and sustainable development alongside continuous interaction. Efficient training methods stand vital for bank workers according to this study. An effective strategy for Agile methodology implementation depends heavily on delivering suitable educational programs regarding efficient Agile method applications. The training equips staff members with important capabilities and understanding to execute efficiently in Agile teams. Phased implementation is considered essential. Banks can determine how their Agile implementation progresses through a step-by-step process which provides them with outcomes to evaluate and solve problems that might emerge early in their transition period. This step-by-step process creates safeguards against dangers during the transition to work with new methods. Banking institutions must dedicate funds to buy suitable tech solutions according to research findings. New generation information technology tools serve as fundamental elements that enable Agile practices function properly. Software solutions and team communication tools provided by Agile help banks achieve full benefits from their implementation. Agile adoption success within Jordanian banking needs leaders who fully support Agile strategies together with trained staff and cultural alignment to Agile ways while implementing Agile slowly with proper technological investments.

Recommendations for Improving Agile Implementation

To achieve maximum Agile implementation success Jordanian banks should:

- Leadership culture in organizations must develop a full acceptance of Agile principles.
- The organization should design educational programs which match Agile management systems.
- The implementation of Agile should proceed through multiple phases to decrease employee opposition.
- Banks in Jordan must allocate funding for IT structure that promotes Agile workflow implementation.

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Enhancing Price-To-Win Targeting with Value-Base Pricing: A Bayesian Network Approach

By Nicolas Gless & Dr. Jean Paul Favre

Abstract- Value Base Pricing (VBP) in the B2B industry is a recognize profit generatorsuported by multiple studies in the theoritical and empirical pricing field. VBP focus on customer's expectations and not just costs. However, despite its acknowledged benefits value-based pricing can be challenging. In this article we place VBP in Non-zero-sum game conflict negotiation and highlights that VBP is not facilitated in cooperative equilibrium between the buyer and seller. We will present given Tools of pricing negotiations like Price Wining Target (PWT) in the field of Multiple-Choice Criteria Models (MCDM). We will focus on Analytic Hierarchy Process (AHP) which is used in the field of negociation to enhance decision making but with drawbacks we will identify. We propose then an improvement through deployment of Bayesian Network and PWT hybridification and present an operational application.

Keywords: *value-base pricing, negociation, price winning target, bayesian network, complexity, uncertain causal logic, multi-criteria decision making, analytic hierarchy process, dynamic pricing, game theory.*

GJMBR-A Classification: *JEL: C11*



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Nicolas Gless [α] & Dr. Jean Paul Favre [σ]

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Keywords: value-base pricing, negociation, price winning target, bayesian network, complexity, uncertain causal logic, multi-criteria decision making, analytic hierarchy process, dynamic pricing, game theory.

I. Introduction

In the B2B market we have seen for years an in equal relationships between customers and Suppliers. Suppliers deplore a behavior exclusively focused on costs, innovation capture, which in consequence generates an indifference to their recognizable values and push them to become a cohort of simple suppliers' commodities.

Let's take the illustration of the European B2B automotive industrial environment which is a "hard industry and unrestrained when it comes to further increasing the pressure." (Roland Berger)[1]. This industry is accustomed to exclusive pricing practice. The sector is now facing fierce Chinese competition, rising costs, end customer market hesitating adopt electric vehicles (EV). Facing these challenges, companies often take familiar patterns, favoring conservative approaches to cost management to the detriment of a value creation strategy.

In this industry, generally speaking, finding solution, consist oneself to work on cost in order to manage change quickly in a controlled manner. Yet, let's take a more general perspective pointed out by Roger L. Martin[2]. In his famous HBR article in which he deplores the strategy of concentrating on costs, Martin talks generally about classical strategic planning failure concentrating on cost. We can ask, isn't it the same in most field business planning and where the same causes are responsible for the same effects? We are talking namely on tendency which has three major pitfalls: (1) expose an ambitious vision with a list of detailed and long initiatives that the firm must carry out to achieve the objectives and which are conditioned by the costs and the resulting financial performance. (2): concentrate on a cost way of thinking. (3) believe on a "self-referential strategic framework". This logic is particularly visible in B2B, where the fixation on the price-cost-volume triptych, inherited from Hirschmann's learning curve[3] is no longer corresponds to current market dynamics according Montebello[4].

As Liozu[5] and Montebello point out many manufacturing firms are still favorizinga revenue and volume approach instead capturing the value linked with an optimal price. In this way W. Chan Kim and Renée Mauborgne[6] are highlighting that "Basic B2B industries..., taking it for granted that the product [...] is trivialized and that there is only one criterion on which to be beat, the price when in fact the factors of competition usually include evaluation and technical assistance services, delivery times, stock availability, etc. ». However Hinterhuber and al., comment that B2B selling is undergoing a major shift, because it is not about communicating unique selling points (USPs) but more diagnose and propose solutions. Empirical studies (Ingenbleek and al[7]. (2003)[8]) confirms that in the B2B, electronics and engineering sector, customer value-based pricing approaches are positively correlated with the success of new products, but nothing is said about recurring products. Monroe (2002)[9] observe that: "The profit potential of a value-based pricing strategy that works is far greater than any other pricing approach". Similarly, Hinterhuber which recalls Cannon and Morgan (1990)[10] recommend value-based pricing if the objective is profit maximization. Docters and al. (2004, p. 16)[11] consider value-based pricing to be "one of the best

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pricing methods". The Value-Based Pricing (VBP) approach is not simply an alternative, but a strategic approach to ensure sustainable competitiveness in a changing environment, VBP is based on a thorough understanding of the uncertainties and dependencies between the different variables influencing the perception of value. In this context, a Bayesian network approach is particularly relevant for modeling B2B pricing decision-making. In this article, we will explore how to combine the Bayesian approach with the uncertainties inherent in B2B markets. By setting out the factors of value perceived by the customer, the internal constraints of the company, the competitive dynamics, the evolution of demand, we want to put forward an approach that allows to provide solutions to values disclosure issues during B2B negotiation as per example Request For Quotation process.

II. Principles of VBP

Framing the principle of Value is still not an easy task. Just focusing on their temporalities is enough to understand that they are evolving and changing. This polysemy of values results in a difficulty of definition in management sciences. It is particularly true in context of pricing. Values must be placed around the frameworks which are specific to them. According to Forementini (2016), the B2B pricing process often offers vague description in literature. The literature review made by Formentini and All (2016)[12] allows to illuminate the Value-Based Pricing (VBP) concept, which is "the set of pricing methods used by the supplier to set the selling price around the value that a product or service can bring to its customers rather than as a margin added to costs" (Hinterhuber, 2004[13]; Hinterhuber, 2008[14]; Farres, 2012[15]). Nevertheless, there is not only the VBP in the pricing approach but also other methods like ABC, TC, KC, QBP and GBB which have been mentioned by Formentini and Mohamed[16] and which we summarize as follow:

Activity-Based Costing (ABC) methods	*What they have in common is that they concentrate the setting of the price in the hands of the customer and a market environment.*
Methods for calculating target costing (TC)	
Kaizen Cost Calculation Methods (KC)	
Quality Based Pricing (QBP)	*Based on the definition of quality criteria e.g. agricultural. Montobelloi[17] combines value with perceived quality for the premium market.*
Pricing for Good-Better-Best Pricing (GBB)	*Based on an approach of increasing value through quality associated with price, but this is a consequence of a VBP.*

According Dutan (and All)[18], VBP is the most in-depth analytical approach to pricing but also and not a variable process that can be easily adjusted according to the customer, innovation or discounts. Due to all these reasons we will continue to focus on VBP in the full article. Indeed, the method it is recognized as profit margins driver because it aligns prices with perceived value of customer. However, the difficulty of implementing VBP persist as being sophisticated due to the customer specificities and complexity. Still organizations such as Sanofi-Aventis, SAP, BMW, among others, have adopted the advantages of VBP (Hinterhuber 2008) because VBP focus on customer's expectations and not just costs and competition. Based on our own research we can add the 3M company as well as Thales Group (military industry), Saint Gobain and Freudenberg (French and German Suppliers) in the list of VBP adopters. Nevertheless a 2008 survey (made by Hinterhuber) reveals that 44% of pricing is based on competition linked to the inability of firms to quantify the value of the product and therefore stay simply hidden. In fact, not all VBP are applicable in all sectors neither. A 2021 study on the German sector recognizes that its implementation is facilitated in the technological sector but face resistance in the pharmaceutical industry (Steinbrenner-Turčínková[19]). VBP poses also an organizational challenge and mainly in terms of remuneration of human resources. Hinterhuber argue salespeople, the first actors in pricing, should be remunerated in organization based on the level of profit generated and not just on volume which is usually the case. This puts VBP implementation in a disadvantage, which would require a governance decision to encourage profit in favor of an associated remuneration system. Understandably such a complex strategy need implementation toolkits. Thull[20] and Liozu[21], propose deploying VBP techniques based on step by step deployment like discover (in other words define references), diagnose (in other words list and select competitive advantages), design diagnose (in other words quantify and submit). It should be noted that the performance of VBPs is not widespread because only

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5% of firms are able to apply this philosophy (Art and Science). Liozuas well as (Heiko Gebauer, Elgar Fleisch, Thomas Friedli)[22] assures the implementation is still difficult and often questioned because of asymmetrical captures of Values.

In a commercial framework of supplier-customer values, values are based on a dialogue around shared elements. Not all values can be shared between seller and buyer because the objectives of the actors are opposed in a context of "exacerbated conflict". Indeed Pekka Töytäri, Risto Rajala, Thomas Brashear, Alejandro[23] explains, the more attractive is the VBP for customer, not necessarily more profitable it is for the seller. It goes without saying that like in the prisoner's dilemma, it has something to do with conflict illustrated by game theory in negotiation situations. This description of unbalanced deal translated into game theory language means a non-zero-sum game since a vcfair seller will want to sell a value to his customer at equal gains but the buyer. At the opposite the buyer want capture all value without consideration of it opponent. (Brennan et al., 2007)[24] speak of "zero-sum game" pricing. More rarely, the opposite phenomena of values captured by the seller come into play, but let us not exclude such cases.

a) Non-Zero-Sum Games, Zero-Sum, Cooperation, Conflict-Negotiations

In VNM's game theory logic, (VNM stands for Von Neuman-Morgenstern Oskar Morgenstern)[25], non-zero-sum games are situations where the winnings and losses of the participants do not necessarily cancel each other out. Unlike zero-sum games, where the gain of one is exactly the loss of the other, non-zero-sum games allow outcomes where all participants can win or lose together.

Zero-sum games	Non-zero-sum games
Losses and gains of the seller and customer cancel each other out. There is total conflict	Seller and customer gains and losses lose or win together

b) Conflicts Related to VBP

In a Customer-Supplier Gain-Loss relationship, in which an agonic context is inscribed, such a struggle corresponds to a zero-sum game. A conflict framework of agonic context corresponds to an asymmetrical situation and a competitive struggle where the seller wants to take advantage of the Client or the Client wants to take advantage of the Seller. In other words, the gain of one constitutes a loss of the other and can be include in pricing methods such as Activity-Based Costing (ABC), Target Costing (TC) and Kaizen Costs (KC). The interpretation of the conflict also reveals a cooperation where the value created by the seller satisfies the customer in a mutual gain and corresponds to a VBP Value Base Pricing. In itself, cooperation is everyone's benefit.

Zero-sum game Asymmetric Agonic Conflict	**Cooperation** Symmetry
Non-Zero-sum game Dissymmetry Total Agonic Conflict	**Zero-sum game** Asymmetric Agonic Conflict

The conflict table above is a synthesis of the negotiations conflict between an integration of profit solutions for the benefit (Distribution = Symmetry) of all and a distribution (Distribution = Asymmetry) for the benefit of some as defined by Dean Pruitt (1937-) Prius Mary parker Follet (1994) and Walton Mc Kersie (1965)[26]

c) Negotiations

In absolute terms the VBP found its efficiency in symmetrical negotiation. It is obvious that such a step is first and foremost an optimal result of a good negotiation but rarely the starting point. Before go further, we want to remind the theory of negotiations around the axes of chord symmetry, chord asymmetry, and chord asymmetry that are perfectly defined:

1. *Symmetry:* Corresponds to the Harvard-Model or Harvard concept which is the result of Harvard's University Law Scholl imagined in the 1970s in order to create a win-win situation. The American jurist Roger Fisher and the anthropologist William Ury conceptualized the goal of successful negotiation in the principles of the Harvard Concept contained in the book Getting to Yes in 1981. The BATNA Best Alternative to a Negotiate Agreement is the result, in other words, the question: "what is the best alternative if the negotiation fails?". BATNA also allows to sort out the best options and an alternative for each party.
2. *Asymmetry:* Corresponds to the theory of ripening in which different techniques, mediation, ripening, eagerness are engaged, when both parties realize that they are in a costly impasse motivated by a

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catastrophe for which a possible just and satisfactory solution is needed.

3. *Dissymmetry:* Corresponds to an open conflict and corresponds to a point of no return. Druckman[27] introduces the concept of the Turning Point to leave the conflict zone and represents a framework for interpreting the negotiation that allows us to analyze whether the discussion is moving towards a point of resolution or a standstill.

In order to obtain a possible agreement, VBP is engaged in those different stages of negotiation which takes into account behaviors that change rapidly, allowing agents to reassess their positions and strategies based on new data that are essential to adapt the dynamic and strategic decision strategy in the various phases identified above.

This makes it possible to update beliefs and strategies in real time and to model both symmetric and asymmetric relationships to correct a changing negotiation phase. For example, in a symmetrical negotiation, the parties may have equal mutual influences, while in an asymmetrical negotiation, one party may have greater influence over the other. This means that the agent can model the mutual influences between the different stakeholders and their respective positions. Adjusting conditional probabilities based on new information received allows beliefs and strategies to be updated in real time. Knowing these differences allows strategies to be adjusted accordingly so that negotiators can make more informed decisions by evaluating the assumptions of the different possible outcomes and get closer to an optimum. This makes it possible to better anticipate the reactions of other parties and to plan more effective strategies.

d) Given Tools of Pricing Negotiations

In negotiation, managers can rely on methods to target their prices and values (Hinterhuner & all.)[28] like the WTP (Winning Target Price), Price to Win (PTW) and RBV (Resource-Based View). In the area of price negotiation, there is a glimpse of an open scientific field. In the perceived reality, the framing of the price is done in coherence according to the experience of the firm agents which tracks price, costs, finance indicator history and possible customer feedback or don't disclose it: even luck. WTP, PTW and RBV have a very broad mathematical field that is essential in precise targeting of prices and values. We propose a synthesis of the mathematical tools implemented that unite and govern the models.

	Mathematical models implemented
WTP	1. *Costing:* Analysis of costs by evaluating direct and indirect costs associated with the production or provision of services.
PTW	2. *Statistics:* Mathematical regressions by comparison of available competitors' prices. Forecasting Models by using statistical techniques to forecast demand based on different price levels. 3. *Logical:* Mathematical optimization via programming maximization or minimization of objective functions under certain constraints via e.g. algorithms in order to find the optimal price that maximizes the chances of winning while respecting cost and margin constraints. For example,a Game Theory analysis via "What-If" Scenarios by evaluating the impact of different assumptions on the optimal price.
RBV	4. *Qualitative:* Valorization and temporal dynamics.

We observe a deployment shift in the given tools and propose an additional perspective of ranking RBV, WTP and PTW in regards of temporality, which will show a split between tariffication anteriority and active posteriority actions of negotiation.

Temporality	Act	Type	Details
Ex-Ant	Tariffication / Preparation	RBV	An internally oriented preparatory process that helps assess internal resources prior to negotiations.
Ex-Post	Negotiation / Action	WTP	An externally oriented activity based on a target but not necessarily optimal price for the organization like in most Request For Quotation (RFQ)B2B Automotive
		PTW	An externally oriented more geared towards finding the best optimal price based on values like in Request For Quotation (RFQ) B2G Military per example.

If the applications of RBV[29] are numerous applications in commercial, marketing, and entrepreneurship, however, the criticisms still remain against by questioning the capacity to differentiate in a

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competitive environment also due to its static and tautological aspect. Therefore, we suggest, among the three methods to keep PTW as the most actively incorporate in active negotiation to sale values. PTW combine efforts of collecting HUmanINTelligence (HUMINT) information _by sales managers_, analyze and work on the best price to win based on Open Source INTelligence (OSINT) on external and internal sources lead by PWT Managers.

e) PWT Cross VBP

As already said, the "Price Winning Target" (PWT) is a strategic approach that focuses on the optimal price to win. This method involves a thorough analysis of competitive prices, internal costs and the value perceived by the customer. In contrast, Value-Based Pricing (VBP) is a strategy that sets prices based on the perceived customer value of the product or service and less on production costs or competitor prices. This approach requires a thorough understanding of customers' preferences and the benefits of offered products or services. If the main difference between PWT and VBP is their focus: PWT centered on competitiveness while VBP is focus on maximizing profitability, in our opinion both approaches can converge on market and price: the PWT to set an optimal price according to costs and competition, the VBP to extract the most value from the price. This approach is not contradictory to the literature and shows the integrative capacity of VBP. We could interpret their convergences on the intersection: VBP∩VBP= (Market, Price). Precisely the preferential choice methods included in PTW approaches, in a dynamic framework of pricing management in negotiation, which the B2B and B2G industry also use, can be those related to the Multiple-Choice Criteria Models (MCDM).

MDCM extend the spectrum of criteria and variables and have a very high range of model (WSM, WPM, TOPSIS, etc.). We have studied them in detail and can therefore differentiate them between three types of approaches called MADM (A for Attribute), MODM (O for Object) and Uncertain. The main characteristic of MADM-MODM is around the forms of classification under distance and topology conditions; the main characteristic of the Uncertain is probabilistic and consists of fuzzy and Bayesian logics among others. (Figure 1).

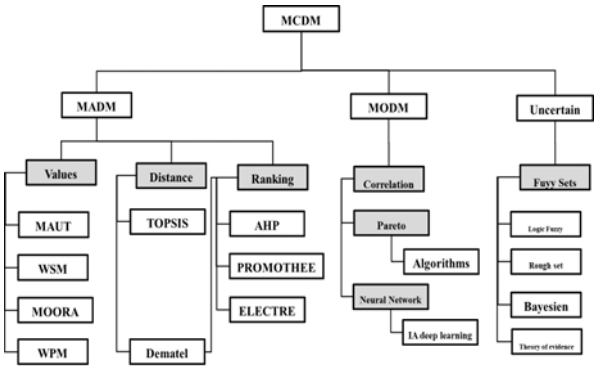


Figure 1: MCDM Structure (by Author)

III. MCDM Applications in Negotiations

In the field of strategic and complex negotiations, a particular form of method (MADM) called AHP (Analytic Hierarchy Process) is frequently used and recognized in the hierarchy of choices of complex decisions at several levels (Taherdoost)[30], (Stofkova and All)[31]. AHP helps, for example, to select suppliers in a manufacturing company in India (Kamath & All.)[32] but also improve service quality in Healthcare[33]. More specifically in the field of larger military, construction equipment Request for Quotation (RFQ) procurement use AHP which represents an effective strategic decision-making tool. Especially for the Business to Government (B2G) market and particularly for the Singapore Defense Industry of the Ministry of Defense (MINDEF) and the Armed Forces of Singapore (SAF) (Knowj Yoong Fui and Liam Hang Sheng)[34] AHP is an incomparable tool. The Analytical Hierarchy Process stems from the research of Thomas L Saaty[35] (1926 - 2017). The AHP allows a comparison using the same scale of ratios in intangible criteria in a hierarchy of choices to be evaluated by assigning them on cross-importance levels. The basis of a tool requires initial training but once acquired is simple to use. Thus, if we take the method in a negotiation framework, AHP helps to structure complex problems in a simple and clear way by taking into account the subjective preferences of decision-makers even during negotiation. Kiruthika and All[36] applied AHP to predict opponents' preferences in automated negotiations and were able to reduce the number of rounds of negotiation required to reach an agreement. In this way, the results of the AHP are transparent and easy to interpret, which can increase confidence in decisions.

a) General Case Study

We take the case of a competing firm on a B2B issued by an OEM (Buyer) for a Request for Quotation

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(RFQ) for a parts or system production and delivery (Seller). If the firm is in competition with other similar scaled competitors, we assume the customer's answers can be vague enough that perfect information cannot be transmitted to the salesperson. A PWT Team is in charge to evaluate the best VBP strategy in coordination with the Sales Team. Assumptions: we consider a supplier that produces semi-complex products. The firm is expected to produce A, B and C products with different levels of integration and profitability and that competitors do the same. Coalitions are not possible. The market is mature. The sector is not given specifically. The value of each firm is considered individually in the sense of a VBP.

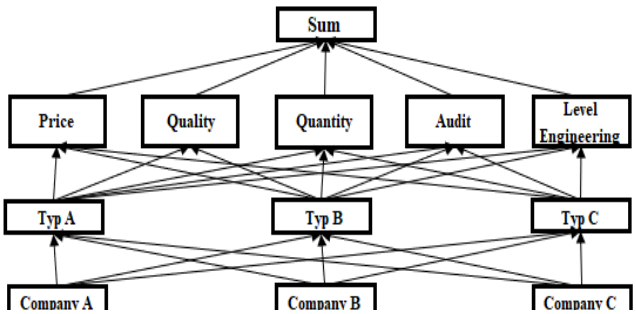
b) Deployment of the MADM AHP in PWT

To conduct an AHP, a pairwise comparison matrix is constructed by following the following steps. The first action is to create a probability of dependence of the criterion aijon the criterion aji such that the subjective probability P (aij/aji) is determined on the basis of Saaty's table of subjective scores (Table 1). The pairwise comparison matrix makes it possible to evaluate the preferences of the criteria being compared on a scale ranging from 1 to 9 (H Taherdoost)[37]. Table 1 Saaty Scoreboard

1. Equally important Preferred
2. Equal to moderate importance Preferred
3. Moderately important Preferred
4. Moderately to Strongly Important Preferred
5. Highly important Preferred
6. Strongly to Very Strongly Important Preferred
7. Very strongly important Preferred
8. Very strongly to Extremely important Preferred
9. Extremely important Preferred

Let consider the simple case of a hierarchical negotiation on three levels opposite and adapted to the AHP approach of three firms in competitions (level 3) intra or extra-competitive, it does not matter, so that they can offer products (A, B, C) (level 2) on the values in typology of price, quantity, quality, response to audit and engineering note (level 1). The sum of the links represents the level 0.

