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Influence of Organizational Culture on Top Management Support for Blockchain Adoption in the Yerba Mate Industry

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RESUMO

A qualidade e a autenticidade de produtos agroalimentares têm despertado interesse crescente entre consumidores, indústrias alimentícias e entidades reguladoras nos últimos anos. No entanto, os sistemas tradicionais de rastreabilidade de alimentos não são concebidos para o controle de fraudes, o que faz da rastreabilidade um assunto crucial para o setor. Mercados mais sofisticados, atentos à origem e à qualidade de seus produtos, pressionam o setor a iniciar urgentemente a digitalização de suas cadeias de suprimento, sob o risco de perder competitividade. A indústria brasileira da erva-mate enfrenta preocupação semelhante. O grande potencial da erva-mate como matéria-prima na gastronomia e em produtos como energéticos, chocolates, licores, infusões, entre outros, abriu novas oportunidades em mercados internacionais. A conformidade com padrões agroalimentares aceitos globalmente torna-se, assim, essencial. Nesse contexto, a tecnologia blockchain vem sendo reconhecida como possível solução para a rastreabilidade de produtos agroalimentares. Todavia, como muitos ainda desconhecem seus benefícios, é preciso identificar os incentivos e barreiras para implementação mais ampla dessa tecnologia. Estudos recentes indicam o apoio da alta administração e a cultura organizacional como fatores preponderantes na adoção de blockchain. Esses fatores, contudo, são investigados de forma isolada, sem uma compreensão integrativa de seus impactos. Buscou-se neste trabalho o preenchimento dessa lacuna, com avaliação preditiva do impacto da cultura organizacional sobre o apoio da alta administração à adoção de blockchain na indústria ervateira. A dissertação compreende dois artigos. No primeiro, conduziu-se uma revisão sistemática de 48 estudos empíricos no âmbito da teoria denominada Tecnologia-Organização-Ambiente, buscando identificar, esclarecer e sistematizar fatores organizacionais que afetam a adoção da tecnologia blockchain. Constatou-se que muitos artigos, embora afirmem aplicar essa teoria, classificam os construtos de forma bastante ambígua, sem considerar potenciais conexões entre eles. Verificou-se, também, que muitos construtos são permeados por inconsistências e definições sobrepostas. Após o agrupamento de construtos com o mesmo sentido, o apoio da alta administração, a cultura organizacional e a prontidão organizacional foram identificados como os fatores que mais afetam a adoção de blockchain. A partir dos resultados da revisão sistemática, realizou-se um estudo empírico em 69 indústrias da erva-mate com o objetivo de investigar a magnitude e o poder preditivo do impacto de quatro tipos de cultura organizacional – cultura adocracia, cultura de clã, cultura de hierarquia e cultura de mercado – sobre o apoio da alta administração à adoção de blockchain. A análise dos dados coletados foi feita pelos métodos PLS-SEM e PLS-Predict com a utilização do software SmartPLS 4. Os resultados mostram significativo e positivo impacto da

cultura adocracia no apoio da alta administração à adoção de blockchain, confirmando estudos anteriores no sentido de que esse tipo de cultura é um eficiente catalisador de digitalização. Os resultados também mostram que a relação entre os demais tipos de cultura organizacional e o apoio da alta administração é estatisticamente insignificante, não promovendo nem dificultando a adoção de blockchain no setor. Os números do PLS-Predict, por sua vez, indicam alto poder preditivo dos resultados da pesquisa em relação à adoção da tecnologia blockchain na indústria ervateira.

Palavras-chave: Tecnologia-Organização-Ambiente, cultura organizacional, alta administração, blockchain, erva-mate.

ABSTRACT

Agrifood quality and authenticity have aroused growing interest among consumers, agrifood industries, and regulators in recent years. Nevertheless, traditional food traceability systems are not specifically designed for fraud control, making agrifood traceability a critical issue. More sophisticated markets demanding to know the origin and quality of agrifood products push the sector to urgently start the digitalization of their supply chains, at the risk of losing competitiveness The Brazilian yerba mate industry also faces similar concerns. The great potential of the yerba mate as raw material for gastronomy, energy drinks, chocolates, liquors, tea infusions, among others, opened new opportunities for the sector at international markets. Therefore, ensuring compliance with globally accepted agrifood standards becomes essential. In this context, blockchain technology has been recognized as a possible solution for agrifood traceability. However, as most people remain unaware of its benefits, drivers and barriers need to be identified for a wider implementation of this technology. Recent studies rank top management support and organizational culture as the most prevalent factors affecting blockchain adoption. Current literature, however, has investigated them as independent factors, lacking integrative understanding of their impact on blockchain adoption. This study seeks to fill this gap by assessing the impact of organizational culture on top management support for blockchain adoption in the yerba mate industry, aiming to predict blockchain adoption in the sector. The master´s thesis comprises two research papers. In the first, a systematic review of 48 empirical studies within the Technology-Organization-Environment (TOE) theory has been conducted seeking to identify, clarify, and systematize organizational factors affecting blockchain adoption. The review found that many papers claim they applied the TOE theory but categorize constructs in a rather ambiguous manner without considering key interactions between them. The review also found that many constructs explored in the reviewed papers are permeated with inconsistencies and overlapping definitions. After aggregating overlapping constructs, top management support, organizational culture, and organizational readiness were found as the most prevailing organizational factors affecting blockchain adoption. Drawing from the review findings, the second paper reports an empirical study in 69 yerba mate industries seeking to investigate the magnitude and predictive power of the impact of four organizational culture types – adhocracy culture, clan culture, hierarchy culture, and market culture – on top management support for blockchain adoption in the sector. Data analysis was carried out through PLS-SEM and PLS-Predict methods using SmartPLS 4 software. The results show that adhocracy has a positive and significant impact on top management support for blockchain adoption in the yerba

mate industry, confirming previous studies findings that adhocracy culture is a powerful catalyst for digitalization. The results also show that the relationship between the remaining culture types and top management support is statistically insignificant, neither promoting nor hindering blockchain adoption in the sector. The PLS-Predict results, in its turn, indicate high predictive power of the study findings towards blockchain technology adoption in the yerba mate industry.

Keywords: Technology-Organization-Environment, organizational culture, top management, blockchain, yerba mate.

TABLE LIST

FIGURE LIST

ABBREVIATIONS

ABDI: Brazilian Agency for Industrial Development
ADO: Antecedents, Decisions, and Outcomes
AFSCs: Agrifood Supply Chains
BT: Blockchain Technology
BTA: Blockchain Technology Adoption
CB-SEM: Covariance Based-Structural Equation Modelling
CNA: Confederation of Agriculture and Livestock of Brazil
CVF: Competing Values Framework
DOI: Diffusion of Innovations Theory
EMATER: State Technical Assistance and Extension Services Enterprise
EMBRAPA: Brazilian Agricultural Research Corporation
EU: European Union
EUDR: Reforestation Free Product
IBGE: Brazilian Institute of the Geography and Statistics
IBRAMATE: Brazilian Institute of the Yerba Mate
IoT: Internet of things
IT: Information Technology
MAE: Mean Absolute Error
OC: Organizational Culture
OCAI: Organizational Culture Assessment Instrument
OF: Organizational Factor
PLS-SEM: Partial Least Squares Path Modelling
PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RMSE: Root Mean Square Error
UTAUT: Unified Theory of Acceptance and Use of Technology
SEBRAE: Brazilian Service of Support for Micro and Small Enterprises
SC: Supply Chain
SCM: Supply Chain Management
SDGs: Sustainable Development Goals
SEM: Structural Equation Modelling
SINDIMATE/RS: Yerba Mate Industry Union of the Rio Grande do Sul State
SLR: Systematic Literature Review

SMEs: Small and Medium Enterprises

TAM: Technology Acceptance Model

TMS: Top Management Support

TOE: Technology-Organization-Environment

TRA: Theory of Reasoned Action

VIF: Variance Inflation Factor

WoS: Web of Science

SUMMARY

INTRODUCTION

1 Master´s thesis context

The quality and authenticity of agrifood products have aroused growing interest among consumers, agrifood industries, and regulators in recent years (Kwasi Bannor, Arthur, Oppong, Oppong-Kyeremeh, 2023). Consumers are increasingly demanding more information about the sources and methods of food production (Casino *et al.,* 2020*)*, with an increased attention to the health properties of agrifood products, mostly in the organic markets (Annosi, Appio, Brenes, Brunetta, 2024). In addition, agrifood companies are requested to align to the Sustainable Development Goals (SDGs), ensuring sustainability attributes of their products, such as anti-deforestation (Tran, Schouteten, Gellynck, De Steur, 2024) or combating child labor (Lafargue, Rogerson, Parr, Allainguillaume, 2022). Furthermore, as many agrifood items cross borders worldwide, ensuring their compliance with international standards becomes essential (Khanna, Jain, Burgio, Bolshev, Panchenko, 2022).

In this context, adhering to globally recognized food standards is crucial for global market entry (Tarchi et al., 2024), especially in the European Union (EU), in view of its recent regulation on Reforestation Free Product (EUDR), of 31 May 2023, which provides that the European Commission shall establish and maintain an Information System aimed to ensure that every stage of agrifood supply chains (AFSCs) is monitored, documented and accountable, ensuring compliance with EU standards (EUROPEAN COMMISSION, 2023).

However, despite some efforts to manage AFSCs efficiently, many food fraud incidents have been reported (Van Ruth, Huisman, Luning, 2017), as a recent case of honey fraud in the EU, in which it has been found that nearly half of all honey imported into the EU is suspected of being adulterated. The findings, published in the EU report "From the Hives", revealed that the honeys' true geographical origins were masked using forged traceability information (EUROPEAN COMISSION, 2023). Incidents like this highlight the urgency for better management of agrifood traceability.

Traditional food traceability systems, nonetheless, are not specifically designed for fraud control (Van Ruth *et al.,* 2017). Current AFSCs, particularly those connected to large distribution platforms, have a significant number of participants dispersed along the chain, resulting in poor information exchange and potentially unreliable data among participants (Wang *et al.,* 2021). In this context, the need for effective traceability systems to improve quality and authenticity of agrifood products makes traceability a key issue in AFSCs.

The Brazilian yerba mate industry also faces similar concerns. The yerba mate, an evergreen plant native to the subtropical South America, is found in the wild state or in plantations in Argentina, Brazil and Paraguay, the only countries in the world that produce the yerba mate. Although it does produce flowers and fruits, only the oval-shaped leaves are picked for the "chimarrão", a traditional beverage inherited from the indigenous culture, prepared by hot infusion of dried yerba mate leaves powder in a gourd and gently sipped with a metal straw.

Fig. 1. Yerba mate plants and a "chimarrão" gourd.

Source: Author´s personal collection.

As reported by the Yerba Mate Industry Union of the Rio Grande do Sul State (SINDIMATE-RS, 2023), nearly all the Brazilian yerba mate production is concentrated in the states of Paraná – PR (51,2%), Rio Grande do Sul – RS (34%), and Santa Catarina – SC (14,6%), with a small contribution from Mato Grosso do Sul – MS (0,2%). In 2002, the Amazonas state (AM) also started producing yerba mate in a tiny area of 3 ha. Between 1992 and 2022, Brazilian yerba mate production increased 323,8%, soaring from 145.973 tons in 1992 to 618.601 tons in 2022, as we can see in Fig. 2.

Fig. 2. Brazilian Yerba Mate Production in 2022.

Brazilian Mate Production

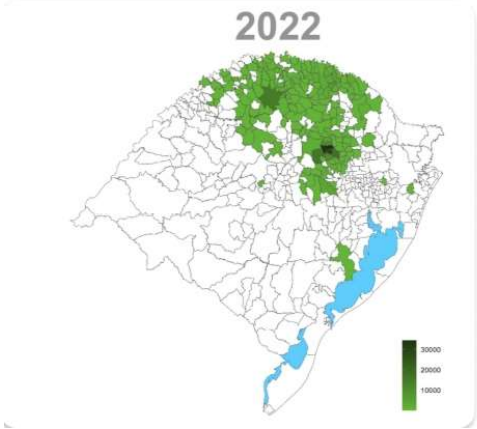
	1992		2002		2022	
	t	%	t	%	t	%
PR	6.222	4,3	221.779	43,2	316.615	51,2
SC	16.516	11,3	45.600	8,9	90.518	14,6
RS	123.230	84,4	240.252	46,8	210.462	34,0
MS	5	0,0	5.895	1,1	1.005	0,2
AM	-	-	-	-	1	0,0
BR	**145.973**	**100**	**513.526**	**100**	**618.601**	**100**

Source: SINDIMATE-RS (2023). Adapted by the Author.

According to SINDIMATE-RS (2023), there are in the Rio Grande do Sul, the geographical focus of this study, approximately 250 yerba mate industries spread across 205 municipalities, most of them in the northern part of the state.

Fig. 3. Rio Grande do Sul Yerba Mate Production in 2022.

Rio Grade do Sul Mate Production Areas



Main municipalities production

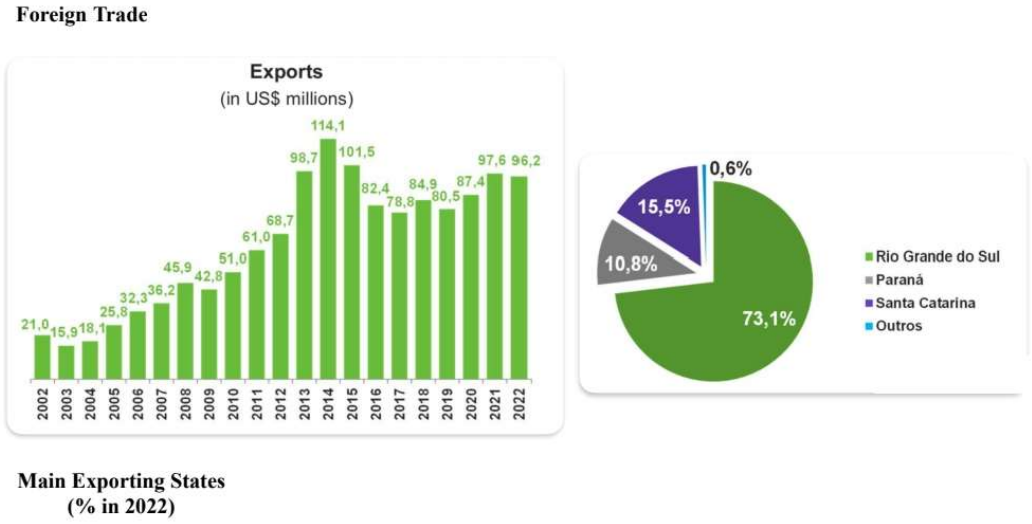
	2022	t	%
1º	Arvorezinha	34.500	16,4
2º	Ilópolis	30.400	14,4
3º	Anta Gorda	16.800	8,0
4º	Fontoura Xavier	15.370	7,3
5º	Palmeira das Missões	14.400	6,8
6º	Putinga	10.400	4,9
7º	Itapuca	10.340	4,9
8º	Áurea	6.840	3,2
9º	Viadutos	4.800	2,3
10º	Nova Alvorada	4.200	2,0
	Group Total	**148.050**	**70,3**
	Other Municipalities	62.412	29,7
	Total	**210.462**	**100**

Source: SINDIMATE-RS (2023). Adapted by the Author.

For many years, the dehydrated leaves of the yerba mate have been used mainly for the "chimarrão" (Oliveira, Waquil, 2015). Over recent years, however, due to its great potential as raw material for other products, the yerba mate stirred up interest for its use in gastronomy, energy drinks, chocolates, liquors, tea infusions, among others, open new opportunities for the sector, especially at global markets. From 2012 to 2022, the volume of yerba mate exports in

Brazil grew 32.5% (Fick, Azolin, Haas, 2023), with Rio Grande do Sul as the main exporting state, accounting for 73.1% of the exported volume (Fig. 4). The top ten exports destinations in 2023 were Uruguay, Argentina, Chile, Syria, Germany, Spain, United States, France, Paraguay and Bolivia (SINDIMATE, 2023).

Fig. 4. Brazilian Yerba Mate Exports Earnings and Main Exporting States.



Source: SINDIMATE-RS (2023). Adapted by the Author.

Notwithstanding this promising scenery, the sector still faces some challenges, such as ensuring product quality from harvesting to the final consumer (IBRAMATE, 2018), especially for accessing international markets. Historically, the sector has been tied to "traditionalism", both in the habit of "chimarrão", and in the industrial process of the yerba mate, which has changed little since the beginning of its production (Greff, Farias, Souza, 2020), leaving aside considerations such as the origin of the yerba mate leaves, harvesting, and environmental impact (Pretto, 2021).

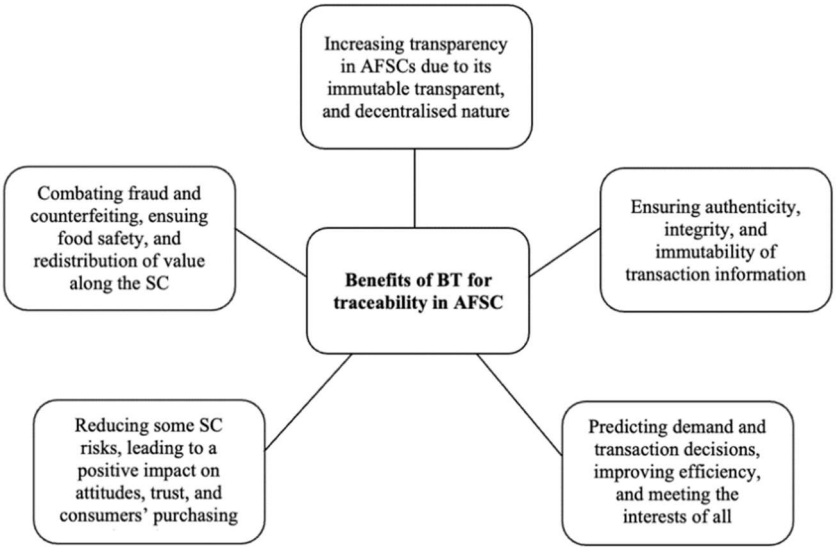
Nowadays, however, the sector has begun to face a more competitive environment (Gref *et al.,* 2020). Due to the emergence of new market opportunities, producers need to develop and value their intangible assets to deliver better products, as yerba mate products can show a high diversification of quality depending on harvesting methods, processing systems and packaging choices. More sophisticated markets demanding to know the traceability of agrifood push producers to urgently start the digitalization of its supply chain (SC), at the risk of losing competitiveness (Pretto, 2021). In this context**,** concepts such as authenticity and traceability become pivotal (Iommi, 2021), representing, therefore, an important challenge for the sector.

Some measures have been taken to overcome these challenges, such as the IBRAMATE initiative in training and qualifying yerba mate producers to adhere to organic certification (IBRAMATE, 2018). In the same way, the State Technical Assistance and Extension Services Enterprise in Rio Grande do Sul (EMATER/RS) developed in 2017 a Quality Certificate of Yerba Mate for monitoring its quality from the raw leaf to the final processing and shipping. Certification is a key strategy for the yerba mate industry to gain access to new markets, but there is still a lot of work ahead, including, for instance, aspects related to geographic identification and an efficient traceability system.

Over the last few years, considerable progress in agrifood traceability has been made by the current digital era known as Industry 4.0, such as Artificial Intelligence, Big Data, the Internet of Things (IoT), and blockchain technology (BT) (Hassoun *et al.,* 2023). Among these technologies, BT has been recognized as a possible solution for AFSCs traceability from farm to fork (Dal Mas *et al.,* 2023), improving transparency and enabling a robust and efficient traceability system (Galvez, Mejuto, Simal-Gandara, 2018).

A recent review by Joshi; Tewari; Kumar and Singh (2023) identified different uses of BT as traceability solutions for SCs activities Behnke and Janssen (2020), increasing visibility and transparency for products and processes, especially in AFSC. Although many of these applications are just emerging, the increase in number of established collaborations and consortia indicates the increasing potential of BT for many business and enterprise applications (Ahmed, Maccarthy, 2022).

Fig. 5. Benefits of BT for AFSC.



Source: Adapted from Hassoun et al., (2023).

In the Brazilian context, the Brazilian National Federation of Agriculture and Livestock (CNA) has underlined the potential of BT as an efficient tool for competitiveness, pointing that it appears as an irreversible technological evolution for all agrifood products in the foreign trade (CNA, 2023). In this ambience, a recently announced project of the CNA in partnership with the Brazilian Agency for Industrial Development (ABDI) and the Brazilian Service of Support for Micro and Small Enterprises (SEBRAE) regarding the development of a traceability system for geographical identifications in the yerba mate industry (CNA, 2023) is a promising landscape for blockchain technology adoption (BTA) in the sector.