The First Step: On AHP consists by creating a probability of dependence of the aij criteria on the aji criterion in the form of a matrix called the pairwise comparison matrix and which includes the subjective data collected between attributes. To fill the lower triangular matrix, the reciprocal values of the upper diagonal aji=1/aijare applied.



	Prix	Audit	Quantity	Quality	Level engineering
Prix	1	…	…	…	a_{1n}
Audit	…	1	…	…	…
Quantity	…	.	1	.	…
Qualité	…	…	…	1	…
Level engineering	a_{n1}	…	…	…	1
∑ =					

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Second Step: After normalization which consists dividing each element of the matrix by the sum of its column. A normalized relative weight is obtained. The sum of each column is 1. The resulting principal eigenvector of the matrix and noted by "w" is divided by the number n of criteria.

In order to check the consistency of the response, the principal eigenvalue (also called maximal eigenvalue) is defined. The Principal Eigen Vector λmax is obtained by summing the products of each element of the Eigen Vector and the sum of the columns of the reciprocal matrix. Saat a hghghdcproposes to use this index by comparing it to the appropriate coherence index which is called the random coherence index (RI).

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0,52	0,89	1,11	1,25	1,35	1,4	1,45	1,49

The consistency index (CI) allows to calculate the consistency of the structure on the basis of the number of criteria.

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

The ratio (CR) of the consistency index and the average consistency index should give a result of less than 10%, and in which case shows a coherence of the structure and the results of the comparison are acceptable.

$$CR = \frac{CI}{RI}$$

Final step: the goal is to hierarchy the importance of each variable so that the negotiator can handle in one direction or in another to structure the negotiation with consistence. The process is repeated as many possible interactions and for as many pairwise comparisons (1125=1*5*3*5*5*3_in case of the sample) as possible. Therefore, under the appearance of simplicity, the methodology is still heavy to exploit (Knowj Yoong Fui and Liam Hang Sheng)[38] and is facilitate with help of specific software.

AHP belong to rational decision models, which is an advantageous for explanation but has also flaws to exploit the full observable and hidden reality. Indeed as AHP belong to pure domain of MADM, it does not respond to the injunctions of uncertainty. The reality of the answers in a field negotiation suggests nevertheless uncertain events.

In order to solve the problem of uncertainty, an improvement is often retained in the literature. Choices in uncertainty present propositions of AHP associated with fuzzy logic, that we are not going to study here, but which have the advantage of considering the uncertain, which AHP alone simply cannot regulate alone (Figure 2).

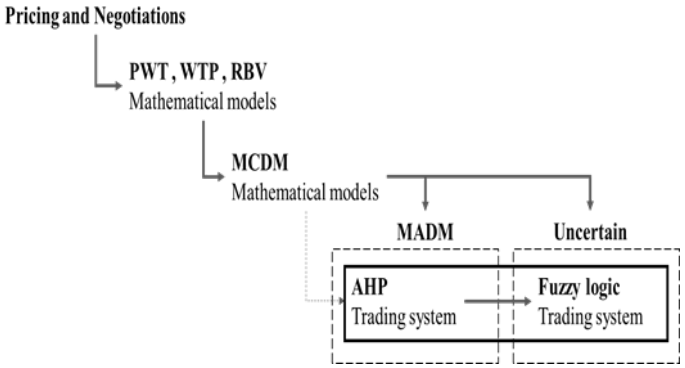


Figure 2: Pricing and negotiations with MCDM Models (by Author)

(Liu, Eckert, Earl)[39] (Ting-Ya Hsieh, Shih-Tong Lu, Gwo-Hshiung Tzeng)[40] (Jaskowski, Biruk, Bucon)[41] associate the AHP with fuzzy logic in the negotiation process. By using fuzzy numbers for linguistic terms or deflecting weights, we can see an aid in including value during negotiation. However, this approach is still anchored in a static nature, whereas negotiation evolves dynamically. While some examples prove the usage of MCDM-MADM_AHP tolls most currently negotiations under uncertain are frequently workout without any tool. We propose to change this approach with the support of MCDM-Uncertain.

The Advantages and Disadvantages of AHP have been Demonstrated by Lui and Yang[42]: On one hand, the method allows structured decision frameworkt which simplifies the understanding of complexity and improve clarify complex decisions. However, on the other hand. evaluation is limited and "leads decision-makers to make conflicting judgments. Finally, the results obtained by AHP are not fixed and, with the same hierarchical structure, decision-makers can create different

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evaluation matrices in different situations to obtain different evaluation results." (Lui and Yang).

c) Improvement in Negotiations in the MCDM Field of Uncertain through Bayesian

We have described fundamental characteristics in negociations: (1) Modeling of Dependencies and Independences, (2) Management of Information Asymmetry, (3) Adaptation to Change, (4) Symmetry and Dissymmetry. These items can be handle by Bayesian Equilibrium and its capabilities extended of non-cooperative game theory[43]. Bayesian is powerful tools in MCDM Uncertain for modeling and managing uncertainty in a variety of situations, including negotiations.

In asymmetrical negotiation, the Luce-Raiffa matrix[44] (Figure 3) is a hypothesis according to which the opponents are able to correlate their strategies with communication, by transmit information to each other and agree on common point. This is a Bayesian game in which the information transmitted is understood by the opposing party which adapts its behavior a posteriori.

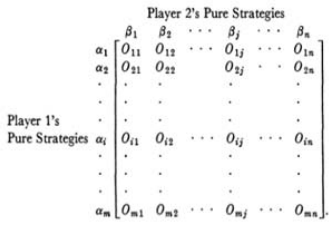


Figure 3: Luce-Raiffa Matrix

d) Bayesian Equality

Before talking about Bayesian network, we must talk precisely about Bayesian equality, or Bayes' theorem, which is a fundamental formula in probability that allows to update the probabilities of previous events according to posterior information.

It is expressed as follows: P (A|B)= [P(A). P (B|A)]/P(B)

where:

(P(A|B)) is the probability of the event A knowing that B is true.

(P(B|A)) is the probability of event B knowing that A is true.

(P(A)) and (P(B)) are the probabilities of A and B independently.

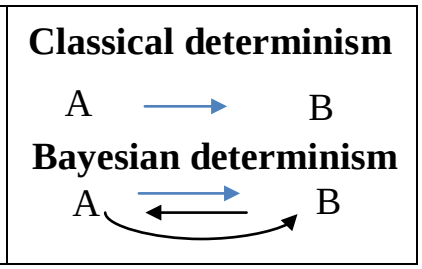
The search for a perfect equilibrium between A and B thanks to Bayesian equality makes it possible to correct the ex-Post actions to the ex_Ant actions of both.

The Bayesian model of equality is based on principles of determinism and certain and uncertain stochastic graph theories, Markov theories. Discovered 261 years ago by the English Presbyterian pastor Thomas Bayes (1701-1761) and now extended in the broader form of modeling, commonly referred to as the Bayesian network, this tool represents an artificial intelligence whose goal is to offer a flexible and efficient tool for managing uncertainty. (CF. Figure 7)

The Bayesian Network is a representation of graphs with nodes that are random variables and links that are influences from the basic mathematical model and as defined by Gonzales and Wuillein[45], whose "strength" lies in its influence to associate with probability distributions probabilistic expert system whose first advantage is to make prediction or diagnosis contrary to a classical determinism.

– *Prediction: The known causes what are the probable values of the consequences.*

– *Diagnosis: Known consequences what causes are likely*



e) Bayesian Networks (BN)

Classical analytical approaches tend to be based on a historical understanding of threat and risk datasets, and do not account for subjective assessments of how intelligent customers will change their strategies to be different from the historical model.

Bayesian networks, also abbreviated by BN, overcome these limitations. The Bayesian networks are based on the seminal work of Pearl[46] and Neapolitan[47], including game theory and systemic applications of models and covers the entire field of linear and nonlinear systems.

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The theoretical basis of the BN and the Markov chain are conjoined through interference. A Markov chain is defined in a space x by the Transition Probability P such that: P (x_n,x_(n+1)) once put end to end, this creates a sequence of random variables called Markov chain. The Markov chain has two behaviors of recurrence (state that once visited is visited an infinite number of times) and transient (state visited only a number of times). The basis of Bayesian Network Inference, as described in the literature by Neapolitan (2003), recalls that the sum of the actions of sets of events X in time is equal to 1. The Bayesian structure satisfies the Markov condition if it has a single parent source. If such a structure has two parent s-sources, it is not Markov compatible. When a structure satisfies the Markov condition, then P is equal to the product of its conditional distributions of all nodes given the values of their parents, whenever these conditional distributions exist. In such a way that when a structure is Markov compatible, we have to deal with a chain on which we can go up and down the frame of events and draw conclusions about inferences of ex-Post, ex-Ant events. Bayesian networks can be associated with different types of models depending on the amount of information available or not on the inner workings of the system.

Bayesian networks can be affiliated with black-box, gray-box, or white-box models depending on the level of internal information available and used in the optimization process.

1. *White Box Models:* Are models with full transparency and where the inner workings of the system is fully known and can be used in the optimization process.
2. *Grey Box Models*: Are models which combines the black box approach with some internal knowledge of the system. For example, Bayesian gray-box optimization methods use partial information about internal calculations to improve performance.
3. *Black Box Models:* Are models which treat the system as completely opaque, meaning that you only the inputs and outputs without any knowledge of the internal processes are accessible. Classical Bayesian optimization often assumes a black-box approach.

Unlike "black box" technologies such as neural networks, the variables and parameters of a Bayesian network are cognitively significant and directly interpretable. Bayesian networks use a logically consistent computation to manage uncertainty and update conclusions to reflect new evidence. There are processable algorithms to calculate and update the evidentiary support for the hypotheses of interest. Bayesian networks can combine data from a variety of sources, including expert knowledge, historical data, new observations, and results from models and simulations. These information's are coming from experts to build the structure while being very flexible. The structure is the first step in building a Bayesian network. We repeat it needs a small group of experts capable of identifying the different processes of complex risk selling in order to truly build the structure capable of predictions.

Bayesian networks offer a structured and flexible approach to managing negotiations, taking into account information asymmetries, dynamic changes, and complex dependencies and dependencies by disclose Visible and Hidden events. Oliehoeket (2012)[48], links Bayesian networks, non-zero-sum games and cooperative games, showing methodologically how probabilistic structures and coordination graphs can be used to model and solve multi-agent decision-making problems in uncertain environments corresponding to business negotiations.

f) Connecting the Dots of Values

According Brechet[49], values are data such as those of the market, such as price, quantity, physical data... but values are also ambiguous because they are given and first constructed specifies. We would like to add that they are also subjective. This is why we can share (Liozu)'s[50] vision around the principle of VBP is a combination of art and science.

Valuesare also built around the principle of mimicry of a conventional agreement (Gomez 1994, 1996)[51] which is based on a form of learning (René Girard) and motivation (Albert Bandura) of the agents of the internal and external organization.

Therefore, values are a combination of data constructed in science and in subjectivity and recalls Liozu and other expression about a conjunction of Scien and Art. In an evaluation of values, the Bayesian approach has the advantage of taking into account both the constructed and subjective data that represent the values.

Bayesian equality can be used to evaluate optimal strategies based on the information available in a complex B2B sales negotiation framework. For example, in a game where players must decide whether to cooperate or betray, they can use Bayes' theorem to estimate the probability that the other player will cooperate, based on previous information and observed behaviors.

The representation in the form of Bayesian has a frequency aspect. A repetition of observations can be a set of at different times. The network "constitutes a representation of the model during a certain number of periods", as shown in the figure (Figure 4), which is similar to a series of known or anticipated events.

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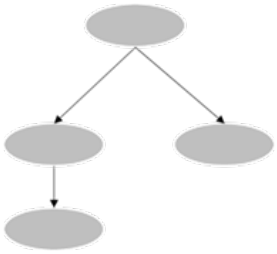


Figure 4: Simple Bayesian Model Illustration (By Author)

When several events follow one another, a Bayesian network allows events to be linked together, the Markovian character of Bayesian networks makes it possible to take into account the temporal link between events that can be linked. To be more precise, it is a contortion of possibilities over time in search of spectrum of solutions in a space of interconnected values in the form of superimposition of logical "layers" integrating levels to be reached and not exceeded. In this we will have an overall ex-Post logic but with an additional variability of the complete ex-Ant network without having to go through a financial body but perfectly integrated into the topology of negotiations over time.

Concretely, create a temporal hierarchy related to the occurrence of values and create nodes (Figure 5). Potential impacts of each value node are scaled around their impacts. If the impacts are not known, elicit them. The network will be oriented according to the temporal hierarchy (from top to bottom) and will take into account the potential impact (from left to right).

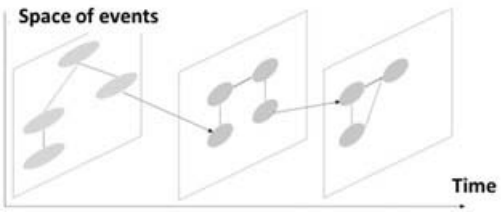


Figure 5: Negotiation (Time Axis) in Bayesian form (Space Axis) (By Author)

This represents a paradigm shift because the model does not sacrifice the interactivity of events with each other at the cost of an intrinsic simplification that is very often observed, but preserves them by comparing them.

g) Bayesian Network and Human Logic

Pearl and Kim are both pioneers of Bayesian Network and Artificial Intelligences[52]. Back in 1983 both had point out the closeness of prospect theory (Kahneman and Tversky[53]) with Bayesian logic. BN provides the theoretical foundations that show show humans decision behavior find it natural way to think in terms of Manifestation=>Cause rather than in terms of Cause=>Manifestation. To be more specific, let's assume an example of B2B negotiation, between a seller and a buyer based on a quantity (Q) of parts [p] at prices (P). If the selling agent offers the buying agent the price (P) of a [p] composed of different materials and offers him a final price but calibrated to the variability of the material indices (I) of [p]. According to the terms of the prospect theory (Kahneman-Tversky), the majority of buyers would prefer to play the confidence game with a predictable and therefore fixed price rather than an adjusted pricing that is considered risky according to the agents since they lack confidence in the predictions of the variability of the index. In prospective terms, this corresponds to the natural tendency to overestimate potential losses against potential gains. This leads to a preference for safer and more predictable options. Indeed, taking into account the lessons of prospect theory, we know that agents evaluate economic decisions according to their own reference and in the framework of uncertainty in which they make their decisions.

Let's playnow the event A which precede event B. In the human understanding of priors, the relationship Manifestation=>Cause (acc.Kim-Pearl) corresponds to an intuitive logic B=>A, i.e. it is a logic of plausibility facilitated with similar examples and experiences that come to mind and correspond to heuristics (Kahneman & Tversky). The relationship Cause=>Manifestation corresponds to an A=>B logic, i.e. it is a so-called a posteriori logic and rather counterintuitive. Thus, by respecting the conditions of Bayesian logic, the logic of intuitive plausibility naturally interpreted P (B/A, C) by humans can be revised to the level of the a priori laws observed on unknowns, and following updates when the system will provide more information, will give the law a posteriori which is counterintuitive and corresponds to a relationship Cause=>Manifestation as follow:

$$\text{Law a Posteriori} \propto \text{Law a Priori} * \text{Probability}$$

$$P(A / B,C) \propto P(A /C) * P(B / A,C)$$

Consequently, back to example, all the ambiguity of the buyer about price value is due to the index which corresponds to a plausibility that does not make evident sense to him. However, he should rather calibrate his interpretation to the law a priori by taking in account the occurrence the material index in such a way that it never loses.

In the complex case of the interaction between several causes, Kim and Pearl propose Bayesian model as a formalization to reflect humans' causal perceptive relationships, while maintaining computational efficiency and remaining consistent with the principles of probability theory. The model captures interactions between multiple causes using conditional probabilities and local belief updates like downstream observed data

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and influences the probability of a cause and reinforces the evidence of the diagnosis.

The model described by Judea Pearl and Jin H. Kim has directly influenced Bayesian networks development that are implemented today such as in Directed Acyclic Graph (DAG), Conditional Probability Tables (CPTs), Belief Propagation, Messages used to propagate information through the network, conditional independence (Bayesian networks exploit the properties of conditional independence to propagate information through the network simplify calculations) and finally Inference and Learning. That is to say, to calculate the probability of a given variable according certain observations. This last point is crucial because through learning, Bayesian networks can fit the model parameters (conditional probabilities) based on the observed data.

Consequently, Bayesian logic takes into account human logic but readjusts it by the rational logic of observation, to correct a logic that would be eventually counterintuitive and biased. After adjustment on a large number of variables that traditional decision models are not able to handle BN help readjust the truth. Bayesian networks represent a step forward in complex thinking because of their counter-intuitive characteristics.

h) Deployment of Bayesian Network in PWT

The most important understanding of Bayesian network is that it can help reinforce the possibilities of obtaining best possible VBP during a complex negotiation which extend over a topology of different events like eBid (electronic auction), CBD (Cost Break Down), face-to-face negotiation, which are all different in term of temporality, product, program and customers. In order to not exclude or include core input elements allowing to influence nodes decisions, it is equally important to understand that the dynamic over time improve the network (System) though its own learning processes. That haven been written, the deployment of a Bayesian Network will have to follow a certain number of rules. We will bring up some according recognized by Highest Bank authority (Federal Reserve Bank of Richmond) and exposed in literature of Bank Risk Finance Model (Naim, Condamin[54]). The first and foremost priority is to establish a core team of Experts (Figure 6) equivalent to a Delphi group. We consider a Core team to be made up of members of the VBP and PWT members of Sales team and "flying agents" for particular purpose of collecting and distribution hidden information's. The total number of agents should according us not exceed 10 or 15 according (Hackman)[55] agents for reasons of uncontrolled noise and mimicry within this small structure.

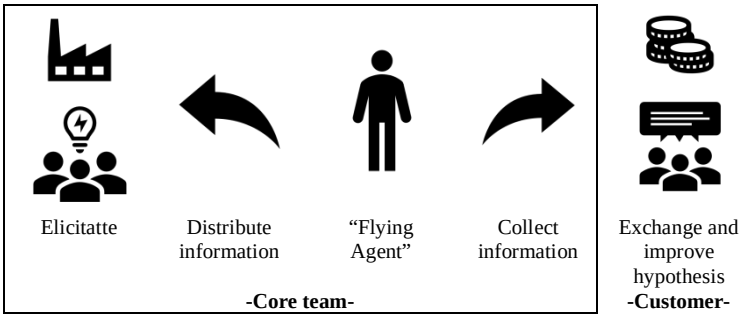


Figure 6: Core Team Concept (By Author)

Once the expert team has been implemented within the organization or a laboratory, the objective will be simulating the scenarios most likely to succeed. As well it is crucial to include a mediator (Raiffa[56]) which rule is an arbitrator and facilitator of the full methodology. Pricing managers as well as sales executives will have then to follow the algorithm of Bayesian Network deployment (Figure 7) which represent the architecture of multiple specific steps we will detail through an example.

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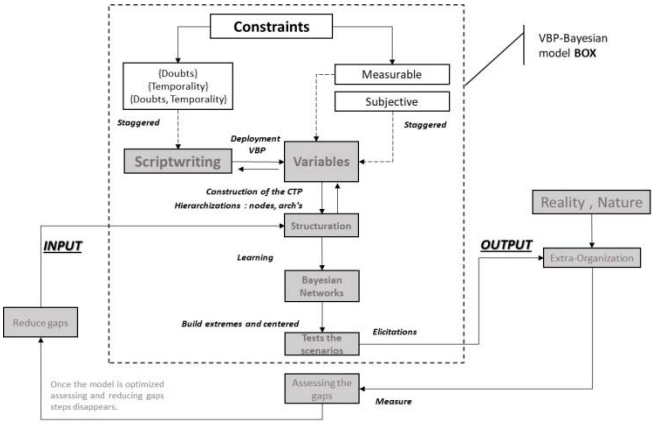
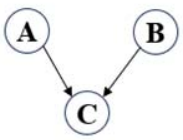


Figure 7: Algorithm deployment of a Bayesian Network in VBP (By Author)

i) Construction of the Bayesian Network in PWT

In a VBP pricing framework a Bayesian network can effectively handle both known and unknown variables and is able to improve precision thanks to the incorporation of prior knowledge and updating of new data. The major problem arising will result in the relationship between variables that influence values and price. Therefore, the level of precision will be adapted to the subsequent experiment decision. To be more specific: once the variables of the Bayesian network are defined, by the experts, a CPT (Conditional Probability Table or also described as Conditional Possibilities Distribution in literature) can be define. The CPT could include for example in a complex B2B negotiation, the ability to produce types of parts, the quality of suppliers, the distance to the customer (physical values), the subjective internal and external culture distance. The variables corresponds to the edges and nodes of the structure which, once interconnected according to their occurrence rates, will be linked in a Bayesian structure in the form of a DAG (Directed Acyclic Graph).

CPT and DAG are the backbone of every Bayesien Network



DAG

A	B	P(C=1)	P(C=0)
1	1		
1	0		
0	1		
0	0		

CPT

The arcs represent the dependency (between A and C and between B and C) and correlated links between variables and events between a decision node (C) and the parents (A and B).