In line with these developments, the Brazilian Agricultural Research Corporation - EMBRAPA, linked to the Ministry of Agriculture and Livestock, developed in 2022 a system called Brazilian Agro-Traceability System (SIBRAAR) aiming to add value to agrifood products at national and international market. The system uses BT to trace agrifood products, providing information on products origin and quality in a transparent and reliable manner (SIBRAAR, 2022). Using a QR Code printed on the packaging, consumers have direct access to information from the farms to its distribution and commercialization. This technology has been employed for the first time in the brown sugar sector. Since July 2023, traceable brown sugar has been available in Brazilian supermarkets from a partnership between EMBRAPA, the Cooperative of Sugarcane Producers of São Paulo State and the Usina Granelli (CNA, 2023).

More recently, the Brazilian branch of the giant agribusiness Bunge and the Bangkok Produce Merchandising Public Company, a subsidiary of Charoen Pokphand Foods, have jointly begun testing a BT based a platform for sustainable soy traceability by shipping three vessels totaling 185,000 tons of deforestation-free soybean from Brazil to Thailand. According to Charoen Pokphand Foods, the use of BT allowed for full tracking of the product, from the origin of the grain on the farms, through its processing and transportation until its destination (BUNGE, 2024).

Despite all benefits of BT as a traceability solution for AFSC, most people remain unaware of this technology and its value for SC traceability (Mirabelli, Solina, 2020). As observed by Longo; Nicoletti, Padovano; d'Atri and Forte (2019), while the implementation of BT has been considered revolutionary for the agrifood sector, some drivers and barriers need to be identified for wider implementation of this technology. Identifying and exploring relevant organizational factors (OFs) which may affect BTA in the yerba mate industry is, therefore, an important step for better understanding of its opportunities for the sector.

Recent studies on OFs affecting BTA found that top management support (TMS) plays a significant role towards the adoption of this technology (Clohessy, Acton, 2019; Alshamsi, Al-Emran, Shaalan, 2022). TMS, for example, reveals how well management understands the implications of new technology and how involved they are in the technology adoption process (Clohessy, Acton, 2019). Without TMS organizational adoption of BT is less likely because top management is the authority that allocates resources for technology adoption (Malik et al., 2021).

Many studies also found that organizational culture (OC) plays significant influence on BTA (Schuetz, Venkatesh, 2020), as the readiness of an organization in adopting BT is dependent on the internal policy of the whole organization (Suwanposri, Bhatiasevi, Thanakijsombat, 2021). As put by Boakye, Zhao and Ahia (2022), OC has a prominent role in determining whether a company should adopt BT, as adopting BT will not be easy unless this technology is consistent with current business practices.

Considering this background, investigating the relationship between OC and TMS for BTA in the context of the yerba mate industry, with a focus on sustainable competitiveness towards emerging opportunities at international markets seems to be a worthy and achievable objective.

2 Defining Blockchain, top management support and organizational culture

2.1 Blockchain

BT is a distributed ledger technology that records peer-to-peer transactions in timestamped blocks linked to each other in a chain (Ganne, 2018). Each new block contains a new piece of information with its own timestamp, which is linked with the previous block through a cryptographic hash (Shen, Pena-Mora, 2018). The entire record of transactions is visible to every single user connected to the BT network (Astill *et al*., 2019; Fu, Shu, Liu, 2018; Kouhizadeh, Sarkis, 2018; Kshetri, 2018), eliminating, therefore, the need for a third-party to verify the transactions. These features ensure real-time transparency by tracing transactions from their origin to the destination (Fraga-Lamas, Fernandez-Carames, 2019).

The key feature of BT is that there is no central system or central authority which controls the entire BT. Each member of the BT holds the same copy of the digital ledger, which contains the details of all the transactions (Fraga-Lamas, Fernandez-Carames, 2019). Blocks, once added to the BT network, cannot be changed or deleted (Shen, Pena-Mora, 2018). Data modification of a single block requires access to all previous blocks, which makes manipulating data practically

impossible (Josh *et a*l., 2023). These combined characteristics of BT make the technology unique and potentially transformative for existing business models and SCs (Baiyere, Salmela, Tapanainen, 2020; Janssen *et al.,* 2020), especially as a tool for agrifood traceability.

2.2 Top management support

Definitions of TMS include managerial beliefs about technological initiatives, participation in those initiatives, and the extent to which top managers support technological advancement (Kulkarni, Robles-Flores, Popovič, 2017). In this sense, TMS plays a significant role towards the adoption of new technology within organizations (Clohessy, Acton, 2019). If they are ready to take risks to adopt technology and are ready to provide all necessary support for technology adoption, then this would drive the organizations to adopt the new technology (Tasnim et al., 2023).

In the BT context, TMS is defined as the ability of top managers to provide direction and resources during and after BTA (Queiroz, Fosso Wamba, 2019) and the degree to which they understand the importance of and are involved in BTA (Wong *et al.,* 2020; Wong *et al*., 2020a). Since BTA may involve acquiring new resources and complying with new regulations, support from top management is critical as managers can create a supportive environment for BTA (Lin, 2023).

2.3. Organizational culture

According to Shein (1996), OC can be defined as the collection of shared or unspoken values, beliefs, and assumptions held by members of an organization. In this way, OC goes beyond established values. It encompasses a broad spectrum that includes people's actions, expectations, interactions within the organization, and the perceptions and beliefs used to respond to the environment (Mcdermott and O'dell, 2001). From this perspective, as observed by Leal-Rodríguez *et al.,* (2023), culture serves as a 'function'. On the other hand, other authors have emphasized the importance of 'structure' rather than 'function'. From this angle, cultural systems are structured combinations of various activities, social conflicts, and moral dilemmas that individuals face in their lives (Mohr, 1998).

These perspectives underline two contrasting approaches in the conceptualization of OC (Burrell, Morgan, 1979): the functionalist approach, which emphases causality, and the structuralist approach, which emphasize association (Hughes, Lambert, 1984). For functionalists,

OC is the process that gives rise to ‘adaptation’, which refers to the ‘fit’ between the organization and its environment. In this sense, cultures play an essential role in organizations, as cultural values serve as the foundation for decision-making that operate through causal relationships (Sułkowski, 2014). Structuralism, on the other hand, emphasizes balance and harmony. The values that lead one organization to success may hinder another (Hampden-Turner, Trompenaars, 2006). Consequently, from this perspective, culture of organizations cannot be treated prescriptively, as there is no such thing as a universally better culture (Leal-Rodríguez *et al.,* 2023). This study combines these two perspectives to provide a more comprehensive analysis of the impact of OC on TMS for blockchain adoption in the yearba mate industry.

3 Master´s thesis scope

It has been suggested in the literature on the relationship between OC and technological innovation that OC can influence an organization’s decision-making processes towards technology adoption (Rahman *et al.,* 2013; Senarathna *et al*., 2014). In the same way, Hogan and Coote (2014) proposed that OC can influence the behaviors of organizational members to support innovation because it can lead them to accept some basic values of organizations and foster their commitment to these values (Hogan, Coote, 2014).

Considering this interplay between OC and the support of organizational members for technology adoption, a deeper understanding of the relationship between OC and TMS for BTA represents, therefore, a compelling research agenda. Nonetheless, academic researchers have investigated them as independent factors. As a result, the current literature on BTA lacks integrative understanding of the relationship between OC and TMS by examining, for example, how different archetypes of OC may affect TMS for BTA.

3.1 Research question and objectives

This study seeks to fill the above gap by answering the following research question: is there a significant impact of OC on TMS for BTA in the yerba mate industry?

The main objective of this work is to predict the adoption of BT in the yerba mate industry through quantitative analysis of the relationship between OC and TMS. For this purpose, we set the following specific objectives:

- To evaluate statistically the significance of the relationship between OC and TMS for BTA in the yerba mate industry;
- To assess the magnitude of the impact of OC on TMS for BTA in the yerba mate industry;
- To estimate the predictive power of the study results towards BTA in the yerba mate industry.

3.2 Theoretical foundation

Many theories have been used to explain BTA (Zhu, Bai, Sarkis, 2022). Widely used theories include, for example, the Diffusion of Innovations theory (DOI) (Rogers, 2003), the Technology-Organization-Environment (TOE) theory (Tornatzky, Fleisher, 1990), the Unified Theory of Acceptance and Use of technology (UTAUT) (Venkatesh, Morri, Davis, 2003), and the Theory of Reasoned Action (TRA) (Ajzen, Fishbein, 1977), a consumer-level theory that explains the relationship between subjective attitudes toward intentions and behaviors. Theories like TRA and UTAUT, however, are individual-level theories for predicting technology adoption, whereas DOI and TOE are organization-level ones (Gangwar, Date, Ramaswamy, 2015).

Behavior theories focus on identifying factors that may influence individuals as they decide to use new technologies. They are more suitable, therefore, for understanding technology adoption at an individual level, as they lack the organizational or environmental perspective towards technology adoption behavior within the organizational and technological contexts (Ullah *et al.,* 2021). The shortcomings of studies on technology adoption behavior at an individual level call for attention to context for exploring technology adoption at organizational level to avoid potential construct validity issues (Compeau, Correia, Thatcher, 2022).

In view of that, researchers have suggested using the TOE theory to explore technology adoption behavior within organizations (Zhang *et al.,* 2020). TOE is found to be the most robust and widely used theory on technology adoption behavior at organizational level, compared to others theories, which analyze technology adoption behavior at the individual user's level (Gangwar *et al.,* 2015; Awa and Ojiabo, 2016). The TOE theory represents, therefore, an important theoretical underpinning for BTA as it addresses adoption behavior at organizational level.

As the main objective of this study was predict the implementation of BT in the yerba mate industry through quantitative analysis of factors affecting BTA at organizational level, the

TOE theory has been adopted as the theoretical foundation for the latent variables of our research model.

3.3 Research approach

The decision on which type of research approach to undertake is based on the underlying research philosophy (Saunders; Lewis; Thornhill, 2016). As pointed by these authors, academic research in the field of business is based on five main philosophies: positivism, critical realism, interpretivism, postmodernism, and pragmatism.

The quantitative measurement and deductive approach are elements that identify the positivist philosophy, which relies on theory to develop hypotheses to be tested during the research process allowing the use of quantitative measures (Saunders *et al.,* 2016). Hence, research findings from this perspective are observable and statistically quantifiable (Wilson, 2014).

Some studies, aligned to the functionalist approach of OC, argue that culture as an abstraction cannot be measured but observed. Shein (2010), for example, states that culture should be studied using a more qualitative method of inquiry, as an organizational phenomenon that should be observed rather than measured, focusing on the experience of those who participate in the culture setting (Schein, 2010)**.** Conversely, other studies, in tune with the structuralist approach of OC, argue that each organization has its own distinctive culture and, therefore, as put by Cameron and Quinn (2011), can be measured using quantitative instruments.

In a recent study employing Quinn and Rohrbaugh's (1981) traditional culture archetypes according to the Competing Values Framework (CVF) of organizational culture, Leal-Rodríguez *et al.,* (2023) identified similarities between structuralist theory, functionalist theory, and Quinn and Rohrbaugh's classic cultural archetypes, as they emphasize the role of social institutions in shaping individual behavior and societal functioning. They then suggest that combining these approaches can provide a more comprehensive understanding of organizational dynamics.

Drawing from these insights, we use in this study the Quinn and Rohrbaugh's (1981) archetypes of OC according to the CVF, in a version improved by Cameron and Quinn (2011), namely adhocracy culture, clan culture, hierarchy culture and market culture, which integrates both functionalist and structuralist elements of OC (Leal-Rodríguez *et al.,* 2023). In line with this, we adopt in our research a deductive approach to analyze the influence of OC on TMS for BTA in the yerba mate industry, looking for relationships between them by collecting data using

quantitative measures and analyzing them in a deductive way. From this standpoint, our research approach fits the positivist paradigm.

3.4 Motivation

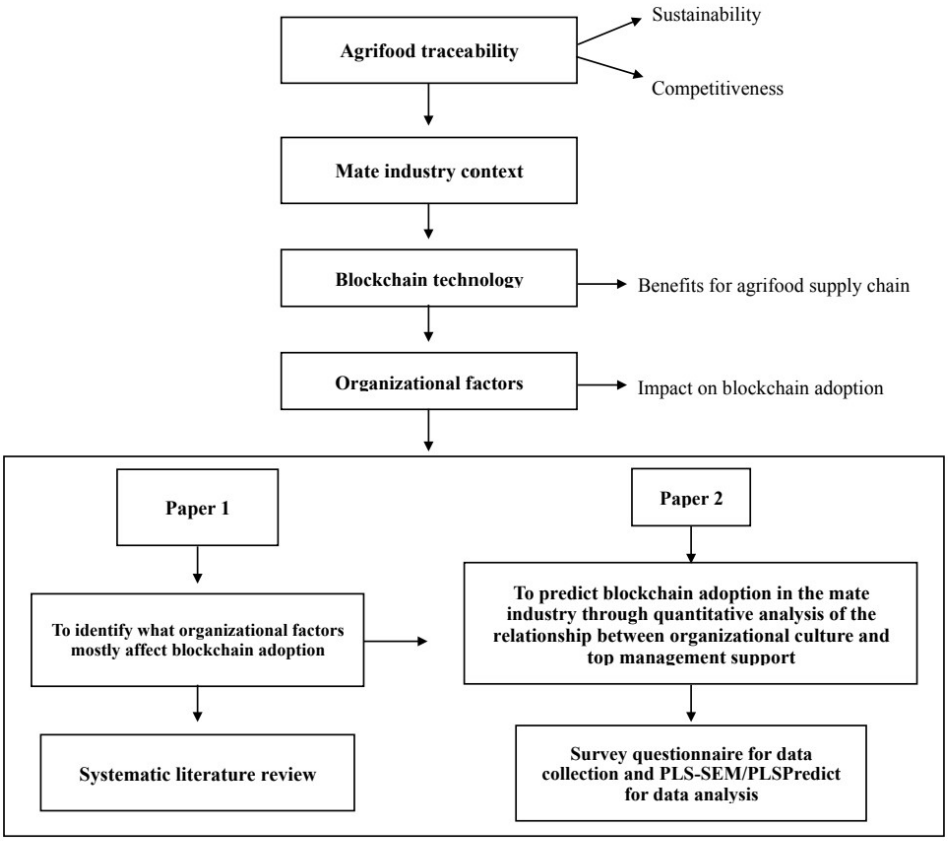
The choice of what to research is likely to be influenced by topics that excite us and by the skills we believe we can develop (Saunders, *et al.,* 2016). Our interest in exploring BTA in the yerba mate industry was inspired by a longstanding dream of starting a small business focusing on high quality tea from trusted tea farms around the world. This led us to search for more information about the tea industry in attending some tea events over last few years, including the 20th World Tea Conference in Las Vegas in March 2022, and a traditional tea experience in a tea farm in Japan in May 2023 (Picking and Rolling Event, Obubu Tea Farm and Factory).

From these experiences, we have been able to understand the importance of agrifood traceability in ensuring product quality and authenticity. Given our love for “chimarrão” as a native of the Rio Grande do Sul state, we envisaged the chance of exploring the implementation of BT in the yerba mate industry towards sustainable competitiveness with a focus on international markets.

3.5 Master´s thesis structure

This master’s thesis comprises two research papers: a systematic literature review (SLR) and an empirical study. The first paper aimed to identify what OFs most affect BTA. Drawing from the findings of the first paper, we develop**,** in the second paper, an empirical study on the impact of OC on TMS for BTA in the yerba mate industry. Both papers jointly contribute for the main objective of the master´s thesis.

Fig. 6. Master´s thesis structure**.**



Source: elaborated by the Author.

4 Research papers overview: research question, objectives, method and results

Paper 1

Organizational factors affecting blockchain adoption through the perspective of the Technology-Organization-Environment (TOE) theory: a systematic literature review

This paper develops an SLR seeking to answer the following research question: what TOE organizational factors (OF) mostly affect blockchain technology adoption (BTA)? For this purpose, the study set two specific objectives: 1) To identify, within empirical studies using the TOE theory, OFs affecting BTA; 2) To clarify and systematize TOE organizational constructs used in empirical studies on BTA. For this review we have searched Scopus and Web of Science (WoS) databases covering publications up to December 2023. Out of 153 screened studies, 48 papers were shortlisted for the review. The review found that many papers claim they applied the TOE theory but categorize constructs in a rather ambiguous way without considering key interconnections between them. The review also found that many of the TOE 83 constructs explored in the reviewed articles are permeated with inconsistencies and overlapping definitions. After aggregating overlapping constructs and clarifying them, we found that top management support (TMS), organizational culture (OC) and organizational readiness (OR) are the most prevailing OFs affecting BTA. Notwithstanding the importance of OC as a key OF affecting BTA, few studies have focused in depth on this construct. Considering that internal practices, processes and sharing values are essential factors in new technologies adoptions, we suggested an alternative perspective by using OC as an independent variable in the relationship between OC and TMS for BTA. Despite the contribution of some reviews on OFs affecting BTA within the TOE theory, as far as we are concerned, no previous review aimed to clarify and categorize multiple organizational constructs in this context. By identifying OC, TMS, and organizational readiness (OR) as core TOE organizational constructs, we expect this review can contribute to empirical studies on technology adoption through the TOE theory perspective.

Status. This paper is ready for publication. We are currently searching for a high-impact journal for the paper submission.

Paper 2

Impact of organizational culture on top management support for blockchain adoption: evidence from the yerba mate industry

Drawing from the first paper findings, we developed in the second paper an empirical study seeking to investigate the magnitude and predictive power of the impact of OC on TMS towards BTA in the yerba mate industry by answering the following research question: is there a significant impact of OC on TMS for BTA in the yerba mate industry? The main goal of this study was to predict the adoption of BT in the yerba mate industry through quantitative analysis of the relationship between OC and TMS. For this purpose, the study set the following specific objectives: 1) To evaluate statistically the significance of the relationship between OC and TMS for BTA in the yerba mate industry; 2) To assess the magnitude of the impact of OC on TMS for BTA in the yerba mate industry; 3) To estimate the predictive power of this study results towards BTA in the yerba mate industry. Combining the functionalist and structuralist approaches to OC, the paper defines, as independent variables, four types of organizational culture according to the CVF of OC, namely adhocracy culture, clan culture, hierarchy culture, and market culture. TMS for BTA has been defined as the dependent variable in the study model. Using a five-point Likert scale questionnaire to collect data, we obtained 69 filled questionnaires from 149 registered yerba mate industries in the Brazilian state of Rio Grande do Sul. Data analysis was carried out through Partial Least Squares Structural Equation Modelling (PLS-SEM) and PLS-Predict using SmartPLS 4 software. The PLS-SEM results show that adhocracy has a positive and significant impact on TMS for BTA in the yerba mate industry, confirming previous studies findings that adhocracy culture is more responsive to innovation and a powerful catalyst for digitalization. On the other hand, the results show that the relationship between clan culture, hierarchy culture, and market culture, as independent variables, and TMS, a dependent variable, is statistically insignificant and, therefore, neither promote nor hinder BTA in the yerba mate industry. Furthermore, PLS-Predict results indicate a high predictive power of the study results towards BTA in the yerba mate industry. These findings reinforce the need for organizations to foster specific traits of culture that support and encourage technological innovation.

Status. This paper is ready for publication. We are currently searching for a high-impact journal for the paper submission.

Table 1. Research paper`s summary.

Papers	Research question	Objectives	Methodology	Findings	Contribution
Paper 1	What OFs mostly affect BTA?	Main objective: to identify, in empirical studies within the TOE theory, prevailing OFs that affect BTA. Specifics objectives: to clarify and systematize TOE organizational constructs used in empirical studies on BTA. .	SLR of 48 empirical studies from WoS and Scopus using PRISMA Protocol.	Constructs inconsistencies and overlapping definitions. OC, TMS and Organizational Readiness ranked at the top among 84 OFs affecting BTA. Few studies on OC as a key construct affecting BTA.	The review clarifies key organizational constructs affecting BTA and proposes an enhanced TOE theory emphasizing the relationship between OC and TMS as antecedent of organizational readiness towards BTA.
Paper 2	Is there a significant effect of OC on TMS for BTA in the yerba mate industry?	Main objective: to predict the adoption of BT in the yerba mate industry through quantitative analysis of the relationship between OC and TMS. Specific objectives: 1. To evaluate statistically the significance of the relationship between OC and TMS for BTA in the yerba mate industry. 2. To assess the magnitude of the impact of OC on TMS for BTA in the yerba mate industry. 3. To estimate the predictive power of TMS for BTA in the yerba mate industry.	Survey five-point Likert scale questionary for data collection and Partial Least Squares Structural Equation Modelling (PLS-SEM) and PLS-Predict using SmartPLS4 software for data analysis.	ADH has a positive and significant impact on TMS for BTA in the yerba mate industry. The relationship between clan culture, hierarchy culture, and market cultures, as independent variables, and TMS, as a dependent variable, is statistically insignificant and, therefore, neither promote nor hinder BTA in the yerba mate industry. PLS-Predict indicates a high predictive power of the research model results towards BTA in the yerba mate industry.	This paper provides the opportunity for further studies to inquire about the influence of OC on OFs affecting BTA, improving knowledge on existing literature.