While building the network the expert group will have to carefully take care not overload the size of attributes and set manageable scenarios so as not to overcomplicate and no longer measure results avoiding ambiguity. The consistency ratio reaches limits when the number of parameters exceeds 10 and the subjective nature of dependencies therefore it is advised to keep them between 5 and 10. It is recommended to optimize the model where impacts and occurrence are better defined with less parents. Reducing the number of parents per variable and connections (the arcs) is a primary objective in order to avoid overtraining (Vapnik)[57] but must also correspond to enough observations to validate the variables (James)[58] (Hastie)[59] (Burnham)[60] to justify a deterministic and stochastic prove of correlations.

Once the references have been established, it is question of taking up the principles of VBP deployment according to Hinterhuber[61] and Thull[62] which cross the statistical deployment (Schmueli[63]) by following process: defining the goals≻studying and collecting the data≻preparing the data≻exploratory of data analysis≻choose variables and built the model according to the Trinity of boxes of a Bayesian Modeling process in order to test the adaptation of a Bayesian model to VBP pricing in B2B request for quotation.

j) Application of Uncertain Bayesian Network in PWT

We use the same example also used on the AHP method to illustrate how does work a BN. To simplify, we only take the case of one firm (company A) among the three presented and for one type of product

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(Type A) among the three, to quantify all the dependencies with respect to the Level Engineering criterion by adding, for more precision on the level of vertical integration (product/process) of this product (see image on the left). The model we get is a naïve Bayesian model. A Naive Bayesien model applies the Bayes Theorem, when, letAi be the possible arguments and Ci the corresponding criteria, the ranking of the arguments A and criteria will follow a logic such as:

$$P(Ci/Ai) = \frac{P(Ci).\ P(Ai/Ci)}{P\ (Ai)}$$

k) Metavariables in Relation with PWT

Bernard Roy (1934 – 2017)[64], French pioneer in "decision making" and inventor of the ELECTRE method, emphasizes that approximation of criteria has to be considered as a reality. In such way even imprecise information is not necessarily rejectable. Therefore, notions of discrimination thresholds and pseudo criteria as parameters are to be considered. In the context of BN it suggest there are no fixed meta-variables as BN represent model and a probability distribution. According Roy "A model is a schema which, for a field of questions, is taken as a representation of a class of phenomena, more or less skillfully removed from their context by an observer to serve as a support for investigation and/or communication." The BN logic is based on observed dependency relationships between variables which create metavariables. Constraints fixed Meta-variables in advance would contract the Bayesian logic flexibility. However, sampling technics highlight the way to disclose metavariables.

Sampling Meta-Variables

There is a number of relevant intangibles to update beliefs about variables. We highlight some of them that could be collected and we propose to classify according their level of deduction, induction, subjectivity:

Definitions:

- *Deduction:* Which can be directly measured and verified by objective data.
- *Induction:* Based on repeated observations and experiments and less accurate than deductible values but can be estimated from historical data
- *Subjectivity:* Depend on individual perceptions and can vary from person to person. They are more difficult to quantify and standardize.

Direct Observations	Latent Variables	Market Indicators	Behaviors and Reactions
Deductive [De]	Inductive [In]	Inductive [In]	Subjective [SU]
– Prices offered and accepted. – Quantities of goods or services traded. – Specific conditions of the negotiation (dead-lines, payment terms, etc.).	– Estimates of marginal costs or profit margins. – Agents' preferences (buyer and seller) regarding the terms of the negotiation.	– Commodity price indices – Relevant economic or sectoral trends.	– Agents' reactions to proposals and counter - proposals. – History of past nego-tiations – Patterns of behavior.
Hard Dependence	Strong Dependence	Strong Dependence	Fuzzy Dependence

The following case study will help to better understand the deployment of meta-variables sampling.

l) SKF Case Study

We propose to take up of SKF(a Swedish ball bearing company) documented case in literature by Hinterhuber and All in "Value First, The price, Building base Valued-Baes princing strategies". In this illustration, Hinterhuber and All present the values that have been determinate according "a value calculator to document to customers the customer's next best alternative" to demonstrate how SKF has managed to convince their customers of the higher value of their products despite a higher price. By doing the work backwards based of resulting SKF values, we can show how to build a Bayesian network. Indeed, in normal case, Bayesian Network construction framework leads to obtain values. Of course, this represent an ex-Ant approach which could be criticized by being a typical case of intuitive logic (B=>A) of plausibility. We do not make this mistake because we are only re-establishing a structure on the basis of real answers by reducing all other speculations. The work of counter factuality (against time) that we carry out is based consequently on the search for possible dependencies, i.e. the a priori laws that are the opposite of biases. We give abbreviations to 6 values highlighted in the SKF case study:

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Valeur 1	Valeur 2	Valeur 3	Valeur 4	Valeur 5	Valeur 6
Reduced Lubrication	Energy Savings	Inventory Reduction	Faster installation	Increased Reliability and Durability	Process Optimization
(RCL)	(EE)	(RNS)	(IR)	(RM)	(UL)
SKF has shown that its bearings reduce lubrication costs, which translates into cost savings for the customer.	SKF bearings are more energy-efficient, saving customers money on their energy bills.	By using SKF products, customers can reduce their inventory levels, which lowers inventory management costs.	SKF bearings are designed for faster installation, which re-duces downtime and improves operational efficiency.	SKF products offer superior reliability and durability, which trans-lates into lower mainten-ance costs and less frequent replacements.	SKF helps customers optimize their produ-ction processes with tailor-made solutions, which improves overall efficiency

The majority of the values described in the SKF case study correspond to use and management cases that we group in Use value = {Reduction in lubrication operational costs; Energy saving; Quick installation; Maintenance; Versatility of use} and Management value = {Inventory level reduction}. From this on we can classify values into categories according to their level of deductibility (logos), inductility (experience), subjectivity (feeling):

Deductive [De]	Inductive [In]	Subjective [SU]
(RCL) (EE) (RNS)	(IR) (RM)	(VU)

By adding causality parent elements, we extend the structure of the Bayesian network to a higher level to hypothetically create the conditions that act on Bayesian networks. Since we cannot speculate, we look in the document to see if it provides us with causalities related to the identified values (RCL, EE, RNS, IR, RM, VU).

	(RCL)	(EE)	(RNS)	(IR)	(RM)	(VU)
Parent Causality	SKF bearing design	Energy efficiency of SKF products, which consume less energy during operation	Reliability and durability of SKF products	Design of SKF products, which are optimized for fast and efficient installation	Resulting from the high quality and durability of SKF products	Flexible design of SKF products
Child Consequence	Reduced Lubrication	Energy Savings	Inventory Reduction	Faster installation	Increased Reliability and Durability	Process Optimization

However, the case study only mentions the values of SKF products without specifying reference quantities. We can therefore propose a possible dependence by formulating the hypotheses on the basis of a logical syntax by grouping them into three groups: Materials (MAT), Design (DES), Durability (DUR). Indeed, the materials (MAT) chosen allow for greater energy efficiency (EE) since from the optimization but also the limits of the tribological nature (TRIB) which also has an influence on the durability of the products and therefore the stock (RNS). The design (DES) alone allows for faster installation (IR) as well as process optimization (VU) and combined with materials ensures a reduction in the lubrication level (RCL). Finally, durability depends on materials (MAT) and design (DES) and influence reliability (RM) and level (RNS).

From the statistical collection, customer satisfaction, the organization will be able to build the conditions for value creation as follow:

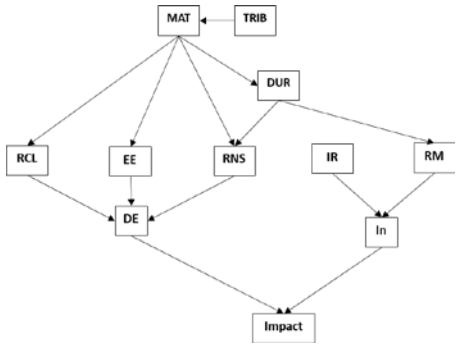
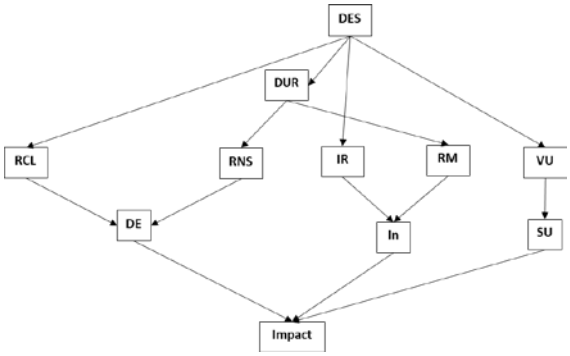
1. The dependencies from which the parent (MAT) derives are of the order of engineering science.
2. The dependencies from which the parent (DES) derives are of the order of customer use and therefore oriented towards Sales, Service, Marketing, Quality

For example, dependency (DES/IR), which is an induction, can be obtained by precise questioning of the customer cohort on the basis of targeted questions such as customer complaint feedback on various technical points.

At this points we can create two types of DAG: a DAG which include Engineering Sciences and a DAG which include (Sales, Service, Marketing, Quality). Such a DAG makes it possible to obtain the results of a

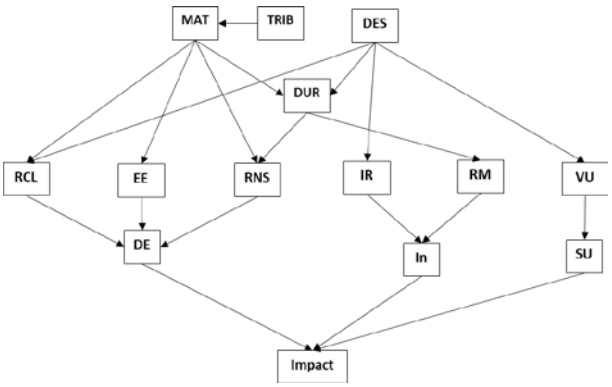
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system but it must be built on the synergy of deductions and inductions, which implies the work of a large number of sub-assemblies of the organization: engineering, sales, service, marketing, quality.

DAG Engineering Sciences	DAG Sales, Service, Marketing, Quality
	

By grouping these elements together, the complete DAG is obtained.

Full DAG



We can continue to construct a Conditional Probability Table (CPT) by considering the scales and build up the BN.

Variables - Values	STATES	Description
Materials (MAT)	Conditions: Wear-resistant, Lightweight, Standard	Description: Materials can be wear-resistant, lightweight, or standard.
Design (DES)	Statuses: Optimized for Efficiency, Standard	Description: The design can be optimized for efficiency or standard.
Durability (DUR)	Status: High, Medium, Low	Description: Durability can be high, medium, or low.
Réduction des Coûts de Lubrification (RCL)	States: Yes, No	Description: Indicates whether or not lubrication costs are reduced.
Energy Saving (EE)	States: Yes, No	Description: Indicates whether or not energy savings are being achieved.
Quick Installation (IR)	States: Yes, No	Description: Indicates whether or not the installation is quick or not
Reduced Maintenance (RM)	States: Yes, No	Description: Indicates whether or not maintenance is reduced.
Versatility of use (VU)	States: Yes, No	Description: Indicates whether the product is versatile or not.
Reduction of Stock Level (RNS)	States: Yes, No	Description: Indicates whether or not inventory levels are reduced.
Impact	States: High, Low	Description: Indicates whether the overall impact is high or low.

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m) Practical Structuration to Generate Values

Once meta-variable logic have been set up we propose create a CPT based on the AHP example. It should be noted that the way of building a Bayesian network is dependent on the links of distributive estimates, regression logic, and Boolean law. Then we estimate and specify the conditional probability distribution of the various sources of information. In Bayesian networks, variables can be discrete has a finite number of values or a continuous which has an infinite number of values between two limits. Let's consider the Basic structure (Figure 8) which built in three steps:

Step 1: Three type of companies (real or hypothesis to quantify the doubt) propose a type of product (A,B,C).

Step 2: The product type is broken down by its integration rate of production and purchase.

Step 3: The product type is judged by the customers engineering team to its confidence trusts level.

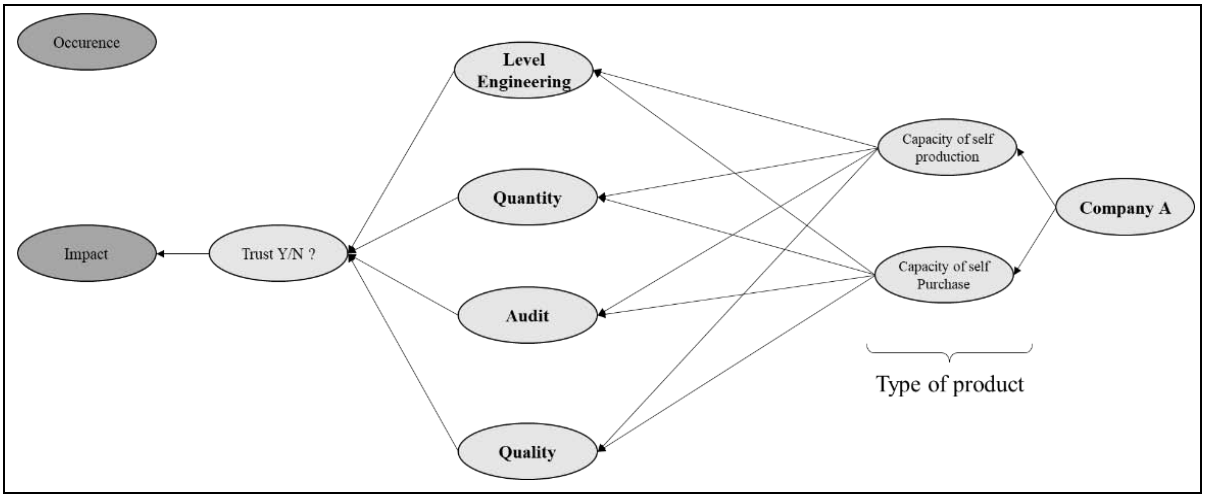


Figure 8: Basis Structure of Illustration (By Author)

As Naim and Condamin point out (source Operational Risk Modeling in Financial Services by Naim and Condamin), "occurrence modelling is generally the most difficult taks", and it is recommended to follow logic: "The event hits the exposed object during the next period". In other words, the hypothesis of occurrence of the event should only answer the True or False hypothesis. This corresponds to a quantification in yes/no or probable form of the arc. For example, by counting the number of wins or losses over a period of time. By applying a general evaluation that is deductive, inductive and subjective, as we have already specified, we refine the level of occurrences as well as the associated impact dependencies.

Impact modeling follows a similar logic since it is quantified to the extent of the impact of Gains or Losses that has already taken place by experience. That is to say that we must quantify in a pragmatic way (we paraphrase Naim and Condamin) at the level of the impact conditions.

Practically that does Mean Following:

– The Impacts are the engineering level, quantity, audit, quality represents the link to impact.
– The Quantification is the engineering level, quantity, audit, quality changes with the effort put into the number of iterations to positively change the impact confidence.
– The Occurrence: The scenario occurs when engineering level, quantity, audit, quality changes confidence increases.

Then we can improve this structure with the structure improved by elicitations and adding values (Figure 9).

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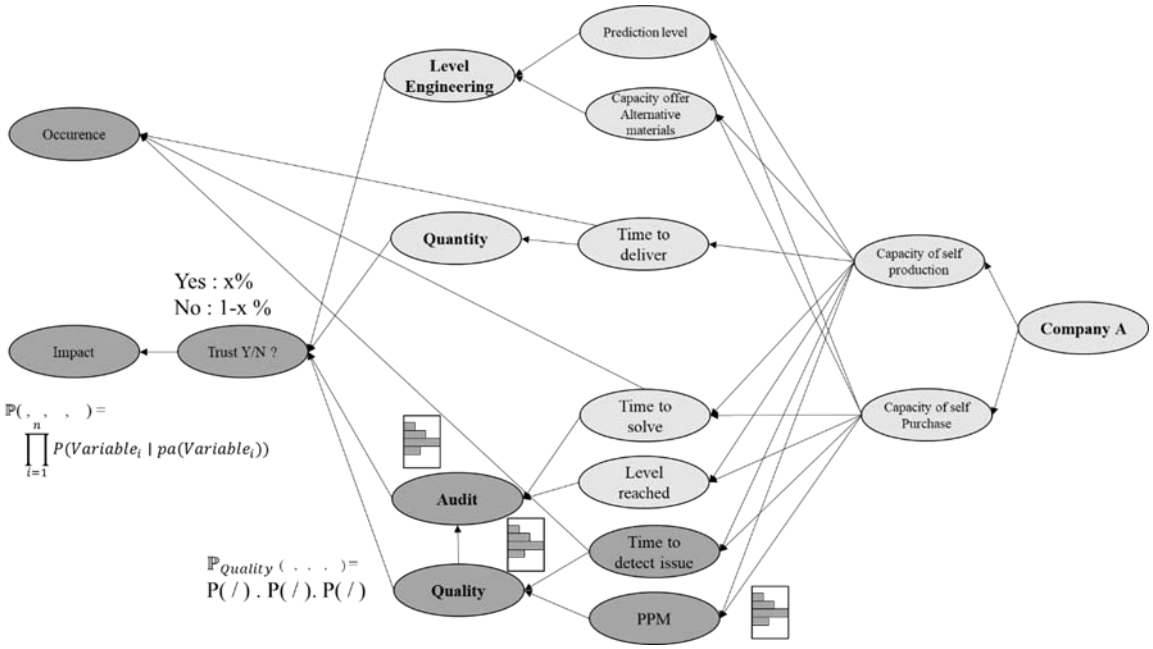


Figure 9: Basic Improved Structure (By Author)

The organization has legacy of experiences or create expected dependances and can quantify this new link which will require up-front expert judgements. We want to put the scope on the quality-audit branches as an illustration.

Adding Values: To improve occurrence scenario, we can add different values like predictions performance to influence the engineering level or time to detect issues for the quality.

In the example, the resulting naïve Bayesian model will calculate the probability of the target variable corresponding to the Company A, which is the entity under study in the scenario.

Trust (Y/N): Indicates the level of confidence of the Quality Criteria during the negotiation given to an entity (Boolean variant) and is a function of the other variables (Production/Purchasing Capacities, Type, etc.):

$$\mathbb{P}_{Quality}\ (Trust \mid Variables) = P(Trust) \times \prod iP(Variablei \mid Trust)$$

Technically, the CPT construction principle must be used in order to optimize the complete network and build the dependencies. A certain amount of data is necessary and that is based on the firm, and their experts as well as the surrounding data. In the example, the resulting semi-complete Bayesian model will calculate the probability of the network that satisfies the Markov conditions by calculating the network path, i.e., the product of the dependencies of the variables (Variable i) and their parents noted pa(Variable i).

$$\mathbb{P}(Trust, Variables, Types, Capacity, Company) = \prod_{i=1}^{n} P(Variable_i \mid pa(Variable_i))$$

Thanks to this path, retroactivity, i.e. the ex-Ant pathway, is direct and possible unlike an AHP approach. In addition, an ex-Ant analysis impacts all the elements of dependency and not just one. The reader will probably have noticed that there is a major difference with AHP since we do not apply subjective judgments between dependencies but we rely on logical links, which is much more credible and effective for a dynamic simulation in negotiation.

IV. Software Tools

RB modelization effort will not be effective without a suitable software support. Many systems commercial exist such as Bayselab, BayesiaLab, Bayes Fusion, Hugin, Neticaor R-based programming tools (Scutari[65]) such as: bnlearn, Catnet, deal, pcalg, gRain, Rbmn. After crossing literature analyses (Michiels[66], Naim[67]) and criteria such as general coverage in terms of applications, accessibility, self-autonomy and moderate price, we chose Netica from Norsys Software Corp. Netica is widely used in many case studies (The entry "Netica" & "Case study" gives 2990 results in google Scholar in 2025). The tool is simple thanks to its user-friendly interface and accessible to first-time users as well as experts and covers the majority of the tools needed for analysis. The product facilitates elicitation

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and inference, which is essential because of the expert origin datas that the agents can use to generate complex cases, which leads to the creation of various scenarios required in complex negotiation.

a) Validating the Robustness of Bayesian Networks

The main objective in Bayesian networks is to continuously update the level of likelihood. This can be achieved by various techniques that we will list here without going into detail. There are two general approaches to making a Bayesian network robust, namely parameter learning and structure learning.

– *Learning Parameters:* where the system is fixed but for which it is necessary to estimate the conditional possibilities of each node of the network, therefore quantitative, which are defined by data as well as that of expert(s). It is divided into three depending on whether the data is Complete, Incomplete and missing data.

– *Complete Data:* When the data are complete, statistical estimation techniques such as likelihood maximization (MV), posterior maximization (MAP), and a priori expectation (EAP) are used. Bayesian IRL, for example, combines MV and MAP with softmax logic to infer reward functions.

– *Incomplete Data:* In the majority of complex cases, the data is incomplete and there are methods such as Estimater-Maximizer (EM), Missing Completely at Random (MCAR), Missing at Random (MAR), and Not Missing at Random (NMAR). These methods, developed by Little & Rubin (1987), are described in the literature by Leray, Naim et al. (2017), and Jouffe and Munteanu.

– *Noisy Data:* When data are scarce but a priori knowledge is available, the principle of elicitation is applied, often associated with a confidence scale and corresponds to expert knowledge.

– *Learning the Structure:* where the system must respond to the best graph to solve the task to be performed hence qualitative and defined by expert(s). Algorithms such as PC (Peter and Clark) and IC (Inductive Causation) are used to identify conditional independence in the data, simplifying the model and making inference more efficient. Criteria like entropy, AIC, and Bayesian scores can be used to evaluate and compare different model structures.