Source: Elaborated by the Author.

CHAPTER 2

Organizational factors affecting blockchain adoption through the perspective of the Technology-Organization-Environment (TOE) theory: a systematic literature review

1 Introduction

1.1 Theories on blockchain technology adoption (BTA)

Blockchain technology (BT) is a distributed ledger technology that records peer-to-peer transactions in timestamped blocks linked to each other in a chain (Ganne, 2018). Each new block contains a new piece of information with its own timestamp, which is linked with the previous block through a cryptographic hash (Shen, Pena-Mora, 2018). The entire record of transactions is visible to every single user connected to the BT network (Astill *et al*., 2019; Fu, Shu, Liu, 2018; Kouhizadeh, Sarkis, 2018; Kshetri, 2018), eliminating, therefore, the need for a third-party to verify the transactions. These features ensure real-time transparency by tracing transactions from their origin to the destination (Fraga-Lamas, Fernandez-Carames, 2019).

The key feature of BT is that there is no central system or central authority which controls the entire BT. Each member of the BT holds the same copy of the digital ledger, which contains the details of all the transactions (Fraga-Lamas, Fernandez-Carames, 2019). Blocks, once added to the BT network, cannot be changed or deleted (Shen, Pena-Mora, 2018). Data modification of a single block requires access to all previous blocks, which makes manipulating data practically impossible (Josh *et a*l., 2023).

A recent review by Joshi *et al.,* (2023) identified different uses of BT across various supply chain (SC) activities, focusing on traceability solutions in wider SCs (Behnke, Janssen, 2020), increasing visibility and transparency for products and processes especially in AFSC. Although many of these applications are just emerging or are in development, the increase in number of established collaborations and consortia indicates increasing interest in BT by many business and enterprise applications (Ahmed, Maccarthy, 2022).

In this context, BT for SC traceability has received widespread research attention (Salah *et al.,* 2019; YIU, 2021; Bischoff, Seuring, 2021; Centobelli *et al.,* 2021; Omar *et al.,* 2022; Varavallo *et al.,* Terzo, 2022), as food traceability can be more safely established through BT, improving transparency and enabling a robust and efficient traceability system (Galvez *et al.*, 2018).

Despite, however, all advantages of BT, most people remain unaware of this technology and its value for agrifood traceability (Mirabelli, Solina, 2020). As observed by Longo; Nicoletti, Padovano; d'Atri and Forte (2019), while the implementation of BT has been considered revolutionary for the agrifood sector, some drivers and barriers need to be identified for wider implementation of this technology.

Many theories have been used to explain BTA (Zhu, Bai, Sarkis, 2022). Widely used theories include, for example, the Diffusion of Innovations theory (DOI) (Rogers, 2003), the Technology-Organization-Environment (TOE) theory (Tornatzky, Fleisher, 1990), the Theory of Reasoned Action (TRA) (Ajzen, Fishbein, 1977), and the Unified Theory of Acceptance and Use of technology (UTAUT) (Venkatesh, Morri, Davis, 2003)

In a recent systematic review focusing on popular theories that have been applied to explain BTA within SCs, Zhu; Bai; Sarkis (2022) point, however, that "much of the current research has been relatively atheoretical, lacking theory development and theory application" (Zhu *et al.*, 2022). The need for theory and its relationship to BTA, as put by these authors, is an important question for understanding and building a strong basis for its adoption, management, and outcomes, especially in sustainable SCM research (Zhu *et al.*, 2022).

The DOI theory explains how an idea, product, service, or technology is adopted by a system over time (Kaminski, 2011). Innovation adoption occurs at different stages and includes categorizations covering innovators, early adopters, early majority, late majority, and late laggards (Rogers, 1995). The literature on this theory has found that the idea of BT has spread across numerous sectors, but the level of diffusion varies, and actual adoption remains at the early diffusion stage (Kar, Navin, 2021, Wamba, Queiroz, 2022). Early adopters can act as change agents to improve BTA and diffusion (Kouhizadeh, Sarkis, 2018, Woodside; Augustine; Giberson, 2017).

The UTAUT theory, which includes the widely used Technology Acceptance Model (TAM) (Davis, 1989), considers decision-making processes for technology users when adopting and implementing a new technology (Davis; Venkatesh, 1996). TAM theoretical model focuses on perceived usefulness and ease of use as crucial factors for technology adoption, given the technology's inherent complexity. TAM has provided a conceptual framework for better understanding how individuals perceive norms and adopt new technologies. UTAUT theory has further improved TAM to help explain technology adoption. Additional constructs include performance expectancy, effort expectancy, social influence, perceived credibility, perceived cost, and perceived convenience (Hira *et al.,* 2021; Suwanposri *et al.,* 2021); task-technology fit

(Liang *et al.,* 2021; Tarhini *et al.,* 2016); and inter-organizational trust (Hira *et al.,* 2021; Sheel and Nath, 2020).

Both UTAUT and TAM are derived from the TRA, a consumer-level theory that explains the relationship between subjective attitudes toward intentions and behaviors. Drawing from the TRA theory, the TAM model approaches technology adoption by applying the constructs of user perceived ease of use and user perceived usefulness. UTAUT theory has further improved the TAM model to help explain BTA. Additional constructs include performance expectancy, effort expectancy, social influence, perceived credibility, perceived cost, and perceived convenience (Hira *et al.,* 2021; Suwanposri *et al.,* 2021); task-technology fit (Liang *et al.,* 2021; Tarhini *et al.,* 2016); and inter-organizational trust (Hira *et al.,* 2021, Sheel, Nath, 2020).

Theories like TRA and UTAUT, however, are individual-level theories for predicting technology adoption (Gangwar, Date, Ramaswamy, 2015). Individual-level theories focus on identifying the factors that may influence individuals as they decide to use new technologies. They are more suitable, therefore, for understanding technology adoption at an individual level as they lack the organizational or environmental perspective towards technology adoption behavior within the organizational and technological contexts (Ullah *et al.,* 2021).

The shortcoming of call for attention to context to avoid potential construct validity issues (Compeau *et al.*, 2022). To address these limitations, researchers suggest using TOE theory for exploring technology adoption behavior at organizational level (Zhang *et al.,* 2020). Although the DOI theory also explains technology adoption at an organizational level, the TOE theory is found to be the most robust and widely used theory on technology adoption literature compared to others theories (Gangwar *et al*, 2015; Awa, Ojiabo, 2016).

The TOE theory was first developed by Tornatzky and Fleischer (1990) in the book *The Processes of Technological Innovation*, in which they describe and explore the entire process of innovation and its adoption and implementation within a firm context. It provides a taxonomy for dealing with relevant factors in adopting new technologies by explaining three different dimensions of a firm's context that influence decisions on technology adoption: the technological dimension, the organizational dimension, and the environmental dimension.

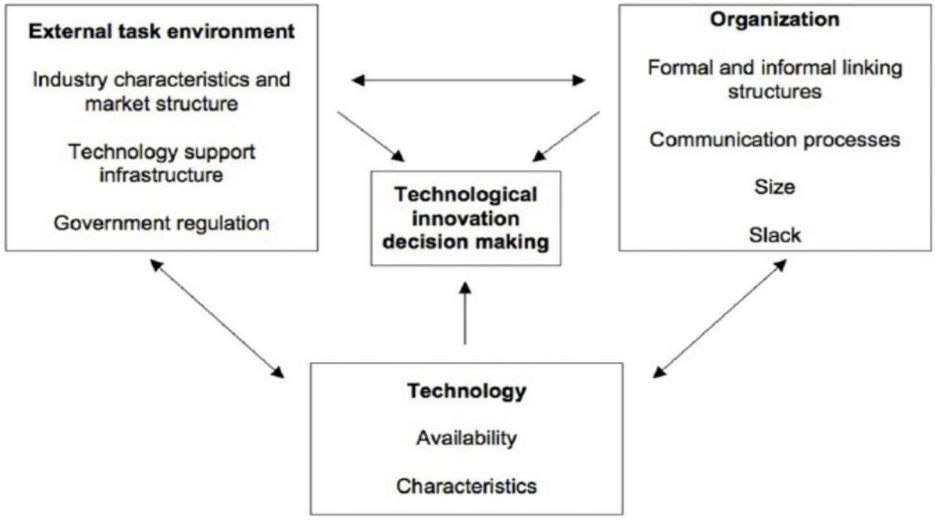
The technological dimension considers all relevant technologies to an organization which are already in use, available for purchase or in development (Tornatzky and Fleisher, 1990). It also relates to the level of complexity of new technologies and their compatibility requirements with existing technologies (Chatterjee *et al.,* 2021).

The organizational dimension, in its turn, refers to the formal and informal link structure, intra-firm communication processes, firm size, and slack resources. Organization structure,

including formal and informal links between employees, can be explored to identify its relationship to technology adoption process. Communication processes within the organizational context can also promote or inhibit innovation. Furthermore, top management can foster innovation adoption by providing direction and resources that expands the firm's core mission and vision (Tushman and Nadler, 1986).

Finally, the environmental dimension includes the industry characteristics and market structure, technology support infrastructure, and the regulatory environment. Industry structure can involve, for example, intense competition among firms, which can foster innovation adoption (Edwin, *et al.,* 1977). In the same way, dominant firms within the SC can influence other chain partners to innovate (Dwivedi *et al.,* 2012). Regarding technology support infrastructure, the availability of consultants and suppliers of technology services, for example, can also stimulate innovation (Dwivedi *et al.,* 2012). Fig. 7 depicts these three organizational dimensions and their underlying constructs.

Fig. 7. TOE original constructs.



Source: Tornatzky, Fleisher (1990)

Notwithstanding the wide use of the TOE theory to explain technology adoption at organizational level, it has been pointed out that there is a relative lack of evolution of this theory since its initial development. From this view, the TOE has been described as a "generic" theory (Zhu, Kraemer, 2005), in which various factors can be placed, making the TOE highly adaptable. Another aspect underlined in the literature is that TOE theory may have relatively little evolution because it has been viewed as aligned with others innovation adoption theories and offers complementary, instead of competing, explanation to them (Baker, 2012).

However, as put by Dwivedi; Wade; Schneberger (2012), while these arguments are well-founded, they can limit the comparison of theories with one another. By avoiding comparison and critique of the various theories on technology adoption, the refinement of these theories is restricted. In that sense, this study expects to add new perspectives of applying TOE theory in real-life business environment.

1.2 The nature of TOE

Some studies in this SLR approach TOE as a stand-alone theory for explaining and predicting BTA (Nandi *et al.,* 2020; Orji *et al.,* 2020). Most of them, however, refer to TOE either as a framework (Yadav; Shweta; Kumar, 2022; Guan *et al.,* 2023) or as a model (Jackson, Allen, 2023; Chittipaka *et al.*, 2022), as if these expressions mean the same and could be interchangeable. However, as theory, framework and model have different and clear academic meanings, it is necessary to clarify the nature of TOE for better understanding of its versatility in explaining and predicting new technology adoption at organizational level.

A theory is a generalized statement that brings together "interrelated concepts, definitions, and propositions that explain or predict events or situations by specifying relations among variables" (Glanz; Rimer; Viswanath, 2008). On the other hand, a theoretical framework comprises other people's theoretical perspectives that the researcher will interpret as relevant for the data analysis and interpretation (Kivunja, 2018). A conceptual framework, in its turn, comprises the research design, the problem to be investigated, the questions to be asked, the theories to be applied, the method and procedures, the data analysis, and the research conclusions (Ravitch, Riggan, 2017).

Borrowing from these insights, TOE is to be used in this work as a set of concepts, definitions, and propositions within an organizational context for exploratory and predictive aims, by looking at the relationship between interconnected constructs that can be quantitively measured. From this perspective, TOE is addressed in this study as a stand-alone theory.

Some researchers have argued that perhaps it is not possible to have a single theory that applies to all types of innovations, because innovations are of different types (Swanson, 1994). In this way, it would not be reasonable that a single theory can be developed to describe the adoption of different types of innovations (Zhu; Kraemer; Xu, 2006). In line with this perception, many studies examined in this SLR have included other theories and models in their TOE-based studies to extend TOE OFs affecting BTA as, for example, TOE and TAM (Nyazabe; Hwang;

Manyole, 2023), TOE and UTAUT (Wang *et al.,* 2023), and TOE and DOI (Fernando *et al.*, 2022).

These approach, however, may not provide a coherent picture of TOE OFs affecting BTA. According to Baker (2011), one of the largest problems facing the TOE literature is the lack of ability to develop a meaningful theoretical base (Baker, 2011). By mixing theories such as DOI, TRA, UTAUT, and TOE theory to describe constructs affecting BTA, this approach complicates the level of analysis insofar it treats at the same level organizational and individual factors.

1.3 Previous reviews

The TOE theory provides a comprehensive approach to technological, organizational, and environmental factors affecting BTA. The focus of this SLR is on the TOE organizational dimension as it comprises the largest number of new constructs added to the original TOE by the emerging literature on BTA. Furthermore, contrary to constructs tied to the environmental and technology dimensions, which easily fit within the original TOE categories, many of the new factors at the organizational dimension show overlapped meaning, which justify our review objectives in identifying and clarifying prevailing factors affecting BTA at the TOE organizational dimension.

The use of TOE theory on BTA has been reviewed in some studies, including a thematic analysis examining behavioral and organizational antecedents that influence BTA in AFSC (Oguntegbe; Di Paola; Vona, 2022), a SLR on antecedents of OFs affecting BTA (Clohessy, Acton, 2019), and a review of articles discussing challenges of BTA in the education sector (Mthimkhulu, Jokonya, 2022). Review studies in this perspective also include a SLR about BT challenges and opportunities across various sectors, revealing that supply chain management (SCM) is the main domain in which BT applications were adopted (Mohammad, Vargas, 2022), a review exploring challenges and opportunities of BTA in the United Kingdom automotive industry (Upadhyay *et al.,* 2020), and a study on frameworks most used to assess BTA in business sectors (Taherdoost, 2022).

Despite the valuable contribution of these studies, no previous review aimed to clarify multiple organizational constructs emerging from empirical research on BTA using the TOE theory. The purpose of this paper is to fill this research gap by providing a consistent understanding of the TOE theory constructs for empirical studies on BTA. In addition, it is important to add that the body of empirical research on OFs affecting BTA within the TOE theory, despite its novelty, has sufficient papers, in substance and quality, to merit a SLR.

1.4 Research question and objectives

The main objective of this SLR is to identify prevailing OFs affecting BTA by answering the following research question: which OFs mostly affect BTA? For this purpose, we set two specific objectives: 1) To clarify and systematize constructs within the TOE organizational dimension used in empirical studies on BTA; 2) To identify, from the reviewed studies, prevailing organizational factors affecting BTA;

Construct clarity is relevant not only for building new theories (Suddaby, 2010), but also for developing measurement tools (Byrne; Peters; Weston, 2016), as well as for comparing empirical studies (Fisher, Aguinis, 2017). As fields emerge and develop, inconsistent meaning of constructs and ambiguities in their use may arise. Therefore, this review can contribute to the TOE theory by identifying and clarifying key organizational constructs for further empirical studies on BTA.

2 Methodology

A detailed review protocol is essential for SLR as it describes the steps that will be taken in the review and thus reduces research biases (Busalim, Hussin, 2016). After the research question and objectives were defined, this review observed three steps (planning–screening–findings and discussion) based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020 statement) (Page, M. J. *et al.,* 2020), a widely recommended protocol for systematic reviews and meta-analyses to ensure the transparency and reproducibility of the review process and findings.

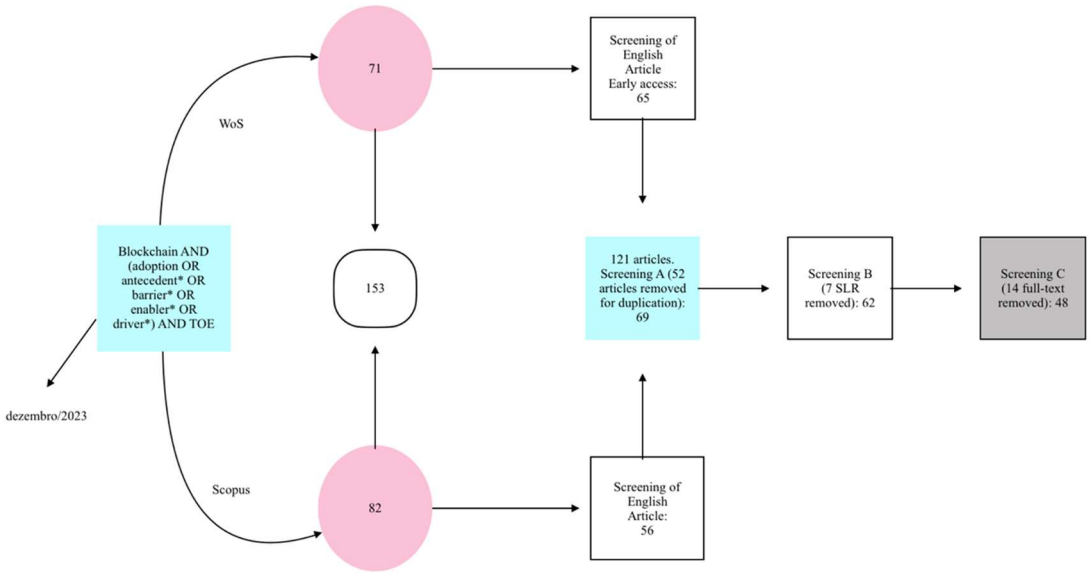
2.1 Planning

Two prominent databases have been chosen for this study: Web of Science (WoS) and Scopus. The research questions were divided into keywords to develop a search string using Boolean expressions. The following keywords have been defined for the search: “Blockchain” AND (adoption OR antecedent* OR barrier* OR enabler* OR driver*) AND "TOE". Finally, the search string was customized according to the search criteria in each database.

2.2 Screening

The initial screening aggregated a total of 153 articles published up to December 2023 (WoS = 71; Scopus = 82). In a refined search in both databases, limited to articles in English and excluding grey literature, the number drops to 65 in the WoS and to 56 in the Scopus, totalizing 121 articles. These articles were then processed using Zotero, a reference management software, for duplicate removal. This resulted in the reduction of the total number of articles to 69. After excluding 7 review papers, the number dropped to 62. Finally, after full text reading, 14 papers have been excluded because they are unrelated to the research question, shortlisting the final number to 48 peer-reviewed articles (Fig. 8).

Fig. 8. SLR steps



Source: flowchart based on the PRISMA 2020 Statement (Page, M. J. *et al.,* 2020)

2.3 Findings and discussion

The first papers on BTA through the perspective of the TOE theory were published in June 2019. Only two papers were published in that year: Clohessy and Acton (2019), and Wong, Leong, Hew, Tan, and Ooi (2019). Both papers have found the same three TOE organizational factors affecting BTA (TMS, Organizational Size, and Organizational Readiness). From 2019 up to December 2023, the time framing of this SLR, the number of empirical studies on BTA through the TOE prism in different sectors reaches 48 peer-reviewed empirical studies. In the same

period, the total factors within the TOE organizational dimension found to be impacting BTA soared from the just three factors in 2019 to 56 factors in December 2023 (Table 2).

The distinctions between the three TOE constructs dimensions (technology, organization, and environment) are clear in the original TOE but not clear in many of the reviewed papers. According to the original theory, technology factors should be associated with the technology features, which are exclusively linked to the technology itself without consideration of any organizational contexts. Organizational variables, in their turn, should be tied to a certain specific organizational context. Finally, environmental variables must be tied to external environment, not to internal organizational settings (Thomas, Yao, 2023).

Some papers in this study claimed they applied the TOE theory but categorize constructs in a rather ambiguous way. For example, competitive pressure, typically tied to external environment was examined as tied to the organizational context (Wang *et al.,* 2022). Suitable application, in its turn, clearly a technology feature, was considered as an organizational factor (Suwanposri *et al.*, 2021). In the same way, security concerns, a construct also associated with technology features, was assessed as an organizational variable (Li; Zhang; Xu, 2022).