Most of these techniques are integrated into Bayesian software: Netica, Bayselab Bayesia Lab, Bayes Fusion, Hugin and Bayserver which is a Bayesian modeling software available online.

b) Illustration Supported by Software ToolNetica

As already mentioned, we propose to focus on one DAG: the quality branches of the network. To build a quantized Bayesian network, each node must be associated with a conditional probability table (CPT) which describes the probability of each possible state of the node based on the dependencies of its parents. To Define Node States, we must identify the possible states of each node.

– *Occurrence:* {Rare, frequently}
– *Impact:* {Low, Medium, High}
– *Trust:* {Yes, No}
– *PPM (Parts Per Million):* {Low, Medium, High}
– *Detection Time,:* {Short, Medium, Long}
– *Quality:* {Good, Medium, Bad}

We assume to build the corresponding CPT based on expert information (Figure 10). As we do not have experts around, we have asked Chat_GTP to generate the number in order to avoid to be self-biased by some self-predicting results.

		Occurrence		Time_of_detection					Impact			Quality			
Company A	Trust Y/N	Rare	Frequently	Quality	Short	Long	Medium	PPM	Low	Medium	Strong	Audit	Good	Medium	Bad
Capable	Yes	0.90	0.10	Good	0.70	0.20	0.10	Low	0.80	0.15	0.05	Yes	0.85	0.10	0.05
Capable	Yes	0.90	0.10	Medium	0.30	0.50	0.20	Medium	0.60	0.30	0.10				
Capable	Yes	0.90	0.10	Bad	0.10	0.30	0.60	High	0.40	0.35	0.25				
Capable	No	0.70	0.30	Good	0.50	0.30	0.20					Yes	0.70	0.20	0.10
Incapable	Yes	0.40	0.60												
Incapable	No	0.20	0.80	Medium	0.20	0.40	0.40	Low	0.50	0.40	0.10				
Incapable	No	0.20	0.80	Bad	0.05	0.20	0.75	Medium	0.30	0.50	0.20	No	0.30	0.40	0.30
Incapable	No	0.20	0.80	Bad	0.05	0.20	0.75	High	0.10	0.40	0.50	No	0.30	0.40	0.30

Figure 10: CPT of Illustration (By Author)

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As you can see, the CPT only contains a certain amount of information that we have left free so that the system is able to extract new knowledge: we use Netica from Nordsys © for our simulation. Taking the learning function that is based on a CPT that we have firstly entered in an Excel file, Netica will execute the corresponding Bayesian network and the researcher will create the links, so to obtain the corresponding DAG below (Figure 11).

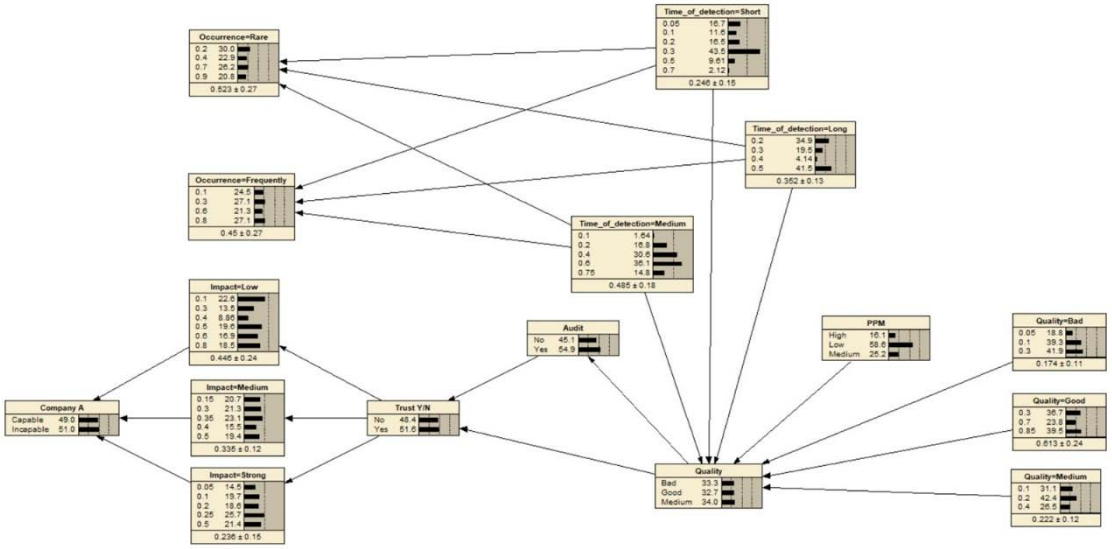


Figure 1: DAG of Quality structure underNetica® (By Author)

c) Simplification of the Nodes

As already mentioned, the number of connections clime rapidly and there is a necessity of reduction, otherwise the number of parent links with eventually to much entries and generate to much variables and lead to overlearning and overprocessing. This action is difficult but necessary. On the illustration (Figure 12) we can report a randomization of the new model with better Capability Output [35.1%/ 64.9%] against the previous model [49% / 51 %].

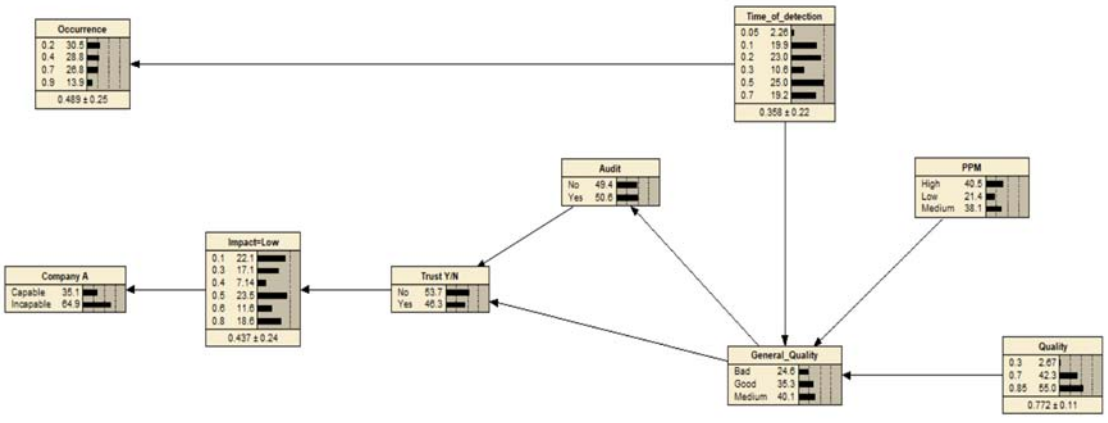


Figure 12: DAG of Quality Improved Structure under Netica® (By Author)

Since this is a case study, we would like to remind the reader that it is of course necessary to confirm with the expert elicitation and validate the principle in each specific organization on each specific case (product, market i.e)

d) Extended Perspective and Operational Deployment

There is a novelty in this work because we can predict the behavior of the price in a negotiation by applying a hybrid Bayesian network method.

First, by establishing a set of variables to construct a Bayesian network in order to obtain a final

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conditional dependency in order to obtain an impact and an occurrence of the scenario studied and where:

1. *Impact (Ii):* Discrete variable with possible values {low, medium, high}.
2. *Occurrence (Oi):* A discrete variable with possible values {rare, frequent}.

Then, considering during the negotiation the prices Pi (€) are proposed with a correlation of the Lerner index Li (%) in order to categorize the following (Figure 13) four cases:

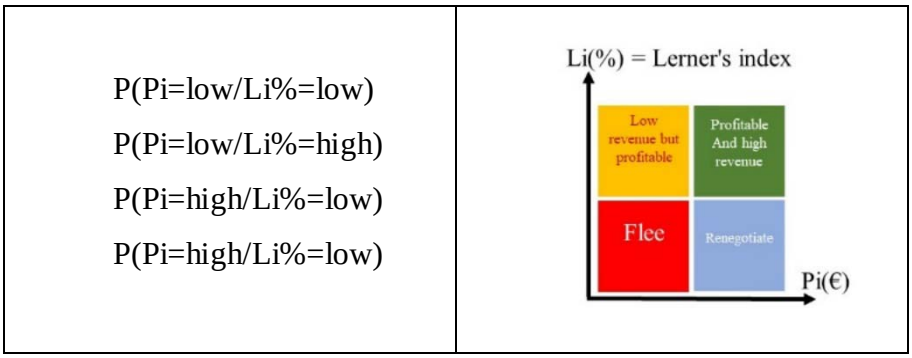


Figure 13: Lerner/Pi Matrix

The price Pi (€) itself is given by the negotiation that the seller manages with his customer, but Li (%) is influenced by the total cost CTi (€) and the price Pi (€), i.e. the extra and intra-organization. Consequently, we can establish a correlation between the price, the Lerner index and Pi (%) and therefore Oi (%) and Ii (%) in the following way (Figure 14):

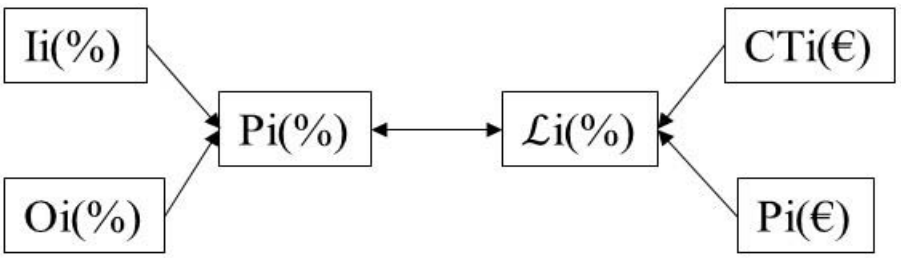


Figure 14: Measure Outputs (By Author)

Thanks to these links, the work of the Experts can start in a coordinated way.

Thus, to return to the example. Lerner Index is moreover semi-empirical because MC is fixed and the price is variabilized by an observation variable. If we take the Lerner index as an observation variable that the selling agent can use, it represents for him a good indicator of the performance of a deal a priori. In a Bayesian update, it corresponds to the likelihood in the Bayesian theorem. Thus, either:

- The price (P) is a direct observation.
- The marginal cost (MC) is a latent variable estimated and subject to the variability of indices and can be updated via Bayesian learning.
- The set (L) influences the actualization of the strategies .
- Index (I) calibrated to costs Marginal (MC) with respect to the number of times that if the marginal cost exceeds a certain level due to material effects, the compensation will be adjusted to the price (P)

The index corresponds to an a priori law that is adjusted to the likelihood, for example, that the customer is not in a position to take a risk:

$$\text{Law a Posteriori} \propto \text{Law a Priori} * \text{Probability}$$

$$\text{Risk indice/Profit} \propto \text{Lerner Index} * \text{Price/Risk index}$$

Bayesian logic allows this counterintuitive approach which, as in the example, will allow both the selling agent and the buying agent to adjust the level of the Index (I), the frequency of the number of occurrences of times when the index will exceed a certain level without this impacting either the seller or the buyer.

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The Lerner index is a reference -or a priori law- associated with the measurement of impact and occurrence since they together represent an indicator of the performance of the structure. In the case of a high impact in terms of profit associated with a high occurrence represents a favorable case. On the other hand, if the Lerner index meets the objectives, corresponding to a high impact but associated with a low occurrence, the structure can be corrected with much more precision in order to correct the occurrence. It should be noted that with the increasing performance of LLMs (GTP-4[68], Llama[69]) which are more and more capable of complex and subtle reasoning, the evaluation of Occurrence and Impact can be helped by AIs that will allow questions to be asked and cross-referenced. Thus, like Virginia Tech's CrowIdea[70], which is a software platform that reveals meaning without supervision in order to reveal reasoning processes, multi-agents will confront evidence of factualities justifying conclusions to avoid human biases of over or under interpretation. As a result, Bayesian networks are generally able to assess both impact and occurrence, which in some specific cases can present challenges that require continuous updating of learning by experts, elicitation, learning tests and reduction in the number of links that can lead to super-computation.

Thanks to inference, the PWT,VBP team will be able to retroactively (ex Post) correct Ii (%) and Oi (%) by adding other variables to the Bayesian network in order to optimize Pi (%) and refine Pi (€)

Thus, in the DAG Client example, despite frequent detection of quality cases and despite the client's trust thanks to a positive audit, there is a strong possibility that the organization will be judged incompetent because despite the good qualitative focus, the organization could not be judged to be sufficiently responsive in cases of problem solving.

Therefore, in the broader context of vertical production, a high level of quality assurance of its suppliers must be maintained if the integration rate is low. In general, extending the level of quality in correlation with the vertical integration of self-produced or purchased components will have an impact. This is nothing new, one might say, but the algorithm shows the logical links that lead to such an impact.

The Quality DAG is one of the many scenarios. In order to obtain the impact and occurrence of the complete network, it is therefore necessary to build all the DAG scenarios.

e) Operational Deployment

During the negotiation, the propagation of beliefs, via a more general inference, which is automatically calculated in software such as Netica, makes it possible to obtain up-to-date results useful to the PWT, VBP teams based on the work of the sales team and reinforces the learning phenomenon of the system.

This structured and logical approach makes it possible to analyze and anticipate price behavior in a negotiation using a hybrid Bayesian network thanks to a set of discrete variables while remaining unclear in some cases to evaluate the impact (Ii) and occurrence (Oi), Using the Lerner index to categorize the prices in four cases, we relate the proposed price Pi to the gross margins (Li), also incorporating the impact of the total cost CT. This allows pricing and margin strategies to be defined under specific conditions, which is therefore particularly useful in the complex negotiations that the seller has to conduct. Ex post feedback through inference to correct Ii (%) and Oi (%) allows to adjust the probabilities and correlations in the Bayesian network with new information that will be provided by the whole group as well as the flying agents, making the model more robust and responsive to changes in the context of the negotiation.

The use of Netica integrates Inference which makes it possible to automate the propagation of beliefs because it simplifies the complex calculations associated with Bayesian networks. This allows a dynamic update of conditional probabilities as new information emerges during the negotiation. The result is a marginal probability. To obtain the marginal probability P (Pi = {High; Medium; Low}) of each single PI case it is necessary to calculate the distribution.

That mean calculate the sum products of the conditional probabilities and marginal probabilities of the parent variables:

$$P\left(Pi=\begin{Bmatrix}High\\Medium\\Low\end{Bmatrix}\right)=\sum_{Ii,Oi}P\left(\left(Pi=\begin{Bmatrix}High\\Medium\\Low\end{Bmatrix}\right)/\ Ii,Oi\right).P(Ii).P(Oi)$$

However, it is necessary to ensure a good correlation between price and gross margin accurate information which means that the data must be mastered by the experts PWT, VBP by integrating high, medium, low margins according to the variability of exchange rates, material costs, labor costs, energy costs. This requires precise work upstream or can be the subject of a framework by elicitation. By incorporating margins adjusted for exchange rate fluctuations, raw material, labour and energy costs, greater accuracy is added to the model. This type of upstream work allows price estimates to be better framed according to cost variability.

Indeed, the elicitation framework of the expert group is a good option for managing vagueness, especially when it is difficult to quantify certain elements

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or to accurately predict cost variations. This approach makes it possible to capture expert knowledge, thus facilitating a more realistic and nuanced Bayesian modeling in the context of the negotiation.

Our approach reinforces the robustness of the PWT-VBP_negociation model and limits uncertainties in the evaluation of scenarios while being realistic about the reality of unknown data, and requires a group of the pricing teams (PWT, VBP) and Sales Force assisted by experts corresponding to certain DAGs (Engineering, Quality, Production,...).

In the realm of the unknown, BN representsa breakthrough in a priori, unknown relationships between data a promising approach. For use in the complex, the advantage of Bayesian networks is the causal representation in the form of directed causal graphs. In the factual and counter-factual logic, consequently (according to .. Naim...) BN are better suited to predict, diagnose, control, simulate behavior and analyze system data and ultimately make decisions about the system.

The search for values is a complex field and responds to the same problems in which Bayesian networks can make a difference. In this sense, there are no fixed parameters to be placed in a Bayesian network, but a priori unknown links to detect common values in a pricing system, since the elicitation will be built as the system is built, which is based on a dialogue between buyer and seller.

f) Training

Mastering BN requires a set of prior understanding and training such as being accustomed to basic probability concepts and Bayesian logic but also Behaviorist logic and Prospect Theory in order to help agents s understand the underlying principles of the decision and not make biased interpretation errors. The training consist of theoretical training followed by a set of illustrations around case studies where Bayesian networks have been used to model complex decision-making processes through the use of visualization tools in order to understand belief updates. Finally, it will also consist of creating concrete interactive simulations where users can observe the impact of the data collected on the posteriori probabilities and developing analysis tools that facilitate the collection and integration of relevant by providing intuitive user interfaces. The complete course will consist in three days in accordance with what is recommended by the Bayseialab firm[71] (See more in some cases). By offering these training courses to the PWT and Values functions, agents can work on common cases in order to strengthen their cohesion around the dialogue and opposing difficulties that agents encounter on a daily basis.

V. Recommendations

We presented an extended deployment tool in PWT and VBP by strengthening the PWT-Sales Force expertise. In opposite to most MDCM, Bayesian is data and subjective driven in order to reflect rational and rational limited human organization behaviors and improve decisions. At this stage, our research is theoretical and requires experimental verification to be fully validated. However, experiments are ongoing to be tested in Vitro and in Vivo and the results will be reported in following publications.

VI. Conclusion

The purpose of this article was to highlight that in PTW, Bayesian can be call to help solve the scope of Values in complex B2B, B2G selling negotiation process. The AHP Fuzzy is a tool which help negotiations in B2B but has the disadvantage to be relatively static and not enough fitted for negotiations. According our research a combination of AHP and Bayesien is rare and was only applied according us in marketing research framework but not negociation. Papić-Blagojević and All[72] propose to use Bayesian networks to establish the links of dependencies between tourists, and use the strongest dependencies obtained in order to classify tourists satisfaction with AHP. From a methodological point of view, the Bayesian network is used in a way prior to AHP. By applying the best dependencies, the Bayesian Network is therefore able to establish a preferential structure which in opposition a Postulate methodology would have difficulty producing in fact the treatment of uncertainty.

Bayesian Network overcomes complexity and uncertainty in complex selling. BNs are part of the cohort of artificial intelligences but they must be trained. BNs are tools that connect field experts and analysts to solve problems (Naim)[73] in order to train a system that will improve. Taking into account the uncertainty, the Bayesian network is able to generate scenarios that are very useful in a negotiation, as they are for detecting terrorist risks (Naim-Chapter 14) per example which both are two unlikely unpredictable fields. Zeng and Sycara[74] show also the benefit of learning in the framework of a sequential negotiation model through the process of updating Bayesian beliefs. We cannot hide the main challenge around the fact that the real cause of a consequence is often complex to determine and will influence effectiveness of BN. In fact, the deployment of BNs is similar to that of VBP which request similar attentions. They complement each other but require time and champions (CEOs) to bring them within the organization in order to form “Superforecaster” Experts Team (2016[75]; 2024[76]) which are individuals with characteristics capable of making exceptionally accurate predictions and very useful for complex

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predictions combined with the B2B negotiation framework.

Through this article, we want to convince company champions to systematize their organization by taking into account uncertainty with help of Bayesian deployment in PWT in order to generate elicitation, think toughly about the deterministic/indeterministic which will improve the methodology of knowledge their markets, their customers and obtain better Valued results by increased leadership. The contribution of Bayesian networks to the organization can be used as a Knowledge Tool focuses on a structural logic of the offer so that it can be adapted synchronously and asynchronously with flexibility to the customer.

The power of our proposal is therefore mainly to be a complementary tool to the commercial and program function in order to prepare the negotiations and the possible alternatives by taking into account human behaviors to adjust the best price and the best values during the consultation phase and which can be adjusted after elicitation to the negotiations.

The time phases are: Pre Inference≺ Pre Decision ≺Inference ≺Elicitation ≺Arguments

Consequently, once the conditions for understanding the variables have been well mastered, the frequency of updating is that linked to the frequency of updating the consultation program and which should be built up over a few weeks if we stick to a personal empiricism of the automotive sector, for example. The method is perhaps more suitable for consultation phases and we propose the deployment as follows in a B2B deployment:

Phase	Deployment	Source data	Building the model	Tempo
RFQ or RFI	Preparing the model	Customer Package CoC Data	Pre-Inference by Basic Model Construction	1 week
Phase 0	Basis for the decision	Décision de consultation	Utilisation du modèle de base pour participer à la décision GO/NO-GO	1 day
Phase 1	Deploying the model hardened with internal data: Costs	Response to consultation	Complete inference based on customer contacts, CoC, and internal elicitation	2-4 weeks
Phase 2	Structuring arguments to strengthen the negotiation	Submission of the offer	Elicitation	4-12 weeks
Phase 3	Leason Learn Contract Structuring/Learning Support	Acceptance/Rejection of Offer	Technical and commercial arguments	

Funding Declaration and Conflict of Interest Declaration

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Overview and Purpose

In Pricing, Value Base Pricing (VBP) in B2B industry is a proven profit generator according Hinterhuber, Liozu. The literature also highlights that VBP does not benefit a cooperative equilibration between buyer and seller. In this article, we propose a new methodology for resolving Value Base Pricing deployment, which is captured by the customer in the majority of cases during the commercial negotiation. There are pricing methodologies which do not all operate in the same timeframe in accordance with a negotiation and are therefore not suitable for commercial purposes. Among all the methodologies, the Price Wining Target (PWT) is an active method that does not advocate a target price but an optimal price in ex-Ant correction of ex-Post decisions needed in negotiation cases. PWT relies on decision-making models in limited rationality (H. Simon). As well among all the decision models, Bayesian Model is a robust mathematical framework which manage uncertainty in complex decisions frames. We propose to link the PWT to Bayesian logic. The integration of PWT in Bayesian Network based model create a bridge between the game theory and practical applications of zero-sum games, non-zero-sum games as well as cooperative games. Bayesian Network has already proven itself adding value in multiple domains of Financial and Banking Risk Management, Credit Rating risk, Medical Diagnosis, Complex Genetic modelling, Artificial Intelligence in beliefs updating under uncertainty, Enhancement Cognition, among others and this contribution propose to deploy it in the Pricing organization. We deploy theoretically and practically a methodology based on the mathematical-Bayesian Modeling software Netica. Then we show how theoretically expert of pricing and commercial resources available in organizations can be linked through the model. In order to improve values predictability the connection of Bayesian and PWT model to group of experts, organization will be able to build a large number of scenarios reflecting the complexity and dynamics of

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real situations of symmetrical, dissymmetrical frameworks useful to optimize dynamic negotiation in B2B business relationships.