Furthermore, the review also found that the use of the TOE theory in the context of the reviewed studies is permeated with inconsistencies and overlapping definitions. As we can see in Table 2, for example, constructs such as TMS, OC and organizational readiness have been identified by using different expressions for the same idea. As these constructs, as shown in the third column of Table 2, are the three most frequent OFs affecting BTA, it is important, therefore, to clarify and to systematize them according to the core categories of the TOE organizational dimension.

3 Constructs clarification

Identifying potential OFs affecting BTA is essential in deciding the success of this technology Hence, it is worth clarifying TOE organizational constructs for future studies on BTA. All reviewed studies recognize the three TOE organizational dimensions that may influence BTA, but for each specific industry or sector they use different sets of OFs. In fact, the reference to original TOE has been limited to enumerating the different factors that are important in each context, with little theoretical synthesis.

Table 2 shows the constructs identified in the reviewed studies as affecting BTA within the TOE organizational dimension. The table comprises two columns. The first column indicates how TOE organizational constructs were named in the reviewed studies. The second column

informs the prevalent constructs affecting BTA according to the number of articles in which they appear.

In relation to Organizational Readiness (OR), it has been conceptualized in the literature in three dimensions: 1) The efficient use of human, material and knowledge resources and the processes employed to transform these resources into services (Collins; Phields; Duncan, 2007); or 2) The capacity to implement change in order to improve performance (Devereaux *et al*., 2006); or 3) The existence of supportive infrastructure and sufficient resources that facilitates organizational change (Kerber, Buono, 2005).

As we can see in Table 2, the concept of OR encompasses various constructs identified in the reviewed studies as if they were new TOE constructs. To systematize them in a coherent way within TOE organizational dimension, we grouped into the OR heading all the constructs related to the three dimensions of OR.

To clarify TMS, we aggregate within this construct two overlapping factors depicted in the SLR, namely owner support and senior management support, as they semantically show the same meaning.

Finally, regarding OC, we aggregate into OC heading following overlapping factors, as they express underlying elements of OC: communication process, organization innovativeness, formal and informal linking structures, organizational structure, organization learning capability, adopting strategies, business process transformation, cultural compatibility, digital culture, flexible organization, governance models, information sharing and collaboration culture, internal stakeholder, learning culture, organizational acceptability, organizational characteristics, organizational policies towards technology, organization strategy, and resistance to change.

Table 2. TOE organizational constructs ranking (n = 48 papers).

Constructs (n = 56)	Frequency (N. of papers)
ORGANIZATIONAL READINESS	**31**
Organizational readiness	11
Financial resources	2
Firm's IT resources	3
Technological readiness	1
Slack	2
Adequate skills	1
Business model readiness	1
Monetary resources	1

Resource adequacy	1
Organizational resources	1
Sufficiently skilled people	1
BT knowledge	1
Technological knowledge	1
Awareness and understanding of BT	1
Employees' knowledge	1
Knowledge and expertise	1
Technical know-how	1
TOP MANAGEMENT SUPPORT	**29**
Top Management Support	23
Management commitment and support	3
Higher authority support	1
Senior management support	1
Top management understanding	1
ORGANIZATIONAL CULTURE	**21**
Organizational Culture	4
Organization innovativeness	3
Communication process/channels	4
Formal and informal linking structures	2
Organizational structure	2
Organization learning capability	2
Digital culture	1
Governance models	1
Internal stakeholder	1
Organizational strategy	1
OTHER FACTORS	**51**
Firm size / Organizational size	13
Cost/perceived cost/high switching cost	9
Training and education / facilities	4
Absorptive capacity	2
Capability of human resources / Human resource capacity	2
Employees' technical orientation and experience/knowledge	2
Financial constraints	1
Adequate skills	2
Bootstrapping problem	1

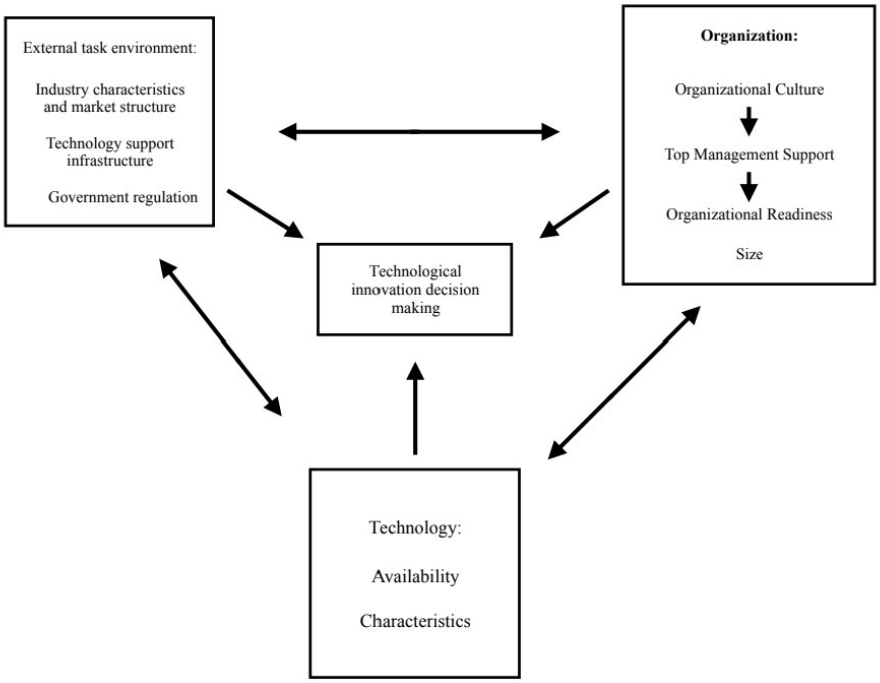
Competence	1
Firm scope	1
Organizational age	1
Power dynamic	1
Purpose washing	1
Resource adequacy	1
Security concerns	1
Stereotypes	1
Suitable application	1
Sufficiently skilled people	1
Transition issues	1
Uncertain investor risk	1
Unconscious adoption	1
Unconvincing return on investment	1
Uncertainty of potential outcome against BT complexity	1

Source: Elaborated by the Author.

After clarifying overlapping constructs related to OR, TMS, and OC, these three constructs rank as the three most frequent OFs affecting BTA, respectively appearing in 31, 29, and 21 of the reviewed papers.

Looking at these three constructs, we acknowledge they can easily fit the original TOE organizational dimensions (Fig. 7) with few adjustments. As the categories “Formal and informal linking structures” and “Communication process” within the original TOE organizational dimension can be classified as elements of OC, they can be defined as factors tied to OC. In the same way, as “Slack” resources are clearly related to the three dimensions of the OR, it can be classified as a factor tied to OR. Finally, as TMS does not appear within TOE original constructs, it can be added as a new TOE organizational construct. With these adjustments, we propose an improved TOE organizational dimension as depicted in Fig. 9.

Fig. 9. Enhanced TOE theory organizational dimension.



Source: Adapted from TORNATZKY and FLEISHER (1990).

4 Prevailing factors affecting blockchain adoption

As we can see in Table 2, OR appears as the most frequent factor affecting BTA through the TOE perspective., followed by TMS and OC. These findings, however, do not provide a coherent picture, as OR is a dependent factor in relation to TMS and OC.

For the adoption of new technologies, firms need material and human resources comprised into the OR heading **(**Table 2**).** Without human and material resources and supportive infrastructure that facilitates organizational change, the organization will not be ready to adopt new technologies. Throught this prism, OR stands as a fundamental construct within the TOE theory.

However, resources alone are not enough, as BTA will also depend, as revealed by the reviewed papers in the next section (4.1), on the support of top managers. TMS for BTA, in its turn, will depend on the OC of the organization, according to reviewed studies explored in section 4.2,

4.1 Top management support for blockchain adoption

Definitions of TMS include "managerial beliefs about technological initiatives, participation in those initiatives, and the extent to which TMS technological advancement" (Kulkarni *et al.*, 2017). In the BT context, TMS is defined as the ability of top managers to provide direction and resources during and after BTA (Queiroz, Fosso Wamba, 2019) and the degree to which they understand the importance of and are involved in BTA (Wong *et al.,* 2020; Wong *et al.,* 2020a). The TMS of an organization can, for example, motivate its employees towards BTA (Wong *et al.,* 2020).

Since BTA may involve acquiring new resources and complying with new regulations, support from top management is critical as managers can create a supportive environment in the preparation for BTA (Lin, 2023). If they are ready to take risks to adopt technology and are ready to provide all necessary support for technology adoption, then this would drive the organizations to adopt the new technology (Tasnim *et al.*, 2023).

However, top management should be aware of the benefits of implementing the latest technologies to support organizational transformation (Chittipaka *et al.,* 2022). In a study on Spanish firms, for example, Hashimy; Jain; Grifell-Tatjé (2022) highlighted that out of 800 respondents, only 213 had adequate knowledge of BT.

TMS also has a significantly positive influence on BTA in SMEs, which will be more inclined to adopt BT if top management has a favorable attitude to the technology (Bhardwaj; Garg; Gajpal, 2021). On the other hand, when SMEs owners are not convinced and do not have enough experience dealing with BTA, this will reduce the intention to adopt it (Wong *et al.,* 2020a). In this perspective, top management, including the board of directors, company leaders and owners of SMEs, should consider BT as a strategic priority to support BTA.

In addition, as BT is still evolving and changing continually, top management needs to offer different forms of support for different aspects (Yadlapalli; Rahman; Gopal, 2022), In this context, TMS could be better specified as a prevalent factor in relation to OR as key factors affecting BTA within the TOE organizational dimension.

4.2 Organizational culture and blockchain adoption

OC affects how firms respond to external pressures and make strategic business decisions (Dubey *et al.,* 2019). Defining OC, however, has been difficult because culture is an abstract concept with unobservable aspects (Schein, 2010). Although there are many definitions of OC

(Ovseiko, Buchan, 2012), all of them describe OC as a set complex values, beliefs, assumptions, and symbols that define how a firm conducts its business.

Scholars have increasingly realized that OC could play a key role in decisions on adopting new technology. It has been suggested that OC can influence an organization's ability to process information, rationalize, and exercise discretion in its decision-making processes in technology adoption (Naranjo Valencia; Sanz Valle; Jiménez, 2010; Baird *et al.,* 2011; Rahman *et al.,* 2013; Senarathna *et al.*, 2014).

Baird *et al.,* (2011) suggested that OC could stimulate innovation behavior among an organization's members because it can lead them to accept innovation as a basic value of the organization and can foster commitment to it. OC can, for example, influence the behaviors of organizational members because it can lead them to accept some basic values of organizations and foster their commitment to these values and goals (Hogan, Coote, 2014).

In the BT context, the literature points that OC plays a significant influence on BTA (Schuetz, Venkatesh, 2020), as the readiness of an organization in adopting BT is dependent on the internal policy of the whole organization (Suwanposri *et al.*, 2021). OC has, furthermore, a significant influence in determining whether a company should implement BT (Boakye *et al.*, 2022), as adopting BT will not be easy unless this technology is consistent with current business practices. BT should, therefore, fit with the OC (Bag *et al.,* 2020).

In a study on SMEs, Leong *et al.,* (2023) have found, for instance, that OCs that promote innovations and accept technological changes can lead to better and faster BT integration in SMEs. As observed by Suwanposri, Hatiasevi, Thanakijsombat (2021), if digital transformation is not one of the organizational missions, it would be difficult to drive the implementation of BT because it requires cross-functional cooperation (Suwanposri *et al.*, 2021).

In the same way, studying BTA in the freight sector, Schuetz and Venkatesh (2020) have found, for example, that when freight logistics firms consider BTA, their decisions are usually based on the unique set of their own organizational characteristics (Schuetz, Venkatesh, 2020). In line with these developments, OC represents, therefore, a significant factor that may impact BTA (Schuetz, Venkatesh, 2020), as the readiness of an organization in adopting BT is dependent on the internal policy of the whole organization (Suwanposri *et al.*, 2021).

In this context, OC could be better focused as a prevalent factor in relation both to TMS and OR as key factors impacting BTA. Hence, any analysis of BTA without considering OC as a prevalent factor within the TOE organizational dimension will not provide a whole picture of OFs affecting BTA, through the perspective of the TOE theory

Despite the prominent role of OC as a prevailing OF affecting BTA, its influence on TMS and OR has not been sufficiently explored. The scarce focus on the relationship among these construct in the reviewed papers may be due to the difficulty of measuring OC. However, considering that OC traits such as internal practices, processes and sharing values, as depicted within the OC heading in Table 2, are essential factors in predicting BTA, alternative perspective that considers the relationship between OC and others well ranked factors within the TOE organizational dimension may contribute to empirical studies on the topic, especially regarding TMS, given its relevance for the OR towards BTA.

5 Concluding remarks

A SLR has been conducted to clarify and to systematize constructs into TOE organizational dimension, and to identify prevailing organizational constructs affecting BTA. The SLR identified that the use of the TOE theory exploring BTA is permeated with inconsistencies and overlapping definitions. Several studies have found that OR, TMS and OC are the most frequent factors affecting BTA. However, they do not consider potential interdependence among them.

To fill this gap, we have proposed an enhanced TOE theory including OR, TMS and OC within the TOE organizational dimension as key constructs for empirical studies on technology adoption through the TOE theory perspective. We also highlight TMS as prevalent factor in relation to OR and OC as a prevalent ones in relation both to TMS and OR.

This SLR clarifies key organizational TOE constructs affecting BTA, namely TMS, OR, and OC. Furthermore, this study fills a theoretical gap regarding the relevance of OC within the TOE theory. This study contributes, therefore, to the TOE theory by expanding the traditional focus on organizational factors affecting technology adoption without considering key interconnections among them. We expect this study can improve the TOE theory towards a more cumulative body of theoretical knowledge in the field.

Alternative theoretical approaches can illustrate different ways of thinking on relevant topics that prior literature does not address (Torraco, 2016). Through this prism, alternative perspective that considers the relationship between OC and others organizational constructs within the TOE theory seems to be an interesting topic to be considered in future research, especially regarding TMS, given its relevance for the organizational readiness towards BTA.

This SLR has examined only academic papers written in English obtained from two specific databases. In this way, the review of the extant literature may not be exhaustive. Future

reviews should consider covering other databases and other relevant papers. Furthermore, the TOE organizational perspective we proposed in this work is derived from empirical studies exploring OFs affecting BTA. Future research should empirically test our proposition regarding other technologies in different contexts.

CHAPTER 3

Impact of organizational culture on top management support for blockchain adoption: evidence from the yerba mate industry

1 Introduction

1.1 Agrifood traceability concerns

Agrifood safety, quality and authenticity have aroused growing interest among consumers, agrifood industries, and regulators in recent years (Kwasi Bannor *et al.,* 2023). Consumers are increasingly demanding more information about the sources and methods of food production (Casino *et al.,* 2020*)*, with an increased attention the health properties of agrifood products, mostly in the organic markets (Annosi *et al.,* 2024). On the other hand, agrifood companies are requested to align to SDGs, ensuring sustainability attributes of their products, such as anti-deforestation (Tran *et al.,* 2024) or combating child labor (Lafargue *et al.,* 2022). Furthermore, as many agrifood items cross borders worldwide, ensuring their compliance with international standards becomes essential (Khanna *et al.,* 2022).

In this context, adhering to globally recognized food standards is crucial for global market entry (Tarchi *et al.,* 2024), especially in the European Union (EU), in view of its recent regulation on Reforestation Free Product (EUDR), of 31 May 2023, which provides that the European Commission shall establish and maintain an Information System aimed to ensure that every stage of AFSCs of a list of products that will be reviewed and updated regularly (EUROPEAN COMMISSION, 2023).

Despite, however, some efforts to manage AFSCs efficiently, many food fraud incidents have been reported (Van Ruth *et al.*, 2017), as a recent case of honey fraud in the EU, in which it has been found that nearly half of all honey imported into the EU is suspected of being adulterated. The findings, published in the EU report "From the Hives", revealed that from 320 tested samples, in 147 (46%) “at least one marker of extraneous sugar sources was detected” - signing the honey was adulterated at some point of the SC. Moreover, the honeys' true geographical origins were masked using forged traceability information (EUROPEAN COMISSION, 2023). Incidents like these highline the importance of better management of agrifood traceability.

Traditional food safety management systems, however, are not specifically designed for fraud control (Van Ruth *et al.,* 2017). Current AFSCs, particularly those connected to large distribution platforms, have a significant number of participants dispersed along the chain, resulting in poor information exchange and potentially unreliable data among participants (Wang *et al.,* 2021). In this context, the need for effective traceability systems to improve agrifood safety, quality and authenticity makes traceability a key issue in AFSCs.

The Brazilian yerba mate industry also faces similar concerns. *Ilex paraguariensis*, popularly known as yerba mate, is an evergreen plant native to the subtropical South America, is found in the wild state or in plantations in Argentina, Brazil and Paraguay, the only countries in the world that produce the yerba mate. Although it does produce flowers and fruits, only the oval-shaped leaves and stems are picked for the "chimarrão", a traditional beverage inherited from the indigenous culture, prepared by hot infusion of dried leaves powder in a gourd and gently sipped with a metal straw.

Yerba mate in Brazil is found in approximately 180,000 rural properties which produces raw material for approximately 600 yerba mate industries (CHECHI *et al.,* 2017). The sector is characterized by small companies, lack of leaders in the market, and few entry barriers (Chechi, Schultz, 2016). Some producers, envisaging the possibility of adding value to their products to foster competitivity, have acquired processing units, placing their brand on the market (Oliveira, Waquil, 2015).

For many years, the dehydrated leaves of the yerba mate have been used mainly for the "chimarrão" (Oliveira, Waquil, 2015). Over recent years, however, due to its great potential as raw material for other products, the yerba mate have stirred up interest for its use in gastronomy, energy drinks, chocolates, liquors, tea infusions, among others. These developments have opened doors at international markets. From 2012 to 2022, the volume of yerba mate exports in Brazil grew 32.5%, with Rio Grande do Sul as the main exporting State, accounting for 76.6% of the exported volume, which reached 48,062 tons in 2022 (Fick *et al.,* 2023).

Notwithstanding this promising scenery, however, the sector faces some challenges, such as combating informality, standardizing products, providing fair prices for all agents across the production chain, as well ensuring product quality from harvesting to the final consumer (IBRAMATE, 2018), especially for accessing international markets.

Historically, the sector has been tied to "traditionalism", both in the habit of "chimarrão" and in the industrial process, which has changed little since the beginning of its production (Greff; Farias; Souza, 2020). During the years, yerba mate actors have competed solely for price and

volume, leaving aside considerations such as the origin of the yerba mate leaves, harvesting, environmental impact, among other factors related to its origin and quality (Pretto, 2021).

Nowadays, however, the sector is beginning to experience a more competitive environment (Gref *et al.,* 2020). Due to the emergence of new market opportunities, producers need to develop and value their intangible assets to deliver better products. More sophisticated markets demanding to know the traceability of foods push producers to urgently start the digitalization of its SC, at the risk of losing competitiveness (Pretto, 2021).

Yerba mate products can show a high diversification of quality depending on harvesting methods, processing systems and packaging choices. In this context**,** concepts such authenticity, quality, and traceability issues become pivotal (Iommi, 2021). According to this author, a deep analysis of selected scientific references and official notifications in the European Union can highlight these possible actions: undeclared and fraudulent addition of carbohydrates; fraudulent identification of origin concerning yerba mate products, unmentioned addition and mixing of yerba mate with other *Ilex* species, and fraudulent labelling (Iommi, 2021).

Some measures have been taken to overcome these challenges, such as the IBRAMATE initiative in training and qualifying yerba mate producers to adhere to organic certification (IBRAMATE, 2018). In the same way, the Technical Assistance and Extension Services Enterprise in Rio Grande do Sul (EMATER/RS), a state company, developed in 2017 a Quality Certificate of Yerba mate for monitoring its quality from the raw leaf to the final processing and shipping. Certification is a key strategy for the yerba mate industry to gain access to international markets, but there is still a lot of work ahead as, for instance, aspects related to geographic identification and an efficient traceability system.

1.2 Blockchain as solution for agrifood traceability

Over the last few years, considerable progress in agrifood traceability has been made by the current digital era known as Industry 4.0, such as Artificial Intelligence, Big Data, IoT, and BT (Hassoun *et al.,* 2023). Among these technologies, BT has been recognized as a possible solution for the implementation of smart traceability systems from farm to fork to deal with the complexities of AFSCs (Dal Mas *et al.*, 2023).

BT is a distributed ledger technology that records peer-to-peer transactions in timestamped blocks linked to each other in a chain (Ganne, 2018). Each new block contains a new piece of information with its own timestamp, which is linked with the previous block through a cryptographic hash (Shen, Pena-Mora, 2018). The entire record of transactions is visible to

every single user connected to the BT network (Astill *et al.*, 2019; Fu *et al.*, 2018; Kouhizadeh, Sarkis, 2018; Kshetri, 2018), eliminating, therefore, the need for a third-party to verify the transactions. These features ensure real-time transparency by tracing transactions from their origin to the destination (Fraga-Lamas, Fernandez-Carames, 2019).

The key feature of BT is that there is no central system or central authority that controls the entire BT. Each member of the BT holds the same copy of the digital ledger, which contains the details of all the transactions (Fraga-Lamas, Fernandez-Carames, 2019). Blocks, once added to the BT network, cannot be deleted (Shen; Pena-Mora, 2018). Data can only be added but not changed or erased (Crosby *et al.,* 2016). Data modification of a single block requires accessing all previous blocks, which makes hacking a block or manipulating data practically impossible (Joshi *et al.*, 2023). These combined characteristics of BT make this technology unique and transformative for existing business models and SCs (Baiyere *et al.*, 2020; Janssen *et al.,* 2020).

After being introduced in the cryptocurrency market as a disruptive technology, advancing electronic payment systems based on cryptographic without the participation of financial institutions (Nakamoto, 2008), BT has been developed and applied to other areas like food safety issues (Vu, Ghadge, Bourlakis, 2021), freight logistics and SCM (Sternberg; Hofmann; Roeck, 2020), energy sector (Wang, Su, 2020), FinTech (Fernandez-Vazquez *et al.,* 2019), agriculture (Kamble, Gunasekaran, Gawankar, 2020), circular economy (Kouhizadeh, Zhu, Sarkis, 2019), health care (Queiroz, Telles, Bonilla, 2019), pharmaceutical SC (Ghadge *et al.,* 2022), among others.

A recent review by Joshi *et al.,* (2023) identified different uses of BT across various SC activities, focusing on traceability solutions in wider SCs (Behnke, Janssen, 2020), increasing visibility and transparency for products and processes especially in AFSC. Although many of these applications are just emerging or are in development, the increase in number of established collaborations and consortia indicates increasing interest in BT by many business and enterprise applications (Ahmed, Maccarthy, 2022).

In this context, BT for SC traceability has received widespread research attention (Salah *et al.,* 2019; YIU, 2021; Bischoff, Seuring, 2021; Centobelli *et al.,* 2021; Omar *et al.,* 2022; Varavallo *et al.,* Terzo, 2022), as food traceability can be more safely established through BT, improving transparency and enabling a robust and efficient traceability system (Galvez *et al.*, 2018).

Furthermore, with growing awareness of sustainability, organizations are looking for technologies to help them in attaining SDGs. AFSCs are requested to align with the increasing demands for sustainability (Agovino; Cerciello; Gatto, 2028; Dias; Rodrigues; Ferreira, 2019).

BT can track social and environmental conditions (Adams; Kewell; Parry, 2018), improving confidence in product sustainability by keeping close and accurate track of their flows in SCs (SABERI *et al.,* 2018). In the same line, Friedman and Ormiston (2022) describe BT as a driver of food sustainability. In this context, BT has, therefore, the potential to advance SDGs in the AFSCs by enhancing transparency, traceability, and accountability (Chandan; John; Potdar, 2023).

1.3 Blockchain opportunities for the yerba mate industry

BT can be an efficient traceability tool for the yerba mate industry towards sustainability focusing on international markets. However, this technology is still at an early stage in the country. As an starting regarding BTA, the Brazilian Agricultural Research Corporation - EMPRABA, linked to the Ministry of Agriculture and Livestock, developed in 2022 a system called Brazilian Agro-Traceability System (SIBRAAR), which uses BT technology to trace agrifood products, providing information on products origin and quality in a transparent and reliable manner (SIBRAAR, 2022).

Using a QR Code printed on the packaging, the consumer has direct access to information from the farms to its distribution and commercialization. This software is the first national technology for agrifood traceability using BT, aiming to add value to agrifood products at national and international markets. This technology has been recently employed, for the first time, in the brown sugar sector. Since July 2023, traceable brown sugar has been available in Brazilian supermarkets from a partnership between EMBRAPA and the Cooperative of Sugarcane Producers of São Paulo State and Usina Granelli (SNA, 2023).

More recently, the Brazilian branch of the giant agribusiness Bunge and the Bangkok Produce Merchandising Public Company, a subsidiary of Charoen Pokphand Foods, have jointly begun testing a BT based a platform for sustainable soy traceability by shipping three vessels totaling 185,000 tons of deforestation-free soybean from Brazil to Thailand. According to Charoen Pokphand Foods, the use of BT allowed for full tracking of the product, from the origin of the grain on the farms, through its processing and transportation until its destination (BUNGE, 2024).

In this ambiance, a recently announced project of the CNA in partnership with ABDI and SEBRAE for the development of a traceability system for Geographical Indications in the yerba mate industry (CNA, 2023) is a promising step towards BTA in the sector.

Despite, however, all advantages of BT, most people remain unaware of this technology and its value for agrifood traceability (Mirabelli, Solina, 2020). As observed by Longo; Nicoletti, Padovano; d'Atri and Forte (2019), while the implementation of BT has been considered revolutionary for the agrifood sector, some drivers and barriers need to be identified for wider implementation of this technology. Identifying and exploring relevant OFs which may affect BTA in the yerba mate industry is, therefore, an important step for a better understanding of its opportunities for the sector.

2 Literature review and hypothesis

To ensure we stay focused on our research objectives, we draw upon existing theories on BTA to clarify the constructs that will be explored in our research model. By building upon established knowledge, we expected to interpret our findings in a meaningful way and draw conclusions that have theoretical and practical implications. As the study departs from existing theories on BTA, we first outline the theoretical foundation for the literature review of the relationship between OC and TMS as prevailing factors affecting BTA at organizational level. From the gaps identified in prior studies, we then specify the OC perspective undertaken for hypotheses development.

2.1 Theoretical framework

Many theories have been used to explain BTA (Zhu, Bai, Sarkis, 2022). Widely used theories include, for example, the Diffusion of Innovations theory (DOI) (Rogers, 2003), the Technology-Organization-Environment (TOE) theory (Tornatzky, Fleisher, 1990), the Unified Theory of Acceptance and Use of technology (UTAUT) (Venkatesh, Morri, Davis, 2003), and the Theory of Reasoned Action (TRA) (Ajzen, Fishbein, 1977), a consumer-level theory that explains the relationship between subjective attitudes toward intentions and behaviors. Theories like TRA and UTAUT, however, are individual-level theories for predicting technology adoption, whereas DOI and TOE are organization-level ones (Gangwar, Date, Ramaswamy, 2015).

Behavior theories focus on identifying factors that may influence individuals as they decide to use new technologies. They are more suitable, therefore, for understanding technology adoption at an individual level, as they lack the organizational or environmental perspective towards technology adoption behavior within the organizational and technological contexts

(Ullah *et al.,* 2021). The shortcomings of studies on technology adoption behavior at an individual level call for attention to context for exploring technology adoption at organizational level to avoid potential construct validity issues (Compeau, Correia, Thatcher, 2022).

In view of that, researchers have suggested using the TOE theory to explore technology adoption behavior within organizations (Zhang *et al.,* 2020). The TOE theory was first developed as a theoretical framework by Tornatzk and Fleischer (1990) in the book *The Processes of Technological Innovation*, in which they describe and explore the entire process of innovation and its adoption and implementation within a firm context. This theory provides a taxonomy for dealing with potential critical factors in adopting new technologies by explaining three different elements of a firm's context that influence decisions on technology adoption: the technological dimension, the organizational dimension, and the environmental dimension.

The technological dimension considers all relevant technologies to an organization which are already in use, available for purchase or in development (Tornatzky *et al.,* 1990). It also relates to the level of complexity of new technologies and their compatibility requirements with existing technologies (Chatterjee *et al.,* 2021). The organizational dimension, in its turn, refers to the formal and informal link structure, intra-firm communication processes, firm size, and available resources, including informal and informal link between employees, communication processes and top management (Tushman and Nadler, 1986). Finally, the environmental dimension includes the technology support infrastructure, the regulatory environment and the industry structure as, for example, intense competition among firms, which can foster innovation adoption (Edwin *et al.,* 1977).

TOE is found to be the most robust and widely used theory on technology adoption behavior at organizational level, compared to others theories, which analyze technology adoption behavior at the individual user's level (Gangwar *et al.,* 2015; Awa and Ojiabo, 2016). The TOE theory represents, therefore, an important theoretical underpinning for BTA as it addresses adoption behavior at organizational level.

In an empirical study comparing the TOE perspective and behavioral theories on technology adoption at an organizational level under the situation where only decision makers' views are considered, Li (2020) shows that both TOE and behavior theories such TRA and UTAUT can offer similar explanation of the adoption action and would practically lead to similar results. His study stresses that the TOE theory is easy to use in real-life business setting and can also generate models compatible with behavioral-theoretic approach, and hence endorses its applicability.

As the main objective of this study was predict the implementation of BT in the yerba mate industry through quantitative analysis of factors affecting BTA at organizational level, the TOE theory has been adopted as the theoretical foundation for the latent variables of our research model.

2.2 Relationship between organizational culture and top management support

TMS plays a significant role in the adoption of new technology within organizations (Clohessy, Acton, 2019). TMS, for example, reveals how well management understands the implications of new technology and how involved they are in the technology adoption process (Clohessy, Acton, 2019). Without TMS, organizational adoption of BT is less likely because top management is the authority that allocates resources for technology adoption (Malik *et al.,* 2021). The lack of TMS may, therefore, reduce BTA (Chittipaka *et al.,* 2022).

Many studies have also found that OC plays an important role on decisions towards BTA (Bhattacharyya, Shah, 2021). OC can influence BTA (Schuetz, Venkatesh, 2020), as the readiness of an organization in adopting BT is dependent on the internal policy of the whole organization (SuwanposrI *et al.*, 2021). Thus, OC may have a significant impact in determining whether a company should implement BT (Boakye *et al.*, 2022), as adopting BT will not be easy unless this technology is consistent with current business practices. BT should, therefore, fit with the company OC (Bag *et al.*, 2020).

In the literature on OC and technology innovation, it has been suggested that OC can influence an organization's ability to process information, rationalize, and exercise discretion in its decision-making processes in technology adoption (Rahman *et al.,* 2013; Senarathna *et al.*, 2014). Baird *et al.,* (2011) asserted that OC could stimulate innovation behavior among an organization's members because it can lead them to accept innovation as a basic value of the organization and can foster commitment to it. In the same way, Hogan and Coote (2014) proposed that OC can influence the behaviors of organizational members to support innovation because it can lead them to accept some basic values of organizations and foster their commitment to these values (Hogan, Coote, 2014).

Considering this interplay between OC and organization members' behavior towards technological innovation, a deeper understanding of the relationship between OC and TMS for BTA represents, therefore, a compelling research agenda. Nonetheless, academic researchers have investigated them as single factors. As a result, the current literature on BTA lacks

integrative understanding of the relationship between OC and TMS by examining, for example, how different types of OC can affect TMS for BTA.

Furthermore, despite the acknowledged significance of OC for BTA, the impact of different types of culture on BTA is still lacking. Most studies on the influence of OC on BTA emphasize OC as unidimensional construct, ignoring that different types of culture can impact BTA in different ways, as not all cultural values, as put by Leal-Rodríguez; Sanchís-Pedregosa; Moreno-Moreno; Leal-Millán (2023), may have an equal impact on fostering innovation as each organization has its own distinctive culture. To our knowledge, there are no empirical studies examining the relationship between OC and TMS for BTA.

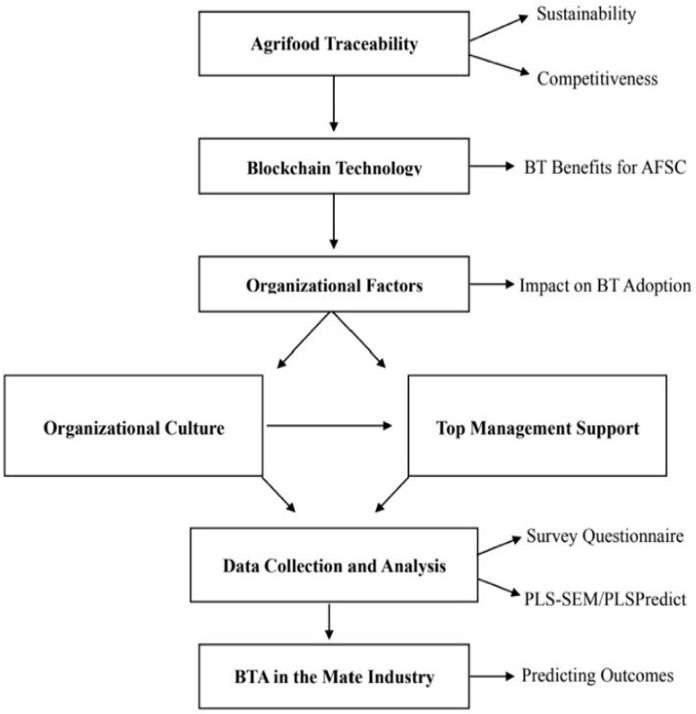
2.3 Research question and objectives

This study seeks to fill this gap by answering the following research question: is there a significant impact of OC on TMS for BTA in the yerba mate industry?

The main objective of this work is to predict the adoption of BT in the yerba mate industry through quantitative analysis of the relationship between OC and TMS. For this purpose, we set the following specific objectives:

- To evaluate statistically the significance of the relationship between OC and TMS for BTA in the yerba mate industry;
- To assess the magnitude of the impact of OC on TMS for BTA in the yerba mate industry;
- To estimate the predictive power of the study results towards BTA in the yerba mate industry.

Fig. 10. Paper Structure



Source: elaborated by the Author.

2.4 Organizational culture perspectives

2.4.1. Functionalism and structuralism approaches

According to Schein (1985), OC can be defined as the collection of shared or unspoken values, beliefs, and assumptions held by members of a company. In this sense, OC goes beyond established values. It encompasses a broad spectrum that includes people's actions, expectations, interactions within the organization, and the perceptions and beliefs used to respond to the environment (Mcdermott, O'dell, 2001). From this perspective, culture serves as a 'function' (Leal-Rodríguez *et al.,* 2014).

Other authors, on the other hand, emphasize the importance of 'structure' rather than 'function'. For them, cultural systems are a structured combination of various activities, social conflicts, and moral dilemmas that individuals face in their lives. Consequently, culture of organizations cannot be treated prescriptively, as there is no such thing as a universally better culture (Leal-Rodríguez *et al.,* 2014).

These perspectives underline two contrasting approaches in the conceptualization of OC (Burrell, Morgan, 1919): the functionalist approach, which emphases causality, and the structuralist approach, which emphasize association and influence (Hughes, Lambert, 1984).

For functionalists, OC is the process that gives rise to 'adaptation', which refers to 'fit' between the organization and its environment. In this sense, cultures play an essential role in organizations, as cultural values serve as the foundation for decision-making that operate through causal relationships (SułkowskI, 2014).

Structuralism, on the other hand, emphasizes balance and harmony. The values that lead organization to success may be a barrier to success in other organization (Hampden-Turner, Trompenaars, 2006). To deal with these competing values, structuralism focuses on the concrete manifestations of culture in everyday practice and employs relational methods to measure the cultural aspects of social structure (Lounsbury, Ventresca, 2003).

In a recent study employing Quinn and Rohrbaugh's (1981) traditional culture archetypes to predict digital culture in organizations, Leal-Rodríguez *et al.,* (2014) identified similarities between structuralist theory, functionalist theory, and Quinn and Rohrbaugh's classic cultural archetypes based on the model known as Competing Values Framework, as they emphasize the role of social institutions in shaping individual behavior and societal functioning.

They initially observers that according to functionalist theory, social institutions exist to fulfill vital social roles, including meeting essential human needs and promoting social stability. This perspective, according to them, aligns with Quinn and Rohrbaugh (1981) assertion that cultural systems serve a purpose within organizations. Conversely, structuralist theory focuses on how social institutions establish and maintain power relations in society. This viewpoint is also consistent with Quinn and Rohrbaugh's (1981) theory that cultural systems can be utilized to uphold established social norms and power structures. Consequently, still according to Leal-Rodríguez *et al.,* (2014), combining these theories can provide a more comprehensive understanding of organizational dynamics.

2.4.2. Competing values framework

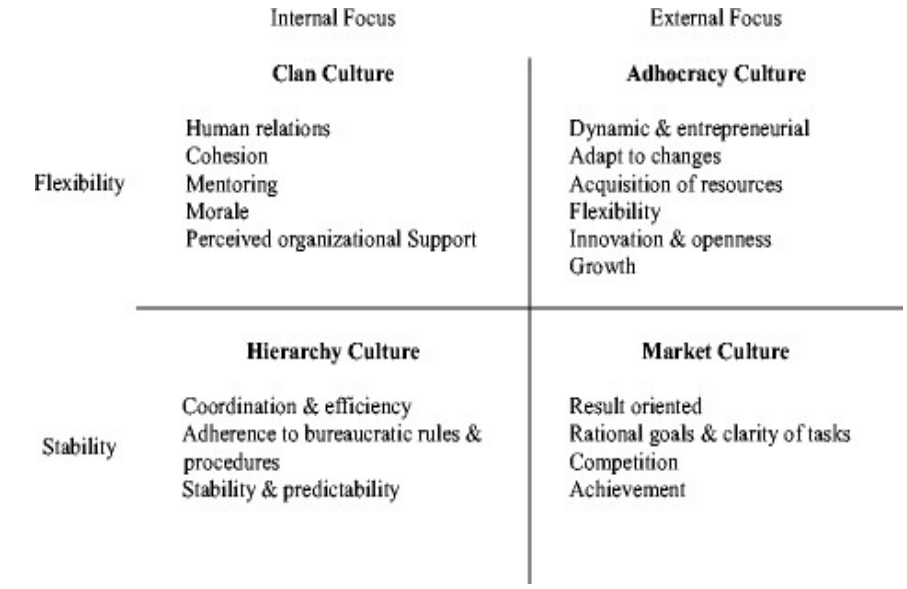
Different dimensions of OC have been used to explore the relationship between culture and innovation in business and management. One of the most used theoretical models is CVF (Quinn, Rohrbaugh, 1981), latter adjusted by Cameron, Quinn (2011), which we use in this study. By focusing on four quadrants of cultural values and norms, identified as clan, adhocracy, hierarchy, and the market culture, the CVF has been widely used in empirical studies which

investigate the relationship between OC and innovation in different contexts (Tian *et al.,* 2018). The CVF has been widely used in an expressive amount of research (Grabowski *et al.,* 2014). It has been replicated and validated by multiple studies (Alharbi; Sidahmed Abedelrahim, 2018), including total quality management (Roldán; Leal-Rodríguez; Leal, 2012), human resource management (Acosta-Prado *et al.,* 2020) and innovation outcomes (Leal-Rodríguez; *et al.*, 2014).

The essence of the CVF is that no organization is purely of one type of culture; rather competing values co-exist at different degrees forming the culture of the organization. The managerial question then is how to balance these competing values to create a culture that steers the organization towards stability, innovation, flexibility, and market responsiveness (Cameron, Quinn, 2011).

The concept of CVF, thus, is that opposing OC dimensions are applied to determine a position for each criterion against the other (Cameron, Quinn, 2011). One dimension is a continuum with flexibility and discretion at one end and stability and control at the other. The other dimension is a continuum between internal integration and external differentiation. Both dimensions, then, form four hypothetical quadrants, each representing a type of OC, identified as clan, adhocracy, hierarchy, and market (Cameron, Quinn, 2011), as in Fig. 12.

Figure 11. CVF quadrants.



Source: Adapted from Cameron and Quinn (2011).

According to Cameron and Quinn (2011), the above types of OC have the following features:

Adhocracy culture is described as creative and adaptable. This culture type fosters innovation, entrepreneurship, and vision in the organization. Adaptation and flexibility are central to adhocracy culture with ad hoc arrangements to meet emerging needs. In Adhocracy culture, changing priorities create opportunities for new approaches.

Clan culture is characterized as a group compared to a family where there is a shared belief within the group. Teamwork is valued and rewarded. People that work in this type of organization are very committed to the organization and its traditions. Likewise, clan culture is characterized as one that takes longer to cultivate, and the goals are for the best interest of the group.

Hierarchy culture is typified by conventional bureaucracy, which includes specialization and formal structures and processes. Key elements are rules and standards, stability and predictability, with a focus on efficiency and procedures.