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Survival and Opportunity: Self-Employment among Women Heads of Families in Mato Grosso's Agribusiness and Traditional Sectors

By André L. Ribeiro Lacerda, Matheus Antunio Canhete & Patricia Cristiane de Souza
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Introduction- For most of the population of pre-industrial societies there was no separation between productive activities and domestic activities. Work was carried out at home or in its vicinity. This situation changed with the advent of modern industry, which caused a separation between the home and the workplace (Giddens, 2005; Nolan & Lenski, 2015).

With the development of the industrialization process of societies, there was a separation between the home and the workplace, making them distinct spheres, the public and the private. Men, who carried out their work outside the home, began to participate more in the public sphere, while many women remained in the private sphere, in the domestic sphere, linked to the tasks of taking care of the house and children.

In recent decades, however, we have witnessed an increase in the departure of women from the sphere of domesticity and their greater participation in the public sphere, especially in the labor market (Schaefer, 2006; Giddens, 2015).

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Survival and Opportunity: Self-Employment among Women Heads of Families in Mato Grosso's Agribusiness and Traditional Sectors

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I. Introduction

For most of the population of pre-industrial societies there was no separation between productive activities and domestic activities. Work was carried out at home or in its vicinity. This situation changed with the advent of modern industry, which caused a separation between the home and the workplace (Giddens, 2005; Nolan & Lenski, 2015).

With the development of the industrialization process of societies, there was a separation between the home and the workplace, making them distinct spheres, the public and the private. Men, who carried out their work outside the home, began to participate more in the public sphere, while many women remained in the private sphere, in the domestic sphere, linked to the tasks of taking care of the house and children.

In recent decades, however, we have witnessed an increase in the departure of women from the sphere of domesticity and their greater participation in the public sphere, especially in the labor market (Schaefer, 2006; Giddens, 2015).

The 2022 Brazilian census points out that more than fifty percent of Brazilian families are headed by women, a proportion that represents an increase of more than fifteen percent compared to 2010. This implies changes in the labor market, in the structure of the family, and the demographic composition of Brazilian society.

Concerning the labor market, some studies (Blanchflowe & Meyer, 1994; Gindling & Newhouse, 2014; Karki & Xheneti, 2018) have shown that a significant number of women are self-employed. Most of the work in developing countries is self-employment. The types of self-employments vary from country to country, whether it is agricultural or non-agricultural, and according to the socio-demographic profile of women. The increase in the number of families headed by women and who live off their self-employment is a change that deserves investigation, either because we have a significant number of new actors entering the labor market, or because this is linked to new types of family structures.

Economist Gary Becker (1965) describes the family as a small factory where individuals' time is an input to produce their daily activities. From this perspective, women face higher opportunity costs when entering the labour market due to the time allocated to unpaid activities such as motherhood and domestic care.

The family is a type of organization, the bearer of a social structure that has been undergoing substantial changes. Family and friendship groups generally function outside of what is considered a broader organization. Still, as populations grow and the dimension of social life increases, organizations begin to penetrate more into our daily lives (TURNER, 2000).

In contemporary Brazil, families are experiencing new organizational forms, stimulated by demographic shifts and economic and social transformations that have shaped their structure and morphology.

Single-parent families have become an essential element of our family system; about a third of women and children spend time in these families. Understand the consequences of the experience of living in a family with just a one parent can be interesting in economic and social terms, when we are concerned about the development of children (BUMPASS & RALEY, 1995).

These transformations have generated changes in the social behavior of Brazilian women. Data form Brazilian census (IBGE) shown a decrease in women's fertility rates and an increase in their participation in the labour market and their level of education. All of this has enabled women to contribute more significantly to the family budget. Around a third of Brazilian families have a woman as an economic reference person in their household. All these changes represent fundamental transformations in the social structure of the Brazilian family (IBGE, 2010).

The data have shown that even in regions where cultural values are recognized as more traditional, women have stood out in terms of schooling and in the condition of being the head of the family. The types of family organizations have changed. According to the data, there has been an increase in single-person family

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organizations, the number of families with a spouse and children has decreased, and the number of family structure with a spouse and without children has increased.

The increase in family organizations in which the woman is now the head of the family can be manifested in single-parent families, in which the woman without a spouse exercises this condition with her children, or in family organizations in which she, with a spouse and with children, is the reference person.

The greater participation of women in the labour market has been carried out according to the nature of societies: stratified. Women who could study and fulfil themselves in prestigious occupations tend to occupy good positions, still women who are born into the lowest socioeconomic positions, have children earlier, and do not have a husband or a partner tend to face significant challenges. Many of them work in self-employment.

Women in such conditions are often part of the informal economy and because of that, your business are not registered and they cannot fully report their production or sales for taxes purposes (Karki & Xheneti, 2018).

The systematic review research carried out by Lacerda and Souza (2020) on the relationship between self-employment and women's condition of heading the family showed that self-employment appears linked to the social situation of immigrants, minorities, older people, and women married with children or not married with children.

According to the literature expressed in the systematic review by Lacerda and Souza (2020), self-employment and being the head of a household are related to having children. But, probably, the woman's condition in a single-parent family differs from that of a two-parent family. In the single-parent family, there is neither the income nor the help that the husband can give to his wife to domestic services such as taking care of children. Lacerda and Souza (2020) suggest that taking care of children is a limiting factor in the self-employment activity of mothers.

Data from the 2022 Census indicate that most Brazilian households are now headed by women. In Brazil, states such as Pernambuco, Maranhão, and Sergipe draw attention to the high rate of households headed by women. Mato Grosso, a state whose economy is driven by agribusiness, has one of the lowest rates of female-headed households in Brazil. But, within the state, we have differences between municipalities, for example, those that are economically linked to agribusiness and those with a traditional economy. There are municipalities with socio-economic data like municipalities in Pernambuco, Sergipe, and Maranhão. The city of Santo Antônio do Leverger has indicators similar to those of those states.

Investigating the differences between the socioeconomic profiles of mothers who are heads of households in single- and two-parent families can be an interesting starting point for knowing the differences in the types of self-employments developed by Brazilian mothers. This study proposed to compare the mothers of single-parent and two-parent families in the sample of female heads of household in the condition of self-employment according to microdata from the CENSUS/ IBGE (2010) and a small sample of data collected in 2024 for the municipalities of Santo Antônio do Leverger (Leverger), a region with a traditional economy, and for Campo Verde, with an economy based on agribusiness.

Unfortunately, IBGE data for municipalities are only available up to 2010. To have more up-to-date data, we did some interviews in the two municipalities in 2024.

The two towns are located close to the capital of Mato Grosso, Cuiabá. Leverger is 30 km away, already in the Pantanal region. Campo Verde is 130 km from Cuiabá and is located 93 km northwest of Primavera do Leste, the largest city in the outskirts of that micro-region.

The fundamental idea is to compare two municipalities with very different economies. One municipality has an economy based on traditional agriculture and livestock is poor and has decreased in population size. In this case, Santo Antônio do Leverger. The other is considered a more prosperous municipality with an economy focused on agribusiness. The opportunities must be very different for a mother who is the head of a household who resides in one or another municipality. We expect to find differences between mothers who are heads of mono households and those who are heads of two-parent families.

Unlike a few years ago, when, in two-parent families, the husband had one salary, and the wife stayed at home, today, this arrangement has been replaced by the notion of a two-income household.

As the greater participation of women in the labour market has shown, the increase in the number of couples with two incomes is related to financial need, a drop in the birth rate, an increase in women's schooling, and the impact of the feminist movement on the transformation of women's consciousness (SCHAEFER, 2006).

Raising children in two-parent family is very different from raising children in two-parent families. Living in a single-income family with only one parent present can be economically stressful. A family headed by a single mother faces even more challenging problems when it involves, for example, a teenage mother, a condition of a significant proportion of Brazilian mothers (Schaefer, 2006).

From a socioeconomic perspective, it can be said that, hypothetically, families with two parents are expected to enjoy better economic conditions, due to the possibility of having two incomes e two caregivers, which implies less emotional stress for the parents.

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Theoretically, a biparental family can expect a better economic situation due to the possibility of having two incomes and less emotional stress, as the task of taking care of children can be divided between the parents. In a single-parent family, this tends to overwhelm the head of the family present, usually the mother (Casper & Bianchi, 2002).

Due to the greater economic instability experienced by single-parent families, some scholars suggest that women heads of single-parent families have, on average, lower income and education than women heads of single-parent families (BERQUÓ, 2001; MENDES, 2002).

In the comparison between the municipalities of Santo Antônio do Leverger and Campo Verde, both in economic terms and terms of schooling, the mothers, both from single- and two-parent families, from Campo Verde, an agro-industrial municipality, are expected to be in a better situation than the mothers from Santo Antônio do Leverger, a city more fundamentally focused on livestock and subsistence agriculture.

Santo Antônio do Leverger is a low-income municipality primarily sustained byfishing tourism and subsistence agriculture. Its population today is around 15.246 people (IBGE, 2022), which indicates that the city has been decreasing in size, as it was 17.000 (IBGE) in the year 2000, most likely due to the few economic opportunities. Part of its population works in the capital, Cuiabá, about 30 km away. Its HDI is 0.736, considered average, and its GDP per capita (IBGE, 2018) is R$ 47.655,17.

Campo Verde has more than 44.585 inhabitants (IBGE, 2022). Agribusiness is the municipality's primary source of funds. The main economic activities are cotton cultivation and raising pigs and poultry, basically chickens. Campo Verde's HDI is 0.750, which is considered high, and its GDP per capita (IBGE, 2021) is R$ 113.394.08, the fourth in the State of Mato Grosso.

II. Theoretical Framework

The choice of rational choice theory to study the behavior of female heads of households who practice self-employment assumes: human action is understood to be goal-oriented and instrumental. Individual and institutional human actors try to achieve the achievement of their goals as much as possible. This assumption is called the assumption of rationality (TSEBELIS, 1998; SANDERSON, 2001).

In the family, the choices of its members can be modeled based on rational choice: marriage, children, divorce, and the type of work to be performed are actions based on the comparison of costs and benefits. In other words, seen from perspective of the theory of rational choice, mothers, and heads of single- or two-parent families are social actors who rationally calculate the costs and benefits of their choices. Social actors make rational choices about the meanings they give to their goals rather than the goals themselves. In other words, values and beliefs are decisive variables in choosing the social actor. The mother of a single-parent family makes choices based on her context of restrictions, beliefs, and values. She may forgo investing in her schooling because her resources are limited, and she prefers her daughter or son to do it.

At the end of the 1990s, Hechter and Kanazawa (1999) took stock of the applications of rational choice theory to the most different research topics, showing its development and explanatory power. About family or gender-related issues, some studies have made good contributions (Youm & Laumann, 2004; Himmelweit Et Al, 2013; Gindling & Newhouse, 2014; Youm & Lee, 2016; Knight & Brinton, 2017; Abraham & Ohemeng & Ohemeng, 2017; Karski & Xheneti, 2018).

For rational choice theory, rational calculations made by social actors are subject to at least two types of constraints. The first type, which we can call external structural limitations, concerns all the physical, economic, legal, and psychological coercions that the individual is faced with. According to Elster (1994), the actions consistent with these coercions form their set of opportunities. That is, individuals face opportunity costs or costs related to the actions of their choices (Hechter; Kanazawa, 1999; Sanderson, 2001). A single-parent mother encounters this first type of constraint when, due to limited economic resources, she must choose between investing in her training or prioritizing her children's education.

Therefore, single-parent families deal with more resource constraints than two-parent families. This hypothesis is consistent with what has been defended in the sociological literature regarding the differences between single- and two-parent families (Casper & Biachi, 2002; Giddens, 2005; Schaefer, 2006).

The second type of constraint, which prioritizes internal mechanisms, refers to the mechanisms that determine which action of the opportunity set will be performed (investing in your education or that of your children?). When she chooses that, although she needs to improve her level of education, the available resources allow only one investment to be made and, therefore, it should be her son or daughter, the mother of a single-parent family is dealing with this type of restriction. That is, she chooses that her son or daughter receive the investment that could improve his or her schooling and, therefore, increase his or her range of choices about self-employment or another type of work. But, he believes that at that moment it is better to invest in the schooling and training of his children.

The self-employment condition concerning mothers, particularly those from single-parent families, is closely associated with low income and limited educational attainment. Self-employment is understood here as the work situation in which the person works for

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himself. That is, she has no institutional or employment relationship. The housewife bakes cakes to sell, and the seamstress who work at home are examples of self-employment. Following Pamplona's definition (2001: pg3), the self-employed person can be characterized in a general way "by independence, autonomy, and control over his work process (activity itself, raw materials, means of production)".

Hypothetically, in self-employment, the owner of the means of production participates directly in productive activity. He deals with uncertainties because his income is not previously defined since it will depend on his work, his capital, and the direct demand of the market for goods and services. In this case, the fundamental objective of work is to make one's job (means of subsistence) feasible and not to value one's capital (Pamplona, 2001).

The main variables that determine the condition for women to become self-employed are the desire to make working time more flexible (given that in formal employment, they would have to "work hours"), to have children, and whether the husband is also self-employed (Omori; Smith, 2010). Certain factors, such as household chores, childcare responsibilities, and an inactive spouse, can negatively impact self-employment, often turning it into a 'third shift' (Rønsen, 2014; Welsh, 2017).

Sociological rational choice theory is relevant because it can help us better understand whether the calculations of mothers of single- and two-parent families differ regarding their choices between self-employment and wage employment and whether the age of their children influences the type of self-employment that is performed.

One can think of the relationship between self-employment and the life cycle of families in the sense that Carter and McGoldrick (1995). Being clearly state that the changes are different for men and women. Women have played central roles in family structures, but the idea that they have a life cycle that does not necessarily coincide with their roles as mother and wife is an idea recent (McGoldrick, apud Carter & McGoldrick, 1995).

Women who pursue self-employment generally carry out activities with which they are somewhat familiar, in which they have a certain level of specialization (ADO, 2017) or that represent innovations in the day-to-day problems of women who take care of the home, as in Ekinsmyth (2012), which shows women who have created "mother-to-mother" enterprises. Over the years, the image of women has also come to be associated with the head of family and business success (Bobrowska, Conrad, 2017).

From an economic perspective, single mothers rarely receive high salaries. They find it very difficult to work long hours since they must also take care of their children. Many receive child support for their young children from the absent father. While single mothers are eligible for various forms of public assistance, neither legislators nor voters wanted to make such generous assistance, lest generosity encourage even more women to raise children on their own. There is a hypothesis that in the United States, the spread of single-mother families would play a significant role in the persistence of poverty. In 1964, when Lyndon Johnson declared war on poverty, only 30 percent of low-income families with children were headed by single mothers. Since the late 1970s, the figure has been about 60 percent (Ellwood and Jencks, 2004).

Not all children from broken families live with what the English call a lonely mother, but other living arrangements are lesslikely to leave children in poverty. Mothers who divorce and remarry tend to do just as well economically as mothers who remain married to the biological father of their children (Ellwood and Jencks, 2004). Single mothers who cohabit with a boyfriend also tend to have significantly more household income than those who are self-employed ones. However, it is unclear how much of the typical boyfriend's income is available to support the mother's children. And when single mothers live with their fathers or other relatives, they also face fewer problems than when they live alone.

The socioeconomic situation of single-parent families tends to worsen when they are located in socioeconomic environments with few opportunities. The comparison between the municipalities of Santo Antônio do Leverger and Campo Verde can help us to problematize the reality of women heads of families who face economic difficulties and who try to circumvent these difficulties by performing self-employment. Self-employment can be a way out in economic environments with good opportunities, but theoretically, it tends not to solve most of the financial problems of these families. Let's see what the comparison between the municipalities shows us.

Family structure is crucial in examining the implications of of low-paid or low-wage work across families. Two components related to family structure help determine a family's economic status: (1) the total income of the family and (2) the proportion of dependents who are salaried in the family. The number of family members and the age, sex, marital status, and workforce status of each member influence both of these components (Casper & King, 2004).

Casper & King (2004) understand that defining low-paying jobs can be complicated and somewhat arbitrary. The meanings and implications of a low-paying job are likely to differ depending on an individual's characteristics and circumstances. Casper & KinK (2004) suggest a comparison: a high school student might be enthusiastic about a part-time job that pays half the minimum wage, while an unemployed civil engineer who can only find a job as a math teacher at a private school that pays $500 per class would likely

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consider his new job a low wage. Family structure, the change in the composition of families over time, the age of the individual, and his attachment to the labor force affect the economic well-being of workers and their families (Casper & King, 2004).

That is the more paid adult-paid workers in the family, the more income the family is likely to have, all else is equal. In addition, the more dependent children or other non-apprentices a family has, the more people there are for support and support. Generally, men tend to earn more than women. As a result, two-parent families generally have more financial stability than single-parent families. Thus, a low-wage job means something very different in a single-mother family in which a mother has to support herself and two children than in a two-person family in which the husband has a well-paying job, and his wife supplements her income with a part-time, low-paying job (Casper & King, 2004).

In Brazil, families headed by women have been characterized as a typical urban phenomenon and single-parent families are younger, with a lower level of education than mothers in two-parent families and significantly more inserted in the informal job market (Berquó, 2001; Mendes, 2002).

Three hypotheses were formulated, inspired by sociological theory of rational choice. They seek to highlight the distinction between single-parent and two-parent families in Santo Antônio do Leverger and Campo Verde.

H1- Since single-parent mothers face more resource constraints than mothers in two-parent families (where there are usually two incomes), it can be argued that single-parent mothers tend to have lower levels of education than those in two-parent families. This hypothesis is compatible with what the sociological literature defends when comparing single- and two-parent families (Casper & King, 2004; Berquó, 2001; Mendes, 2002).

H2- We expect to find a greater diversity of self-employment activities among mothers who are heads of households in Campo Verde than among mothers who are heads of households in Santo Antônio do Leverger. This hypothesis is anchored in the socioeconomic profiles of the two municipalities and the general sociological hypothesis that argues that population growth generates social differentiation through the division of labour.

H3- Mothers from single-parent and two-parent families tend to perform simpler self-jobs in Leverger than in Campo Verde. The social situation was compatible with the concept of restrictions exposed above.

III. Methodology

To support the hypotheses formulated, secondary data from the microdata of the 2010 IBGE Census for the municipalities of Santo Antônio do Leverger and Campo Verde were used, as data from PNAD, an acronym for national household sample survey. PNAD uses a stratified sampling method, which means the country is divided into different geographical strata and households are randomly selected within each stratum to participate in the survey. This approach ensures that the sample is representative of the entire population, considering regional, urban, and rural variations. The data is collected through face-to-face and telephone interviews conducted by trained IBGE interviewers.

Unfortunately, PNAD data for 2022 are not yet available. The release of the 2022 Continuous National Household Sample Survey (Continuous PNAD) is delayed due to difficulties in collecting data for the Population Census. The delay has been explained because of the strike of IBGE employees, the national institute that conducts the surveys, changes in the structure of the system and questionnaire of the survey; and finally, of the Covid-19 pandemic.

The use of secondary census data, such as those from the IBGE, is always a good alternative for discussing family and labor market dynamics. But how to justify the use of data from 2010? Are they still valid? We have no way of knowing. We visualized the data from 2010 as part of a twenty-four-year development dynamic, starting in 2000 and would have its sequence in 2020, but the data could not be collected because of the Covid-19 pandemic. As we said, we interviewed women heads of household in the condition of self-employment in the two municipalities studied to try to circumvent the limitations of having data from 2010 as a reference.

PNAD surveys are important because they provide data from the municipalities, to which we do not have access from any other source. Without the 2022 PNAD data, we applied structured questionnaires in person in Santo Antônio do Leverger and Campo Verde. To discuss the realities of Campo Verde and Santo Antônio do Leverger in 2024, we did a small sample of interviews with women who have children and practice self-employment in both cities. The reason for working with microdata from the PNAD is that they would allow a better understanding of the structure of the two types of families to the extent that they provide sociodemographic data and data on the type of work performed by women heads of the two types of families.

The PNAD microdata comes from a sample survey that represents 10% of the Census population. To make the inference of non-biased population statistics such as totals, mean, and proportions, which are used in this work, the data are weighted by the sample weights. (Silva; Person; Lila, 2002). The data allows representation of intra-municipal areas.

As the formulation of these weights is beyond the scope of this work, it is only worth knowing that the

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estimates produced here are non-biased, given the methodology adopted by the IBGE.[1]

The PNAD shows us that 668 women are heads of households and in a situation of self-employed in Campo Verde, and 122 women in Santo Antônio do Leverger. The following variables were extracted from this sample: income, race, marital status, number of people in the household, level of education, and type of work (Table 1). In other words, we extracted from the sample variables that help us describe the socioeconomic structure of single- and two-parent families. We consider that these variables are appropriate to make a comparison between the types of families, but we recognize that other variables may prove to be important, however, theoretically, these variables are pertinent to our research design.