Market culture relates to an organization that replicates its market environment. The focus is on being competitive and profitable, which requires discipline to maintain a competitive position. Overcoming competitors, with emphasis on winning is key to market culture.

Drawing from these insights, we adopt in this study the Quinn and Rohrbaugh's (1981), archetypes of OC according to CVF, as later developed by Cameron, Quinn, (2011), namely adhocracy culture, clan culture, hierarchy culture, and market culture, which integrates both functionalist and structuralist elements of OC (Leal-Rodríguez *et al.,* 2014).

2.5 Hypotheses development

Adhocracy culture emphasizes future orientation, risk taking (Ahmed, 1998) and flexibility (KitchelL, 1995). Flexibility-oriented culture emphasizes creativity, providing discretion for employees (Shao, 2019). Moreover, flexibility-oriented culture creates an open environment for informal communications among organizational members (Somech, Drach-Zahavy, 2013). These cultural characteristics are supportive of firms adapting to the new environment and bring critical resources together to engage in innovative and creative ventures. The organization with the adhocracy culture is more responsive to innovation (Brettel, Cleven, 2011). In the same way, adhocracy actively promotes change, adaptation, and it is a powerful catalyst for digitalization (Hartl, Hess, 2017). Under such circumstances, we propose the following hypothesis for the relationship between adhocracy culture and TMS for BTA.

H1. Adhocracy culture impacts top management support for blockchain adoption in the mate industry.

Clan culture is typically featured in as a friendly place to work. An organization with a clan culture normally emphasizes the long-term benefit, high cohesion and human development and participation (Cameron, Quinn, 2006). A study by Felipe; Roldán; Leal-Rodríguez (2017) established a positive and statistically significant correlation between clan culture and organizational agility, which can favor innovation. In this way, Hartl and Hess (2017) suggest that a combination of culture types from the CVF, emphasizing values that promote care for people, provide optimal outcomes in digitalization. From these insights, this paper proposes the following hypothesis for the relationship between clan culture (CLA) and TMS for BTA:

H2. Clan culture impacts top management support for blockchain adoption in the mate industry.

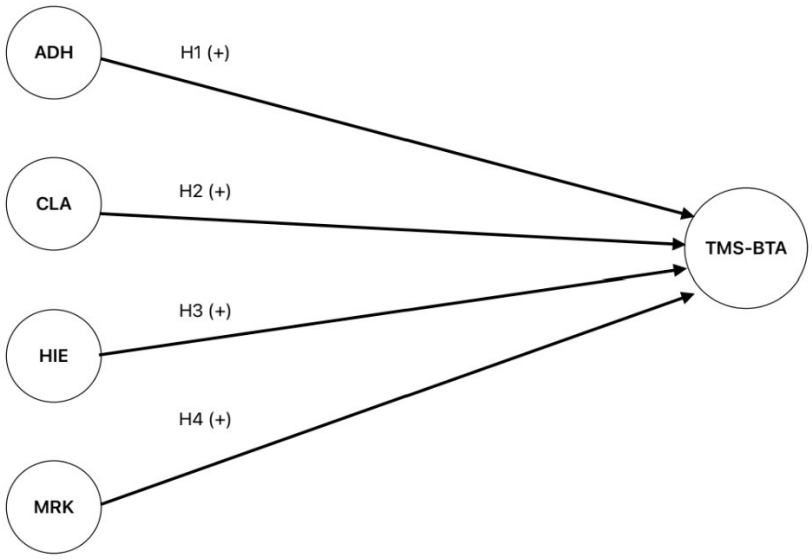
Hierarchy culture places significant emphasis on adhering to norms, formal procedures, and control (Sanz-Valle *et al.,* 2011). In contrast to adhocracy culture, the hierarchical culture is characterized by a formalized and structured place to work, emphasizing stability, predictability, and efficiency (Cameron, Quinn, 2006). The existence of rules, regulations, and explicit goals for responsiveness and productivity in a control-oriented culture provides low discretion for organizational members and high level of uncertainty avoidance (Lewis, Boyer, 2002; Sarooghi; Libaers; Burkemper, 2015). In the hierarchical culture, a company stresses internal control, which may reduce information gathering, organizational learning, and thus be detrimental to innovation (Büschgens, Bausch, Balkin, 2013; Lemon, Sahota, 2004; Naranjo Valencia *et al*., 2010). Under these conditions, we propose the following hypothesis for the relationship between hierarchy culture and TMS for BTA:

H3 Hierarchy culture impacts top management support for blockchain adoption in the mate industry.

Market culture emphasizes competitiveness, goal achievement, and environment exchange. Market culture can be perceived, therefore, as a driver of competitive success with clear objectives and an assertive approach to increase output and revenue (Grover; Tseng; Pu, 2022). However, previous research suggests that cultural values such as tight deadlines and team efficiency within organizations may inhibit processes such as organizational learning or innovation (Sanz-Valle *et al.*, 2011). According to these authors, the market culture focus on control and stability (rather than flexibility) has an adverse impact on innovation. Consequently, we propose the following hypothesis for the relationship between market culture and TMS for BTA:

H4. Market culture impacts top management support for blockchain adoption in the mate industry.

Fig. 12. Study hypotheses.



Source: Elaborated by the Author.

3 Methodology

3.1 Measurement model

When developing constructs, researchers must consider two types of measurement specification: reflective and formative measurement. In reflective measurement, the indicators represent the effect of an underlying construct. Therefore, causality flows from the construct to its indicators. In contrast, formative measurement models assume that the indicators form the construct. Thus, each indicator captures a specific aspect of the construct.

According to Hair *et al.,* (2022), there is not a definite answer to when to measure a construct reflectively or formatively, because constructs are not inherently reflective or formative. Instead, the specification depends on the construct development and the objective of the study.

This study particularly focused on predicting BTA in the mate industry considering four types of OC as exogenous constructs (independent variables) and TMS as endogenous construct (dependent variable). Since the indicators of the five constructs in our model (Fig. 17) were

described as manifestation of each underlying construct, all constructs in our study were be measured reflectively.

3.2 Measurement instrument

A semi-structured questionnaire survey was used to collect data and to test the hypotheses. The questionnaire comprises three groups of points regarding, respectively, (a) demographic characteristics, (b) OC constructs, and (c) TMS constructs. The questionnaire took approximately 10 to 15 minutes to complete.

As the four types of OC measured in this study were established from the perspective of the CVF, as described in the previous section. The group of points related to OC was adapted from the copyrighted Organizational Culture Assessment Instrument (OCAI) developed by Cameron and Quinn (2006) based on the four CVF quadrants, widely employed and validated in many prior studies (Naranjo-Valencia *et al*., 2011; Heritage; Pollock; Roberts, 2014; Pakdil and Leonard, 2015). Approval for the OCAI use was obtained from the instrument's authors (ANNEX B).

The original OCAI consists of 24 items divided into six groups of four statements (one for each culture type), comprising the following dimensions of OC: dominant characteristics, organizational leadership, management of employees, organizational glue, strategic emphasis, and criteria for success.

The instrument originally used an ipsative scale in which respondents divide 100 points among alternatives, but it can also be adapted to a Likert scale, as both versions are compatible to the survey instrument (Quinn, Spreitzer, 1991). Furthermore, it has been argued that each response in OCAI Likert's format creates a degree of independence, which ensures objectivity in the research process (Cameron, Quinn, 2006).

For this study purpose, the OCAI items were adapted to a five-point Likert scale ranging from 1 = strongly agree to 5 = strongly disagree with 24 reflective statements (indicators) provided without numbering, divided into four groups (one for each OC construct) of six statements.

TMS was measured using a five-point Likert ranging from 1 = strongly agree to 5 = strongly disagree with five reflective statements (indicators) provided without numbering, adapted from Wong *et al.,* (2020) and from Badi *et al.,* (2020) studies on BTA.

The initial questionnaire draft was translated into Portuguese and underwent a proofreading by an expert from the mate industry, and an academic with a PhD on BTA in the

agrifood sector to ensure the survey items were clear, meaningful, and understandable. Their feedback contributed to the final version of the questionnaire with minor adjustments (Appendix C).

3.3 Data setting

This study was conducted among mate industries in the Brazilian State of Rio Grande do Sul. Data setting selection was based on non-probability sampling considering a distinctive characteristic of this State. As the main objective of this study is to predict BTA in the mate industry as a traceability solution for ensuring competitiveness at international markets, the distinctiveness of the Rio Grande do Sul as the main Brazilian exporting State, accounting for 73,1% of the exported volume, justified its choice as the geographical focus of our study (Fig. 4).

We have targeted for data collection a list of 149 registered mate industries provided by the Yerba Mate Committee of the Secretary of Agriculture of Rio Grande do Sul. Our decision for registered mate industries considered that they provide a more reliable picture of the sector than a data sample also including informal productive structures.

Managers and owners who were directly responsible for the companies' activities have been chosen as respondents. These key respondents were considered appropriate for the survey because they have a broader perspective of the daily operations and the internal environment of the firm and play an active role in making strategic decisions.

3.4 Sample size

Research design and the unity of analysis are important factors when deciding on sampling size**.** As put by Memom *et al.,* (2020), a complex model with numerous variables requires a larger sampling than a simple model with few variables. In the same way, research at the organization level using top managers as respondents may have a smaller sample size than research at the individual level using, for example, employees and clients (Memom *et al.*, 2020). Considering our research comprises a simple model with five variables using top managers as respondents in a population of 149 industries, a smaller sample size is appropriate for our research objectives. The next step was to estimate the minimum required sample size.

To assess the minimum required sample size for PLS-SEM, Hair *et al.,* (2021) suggest researchers can consider Cohen's (1992) table. This table shows the minimum samples required to obtain minimum R^2 values for any of the endogenous constructs in the structural model at

significance levels of 1%, 5%, and 10% with statistical power of 0.80, standard values used in social sciences, as depicted in Table 3.

Table 3. Recommended minimum simple size for PLS-SEM.

Maximum number of arrows pointing at construct	*Significance level*											
	1%				*5%*				*10%*			
	Minimum R^2				*Minimum R^2*				*Minimum R^2*			
	0.10	*0.25*	*0.50*	*0.75*	*0.10*	*0.25*	*0.50*	*0.75*	*0.10*	*0.25*	*0.50*	*0.75*
2	158	75	47	38	110	52	33	26	88	41	26	21
3	176	84	53	42	124	59	38	30	100	48	30	25
4	191	91	58	46	137	65	42	33	111	53	34	27
5	205	98	62	50	147	70	45	36	120	58	37	30
6	217	103	66	53	157	75	48	39	128	62	40	32
7	28	109	69	56	166	80	51	41	136	66	42	35
8	238	114	73	59	174	84	54	44	143	69	45	37
9	247	119	76	62	181	88	57	46	150	73	47	39
10	256	123	79	64	189	91	59	48	156	76	49	41

Source: Cohen (1992).

Following these guidelines, we used in this study Cohen's (1992) table considering minimum R^2 of 0.250 at 5% of significance level. Accordingly, since there are four arrows pointing at the TMS construct in our model, the recommended sample size was 65 (Table 3). Therefore, the collected number of 69 samples, reported in the next topic, is an adequate sample size for our study aims.

3.5 Data collection

The survey questionnaire was transferred to an online platform for data collection. The visual appearance of the questionnaire, easy to read font type and minimal scrolling pages lead us to use the SurveyMonkey platform.

The questionnaire was accompanied by an introductory letter informing the respondents about the researcher and the purpose of the study. Adherence to ethical considerations was ensured, including informing the participants that their participation was voluntary, that responses were anonymous and that results will only be reported in aggregate form.

The data collection period spanned from January to March 2024. The questionnaire link was initially distributed to participants via e-mail obtained from the target industries websites. The initial e-mail was followed by phone calls reminders two weeks later. After one month, only **7** questionnaires were returned, with a response rate of less than 5%.

Considering 61 of the 147 target industries were concentrated in three municipalities (Ilópolis. Arvorezinha and Áurea) with short distance among them, we decided to personally visit the industries located in these municipalities to expand respondents' numbers. After staying for five consecutive days in a hotel in Ilópolis in February 2024, we personally talked to top managers and owners of 45 mate industries about the research purpose and the online questionnaires. This strategy was effective, as 40 furthers questionnaires were returned during the visit period. After our visit to these mate industries, we received, during March 2024, 22 other questionnaires. The final sample contains 69 respondents, with a response rate of 47%.

4 Data Analysis and results

4.1. Demographic characteristics

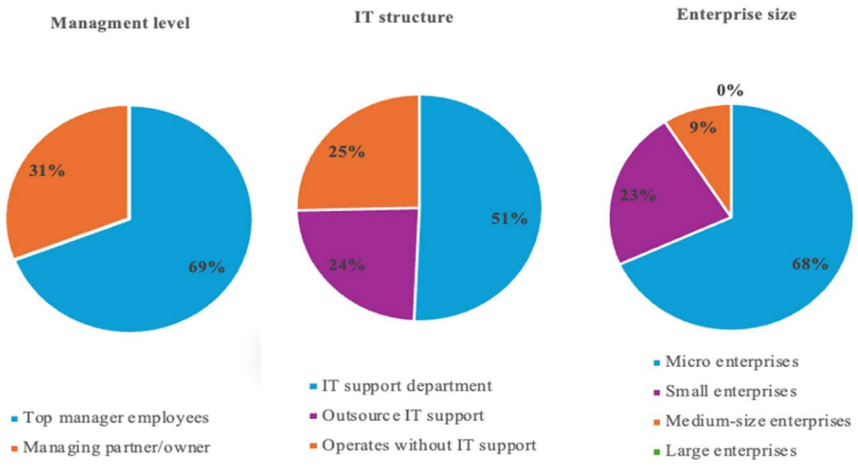
Demographic characteristics were assessed by asking respondents about their management level, enterprise size and information technology (IT) structure. We obtained 68 samples of these items from the total of 69 survey questionnaires returned, just one of them, therefore, with missing values regarding this section. This survey section's results are summarized in Fig. 14.

In relation to the first item, 47 (69,12%) of the 68 respondents answered they were managing partner/owner and 21 (30,88%) of them said they were top manager employees. Assuming partner/owner acting as frontline decision-makers may have more power in strategic management than top manager employees, this factor may affect the support for BTA. As this aspect is outside the boundaries of this study, it was not estimated in the data analysis and could be considered in future research.

For descriptive information about enterprise size, we used the industries classification system of the Brazilian Institute of the Geography and Statistics (IBGE), which classifies enterprises size by the number of persons employed: 1 to 19 persons employed (micro enterprises), 20 to 99 (small enterprises), 100 to 499 persons employed (medium-sized enterprises), and 500 or more persons employed (large enterprises). According to the respondents' answers, 45 (68,18%) of the 68 enterprises surveyed have less than 19 persons employed (micro enterprises), 15 (22,73%) have between 20 and 99 persons employed (small enterprises), and 6 (9,09%) of them have between 100 and 499 persons employed (medium-size enterprises).

Regarding IT structure, we provided in the survey questionnaire the following answers options: (a) Our enterprise has an IT support department; (b) Our enterprise outsources IT support; (c) Our enterprise fully operates without IT support. Of the 68 obtained samples, 33 (48,53%) answered that their enterprise has an IT support department, 17 (25%) answered their enterprise outsources IT support, and 18 (26,47%) said their enterprise fully operates without IT support.

Fig. 13. Demographic characteristics.



IT: information technology

Source: Elaborated by the Author.

4.2 Data analysis technique

Data collected was analyzed using SmartPLS 4 software and the PLS-SEM method. PLS-SEM is a quantitative method widely used in the social sciences, particularly in management, marketing, and economics (Hair *et al.*, 2012). It is well-suited for exploring relationships between latent constructs such as attitudes, beliefs, and behaviors in complex systems (Hair *et al.,* 2014).

There are two types of SEM methods: covariance-based structural equation modelling (CB-SEM) and PLS-SEM. The CB-SEM method is primarily used to confirm (or reject) theories. It does this by determining how well a theoretical model can estimate the covariance matrix for sampling data (Hair *et al., 2022*). In contrast, PLS has a "causal-predictive" approach, focusing on explaining the variance in dependent variables.

According to Hair, Sarstedt and Ringle (2019), these are some rules of thumb that can be applied when deciding whether to use CB-SEM or PLS-SEM: (1) CB-SEM is particularly suitable for testing a theory in a concise theoretical model. However, if the primary research

objective is prediction and explanation of target constructs, PLS-SEM should be given preference; (2) PLS-SEM achieve higher level of statistical power with small simple sizes; (3) PLS-SEM can easily handle reflective and formative measurement models; (4) Its causal–predictive nature makes PLS-SEM particularly suitable for research aiming to derive recommendations for practice.

Given the predictive aims of this study, the small size of our data setting, the use of reflective measurement model and the research focus on recommendation for managerial practices, we considered the PLS-SEM as the most appropriate method for our data analysis. In addition to PLS-SEM, we used PLS-Predict, an advanced procedure available in the SmartPls 4 software, to estimate the predictive power of the study results.

4.3 Missing values

Missing values should be dealt with when using PLS-SEM. Less than 5% values missing per indicator are considered reasonable and researchers can opt for mean replacement (Hair *et al.,* 2021).

Before conducting the data analysis, all data collected were checked for missing values. Considering there were no more than 2 missing values per indicator among 69 samples, we opted for mean replacement, one of the options offered by SmartPLS 4 for missing values treatment.

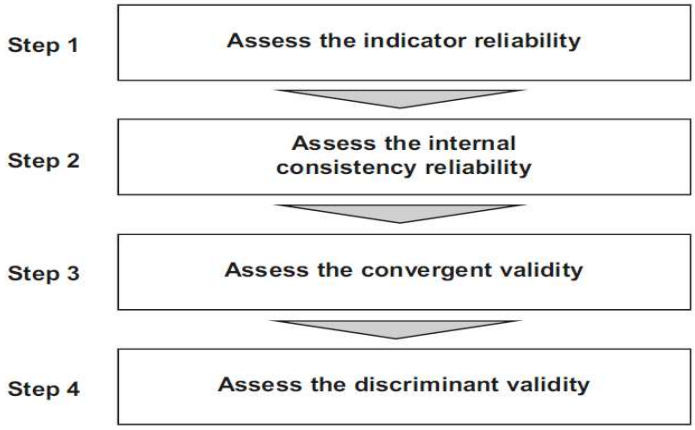
4.4 Results and discussion

The PLS-SEM model results provide empirical measures of the relationship between the indicators and the constructs (measurement model) as well between the constructs (structural model). The results enable the evaluation of the quality of the indicators and if the model delivers satisfactory results in explaining and predicting the target construct. Thus, the PLS-SEM results assessment consists of two stages: (1) The evaluation of the measurement model, and (2) The evaluation of the structural model.

4.4.1 Evaluation of the measurement model

The first stage of applying PLS-SEM is to evaluate the indicators' quality (measurement model), which involves four steps:

Figure 14. Steps for the evaluation of the measurement model.



Source: Adapted from Hair *et al.,* 2022.

Step 1. Indicator reliability

Indicator reliability, also called outer loadings, expresses the relationship between a construct and its indicators. High outer loadings on a construct mean their indicators have much in common (Hair *et al.,* 2022). The recommended value for the indicator loadings should be more than 0.70 to ensure indicator reliability. However, indicators with outer loadings between 0.40 and 0.70 should be considered for removal only when deleting the indicator leads to an increase in the internal consistency reliability or convergent validity above suggested threshold values (Hair *et al.,* 2022). Following these guidelines, two indicators from each construct of our path model have been removed with a new sequence from 1 to 4 in the path model (Appendix D).

After deleting these indicators from the survey, all remaining 20 indicators meet the acceptable threshold value, most of them with outer loads more 0.70 and just one (HIE2<HIE) with 0.53, ensuring, therefore, construct indicator reliability (Table 4).

Table 4. Indicators outer loadings.

	Outer loadings
ADH1 <- ADH	0.842
ADH2 <- ADH	0.616

ADH3 <- ADH	0.675
ADH4 <- ADH	0.767
CLA1 <- CLA	0.817
CLA2 <- CLA	0.632
CLA3 <- CLA	0.845
CLA4 <- CLA	0.782
HIE1 <- HIE	0.665
HIE2 <- HIE	0.795
HIE3 <- HIE	0.794
HIE4 <- HIE	0.533
MRK1 <- MRK	0.844
MRK2 <- MRK	0.702
MRK3 <- MRK	0.771
MRK4 <- MRK	0.606
TMS-BTA1<- TMS -BTA	0.621
TMS-BTA2 <- TMS -BTA	0.896
TMS-BTA3<- TMS -BTA	0.866
TMS-BTA4 <- TMS -BTA	0.848

CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS-BTA: Top Management Support for Blockchain Adoption.
SmartPLS4 Results

Step 2. Construct internal consistency reliability

Internal consistency reliability means the extent to which indicators measuring the same construct are associated with each other. A widely used criterion for measuring internal consistency reliability is Cronbach's alpha. However, due to the limitations of Cronbach's alpha, which is considered too conservative, Hair *et al.,* (2022*)* consider more appropriate to apply a measure known as composite reliability as a different measure of internal consistency reliability.