Table 1: Variables Used

Code	Description
v0502	Relationship with the head of the household
v0637	Has a spouse
v0601	Sex
v6036	Age
v0606	Color
v0627	If you can read
v6400	Education level
v0648	Role at work
v6461	Occupation
v6471	Activity
v6527	Monthly income
v0653	Hours worked
v6643	Total children
v6910	Occupancy condition
v5060	Number of people in the household

Source: IBGE (2019)

The microdata of the research was worked in the statistical software R. They were obtained through the open database "Database" and treated and analyzed with the tidy verse and server packages. The following criteria were used to select the data: female heads of household are all those who responded to the survey characterizing themselves as "person responsible for the household". Based on this identification, self-employed female heads of household are represented by those who are self-employed or employers, with and without CNPJ (National Registry of Legal Entities), and domestic workers without a work contract, thus complying with the conditions of self-employment, as suggested by the literature learned in the systematic review carried out on the subject by Lacerda and Souza (2020).

In the small sample of interviews (N=28) conducted between October and December 2024, 16 in Leverger and 12 in Campo Verde, it was challenging to identify the 668 women who practice self-employment in Campo Verde and the 122 who practice self-employment in Leverger.

The structured questionnaire applied is composed of three parts. The first part identified the sociodemographic profile of the interviewees. In the second part, their attitude towards entrepreneurial conduct, and finally, in the third part, questions were asked about entrepreneurial intentions.

The participants were chosen based on two criteria: (1) locations in the cities where small street vendors develop their work (fairs, street vendors...); and (2) Snowball sampling. The waitress at a café pointed out another waitress who sells clothes in her house; the clothing saleswoman indicated a woman who sells snacks, who indicated a woman who does sewing services, and so on. The questionnaire was applied at

1 IBGE. Results – 2010 Census. IBGE: Rio de Janeiro, 2021. Available at: <https://censo2010.ibge.gov.br/resultados.html>. Accessed on: 30 Jul. 2021.

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the interviewees' workplaces. A consent form has been submitted to have your consent. The interviews lasted an average of 25 minutes

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In Leverger, it is known that a portion of self-employed women are also fishermen, according to a survey we conducted in 2017 (LACERDA, 2024). Still, we could not identify those who practice other types of self-employments, as we would like. Of the 122 identified by the IBGE in 2010, we could interview 16.

In Campo Verde, the difficulty was even more significant. We interviewed self-employed women at the fairs, selling products in public parks and tiny street vendors on the city's main avenues. Of the 668 women who were self-employed in 2010, we were able to find 12 in 2024. It is more difficult to see them in Campo Verde than in Leverger, probably because Campo Verde is a larger city, and some of the women who practice self-employment carry out their tasks in places different from those that a researcher looks for when they walk the streets of the city.

IV. Findings

The data are organized according to the hypotheses.

H1- As the mother of the single-parent family deals with more resource constraints than the mother of the two-parent family (where there are usually two incomes), it can be said that the mothers of single-parent families tend to be less educated than the mothers of two-parent families. Table 2 shows data from 2010, and Table 3 shows data from 2024.

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Table 2: Comparison of the Level of Education between Campo Verde and Leverger

	Family	Condition	Education level	%
Santo Antônio do Leverger	Mono parental	Self-Employed	Uneducated and incomplete elementary school	13,4%
			Complete elementary school and incomplete high school	21,2%
		Domestic worker	Complete elementary school and incomplete high school	8,41%
	Bi parenting	Self-Employed	Uneducated and incomplete elementary school	28%
		Domestic worker	Uneducated and incomplete elementary school	19,3%
			Complete elementary school and incomplete high school	9,71%
Campo Verde	Mono parental	Self-Employed	Uneducated and Incomplete Elementary School	7,42%
			Complete elementary school and incomplete high school	3,72%
			Complete high school and incomplete higher education	7,98%
		Domestic worker	Uneducated and incomplete elementary school	8,08%
			Complete elementary school and incomplete high school	1,24%
			Complete high school and incomplete higher education	1,75%
		Employer	Uneducated and incomplete elementary school	2,29%
			Complete high school and incomplete higher education	1,62%
			Complete higher education	1,76%
	Bi parenting	Self-Employed	Uneducated and incomplete elementary school	19,3%
			Complete elementary school and incomplete high school	5,08%
			Complete high school and incomplete higher education	1,46%
			Complete Higher Education	4,46%
		Domestic worker	Uneducated and incomplete elementary school	14%
			Complete elementary school and incomplete high school	9,24%
			Complete high school and incomplete higher education	7,98%
		Employer	Complete high school and incomplete higher education	1,9%
			Complete higher education	3,7%

Source: Micro Data IBGE/2010

Table 3: Schooling of women in self-employment of single- and two-parent families in Leverger and Campo Verde in %, with N=28.

Schooling	Campo Verde		Leverger	
	Mono	Biparental	Mono	Biparental
Primary education	8,33%	16,66%	6,25%	37,5%
Middle school	33,33%	33,33%	31,25%	37,5%
Higher education	0	8,33%	0	25%

Source: Data collected by the author (2024).

H2- It is expected that a greater level of self-employment will be found among mothers who are heads of households in Campo Verde than in Leverger. Table 3 expresses the number of self-employments categorized by the IBGE, and tables 4 and 5 present the five main types of self-employment.

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Table 4: Number of Self-Employment Activities Performed by Women Heads of Household in Campo Verde and Santo Antônio do Leverger

City	Number of Activities
Campo Verde	20
Santo Antônio do Leverger	05

Source: Microdata IBGE/2010

Table 4 helps to understand the variation in the diversity of activities between Campo Verde and Leverger.

Table 5 : Main Activities Carried Out by Women Heads of Household in a Situation of Self-Employment in Campo Verde

Activity performed	%
Trade in pharmaceutical, medical, orthopedic, dental, cosmetics and perfumery products	8,8%
Hair salons and other beauty treatment activities	7,1%
Legal, accounting, and auditing activities	6,8%
Ill-defined activities	6,4%
Domestic Services	36,9%
Total	66%

Source: Micro Data Census/IBGE (2010)

Table 6: Main Activities Carried Out by Women Heads of Household in a Situation of Self-Employment in Leverger

Activity performed	%
Unspecified trading activities	26,3%
Unspecified crop	14,9%
Fishing	12,6%
Restaurants and other food and beverage service establishments	8,8%
Domestic services	37,4%
Total	100%

Source: Micro Data Census/IBGE (2010)

Table 7: Main Activities Carried out by Women Heads of Household in a Situation of Self-Employment in Leverger

Activity Performed	Percentage
Unspecified trading activities	31,25%
Fishing	31,25%
Restaurants, food and beverage services	37,5%
Total	100,00%

Source: Data collected by the author (2024).

Table 8: Main Activities Carried Out by Women Heads of Household in a Situation of Self-Employment in Campo Verde

Activity Performed	%
Hair Salons & Beauty Treatment Activities	8,33%
Domestic Services	8,33%
Restaurants, food and beverage services	25%
Trade not specified	8,33%
Unspecified crop	50%
Total	100,00%

Source: Data collected by the author (2024).

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Tables 7 and 8 show a greater diversity of activities in Campo Verde than in Leverger. Almost 70% of the activities carried out by women heads of household in Leverger are concentrated in fishing and the food business, such as selling snacks.

H3- Mothers of single-parent and two-parent families tend to perform simpler self-employment in Santo Antônio do Leverger than in Campo Verde. The social situation was compatible with the concept of restrictions exposed above. Table 9 presents the distribution in the percentage of the three main categories of the classification of types of self-employments in Campo Verde and Santo Antônio do Leverger. Table 10 shows the number of single- and two-parent families in the two municipalities.

Table 9: Percentage of Types of Self-Employments in Single and Bi-Parent Families

Types of Self-Employment	Campo Verde		Leverger	
	Mono Parental	Bi Parental	Mono Parental	Bi parenting
Own Account	49%	53,2%	80,5%	49,1%
Domestic work	33,7%	38,5%	19,5%	50,9%
Employer	17,3%	8,33%	0	0
Total	100%	100%	100%	100%

Source: Microdata Census/IBGE (2010)

Table 10: Types of Families in Campo Verde and Santo Antônio do Leverger

Family type	Campo Verde	Santo Antônio Leverger
Mono	32,8%	43,1%
Bi	67,2%	56,9%
Total	100%	100%

Source: Microdata Census/IBGE (2010)

V. Discussion of Results

Hypothesis 1 argues that mothers of single-parent families tend to deal with more resource constraints than mothers of two-parent families (where there are usually two incomes). Therefore, it can be said that mothers of single-parent families tend to be less educated than mothers of two-parent families.

There are differences between Campo Verde and Santo Antônio do Leverger, but not between the types of family, as the hypothesis maintains. Data from 2010 show that in Leverger, among single-parent families, the percentage of women with no education or with incomplete primary education was around 13.4%, while in two-parent families this number reached 47.3%. Among women with complete primary education and incomplete secondary education, the percentage is 29.61% for women from single-parent families versus 9.71% for two-parent families. The data we collected in 2024 shows that 25% of female heads of households have higher education. This data can be seen as non-representative in a sample that is not representative. But it has an explanation. Most of these women with higher education were high school teachers or civil servants who live in Cuiabá but are market stallholders in Leverger on Saturday mornings.

In Campo Verde, 17,79% of women in single-parent families have no formal education or have not complete elementary school, compared to 33.3% in two-parent families. Among those with complete primary and incomplete high school, the percentage is 4.96% for women from single-parent families against 14.32% for two-parent families. In other words, we have an inverse situation of what the hypothesis defends. Why does this happen? One hypothesis to be investigated may be related to restrictions imposed by husbands, still, as the situation contradicts the hypothesis in both Leverger and Campo Verde, it may also be related to taking care of children.

We present some points that may help to explain the inconsistency between what hypothesis 1 defends and the data found for the fact that women heads of single-parent households are more educated than those of two-parent families: (1) since 2000 the IBGE has expanded the concept of family. Concerning the two-parent family, this may have included situations that the theory did not consider when comparing family types. The IBGE now considers the consensual union, an arrangement that it did not consider before 2000. It is a family structure, today larger than religious and civil marriages in which two people live together but are not married. This may be generating in the aggregate data a composition that did not exist before under the name of two-parent families; (2) the sociology and economics of the family have shown that the schooling of women reduces their dependence on their husbands. In two-parent families, we may have resistance from husbands to their wives' investment in schooling, (3) single-parent families are fundamentally urban, unlike two-parent

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families that are found proportionally in greater numbers in rural areas. Educational training opportunities are more available in urban areas, especially in small municipalities.

To the small sample we interviewed, is important to emphasize that women heads of households who live in settlements close to the city may be overrepresented. And, therefore, their profiles with low education gain prominence.

To hypothesis 2, the data show a large difference between Leverger and Campo Verde. The IBGE identified five categories of self-employment activities in Leverger, compared to 20 in Campo Verde. The presence of rural occupations with a high percentage of members, such as fishermen and farming is noteworthy.

As we mentioned earlier, in Leverger, the presence of women in the artisanal fishing business is strong. The president of the Leverger fishermen's colony, which has 450 members, is a woman.

For hypothesis 3, we do not have data for single- and two-parent families about all the activities developed, but the three typologies of the IBGE show that only in Campo Verde do we have women heads of household in the condition of the employer.

Another situation to be considered is that low-income female heads of households tend to have more than one occupation. For example, a woman interviewed gets up at 2 am to sell fish bait to sport fishermen heading to her fishing grounds. At lunchtime, she goes home and later works as a waitress in a restaurant.

Table 11: Have another occupation? % of Yes

Leverger		Campo Verde	
Single-parent	Bi parenting	Single-parent	Bi parenting
31,25%	31,25%	50%	33,33%

Source: Data collected by the author (2024).

Regarding having or not having another occupation, we found no difference in the city of Leverger, comparing single-parent and two-parent families in our 2024 sample. More than 30% of mothers have another occupation. Many women are fishermen, so their other occupations must match the fishing calendar.

In Campo Verde, 50% of mothers from single-parent families have more than one occupation. Theoretically, this is expected. Generally, women heads of single-parent households tend to have a lower income than women of two-parent families. Therefore, it looks for other economic activities to improve its situation. Some women heads of single-parent families we interviewed sell vegetables at the market and sell cosmetics and clothes at home.

The reality that emerges from the data collected in 2024 is not representative of women who practice self-employment in Santo Antônio do Leverger and Campo Verde. This research is another exploration of the 2010 PNAD data. The inconsistency of hypothesis 1 with the data from PNAD 2010 and data collected in 2024 can help us to better understand the implications of the conceptual changes that the IBGE has made and, perhaps, present situations that deserve more rigorous investigations.

VI. Final Thoughts

The increase in the number of single-parent families in Brazil has intensified a series of social problems that represent significant challenges in terms of public policies. It can be said that concern with the schooling of children and their mothers are important indicators for thinking about improving the living conditions of these families.

The comparison between cities like Campo Verde and Santo Antônio do Leverger is relevant because it highlights the contrasts between two distinct economic realities in the state of Mato Grosso: the traditional economy, based on livestock and trade, and agribusiness. It then allows us to investigate the types of self-employments created in these two types of economies. An empirical investigation is needed to delve deeper into the reality of the two cities.

Two main findings emerge from our data. Firstly, further investigation is needed to understand why, contrary to what scholars suggest, women heads of single-parent families have higher levels of education compared to two-parent families, according to data from 2010. Does this persist? Are theoretical adjustments needed or does this have to do with the reality of the two municipalities investigated?

Can be said that, as women's participation in the labor market increases, the type of self-employment developed by female heads of families tends to vary between more or less industrialized cities. What types of self-employment opportunities have been fostered by Agribusiness? Are they primarily linked to the development of new technologies? If women heads of households who are potentially self-employed do not have the required schooling, do they tend to be left out of this environment of opportunities? Here are some questions that data analysis provides for us.

Unfortunately, independent microdata from CENSO/IBGE (2022) are unavailable. They would allow for more accurate mapping. New investigations can help us answer some of these questions.

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Startup Incubation Performance towards a New Conceptualization: Systematic Literature Review

By Elbahjaoui Maryam & Elabjani Abdelaziz

Abstract- The first postulate of this research is that there is ambiguity in the literature about incubation performance, which this systematic review aims to clarify. This idea is crucial for addressing theoretical gaps about the precise concept of incubation performance as well as for the resilience of the incubated startup. In order to determine the essential variables that most significantly influence this performance and help incubated startups become more resilient, we intend to analyze the incubation performance of the two actors involved (the incubator and the incubatee), specifically in terms of the incubation relationship.

Keywords: *Incubation performance, resilience, incubated startup, incubation network.*

GJMBR-A Classification: *JEL: L26*



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Startup Incubation Performance towards a New Conceptualization: Systematic Literature Review

Revue De Littérature Systématique Sur La Performance D'incubation Des Startups Vers Une Nouvelle Conceptualisation

Elbahjaoui Maryam [α] & Elabjani Abdelaziz [σ]

Abstract- The first postulate of this research is that there is ambiguity in the literature about incubation performance, which this systematic review aims to clarify. This idea is crucial for addressing theoretical gaps about the precise concept of incubation performance as well as for the resilience of the incubated startup. In order to determine the essential variables that most significantly influence this performance and help incubated startups become more resilient, we intend to analyze the incubation performance of the two actors involved (the incubator and the incubatee), specifically in terms of the incubation relationship.

Keywords: *Incubation performance, resilience, incubated startup, incubation network.*

Résumé- Cette revue systématique tente de lever l'ambiguïté que connait la littérature sur la performance d'incubation, comme premier postulat de l'objet de ce papier, décisif dans la résilience de la startup incubée, d'une part, et dans les lacunes de la théorie à préciser le type de performance de l'incubation, d'autre part. Nous visons à analyser la performance d'incubation des deux acteurs (incubateur et incubé), donc en termes de la relation d'incubation afin d'en tirer les variables les plus déterminante de cette performance d'incubation et qui contribuent à consolider la résilience des startups incubées.

Motsclefs: *performance d'incubation, résilience, startup incubée, réseau d'incubation.*

I. Introduction

La question de la performance d'incubation des startups a été peu abordée dans les recherches en sciences de gestion, et mal traitée avec différentes voies singulières des auteurs soit la performance des incubateurs ou celle des incubées. Alors que l'intérêt de ce travail est de détecter les fossés théoriques sur la performance d'incubation des deux acteurs (incubateur et incubé) à partir d'une revue de littérature systématique, avant de traiter le phénomène dans sa globalité, afin d'en tirer les variables les plus déterminantes de performance d'incubation d'une part, et les plus contributives à la résilience des incubées d'autre part. L'objet de ce travail s'articule autour de la résilience de la startup incubée par une série de variable les plus déterminante de la performance d'incubation, qui ne seront plus occultées grâce à ce travail d'où la nécessité de cette revue systématique vers un renouveau du concept de performance d'incubation.

La conceptualisation de la performance d'incubation que nous visons traiter dans ce papier à partir d'une revue systématique a pour une tentative d'enlever l'ambiguïté de ce terme, de répondre au vide que connait la littérature sur la performance d'incubation comme étant le fondement de l'objet de ce travail décisif vers la résilience de la startup incubée d'une part, et aux lacunes théoriques à préciser quel type de performance d'incubation d'autre part. Il est évident que la question sur la performance d'incubation a été évoquée souvent et uniquement sur l'étude de l'incubateur comme acteur principal d'accompagnement, en termes de ses meilleures pratiques d'incubation, de la qualité de son offre d'accompagnement, de sa stratégie etc. En outre, dans cette étude nous visons à analyser la performance d'incubation y inclut aussi celle de l'incubé en terme de sa motivation entrepreneuriale, de son degré d'engagement, de son niveau d'étude sur son projet, de son savoir et de son expertise sur son domaine Donc en terme de la relation d'incubation afin d'en tirer la variable la plus déterminante de cette performance, et qui contribue positivement et directement à la résilience des startups incubées. Nous tenterons donc de générer l'originalité de notre travail à partir de cette complexité vers un renouveau de ce concept de performance d'incubation sous l'aide d'une revue de littérature systématique qui s'est bien évidement composée de deux principaux axes:

- Méthode et Méthodologie de la RLS.
- Présentation et discussion des résultats.

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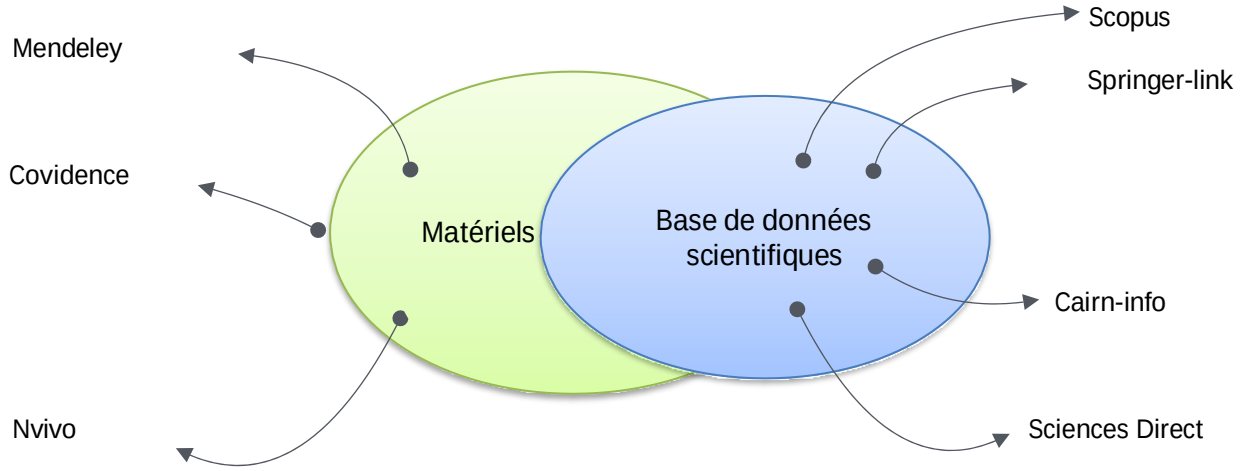
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II. Méthode Et Méthodologie De La RLS

L'objectif de cette étude systématique est d'identifier et de synthétiser les facteurs de performance d'incubation, nécessaires à la résilience des startups incubées, à travers une revue de littérature systématique, en appliquant la méthode PRISMA-P (PRISMA Statement Preferred Reporting Items for Systematic Reviews and Meta-Analyses), basée sur un ensemble de critères de sélection pour la rétention d'articles répondant le plus à notre objectif et étant les plus pertinents pour notre analyse.

a) *Méthode Et Matériel*

Les Bases De Données Électroniques Suivantes: (Scopus, Science-Direct, Springer-Link et Cairn.info) ont été systématiquement interrogés pour identifier les articles publiés entre 2011 et 2021 examinant les facteurs explicatifs de performance d'incubation, et influençant la résilience des startups incubées. Nos principaux efforts ont porté sur la réponse à la question d'ambiguïté du fondement de l'objet de ce papier. La figure suivante présente un aperçu des techniques que nous avons utilisées pour entamer la méthodologie de Prisma Statement.



Source: Auteur.

Figure 1: Matériels Et Base De Données

b) *Méthodologie de Prisma Statement*

Nous constatons la nécessité d'entamer une revue systématique, afin de recenser et d'examiner les travaux de recherche qui traitent les facteurs de performance d'incubation, afin de combler le gap existant entre la performance de l'incubateur et celle de l'incubé peu traitée dans les recherches précédentes, à l'aide de plusieurs critères d'évaluation de la performance et du succès, aboutissant, certainement, à la résilience des startups incubées. Afin d'élargir notre recherche, nous suivrons le protocole de recherche PRISMA Statement, sous les étapes suivantes.

Phase d'identification: la chaine de recherche est basée sur un ensemble de mots clés tout en respectant les paramètres de recherché and/or:

CR1: (Incubation and performance).

CR2: (Incubator or incubated and performance).

CR3: (Startup and incubated and resilience).

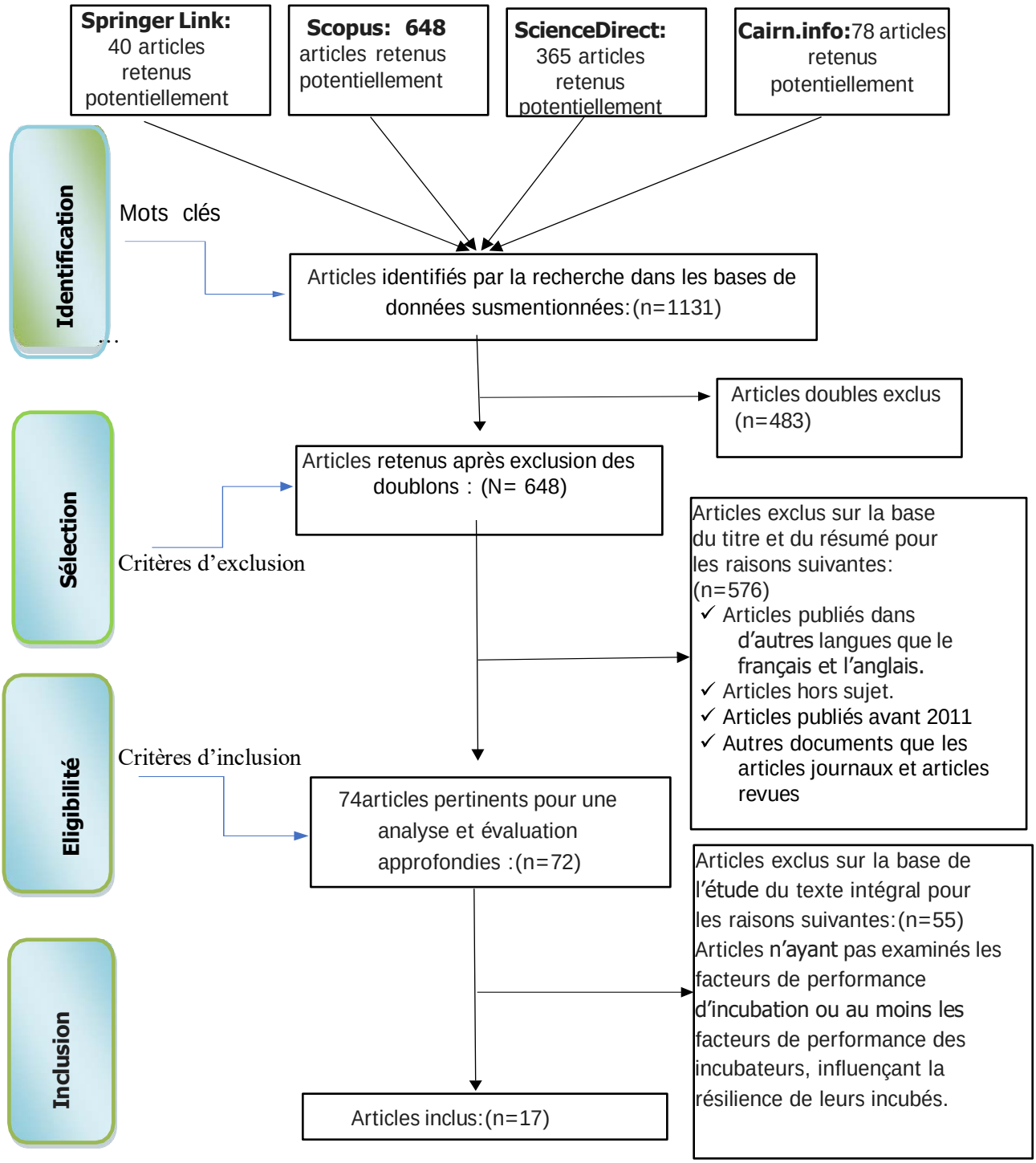
CR4: (Efficacité des incubateurs).

CR5: (La performance d'incubation perçue par les incubés). Phase de sélection d'articles: une série de critères d'inclusion et d'exclusion ont été appliqués pour sélectionner les articles à inclure dans notre analyse. Un article sera inclus s'il répond à tous les critères suivants:

1. L'article doit examiner les facteurs explicatifs de la performance d'incubation.
2. L'article doit être publié entre 2011 et 2021.
3. La disponibilité du texte intégral de l'article.
4. Articles de journaux et articles de revues.

En appliquant la méthode PRISMA à l'aide du logiciel en ligne Covidence; les articles en double et/ou ceux qui ont été publiés dans d'autres langues que le français et l'anglais ont été exclus, ainsi que les articles hors sujet. Le schéma suivant représente un processus de sélection dès la soumission de tous les articles sur Covidence pour extraire ceux les plus pertinents:

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Source: Covidence modifié par l'auteur

Figure 2: Processus De Sélection D'articles

III. Présentation Et Discussion Des Résultats

Après la sélection des articles à l'aide du logiciel « Covidence », nous avons pu extraire 17 articles pertinents susceptibles de répondre à notre objectif, tout en présentant et analysant l'ensemble des résultats de cette étude, afin d'en extraire la variable la plus déterminante de la performance d'incubation.

a) Présentation Desrésultats

Le tableau suivant résume les principaux résultats des 17 articles sélectionnés et les principaux facteurs de performance d'incubation influençant la résilience des startups incubées. Les résultats de cette revue systématique ont montré que la résilience des startups incubées est influencée par une variété de

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facteurs explicatifs de performance d'incubateurs/ d'incubés.

Ceux-ci comprennent des facteurs liés aux catégories suivantes: 1) apprentissage innovation, 2) processus d'incubation, et 3) stratégie de réseautage.

Il est à noter qu'aucun de ces travaux n'a été spécialement réalisé sur les facteurs clés de succès des incubés ou des incubateurs. Toutes ces études se concentrent sur le phénomène de l'incubation en général, sauf le travail de Xiao & North (2017) qui met l'accent sur la performance des startups incubées, et les travaux de Cheng & Schaeffer (2011) portant sur la performance des incubateurs. D'où la nécessité de combiner entre la performance des deux acteurs afin de pallier les failles existantes dans la littérature sur la performance d'incubation (incubateur/incubé), et d'en tirer la variable la plus déterminante de cette performance sur laquelle cette revue se réalise, pour donner une clarté conceptuelle à l'objet de cette étude et, plus spécifiquement, pour s'orienter vers un renouveau de ce concept de performance d'incubation.

Tableau 1: Présentation Des Résultats

Auteurs/ références	Titre	Sample size	Méthodologie	Résultats	facteurs explicatifs de performance d'incubation influençant la résilience des incubées
Cheng & Schaeffer, (2011) 1	Evaluation without bias: a methodological perspective on performance measures For business incubators	24 incubateurs et 67 start-ups incubées	Démarche qualitative: a relevé que les mesures existantes ont certainement des biais inhérents qui les conduisent à sous-estimer le rôle des incubateurs, dont les recherches actuelles continuent de souffrir de limitations empiriques ainsi que méthodologique. Or, cette démarche à aider le lecteur de comprendre qu'il faut savoir les difficultés rencontrées par les incubateurs avant d'entamer l'évaluation de leur performance.	Les résultats démontrent que le nombre d'entreprise incubées détermine fortement la performance d'un incubateur, ce facteur est impacté indirectement par un autre facteur(le type de sélection); la moitié des incubateurs sélectionnent aléatoirement les projets ce qui rend leur image défavorisée dès l'échec de l'entreprise incubée en cause de plusieurs raisons y compris la sélection aléatoire dès le début de processus	Sélection= affectation non aléatoire Ressources partagées Services fournis
C. Bakkali et al., (2013) 2	Pour un outil de mesure et de pilotage de la performance des Incubateurs.	109 incubateurs et 21 acteurs-experts de d'incubation y compris 21 incubées	Une étude hybride: 1ère phase exploratoire : entretien semi-directif auprès des experts; incubateurs, réseaux d'incubateurs, et financeurs. 2ème phase confirmatoire: Un questionnaire fermé a été administré à 109 incubateurs.	cette étude a permis la validation d'un outil de pilotage de la performance des incubateurs fondé sur le modèle du balanced scorecard sous 4 axes :1axe financier :degré de satisfaction des parties prenantes./2 axe client : la relation d'incubation/ 3axe processus d'incubation : appréciation des différentes phases de processus d'incubation/ 3axe apprentissage-innovation : le niveau d'apprentissage et d'innovation de l'incubé au sein de l'incubateur.	Taux de pérennité des entreprises créées/ attrait des services proposés/relation d'incubation/image d'incubateur/gestion d'incubation/innovation/CRM des incubées/capital humain/capital relationnel/capital organisationnel
Julien Cusin, (2013) 3	The role of the tutor in the resilience of the post bankruptcy Entrepreneur: the case of the 60.000 rebonds Association	15 interviewés	Etude de cas unique: cas d'une association à but non lucratif 60000 Rebonds en France qui offre un soutien aux entrepreneurs en difficulté lorsqu'ils étaient incapables de rebondir par eux-mêmes et ont donc cherché un soutien extérieur. La collectes des donnés était multivarié (documentation, entretiens, observation…), suivi par un codage en seconde ordre de	Les résultats montrent que le processus de résilience de l'entrepreneur spécifiquement en post-faillite est lié non seulement aux interactions entre l'entrepreneur et son accompagnateur, mais aussi aux interactions entre l'association dans ce cas et son environnement (à travers une boucle de rétroaction positive pour l'entrepreneur),	Interrelationnel Résilience Capacité cognitive et émotionnelle Capital relationnel Confiance partagée

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			thèmes dans le but est de reproduire fidèlement le discours des répondants.	ce qui explique le rôle de réseaux dans la résilience de l'entrepreneur.	Capacité entrepreneuriale
Vanders traeten et al., (2016) 4	Being flexible through customization -The impact of incubator focus and customization strategies on incubateesurvival and growth	166 incubateurs	Une étude quantitative: Questionnaires administrés auprès de 166 incubateurs brésiliens fondé sur 3 élémentsessentiels au traitement des données: Survie et croissance de l'incubé. Personnalisation du service. Focus sur l'industrie.	Les résultats ont émis que la survie et la croissance des incubées dépendent largement du degré de personnalisation des services : L'efficacité de l'orientation industrielle d'incubateur implique que les incubateurs (spécialisé/diversifiés) peuvent atteindre un avantage concurrentiel au niveau d'amélioration des services de l'offre, et par la suite l'amélioration la performance de leurs incubées. L'effet positif des activités de réseautage sur la performance des start-ups incubées.	réseau de l'organisation efficacité des incubateurs personnalisation de services hétérogénéité de besoins survie croissance taille l'âge
Iacono & Nagano , (2017) 5	Post-incubation of technology-based firms: a case study on the effects of business incubator son growth patterns	5 incubés et 2 incubateurs	Etude exploratoire (méthode des cas multiples) a été menée auprès de 5 entreprises technologiques appartenant à deux incubateurs liés à l'université Estadual Campinas	Les résultats montrent que les entreprises étudiées étaient sur le marché depuis 5ans, dont une depuis 3ans : avaient adopté la différenciation des produits comme stratégie de développement ainsi qu'une a fusionné avec une société étrangère après 3 ans d'incubation, la performance technologique de ces entreprises est justifiée par un ensemble de variables juxtaposées par le soutien de l'incubateur.	Croissance en post-incubation Système de soutien innovation Compétence de l'incubateur Capital relationnel
Van Rijnsoever et al., (2017) 6	Network brokers or hit makers? Analyzing the influence of incubation on start-up investments	935 entrepreneurs technologiques	Enquête unique : les données ont été collectées via un panel en ligne business-to-business d'une grande agence de marketing européenne s'appuyant sur un échantillonnage par quotas, avec des quotas fixés par pays. La sélection des répondants s'est faite selon un ensemble de critères pour inclure seulement les fondateurs des start ups technologiques installés depuis deux ans, analyse des données est ajusté à travers une série de modèles ordinaux et binaires suivant 3 regroupent: taille d'investissement, incubation, et sources de financement.	Les incubateurs ont un effet positif sur le montant du financement que les start-ups attirent, et les capacités des start-ups à attirer le financement des investisseurs formels et des banques. De plus, les résultats ont réussi à prouver que la performance des incubés dépend en grande partie du mécanisme de Network broker et non en tant que mécanisme de faiseur de succès.	Transfert de connaissances Le succès Network broker= (courtier en réseau=incubateur) Taille d'investissement Taille de l'équipe entrepreneurial Expérience entrepreneuriale Expérience dans le secteur Genre/âge Effet d'interaction Capital relationnel

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Xiao & North, (2017) 7	The graduation performance of technology business incubators in China's three tier cities: the role of incubator funding, technical support, and entrepreneurial mentoring	46 TBI privées (technology business incubators) et 19 TBI universitaires	Enquete quantitative basé l'analyse factorielle et la classification des trois villes chinoises selon le calcul de PIB par habitant dans chaque ville pour savoir le degré de concentration de chaque ville sur le soutien aux entreprises plutôt que le nombre de création.	Les résultats soutiennent l'idée que l'efficacité des services d'un incubateur est façonnée par le niveau de développement socio-économique d'une ville et que l'emplacement de la ville d'un techology business incubator a un impact sur la performance de ses incubés en matière de graduation.	Financement d'incubateur Soutien technique Mentorat entrepreneurial Environnement commercial propice aux start-ups technologiques.
Ahmad & Thornberry, (2018) 8	On the structure of business incubators: de-couplingissues and the mis-alignment of managerial incentives	11 incubateurs et 57 incubées	L'étude de cas instrumentale pour la compréhension d'un phénomène particulier où l'accent sera mis sur la structure interne plutôt que l'étude de cas. Compte tenu de l'objectif est de mettre une investigation approfondie de situations particulière et réelles.	Les résultats mettent en lumière le rôle et la capacité des organisation hybrides (incubateurs universitaires) à maintenir et à reproduire efficacement leurs structures dans une grande variété de contextes ce qui détermine leur performance à travers un ensemble de variables marqué par une innovation institutionnalisée.	Mise en réseau et Coopération/connaissance Services/Diversification. Apprentissage/Expérience Gestion d'incubateur/ Efficacité des styles de leadership/ Ressourcespartagées/Relations hiérarchiques/Capital relationnel
Rakthai et al., (2019) 9	Innovative Capacity and the Performance of Businesses Incubated in University Incubator Units: Empirical Study from Universities in Thailand	220 entreprises in cubées	A l'aide de SPSS et une étude quantitative a été mené auprès 220 entreprises utilisant un modèle des équations structurelles pour tester la relation de chaque facteur étudié.	Les résultats ont révélé que les variables explicatives de performance d'incubation universitaires entretiennent des relations étroitement liées entre eux (forte dépendance)	Leadership Orientation entrepreneuriale. Réseau Capacité d'innovation Capital relationnel
Blair et al., (2020) 10	Role of accelerators in innovationecosystems: The case of New Zealand	9 participants: accélérateurs, incubateurs, et mentors	Une étude qualitative exploratoire a été menée basée sur un entretien semi-directif avec des mentors de l'industrie des incubateurs, des participants et des cadres d'accélérateurs. Des données secondaires ont été collectées à partir des présentations sur Youtub, de rapports de consultants et de rapports internes.	La performance de l'industrie des incubateurs et des accélérateurs en particulier réside dans la performance des incubées : la performance des accélérateurs est évaluée par le succès des entreprises après 5ans du programme d'accélération qui donnerait une bonne image au succès des accélérateurs.	Orientation entrepreneuriale Expérience commerciale et technique/Réseaux Capacités entrepreneuriales Formation/Environnement Taux de rendement Apprentissage

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Gozali et al., (2020) 11	Performance Factors for Successful Business Incubators in Indonesian Public Universities	95 gestionnaires d'incubateurs de 19 universités	Etude quantitative : sur la base de diverses analyses documentaires, le questionnaire d'enquête a été construit et développé en un questionnaire consolidé composés de différentes échelles de mesure et de question, chaque facteur de réussite connexe a été mesuré à l'aide de l'échelle de Likert de 1 à 5 qui a été intégré au questionnaire, et les répondants ont été invités à indiquer l'importance des facteurs par rapport aux autres.	Les résultats démontrent que la technologie de l'information en tant que partie des capacités d'un incubateur soutient partiellement leur performance et que les critères d'entrée soutiennent directement la performance. Le réseau de mentorat et le financement soutiennent la performance des incubateurs avec de bons systèmes d'infrastructure comme facteur modérateur.	Technologie de l'information Le réseau de mentorat Le financement Bon système d'infrastructure Apprentissage Gestion relationnelle Qualité des installations
Messeghem, (2020) 12	La performance des incubateurs: proposition et validation d'un modèle de mesure multidimensionnel	209 incubateurs	À partir d'une étude quantitative, fondée sur un questionnaire en ligne auprès 209 incubateurs	Les résultats montrent la validation de 12 dimensions et 35 indicateurs de performance d'incubateurs.	nombre d'emploi des entreprises créées/CA réalisé/nombre de projets incubés/ relation d'incubationnotoriété de l'incubateur/attrait de svc proposés/ subventions/taux de satisfaction des incubés/ accès aux réseaux
Cánovas-Saiz et al., (2020) 13	New evidence on accelerator performance based on funding and location	116 accélérateurs et 619 start-up accélérées	1ère étude inductive de cas multiples sur la façon dont les programmes d'accélération influencent la capacité des nouvelles entreprises à survivre et à se développer. 2ème étude quantitative sur l'évaluation de performance des incubateurs perçu par 619 start-ups américaines basée sur 2 tops accélérateurs.	L'analyse qualitative a suscité beaucoup d'intérêt sur la contribution des accélérateurs dans la création d'emploi par la mise en relation des start-up accélérées avec des investisseurs potentiels pour se lancer en affaire, quant aux résultats quantitatifs: la performance des accélérateurs a un effet positif sur lesrésultats des start-ups accélérées.	L'âge/La rentabilité/ Localisation/Création d'emploi par l'entreprise hébergée/ Investissement Formation solide/Services partagés/ Mise en relation avec les investisseurs/Survie de start-up incubée/ Novel learning
Muslim Saraire, (2021) 14	The Role of Business Incubators in the Economic Development and Creativity in Jordanian Universities: Evidence from Mutah University	208 étudiants-entrepreneurs	Un échantillon aléatoire de 208 étudiants : un questionnaire qui examinait 4 dimensions ont été utilisé pour collecter les données.	Les résultats ont montré que la dimension formation et conseil étaient les plus importantes que les autres dimensions.	Formation Conseil Soutien technique Soutien financier
Sullivan et al., (2021) 15	With a little help from my friends? How learning activities and network ties impact performance for high tech startups in incubators	97 incubateurs technologiques Et 15 entrepreneurs incubées	Une enquête pilote qui comprenait 15 entrepreneurs et 97 incubateurs.	Les résultats constatent que les activités d'apprentissage par domaine (financier, du client…) sont liées aux résultats clés de performance.	Liens forts et faibles Croissance des employés Activités d'apprentissage

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					Lien de confiance Environnement Chance de survie Capital relationnel
Sun & Cheng, (2021) 16	Sustainable efficiency evaluation of regional state-level technology businessincubating service systems in China: A dynamictwo-stageslacks-based measure approach	17 entreprises technologiques incubées	Etude qualitative ; basée sur un entretien semi-directif avec les entrepreneurs incubés. Le guide d'entretien s'est composé sous forme de deux principaux axes : axe1 : Investment attraction stage. Axe 2: incubation stage	Les résultats montrent que la négligence de l'effet dynamique du facteur de report typique peut conduire à la sous-estimation de l'efficience durable des systèmes de services d'incubation ainsi que l'efficience du processus d'incubation. Cependant, le capital humain favorise l'amélioration des efficiences où le soutien gouvernemental et le progrès technologique contribuent d'une manière significative à l'attraction des investissements, tandis que l'investissement a un effet direct sur la performance d'incubation.	Attraction des investissements Le report (nombre des entreprises en incubation) Efficience Durabilité de services Fonds d'incubation Personnel d'encadrement
(Vedel, 2021) 17	Création d'emplois ou création de connaissances, quelle mesure de performance pour l'incubateur ? L'influence des caractéristiques des projets sélectionnés dans le processus d'incubation.	177 entreprises hébergées dans 64 des incubateurs publics	Etude quantitative : test du modèle et des hypothèses à travers les régressions linéaires multiple sur l'échantillon.	Les résultats montrent que la performance des incubateurs peut être évaluée en termes de sélection issue du modèle de (Vedel et Gabarret 2013), et en termes d'expérience, de services fournis, de relationnel, d'environnement issues du modèle (Vedel, Stephany 2010).	*lasélection *lerelationnel *l'environnement

b) Discussion Desrésultats

Au total 17 articles répondaient aux facteurs explicatifs de la performance d'incubation, 27 facteurs issus de la première catégorie d'apprentissage-innovation (taille, âge, transferts de connaissances etc.), 19 facteurs du processus d'incubation, dès la sélection jusqu'à une sortie réussie d'incubation, et 30 facteurs des réseaux sociaux d'incubation (capital relationnel, réseaux, interactivité, interrelationnel…).

Les articles examinés nous offrent une perception interconnectée entre plusieurs auteurs dans un univers enrichissant de connaissances, sur la mesure et l'évaluation globale de la performance d'incubation à travers une variété de facteurs qui sont à la fois hétérogènes, interdépendants et communs entre les auteurs. La méthodologie appliquée dans les 17 articles examinés est résumée dans les tableaux 2 et 3, à travers lesquels on constate que 8 articles ont rapporté des études utilisant une méthodologie quantitative avec des enquêtes et 9 articles ont opté pour une méthodologie qualitative. Néanmoins, nous rappelons que notre objectif, dans cette étude, n'est pas de détecter la fréquence de la méthodologie adoptée dans chaque étude dont la démarche dépend toujours de l'objet, ainsi que de la perception subjective du chercheur. Nous nous intéresserons plutôt, dans cette étude, à la mesure théorique du concept.