One of the primary measures used in PLS-SEM is composite reliability *rho_c* (Hair *et al*., 2021). Composite reliability varies between 0 and 1, with higher values indicating higher levels of reliability. Values of 0.60 to 0.70 are considered acceptable in exploratory research, whereas values between 0.70 and 0.90 range from satisfactory to good. Values above 0.90 are problematic, since they indicate that the indicators are redundant, thereby reducing construct validity.

While Cronbach's alpha is rather conservative, the composite reliability *rho_c* may be too liberal, and the construct's true reliability is typically viewed as within these two extreme values (Hair *et al.,* 2022)**.** As an alternative, subsequent research has proposed the coefficient *rho_a f*or

composite reliability (Hair *et al.,* 2022). Since the reliability coefficient *rho_a* usually lies between the conservative Cronbach's alpha and the liberal composite reliability *rho_c,* it is therefore considered and acceptable compromise between these two measures (Hair *et al.,* 2021)

We report on Table 8 all the above measures for construct internal consistency reliability. Taking the composite reliability *rho_a* as the more appropriate measure, our model shows good composite reliability values ensuring, therefore, construct internal consistent validity.

Step 3. Construct convergent validity

Convergent validity is the extent to which an indicator correlates positively with alternative indicators of the same construct. A common measure to establish convergent validity is the average variance extracted (*AVE*). An acceptable threshold for *AVE* is 0.50 or higher, which indicates that, on average, the construct explains more than 50% of the variance of its items (Hair *et al.,* 2022). As we can see in Table 8, most *AVE* values are above the acceptable threshold of 0.50, except for HIE. However, as the *AVE* value for HIE (0.497) is very close to 0.50, we conclude that our model sufficiently establishes convergent validity.

Table 5. Constructs consistent reliability and convergent validity.

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**	**Average variance extracted (AVE)**
ADH	0.723	0.822	0.818	0.533
CLA	0.799	0.780	0.854	0.598
HIE	0.683	0.712	0.794	0.497
MRK	0.731	0.792	0.823	0.541
TMS-BTA	0.825	0.854	0.886	0.664

CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS-BTA: Top Management Support for Blockchain Adoption.
SmartPLS4 Results

Step 4. Discriminant validity

Discriminant validity is the extent to which a construct is truly distinct from other constructs. Establishing discriminant validity implies that a construct is unique and captures phenomena not represented by other constructs in the model (Hair *et al.,* 2022). To establish discriminant validity, researchers should verify, therefore, if all the constructs in a model are

distinct from each other. Lack of discriminant validity leads to questionable conclusions, as results can be supported because of using a construct twice in the model (Hair *et al.,* 2022).

Many studies use the Fornell-Larcker criterion for the evaluation of discriminant validity. Recent research, however, casts doubt about the efficacy of Fornell-Larcker (Franke, Sarstedt, 2019) and suggests as a criterion for discriminant validity the Heterotrait-Monotrait Ratio (HTMT) with threshold values of 0.85 or 0.90

Considering the above suggestions, we assessed discriminant validity by using the HTMT criterion. As we can see in Table 6, all HTMT results are lower than the conservative threshold value of 0.85.

Table 6. Constructs discriminant validity.

	Heterotrait-monotrait ratio (HTMT)
CLA <-> ADH	0.790
HIE <-> ADH	0.659
HIE <-> CLA	0.782
MRK <-> ADH	0.835
MRK <-> CLA	0.484
MRK <-> HIE	0.641
TMS <-> ADH	0.614
TMS-BTA <-> CLA	0.280
TMS-BTA <-> HIE	0.317
TMS-BTA <-> MRK	0.425

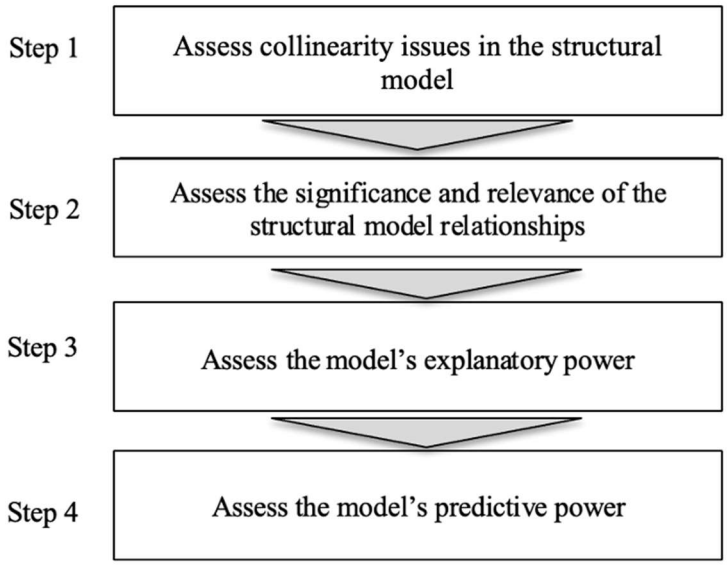
CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS: Top Management Support for Blockchain Adoption.
SmartPLS4 Results

After confirming the construct indicators are reliable and valid, next we evaluate the structural model results.

4.4.2 Evaluation of the Structural model

The second stage in applying PLS-SEM is to evaluate the relationship between the constructs (structural model), which involve four steps:

Figure 15. Steps for the evaluation of the structural model.



Source: Adapted from Hair *et al.,* 2022.

Step 1. Collinearity

In PLS-SEM algorithm, the computation of the path coefficients linking the constructs in the model is based on a series of regression analyses. Collinearity of two variables means that strong correlation exists between them, making it difficult or impossible to estimate their individual regression in a reliable way (Hair *et al.,* 2022). Thus, the researcher must first make sure that collinearity issues do not bias or distort the regression results**.**

The *VIF* (variance inflation factor) is the measured used to access collinearity in regression analysis. Values should be below 5 and preferably below 3 to ensure that collinearity has no substantial effect on the structural model results (Hair *et al.,* 2022). As we can see in Table 7**,** all *VIF* values in our structural model are lower than 3, meeting, therefore, the preferable threshold value for collinearity.

Table 7. Collinearity assessment.

	VIF
ADH1	1.335
ADH2	1.256
ADH3	1.439
ADH4	1.545
CLA1	2.315
CLA2	2.063

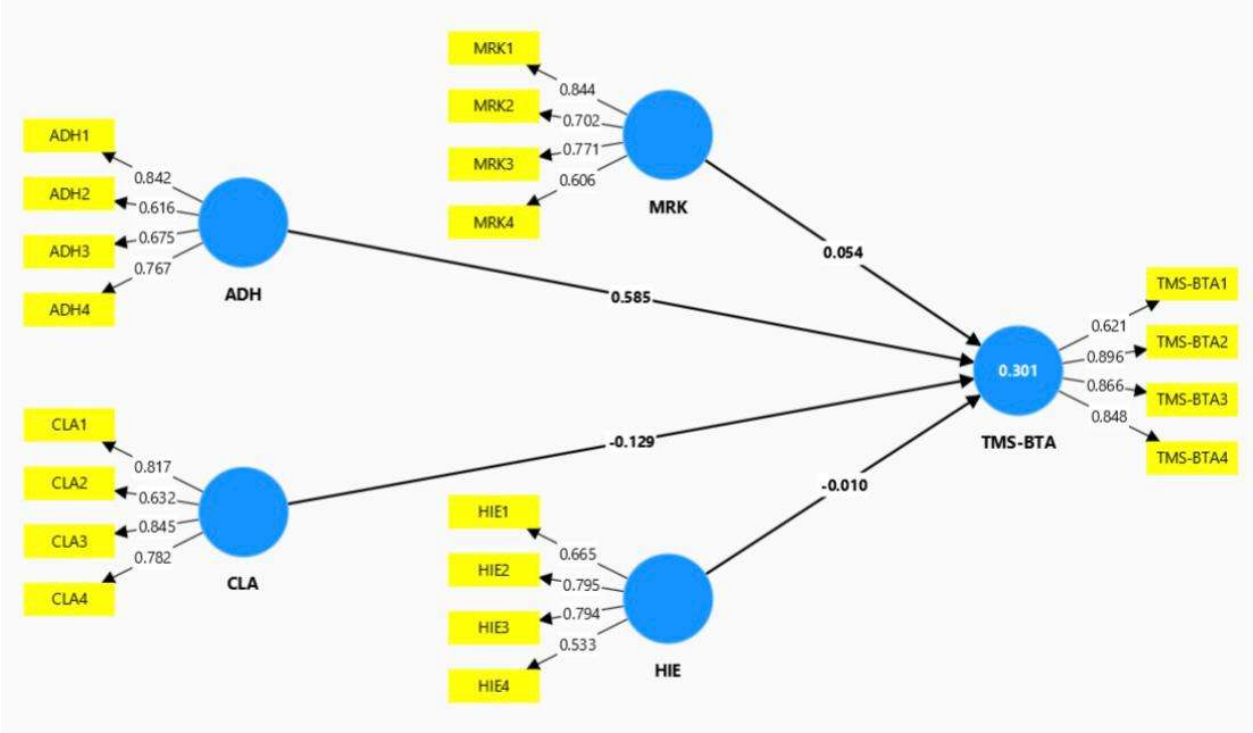
CLA3	1.837
CLA4	1.361
HIE1	1.365
HIE2	1.558
HIE3	1.416
HIE4	1.282
MRK1	1.536
MRK2	1.488
MRK3	1.448
MRK4	1.393
TMS-BTA1	1.261
TMS-BTA2	2.659
TMS-BTA3	2.288
TMS-BTA4	2.466

CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS-BTA: Top Management Support for Blockchain Adoption.
Source: SmartPLS4 Results

Step 2. Significance of structural model relationships

Structural model path coefficients (the arrows towards TMS in Fig. 17), represent the hypothesized relationships among the constructs**.** Path coefficients have standardized values approximately between −1 and +1. Estimated path coefficients close to +1 represent strong positive relationships (and vice versa for negative values) that are statistically significant (Hair *et al.,* 2022). The closer the estimated coefficients are to 0, the weaker the relationships are and the relative importance of the construct to explain another construct in the structural model. Very low values close to 0 are not statistically significant (Hair *et al.,* 2022).

Fig. 16. PLS-SEM Path Model Results.



CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS-BTA: Top Management Support for Blockchain Adoption.
Source: SmartPLS4 Results

The arrows from the exogenous constructs ADH, CLA, MRK and HIE pointing at the endogenous construct TMS-BTA in the Fig. 17 demonstrate the strength of the relationship among them. Looking at the results, we find that the ADH has the highest path coefficient (0.585). In contrast, CLA (0.129), MRK (0.054) and HIE (0.010) display very low values.

These results reveal that there is a positive relationship between adhocracy culture and TMS-BTA. The path coefficient 0.585 indicates a strong relationship between them, suggesting that adhocracy culture positively impacts TMS for BTA in the mate industry. The results also show a negative relationship between clan culture and TMS-BTA. The low path coefficient for clan culture (0.129) indicates, however, a weak relationship between them. Finally, as the results for market culture (0,129) and hierarchy culture (0.010) are very close to 0, we consider the relationship between each of these two constructs and TMS for BTA is not statistically significant.

Whether a coefficient is significant also depends on its standard error obtained by bootstrapping procedure, considering the PLS-SEM algorithm does not make any distributional

assumptions regarding errors (Hair *et al.,* 2022). In bootstrapping procedure, subsamples are created with randomly drawn observations from the original dataset and then are used to estimate the PLS path model, repeating the process until many random subsamples have been created, typically about 10,000.

Using the subsamples from bootstrapping, the researcher can construct a distribution of the parameter under consideration and compute bootstrap standard errors, which allow for determining the statistical significance of the original values (Hair *et al.,* 2022). The bootstrap standard error (*P* value) enables computing the probability of erroneously accepting a significant path coefficient when in fact it is not significant. Assuming a significance level of 5% for example, the *P* value must be smaller than 0.05 to conclude that the relationship under consideration is significant at a 5% level (Hair *et al.,* 2022).

As suggested by (Hair *et al.,* 2022), we ran for this study a two tailed bootstrapping with 10,000 samples assuming a significance level of 5%, typically recommended for social sciences. By going to the bootstrapping results (Table 8)**,** we get a more detailed overview of the path model coefficients.

Table 8. *P values.*

	Original sample values (O)	**Sample mean (M)**	**Standard deviation (STDEV)**	***P* values**
ADH -> TMS-BTA	0.585	0.520	0.151	0.000
CLA -> TMS-BTA	-0.129	-0.064	0.178	0.467
HIE -> TMS- BTA	-0.010	0.047	0.149	0.945
MRK-> TMS-BTA	0.054	0.096	0.143	0.703

CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS-BTA: Top Management Support for Blockchain Adoption.
Source: SmartPLS4 Results

Looking at these results, we have the following findings regarding the proposed hypotheses for this study (Table 8):

With H1, we have predicted a positive impact of Adhocracy Culture on TMS-BTA. The results show that Adhocracy Culture has a strong and significant positive impact on TMS-BTA ($O = 0.585$, $P < 0.05$). Therefore, the proposed hypothesis has been accepted.

With H2, we have predicted a positive impact of Clan Culture on TMS-BTA. The results demonstrate, however, that the relationship between Clan Culture and TMS-BTA is not statistically significant ($O = -0.129$, $P > 0.05$). Thus, the proposed hypothesis has been rejected.

With H3, we have predicted a negative impact of Hierarchy Culture on TMS-BTA. The results show the relationship between Hierarchy Culture and TMS-BTA is not statistically significant (O = -0.010, $P > 0.05$). Hence, the proposed hypothesis has been rejected.

We H4, we have predicted a negative impact of Market Culture on TMS-BTA. The results show that the relationship between Hierarchy Culture and TMS-BTA is not statistically significant (O = 0.054, $P > 0.05$). Consequently, the proposed hypothesis has been rejected.

Table 9. Hypotheses testing summary.

	Relationship?	**Coefficient**	**Significant?**	**Hypothesis confirmed?**
ADH > TMS-BTA	Yes	Positive	Yes	Yes
CLA > TMS-BTA	Yes	Negative	No	No
MRK > TMS- BTA	No	No	No	No
HIE > TMS- BTA	No	No	No	No

CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS-BTA: Top Management Support for Blockchain Adoption.
Source: SmartPLS4 Results

Step 3. Model Explanatory power

The third step of structural model evaluation requires assessing the model's explanatory power. The explanatory power of a model relates to its ability to fit the data at hand by quantifying the magnitude of the relationships revealed by the PLS-SEM path model.

The most used measure to evaluate the structural model's explanatory power is the coefficient of determination (R^2), which ranges from 0 to 1, with higher values indicating higher levels of explanatory power. R^2 values above 0.60 are considered as high, between 0.30 and 0.60 as moderate and below 0.30 as low. However, as observed by (Hair *et al.,* 2022), the R^2 is a function of the number of predictor constructs. The greater the number of predictor constructs, the higher the R^2 value. Therefore, the R^2 should always be interpreted in relation to research context and model complexity.

Moving on in our PLS-SEM path model, we find a moderate R^2 value of 0.301 for TMS-BTA, indicating that approximately 30,1% of the variability in TMS-BTA was explained by ADH, as the relationship among TMS-BTA and the variables CLA, HIE and MRK in the path model is not statistically significant (Fig. 17). Therefore, we can conclude that the R^2 for TMS-

BTA in our model is enough to draw important conclusions about the relationship between ADH and TMS-BTA.

Effect size

In addition to evaluating the R^2 values of all endogenous constructs, the change in the R^2 value when a specified exogenous construct is omitted from the model can be used to evaluate if the omitted construct has a substantive impact on the endogenous constructs (Hair *et al.,* 2022). This measure is referred as the f^2 effect size.

While a *P* value can inform if a significant effect exists, the *P* value will not reveal the size of the effect. In reporting and interpreting studies, both the statistical significance (*P* value) and substantive significance (effect size) are essential results to be reported (Sullivan, Feinn, 2012), as it enables academics and practitioners to understand their practical implications in the real-world. As a guideline, Cohen (1988) values of 0.02, 0.15 and 0.35, respectively represent small, medium and large effect size (Hair *et al., 2022*).

The results on Table 10 show that ADH has a medium-to-large effect size (0.229) on TMS_BTA. On the other hand, CLA (0.014), HIE (0.000) and MRK (0.003), with values close or equal to 0, have no effect on TMS-BTA.

Table 10. Effect size.

	ADH	**CLA**	**HIE**	**MRK**	**TMS**
ADH					**0.229**
CLA					**0.014**
HIE					**0.000**
MRK					**0.003**
TMS-BTA					

CLA: Clan Culture; ADH: Adhocracy Culture; HIE: Hierarchy Culture; Market Culture; TMS-BTA: Top Management Support for Blockchain Adoption.
Source: SmartPLS4 Results

Step 5. Predictive power

For a PLS path model to be useful for managerial decision-making, the model needs to produce generalizable results (Hair, Sarstedt, 2021). Producing generalizable findings requires assessing whether the results not only apply to the data that have been used in the model estimation process but also to other data set not included in the estimation process. The

researchers need, therefore, to assess their model's out-of-sample predictive power, or simply its predictive power (Hair *et al.*, 2022).

The primary approach for assessing the predictive power of a PLS path model is by running the PLS-Predict procedure available in the SmartPls 4 software. When using PLS-Predict it is necessary to make the following key choices (Hair *et al.*, 2022):

- The number of folds
- The number of repetitions
- The prediction statistics

Number of Folds

PLS-Predict is based on the concept of k-fold cross-validation, in which the overall data set is split into k equally sized subsets of data. For example, a 5-fold cross-validation splits the total sample into 5 equally sized subsets (groups) of data. PLS-Predict then combines k-1 subsets (i.e., 4) into a single training sample to predict the remaining subset, which represents the holdout sample for the first cross-validation run. The cross-validation process is then repeated *k* times, with each of the *k* subsets used exactly once as the holdout sample (Hair *et al.*, 2022).

Hair *et al.,* (2022) suggest when choosing a value for *k*, researchers need to ensure that the training sample in a single fold still meets the model's minimum sample size requirements. They recommend predictive studies to set *k* to 10 if the minimum sample size requirements are met. As the overall data in our study is equal to 69, we set *k* to 17 subsets of 4 samples, so the single training sample (69-4) is equal 65, meeting, therefore, the minimum sample size requirement we have specified in Section 3.

Number of Repetitions

PLS-Predict estimates the model r times, generates predictions for each model, and takes the average of these *r* predictions to predict the value of the new observation (Hair *et al.,* 2022). Although choosing a high value for *r* increases the estimates' precision, setting *r* to 10 generally provides a good trade-off between increase in precision and runtime (Witten, Frank, Hall, 2011). Following these guidelines, we set *r* to 10.

Prediction statistic

To assess the model's predictive power, one of the following prediction statistics should be adopted (Hair *et al.*, 2022): the mean absolute error (*MAE*) or the root mean square error (*RMSE*). MAE is the average absolute difference between the predictions and the actual observations, with all the individual differences having equal weight. The *RMSE* is the square root of the average of the squared differences between the predictions and the actual observations. Since *RMSE* often applies to predictive modelling, Hair *et al.,* (2012) recommend its routine for prediction statistic.

PLS-Predict Results

When interpreting PLS-Predict results, researchers should generally focus on their model's key endogenous construct. Once the key target construct has been identified, researchers should first interpret the Q^2 Statistic to ensure that the PLS-SEM–based predictions outperform the most naïve benchmark. A value of 0 or less suggests the predictive power of the PLS-SEM analysis for that indicator does not even outperform the most naïve benchmark. On the other hand, for those indicators with $Q^2 > 0$, next step is to compare the *RMSE* (or the *MAE*) values with the naïve *LM* benchmark. This comparison can have four outcomes (Hair *et al.*, 2022):

- If all indicators in the PLS-SEM analysis have lower *RMSE* (of *MAE*) values compared to the naïve *LM* benchmark, the model has high predictive power.
- If the majority (or the same number) of indicators in the PLS-SEM analysis yields smaller prediction errors compared to the *LM*, this indicates a medium predictive power.
- If a minority of the dependent construct's indicators produces lower PLS-SEM prediction errors compared to the naïve *LM* benchmark, this indicates the model has low predictive power.
- If the PLS-SEM analysis (compared to the *LM*) yields lower prediction errors in terms of the *RMSE* (or the *MAE*) for none of the indicators, this indicates the model lacks predictive power.