Les résultats de cette revue systématique ont montré que la performance d'incubation est influencée par une variété de facteurs liés aux catégories suivantes: apprentissage-innovation, processus d'incubation et stratégie de réseautage, comme le montre le tableau 8 ci-dessous:

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Tableau 2: Fréquences Des Facteurs De Performance D'incubation

Catégories	Facteurs	Références	Nombre de références par catégorie	Nombre de références par facteur
Apprentissage-innovation	Taille	4; 6	27	2
	Age	4; 6; 13		3
	Expérience	6; 8; 10		3
	Capacité cognitive et émotionnelle	3		1
	Capital humain	2		1
	Capital organisationnel	2		1
	Ressources partagées	1; 8		2
	Transfert de connaissance	2; 6; 8		3
	Innovation	2; 5; 9		3
	Capacités entrepreneuriales	3; 10		2
	Novel learning	13		1
	Technologie de l'information	11		1
	Leadership	8		1
	Report	12; 16		2
	Satisfaction	12		1
Processus d'incubation	Sélection	1; 17	19	2
	Services fournis	1; 2; 8; 16		4
	Personnalisation de services	4; 13		2
	Hétérogénéité de besoins	4		1
	Soutien financier	14		1
	Soutien technique	7, 14		2
	Mentoring	7; 11		2
	Diversification	8		1
	Formation	10; 13; 14		3
	Qualité des installations	11		1
Stratégie de réseautage	Relation d'incubation	2	30	1
	Réseau de l'organisation	4; 9; 10; 11; 12; 13;		7
	CRM des incubés	17		1
	Network broker	2		1
	Capital relationnel	6		7
	Interrelationnel	2; 3; 5; 6; 8; 9; 15		1
	Confiance partagée	3		2
	Taille d'investissement	3; 15		3
	Relation hiérarchique	6; 13; 16		1
	Effet d'interaction	8		1
	Gestion relationnelle	6		2
	Coopération	2; 11		1
	Subventions	8		1
	Liens forts et faibles	12		1
		15		

Source: l'auteur.

Les déterminants issus de la troisième catégorie « *stratégie de réseautage* » sont les plus fréquemment cités. La confiance partagée et les réseaux d'incubation étant les principaux facteurs explicatifs de la performance d'incubation, ce résultat est conforme à d'autres résultats empiriques comme ceux de: Carayannis & Alexander (1999), Stam et al. (2014), Spigel (2017), Eveleens et al. (2017). L'influence du processus d'incubation est moins importante que celle des facteurs liés aux stratégies de réseautage. Dans ce sens, l'examen de cette étude a montré que la construction-gestion de la mise en relation avec la dynamique d'apprentissage entrepreneuriale permet l'évaluation de la performance d'incubation perçue par les startups incubées. Ce résultat est cohérent avec d'autres résultats empiriques de: Hackett & Dilts, (2004), Feld (2012), Rakthai et al. (2019). Donc l'influence des facteurs d'apprentissage innovation, et du processus est moins importante que les facteurs relationnels car les incubateurs jouent un rôle crucial, vu qu'ils constituent le pont entre leurs startups incubées et l'environnement externe en créant différentes relations avec les acteurs de l'écosystème entrepreneurial.

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IV. Analyse Critique Vers Un Modèle Conceptuel De L'objet De Revue Systématique

Il est évident que la question de la performance d'incubation a été abordée, mais sous un seul angle, celui de la mesure de la performance des incubateurs, qui fait l'objet d'un intense débat dans la littérature, sans mettre le point sur la performance des startups incubées, vu que la performance d'un incubateur réside dans le succès et la performance de son incubé. Plus récemment, la plupart des chercheurs utilisent la survie et la croissance des incubés comme indicateurs de la performance des objectifs de l'incubateur tels que: Vanderstraeten et al. (2016); (Hackett (2002) qui assimilent le succès des startups incubées au succès des incubateurs. Ce lien est occulté dans la mesure où le but des incubateurs n'est pas de maintenir un stade de vie continu aux startups en difficulté, même si la raison d'être des incubateurs est pour soutenir le développement et la croissance des entreprises. D'après la présentation des résultats susmentionnés, nous avons tiré un raisonnement similaire de Hackett (2002) en ce qui concerne la survie des startups incubés qui subissent un processus de développement à travers l'incubateur. Ce qui nous amène à centrer notre réflexion sur l'intérêt des recherches futures qui devraient porter sur l'évaluation de la performance des incubateurs, suite aux étapes de développement des startups incubées, aspect qui a été assez peu abordé dans les recherche précédentes, et dans la perspective duquel s'inscrit l'intérêt de cette revue pour faire apparaitre ce lien occulté dans une approche axée sur les réseaux sociaux (interrelationnel), reconnaissant qu'un incubateur fait partie de l'écosystème entrepreneurial, et que la performance de l'incubateur se répercutera sur le degré de succès et de performance de son incubé. Compte tenu du nombre accru d'incubateurs, il n'est pas surprenant que les recherches accordent plus d'attention au positionnement stratégique d'un incubateur.

Le positionnement stratégique est conditionné par le type d'incubation d'un incubateur (forte intervention ou laisser-faire), marquée par le degré de l'importance stratégique de la relation entre l'incubateur et l'incubé: Grimaldi and Grandi (2005) « ont fait la distinction entre deux types majeurs pour mieux positionner l'incubateur: un incubateur public et un incubateur privé (indépendant)[1] ». Vanderstraeten et al. (2016). Selon ces auteurs, l'une des caractéristiques distinctives de ces deux modèles est le niveau d'implication, et d'engagement dans les activités de l'entreprise. La littérature suggère que les incubateurs privés investissent leur propre argent, et donc ils sont étroitement impliqués dans les activités opérationnelles quotidiennes des startups incubées, et leur offrent un soutien personnalisé (forte intervention). En revanche, les incubateurs publics agissent davantage comme des intermédiaires, mettant en relation les experts externes et les incubés dans une attitude de laisser-faire. On constate que la littérature a entamé juste une seule option de ce positionnement stratégique d'incubation qui traite uniquement la relation entre l'incubateur et l'incubé, sans s'appuyer sur les détails de l'autre option qui est, par défaut, occultée et intégrée dans la première « relation d'incubation » et qui détermine le succès de l'incubé, à savoir d'opter pour différentes formes du processus de coproduction/personnalisation des services vers un mode de vie d'entreprise continu, non seulement spécialiste sur un type de projet précis, mais pour être multidisciplinaire dans un climat social interconnecté avec le monde des affaires, flexible à maintenir un service divers d'accompagnement, et capable de personnaliser le service selon le besoin du client. L'efficacité de la personnalisation des services nécessite de déterminer la pratique ou, au moins, le moyen le plus efficace pour atteindre un certain objectif. Pour le faire, il faudrait une certaine mise en relation entre les meilleures pratiques d'incubation avec des indicateurs de résultats pertinents, ce qui peut, par la suite, soit aboutir à l'identification d'une seule meilleure pratique d'incubation, soit de plusieurs pratiques tout aussi efficaces. Dans cette optique, il faut s'interroger sur le rôle de la personnalisation des services face à l'hétérogénéité des besoins dans la survie et la croissance des incubés, comme indice d'évaluation de la performance des incubateurs en termes de pratiques, de stratégie, de service etc., et donc de tout le phénomène d'incubation. La personnalisation du service demande certainement une interaction réciproque entre le client (l'incubé), et le prestataire de service (incubateur), assujettis aux mégatendances des pratiques d'incubation des autres acteurs, qui peut entrainer de petits changements dans un processus de développement de service, et l'offre réelle de services. Malgré ces changements, cette interaction est essentielle et fondamentale pour accroitre la qualité de service et la performance organisationnelle de l'incubateur, et aussi pour la création de valeur pour le client. Grâce à cette cocréation de valeur, l'incubateur peut développer un avantage concurrentiel supérieur et une position de différenciation par rapport aux autres incubateurs dans l'écosystème. Toutefois, cette flexibilité de l'offre de service des incubateurs envers les besoins hétérogènes des clients n'existe que rarement sur le terrain, en raison de la diversité des incubateurs dont chacun est spécialiste dans un

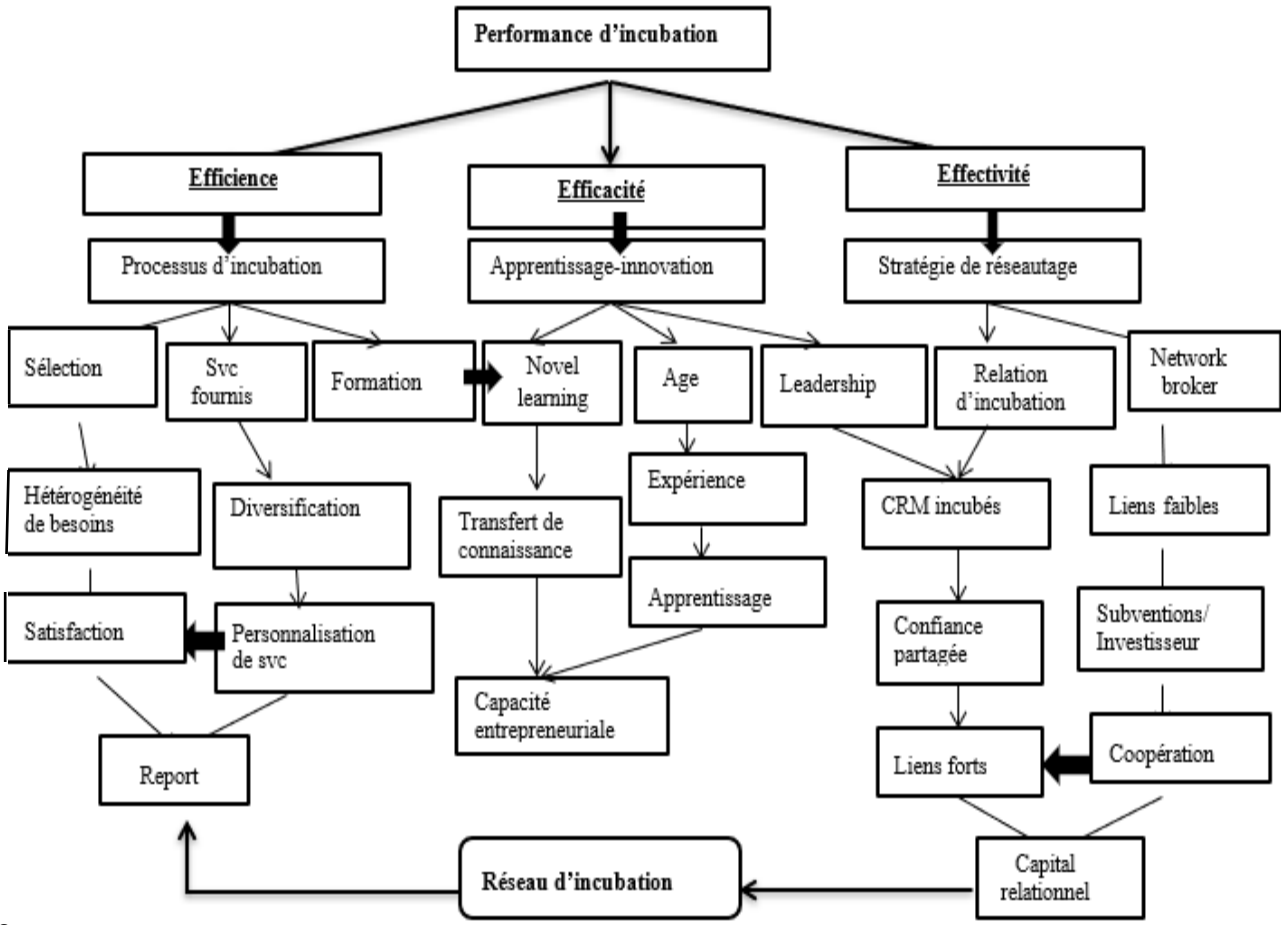
[1] Nous lisons dans l'original: « *suggest two strategic positioning incubator models: public business innovations centers (public BICs) and private incubators (i.e., corporate or independent incubators*). ». (Vanderstreten et al., 2016). P. 48.

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domaine précis et cible uniquement les projets qui relèvent de son métier. La spécialisation est sans doute un facteur explicatif de la performance qui peut réduire l'hétérogénéité des besoins par la segmentation des clients (entrepreneurs) par rapport à la sélection des projets, mais elle n'est pas déterminante et elle peut entrainer un degré plus fort de rigidité au niveau de l'offre de services. Par contre, la coproduction et la modification des offres de services, et donc la personnalisation de services en fonction d'un besoin individuel du client peut, également, réduire l'hétérogénéité et augmenter la satisfaction chez le client par sa participation à cette modification des services offerts par son incubateur, étant donné, que les besoins en services varient d'une entreprise à l'autre, dépendant d'autres facteurs tels que l'expérience antérieure de l'entrepreneur, son capital social, et les contingences environnementales contribuent à la modification des services offerts par l'incubateur, et nécessaires à la réussite de l'incubé. Même si la recherche n'a pas réussi à prouver sur le terrain le lien positif entre la personnalisation des services et la survie de la startup incubée en tant que facteur de la performance d'incubation, mais elle a pu le prouver par l'exploration théorique à travers l'argument de réseautage qui explique les différences observées dans le taux de survie et de croissance des incubés : « la mise en réseau fait référence aux activités des incubateurs pour améliorer le réseau d'une start-up, par exemple en organisant des événements de réseautage[2]».Van Rijnsoever et al. (2017). Ces services aident la jeune startup à acquérir le capital social nécessaire pour accéder aux ressources du réseau de l'incubateur qui améliore sa performance : rester plus visible, plus alignée et mieux connectée à des acteurs extérieurs de l'incubateur, tels que les investisseurs, les banques et autres. Être incubé par un incubateur qui a une bonne réputation contribue, également, à la légitimité de la startup incubée. En outre, la plupart des auteurs sont persuadés que la performance d'incubation pour la startup est mesurée par la croissance d'emploi, le volume d'affaires, la survie, la sortie réussie de l'incubation et le levé des fonds d'investissements lors du démarrage. Elle est souvent utilisée dans les recherches qui explorent la performance des startups technologiques (Batjargal, 2007) ou des incubateurs (Radojevich-Kelley, 2012), Van Rijnsoever et al., (2017). Les investissements proviennent de plusieurs sources (subventions gouvernementales, programmes d'aide à la création, crowdfunding, les amis, la famille, etc.). Ces sources sont souvent accessibles grâce à l'incubateur qui joue le rôle de courtier en réseau (network broker). Toutefois, plus récemment, une enquête (M. van Weele et al., 2017) a été menée auprès de 935 entrepreneurs des startups technologiques pour étudier l'interaction entre l'incubation, et l'utilisation de différentes sources de financement, et leur impact sur la performance des startups incubées. Les résultats tirés de cette enquête ont démontré que les incubateurs ont un effet positif sur le montant de financement que les startups attirent, et leur capacité à attirer le financement des investisseurs formels et des banques. Ces résultats sont des preuves que les incubateurs peuvent contribuer à la performance des startups incubées, mais ils n'arrivent pas à démontrer que ce lien est établi à travers ce mécanisme de mise en réseau, ce qui signifie que le mauvais recul que connait la littérature est causé par ce lien occulté. D'où la nécessité de cette étude scientifique qui nous a aidé à extraire systématiquement la variable de réseau d'incubation en tant que déterminante de la performance d'incubation.

[2] Nous lisons dans l'original : «*The networking mechanism refers to the activities of incubator to improve a start-up's network, for example by providing referrals or organizing networking events* » (M. van Weele et al., 2017).

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Source: Nvivo ajuste par l'auteur.

Figure 3: Modèle Conceptuel De L'objet De Recherche

La figure ci-dessus est générée à l'aide de l'utilisation du logiciel NVIVO qui représente une visualisation globale de concepts clés et contenus dans la revue systématique après quelques légères modifications qui nous ont permis d'identifier les variables les plus pertinentes, et que nous les avons remodelés selon notre contexte.

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Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution at final image size ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs): >350 dpi; figures containing both halftone and line images: >650 dpi.

Color charges: Authors are advised to pay the full cost for the reproduction of their color artwork. Hence, please note that if there is color artwork in your manuscript when it is accepted for publication, we would require you to complete and return a Color Work Agreement form before your paper can be published. Also, you can email your editor to remove the color fee after acceptance of the paper.

Tips for writing a good quality Management Research Paper

Techniques for writing a good quality management and business research paper:

1. Choosing the topic: In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

2. Think like evaluators: If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

3. Ask your guides: If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

4. Use of computer is recommended: As you are doing research in the field of management and business then this point is quite obvious. Use right software: Always use good quality software packages. If you are not capable of judging good software, then you can lose the quality of your paper unknowingly. There are various programs available to help you which you can get through the internet.

5. Use the internet for help: An excellent start for your paper is using Google. It is a wondrous search engine, where you can have your doubts resolved. You may also read some answers for the frequent question of how to write your research paper or find a model research paper. You can download books from the internet. If you have all the required books, place importance on reading, selecting, and analyzing the specified information. Then sketch out your research paper. Use big pictures: You may use encyclopedias like Wikipedia to get pictures with the best resolution. At Global Journals, you should strictly follow here.



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6. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right? It is a good habit which helps to not lose your continuity. You should always use bookmarks while searching on the internet also, which will make your search easier.

7. Revise what you wrote: When you write anything, always read it, summarize it, and then finalize it.

8. Make every effort: Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

9. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several unnecessary diagrams will degrade the quality of your paper by creating a hodgepodge. So always try to include diagrams which were made by you to improve the readability of your paper. Use of direct quotes: When you do research relevant to literature, history, or current affairs, then use of quotes becomes essential, but if the study is relevant to science, use of quotes is not preferable.

10. Use proper verb tense: Use proper verb tenses in your paper. Use past tense to present those events that have happened. Use present tense to indicate events that are going on. Use future tense to indicate events that will happen in the future. Use of wrong tenses will confuse the evaluator. Avoid sentences that are incomplete.

11. Pick a good study spot: Always try to pick a spot for your research which is quiet. Not every spot is good for studying.

12. Know what you know: Always try to know what you know by making objectives, otherwise you will be confused and unable to achieve your target.

13. Use good grammar: Always use good grammar and words that will have a positive impact on the evaluator; use of good vocabulary does not mean using tough words which the evaluator has to find in a dictionary. Do not fragment sentences. Eliminate one-word sentences. Do not ever use a big word when a smaller one would suffice.
Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

14. Arrangement of information: Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

15. Never start at the last minute: Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

16. Multitasking in research is not good: Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

17. Never copy others' work: Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

18. Go to seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

19. Refresh your mind after intervals: Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.

20. Think technically: Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

21. Adding unnecessary information: Do not add unnecessary information like "I have used MS Excel to draw graphs." Irrelevant and inappropriate material is superfluous. Foreign terminology and phrases are not apropos. One should never take a broad view. Analogy is like feathers on a snake. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Never oversimplify: When adding material to your research paper, never go for oversimplification; this will definitely irritate the evaluator. Be specific. Never use rhythmic redundancies. Contractions shouldn't be used in a research paper. Comparisons are as terrible as clichés. Give up ampersands, abbreviations, and so on. Remove commas that are not necessary. Parenthetical words should be between brackets or commas. Understatement is always the best way to put forward earth-shaking thoughts. Give a detailed literary review.

22. Report concluded results: Use concluded results. From raw data, filter the results, and then conclude your studies based on measurements and observations taken. An appropriate number of decimal places should be used. Parenthetical remarks are prohibited here. Proofread carefully at the final stage. At the end, give an outline to your arguments. Spot perspectives of further study of the subject. Justify your conclusion at the bottom sufficiently, which will probably include examples.

23. Upon conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

Final points:

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

The introduction: This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

The discussion section:

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear: Adhere to recommended page limits.

Mistakes to avoid:

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.



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- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
- Avoid use of extra pictures—include only those figures essential to presenting results.

Title page:

Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

Abstract: This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Use comprehensive sentences, and do not sacrifice readability for brevity; you can maintain it succinctly by phrasing sentences so that they provide more than a lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study with the subsequent elements in any summary. Try to limit the initial two items to no more than one line each.

Reason for writing the article—theory, overall issue, purpose.

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

Approach:

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

Introduction:

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.

The following approach can create a valuable beginning:

- Explain the value (significance) of the study.
- Defend the model—why did you employ this particular system or method? What is its compensation? Remark upon its appropriateness from an abstract point of view as well as pointing out sensible reasons for using it.
- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
- Briefly explain the study's tentative purpose and how it meets the declared objectives.

Approach:

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

Procedures (methods and materials):

This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

When a technique is used that has been well-described in another section, mention the specific item describing the way, but draw the basic principle while stating the situation. The purpose is to show all particular resources and broad procedures so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step-by-step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

Materials may be reported in part of a section or else they may be recognized along with your measures.

Methods:

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

Approach:

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

What to keep away from:

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.



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Content:

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

What to stay away from:

- Do not discuss or infer your outcome, report surrounding information, or try to explain anything.
- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

Approach:

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

Figures and tables:

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

Discussion:

The discussion is expected to be the trickiest segment to write. A lot of papers submitted to the journal are discarded based on problems with the discussion. There is no rule for how long an argument should be.

Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implications of the study. The purpose here is to offer an understanding of your results and support all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of results should be fully described.

Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."

Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

- You may propose future guidelines, such as how an experiment might be personalized to accomplish a new idea.
- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

When you refer to information, differentiate data generated by your own studies from other available information. Present work done by specific persons (including you) in past tense.

Describe generally acknowledged facts and main beliefs in present tense.

The Administration Rules

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Please note that following table is only a Grading of "Paper Compilation" and not on "Performed/Stated Research" whose grading solely depends on Individual Assigned Peer Reviewer and Editorial Board Member. These can be available only on request and after decision of Paper. This report will be the property of Global Journals.

Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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