Following Hair´s guidelines, we focus the analysis on the target construct TMS-BTA and consider the *RMSE* metric for interpreting the model predictive power. As we can see in Table

11, all TMS indicators show $Q^2 > 0$, what suggests the predictive power of the PLS-SEM analysis outperform the most naïve benchmark.

Table 11. Model predictive power.

	Q²predict	PLS-SEM_RMSE	LM_RMSE
TMS-BTA1	0.101	0.939	1.138
TMS-BTA2	0.132	0.950	1.008
TMS-BTA3	0.159	1.081	1.211
TMS-BTA4	0.005	0.967	1.007

TMS-BTA: Top Management Support for Blockchain Adoption.
SmartPLS4 PLS-Predict results

The last step in the PLS-Predict results analysis requires comparing the *RMSE* values with those produced by the naïve *LM* benchmark model. Looking at Table 11, we can see that the PLS-SEM *RMSE* analysis produces smaller values than the *LM RMSE* for all TMS-BTA indicators. These results indicate, therefore, a high predictive power of this study results for BTA in the mate industry.

5 Concluding remarks

This study aimed to investigate the magnitude and predictive power of the relationship between OC and TMS for BTA in the yerba mate industry towards sustainable competitiveness with a focus on new markets opportunities. The paper´s results demonstrated, with high predictive power, that adhocracy culture has a positive and significant impact on TMS for BTA in the mate industry, confirming the first hypothesis of this study.

On the other hand, the study results show that the relationship between the remaining OC constructs explored in our research model and TMS is statistically insignificant and, therefore, neither promote nor hinder BTA in the yerba mate industry.

The findings reinforce the need for organizations to foster specific traits of culture that supports and encourages innovation. A core message from the study results is that a strong alignment between adhocracy culture and innovation objectives is crucial for the yerba mate industry to thrive in today's dynamic and competitive business, especially for accessing international markets.

These findings can lead to question on how reconcile the traditionalism of the yerba mate industry, largely characterized by small family business, with the adhocracy culture, which emphasizes innovation and flexibility to meet emerging needs. A further concern deriving from the research findings could be the possible resistance in the sector to change their organizational culture.

Regarding these concerns, the results show that the relationship between the remaining culture types and top management support is statistically insignificant, neither promoting nor hindering blockchain adoption by yerba mate industries. Regardless, therefore, of their prevailing culture types, there is no need for substantial change, as only adhocracy is the target for digital innovation. . This findings suggest lower resistance to changes in their organizational culture.

Furthermore, despite 68% of the surveyed industries are micro enterprises, with 1 to 19 persons employed, 51% of them have an IT support department (Fig. 14), which indicates the existence of supportive infrastructure that facilitates organizational change towards blockchain adoption.

FINAL CONSIDERATIONS

By exploring the influence of OC on TMS as key factors affecting BTA, this study has some noteworthy theoretical and practical implications as follows.

Theoretical implication

1. This study contributes to the debate on BTA at organizational level through the perspective of the TOE theory by exploring the relationship between OC and TMS, as prevalent OFs affecting BTA. This approach differs from previous studies which examine them as single constructs. Furthermore, by clarifying the interconnection between key TOE organizational constructs, we enhanced the TOE theory providing new directions for future studies in the field.
2. Our research combines functionalist and structuralist perspectives of OC for investigating the impact of different types of OC on TMS, hence contributing to the literature on measuring culture based on archetypes, rather than the traditional approach based on OC as a single construct. By measuring culture based on archetypes, we can gain profound insights into different cultural patterns that shape technology's adoption.
3. Prior research has identified significant impact of adhocracy culture, clan culture, hierarchy culture, and market culture on technological innovation in different contexts. The results of this study reveal, however, that clan, hierarchy and market culture neither promote nor hinder BTA in the yerba mate industry. This reinforces the theoretical perspectives that not all cultural values may have an equal impact on fostering innovation as each organization has its own distinctive culture, and that cultural values cannot be treated prescriptively, as there is no such thing as a universally better culture.

Practical implications

1. From the research insights, managers will be better informed on the influence of different types of OC towards the adoption of new technology, which may help to overcome the lack of TMS for adopting BT as an effective tool for agrifood traceability. In the yerba mate industry context, our research findings indicate top managers should encourage employees to think innovatively and pursue new ideas, in line with the adhocracy culture as a key factor affecting BTA in the sector.
2. By identifying adhocracy culture as a crucial factor for BTA in the yerba mate industry, we provide practitioners in the sector with a target culture upon which they are advised to build their cultural change. These insights can help yerba mate industries more effectively to adapt to the evolving digital transformation era of Industry 4.0, including BT, pointing to the need for deliberate efforts to shape their OC in a way that facilitates the development of digital solutions for the sector.
3. BTA in the yearba mate supply chain involves multiple stakeholders, including industries from other sectors which utilize the yerba mate as row material for new products such as chocolate, energy drinks, liquors, and infusions. Considering the importance of BT as an effective traceability system ensuring compliance with globally accepted agrifood standards, these industries, especially public companies with responsibility and commitment to the global sustainability agenda (ESG), can play a leading role in digital innovation throughout the value chain.
4. Given the high predictive power of this study results, they are relevant to administrators and policymakers seeking to foster the use of BT towards sustainability in line with SDGs, an important step for the yerba mate industry for accessing international markets. As a first step towards this purpose, it is advisable to reinforce ongoing initiatives in the sector such as training and qualifying yerba mate producers to adhere to organic certification, considering the increased demand for organic products both at national and international markets.
5. Next step could be the implementation of the SIBRAAR in sector, which uses BT to trace agrifood products, providing information on products origin and quality in a transparent and reliable manner (SIBRAAR, 2022). This software is the first national technology for agrifood traceability using BT aiming to add value to agrifood

products at national and international markets. It has been recently employed, for the first time in July 2023 in the brown sugar sector from a partnership between EMBRAPA and the Cooperative of Sugarcane Producers of São Paulo State and Usina Granelli (SNA, 2023). A similar partnership could be developed between EMBRAPA and the yerba mate industry, considering the promising opportunities for new yerba mate products and the need for an effective traceability system for the sector.

Limitations and future research

Despite the underlying implications of this study, it has some limitations that may offer opportunities for future research.

1. The study was conducted on a limited sample size of 69 yerba mate industries in the Brazilian state of Rio Grande do Sul state. The use of convenience sampling may restrict the generalizability of the results exclusively to the yerba mate industry into this specific geographic area. Future studies can overcome regionalism and sample size limitations by including others economic sectors.
2. This study relies on a quantitative method to gather the perceptions of top managers. The perception of senior managers may, however, be biased by personal features and external environment. Future research may combine quantitative and qualitative methods to capture a wider picture of the research setting. Exploring alternative methodologies could unveil additional insights that contribute to a deeper understanding of the relationship between OC and TMS.
3. The use of cross-sectional data in this study also may limit the predictability of its findings. To overcome this, future research may explore different stages of organizations' digital transformation for more reliable results.

We hope this study can help the yerba mate industry in developing technological strategies to foster competitiveness aligned to sustainability, especially for accessing international markets.

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APPENDICES

APENDIX A

Top management support Scales

Measurement of upper management support (Wong et al., 2020)

UMS1: Upper managers actively respond and pay attention when a project is initiated.

UMS2: Upper managers support by providing labor resources, finances and materials for BT

UMS3: Upper managers are willing to accept risks when adopting BT

UMS4: Upper management inspires employees to apply the latest blockchain technologies in daily work.

UMS5: Upper management encourages innovation.

Measurement of top management support (Badi et al., 2021).

PTMS1 Top management in my organization is aware of the benefits that smart contracts can provide.

PTMS2 Top management influences employees to increase awareness of the important advantages that smart contracts can bring.

PTMS3 Top management provides adequate resources for employees to adopt smart contracts.

APPENDIX B

Adapted Survey Questionnaire in Portuguese

Pesquisa blockchain erva-mate (A identificação entre parêntese refere-se à identificação do indicador no PLS-SEM Model

1 (CV11). Qual a sua função na empresa?
○ Sócio/proprietário administrador
○ Funcionário administrador

2 (CV2). Qual o tamanho da empresa?
○ Microempresa: até 19 colaboradores
○ Pequena empresa: de 20 a 99 colaboradores
○ Média empresa: de 100 a 499 colaboradores
○ Grande empresa: acima de 500 colaboradores

3 (CV3). Qual o envolvimento da empresa com tecnologia da informação (TI)?
○ A empresa conta com serviços de TI na própria empresa ou terceirizados.
○ A empresa não conta com serviços de TI, mas estuda implantá-los.
○ A adoção de TI não tem sido uma preocupação da empresa.

4 (CLA1). A nossa empresa é um lugar muito pessoal. É como a continuação da família.

①	②	③	④	⑤
Concordo totalmente	Concordo	Não concordo nem discord	Discordo	Discordo totalmente

5 (ADH1) A nossa empresa é um lugar dinâmico e empreendedor. As pessoas estão dispostas a se exporem e a assumirem riscos.

①	②	③	④	⑤
Concordo totalmente	Concordo	Não concordo nem discord	Discordo	Discordo totalmente

6 (MRK1). Uma grande preocupação da nossa empresa é com resultados. Nossos colaboradores são competitivos e focados no alcance de metas.

①	②	③	④	⑤
Concordo totalmente	Concordo	Não concordo nem discord	Discordo	Discordo totalmente

7 (HIE1). A nossa empresa é um local muito controlado e estruturado. Procedimentos formais e preestabelecidos geralmente determinam o que as pessoas fazem.

①	②	③	④	⑤
Concordo totalmente	Concordo	Não concordo nem discord	Discordo	Discordo totalmente

8 (CLA2). A liderança na nossa empresa é geralmente considerada como exemplo de orientação e suporte.

①	②	③	④	⑤
Concordo totalmente	Concordo	Não concordo nem discord	Discordo	Discordo totalmente

9 (ADH2). A liderança na nossa empresa é geralmente considerada como exemplo de empreendedorismo e inovação.

①	②	③	④	⑤
Concordo totalmente	Concordo	Não concordo nem discord	Discordo	Discordo totalmente

10 (MRK2). A liderança na nossa empresa é geralmente considerada como exemplo de competitividade, com foco em resultados.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
11 (HIE2). A liderança na nossa empresa é geralmente considerada como exemplo de eficiência em coordenação e organização				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
12 (CLA3). O estilo de gestão na nossa empresa é caraterizado por trabalho em equipe, consenso e participação.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
13 (ADH3). O estilo de gestão na nossa empresa é caracterizado por assumir riscos individualmente, inovação e liberdade				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
14 (MRK3). O estilo de gestão na nossa empresa é caracterizado por competitividade, altas demandas e alcance de resultados.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
15 (HIE3). O estilo de gestão na nossa empresa é caracterizado por coerência e previsibilidade.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
15 (CLA4). O que mantém a nossa empresa unida é a lealdade e a confiança mútua. O compromisso com esta empresa é alto.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
17 (ADH4). O que mantém a nossa empresa unida é o compromisso com inovação e desenvolvimento.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente

18 (MRK4 – 18). O que mantém a nossa empresa unida é a ênfase no alcance de resultados e no cumprimento de metas.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
19 (HIE4). O que mantém a nossa empresa unida são as regras formais. Manter uma empresa em adequado funcionamento é importante.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
20 (CLA5 – 20). A nossa empresa enfatiza o desenvolvimento humano. Alta confiança, abertura e participação são valorizadas.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
21 (ADH5). A nossa empresa enfatiza a aquisição de novos recursos e a criação de novos desafios. Novas experiências são valorizadas				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
22 (MRK5). A nossa empresa enfatiza ações competitivas e o alcance de resultados. Atingir objetivos ambiciosos e vencer no mercado são prioridades.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
23 (HIE5). A nossa empresa enfatiza estabilidade. Eficiência, controle e adequado funcionamento são importantes.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
24 (CLA6). A nossa empresa define sucesso com base no desenvolvimento de recursos humanos, trabalho em equipe e comprometimento dos colaboradores.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
25 (ADH6). A nossa empresa define sucesso com base no desenvolvimento de produtos exclusivos e atuais. Ela é líder de produtos inovadores.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
26 (MRK6). A nossa empresa define sucesso com base em vencer e estar à frente da concorrência.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente

27 (HIE6). A nossa empresa define sucesso com base em eficiência. Entrega confiável, agendamentos adequados e produção de baixo custo são essenciais.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
28 (TMS1 – 28). A direção da nossa empresa tem conhecimento sobre a tecnologia blockchain e seu potencial como ferramenta de rastreamento de mercadorias.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
29 (TMS2). A direção da nossa empresa estaria disposta a investir na tecnologia blockchain para rastreamento de seus produtos como forma de assegurar sua autenticidade e origem, com foco em competitividade.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
30 (TMS3) - 30. A direção da nossa empresa estaria disposta a promover reestruturação interna, incluindo treinamento de funcionários, para eventual adoção da tecnologia blockchain como estratégia de inovação.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
31 (TMS4). A direção da empresa daria apoio à troca de informações entre funcionários e demais níveis de gestão sobre a tecnologia blockchain e sua potencial contribuição como estratégia de competitividade.				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente
32 (TMS5). A direção da empresa estaria preparada para aceitar os riscos associados à eventual adoção da tecnologia blockchain, considerando tratar-se de tecnologia ainda relativamente nova				
① Concordo totalmente	② Concordo	③ Não concordo nem discord	④ Discordo	⑤ Discordo totalmente

APENDIX C
PLS-SEM model (Constructs/indicators)

Clan Culture	
CLA1*	The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.
CLA2*	The leadership in the organization is generally considered to exemplify mentoring, facilitating, or nurturing.
CLA3	The management style in the organization is characterized by teamwork, consensus, and participation.
CLA4	The glue that holds the organization together is loyalty and mutual trust. Commitment to this organization runs high.
CLA5	The organization emphasizes human development. High trust, openness, and participation persist.
CLA6	The organization defines success based on the development of human resources, teamwork, employee commitment, and concern for people.
Adhocracy Culture	
ADH1*	The organization is a dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.
ADH2*	The leadership in the organization is generally considered to exemplify entrepreneurship, innovation, or risk taking
ADH3	The management style in the organization is characterized by individual risk taking, innovation, freedom, and uniqueness.
ADH4	The glue that holds the organization together is commitment to innovation and development. There is an emphasis on being on the cutting edge
ADH5	The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.
ADH6*	The organization defines success based on having unique or the newest products. It is a product leader and innovator.
Market Culture	
MRK1	The organization is very results oriented. A major concern is with getting the job done. People are very competitive and achievement oriented.
MRK2	The leadership in the organization is generally considered to exemplify a no - nonsense, aggressive, results - oriented focus.
MRK3*	The management style in the organization is characterized by hard - driving competitiveness, high demands, and achievement.
MRK4*	The glue that holds the organization together is the emphasis on achievement and goal accomplishment.
MRK5	The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.

MRK6	The organization defines success based on winning in the marketplace and outpacing the competition. Competitive market leadership is key.
Hierarchy Culture	
HIE1	The organization is a very controlled and structured place. Formal procedures generally govern what people do.
HIE2	The leadership in the organization is generally considered to exemplify a no - nonsense, aggressive, results - oriented focus.
HIE3	The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.
HIE4*	The glue that holds the organization together is formal rules and policies. Maintaining a smoothly running organization is important.
HIE5	The organization emphasizes permanence and stability. Efficiency, control, and smooth operations are important.
HIE6*	The organization defines success based on efficiency. Dependable delivery, smooth scheduling, and low - cost production is critical.
Top Management Support	
TMS1	Our company's upper manager is aware of blockchain technology and its potential as a tool for tracking goods.
TMS2	Our company's upper manager would be willing to invest in blockchain technology to track its products to ensure their authenticity and origin, with a focus on competitiveness.
TMS3	Our company's upper manager would be willing to promote internal restructuring, including employee training, for possible adoption of blockchain technology as an innovation strategy.
TMS4*	Our company's upper manager would support the exchange of information between employees and other levels of management about blockchain technology and its potential contribution as a competitiveness strategy.
TMS5	Our company's upper manager would be prepared to accept the risks associated with blockchain technology adoption, considering that it is still a relatively new technology.
* Removed due to low outer loadings according to HAIR *et al.,* 2022 guidelines.	

APRRENDIX D

Yerba mate industries list

Razão Social	Município	Quantidade
Agro Comercial Volhjam LTDA Biomate Ind. de Alimentos Ltda ME ELenza Indústria e Comércio Eireli Ervateira Gaio Ltda ME Importadora e Exportadora Acrevi Ltda Hescam Ind. e Comp. Erva-mate Ltda ME GPM Agroindustria de Erva-mate Ltda	Anta Gorda	7
Ervateira Portão Ltda Ervateira Reinaldo Sanson Ltda Ervateira Sabani Ltda Ervateira Valerio Ltda Ervateira Gaucha da Serra Ltda Vier Beneficiadora de Erva Mate Ltda Ervateira Nutrimate Ltda De Valerios Ind. e Com. Erva Mate Ltda Industrial do Mate Vison Ltda Ervateira Invernada Ltda Natumate Industrial do Mate Ltda Ponche Verde Industrial do Mate Ltda Dall Agnol Serviços do Mate Ltda Ind. de Erva Mate Macedo Ltda Industrial Deusa do Mate Ltda Me Ervateira Alma Gaucga Ltda Me Globo Mate Ltda Epp Ervateira Multimate Ltda ME Ervateira Panis Ltda Indústria Comércio e Exp. EBM Ltda Indústria e Comércio de Erva Mate Coxilha do Vale Ltda Natufolha Industrial do Mate Ltda ME Nativa Ind. e Com. de Alimentos EIRELI Export. Mate Company - Indústria e Exportação de Erva-mate Eireli	Arvorezinha	25
Ind. Com. Erva Mate Maravilha Ltda Ind. e Com. Erva Mate Seiva Verde Ltda Ervateira Aurense Ltda Remonia Indústria e Comércio de Erva Mate Ltda Ervateira Erva Boa Ltda ME Ervateira Vinte e Cinco Ltda Ervateira Nievinski Ltda ME Ervateira Mateada Ltda ME Industria e Com. Erva Mate Vó Neida Ltda Thomas Prichoa & Filhos Ltda (Tio Thomaz)	Áurea	10
Barão - Indústria e Comércio de Erva Mate e Chás S.A. MBF Comércio de Erva Mate Ltda	Barão de Cotegipe	2
Agromed Chá Indiano Ltda Tribom Ind. Alimentos Ltda	Boa Vista das Missões	2
Indústria de Erva Mate Bernardon Ltda	Camargo	1
Chá prenda do Brasil Indústria e Comércio EIRELI	Candelária	1
Impacto Industria e Comércio de Alimentos Ltda	Carazinho	1
Ervateira Boa Esperança Ltda	Cruzeiro do Sul	1
Saphira Ind. e Com. de Erva Mate Ltda Quinta do Vale Alimentos Ltda	Doutor Ricardo	2
Baldo S/A Com. Ind. e Exportação	Encantado	1

Hoppen Hoppen e Cia Ltda Dalbao e Dalbao Ltda Eda Menin Lohmann ME	Erebango	3
Ervateira Andreolla Ltda Industria Ervateira Ouro Verde Ltda Ervateira Picolo Badalotti Ltda Indústria Erva Mate Erechim Ltda Andreola Erva Mate Ltda ME Ervateira Rei Verde Ltda Ind. E Com. De Erva Mate Canção Ltda	Erechim	7
Ervateira Ervalense Ltda	Erval Grande	1
Ervateira Moura	Erval Seco	1
Ervateira Casagrande Ltda	Fontoura Xavier	1
Ervateira Lorenzetti Ltda Gauramate Indústria de Erva Mate Ltda Bom dia Ind. Com. Do Mate Ltda	Gaurama	3
Ervateira Secchi Ltda Ervateira Cuiava e Bresolin Ltda Cooperativa dos Produtos de Erva-Mate Ltda – COPERMATE	Getúlio Vargas	3
Ind Com de Erva Mate Marcon Ltda	Gramado	1
Moccelin & Cia Ltda	Guaporé	1
Ervateira Flor de Gaucha Ltda Ervateira Seiva Pura Ltda	Ijuí	2
Amavel Ind. Com. de Erva Mate Ltda Ervateria Rei Verde Ltda Ximango Indústria de Erva Mate Ltda Ervateira Franzon Ltda Ind. e Com. E. M. Seiva do Mate Ltda Secco Ind. Com. de Erva-mate Ltda Multisafra Com./Ind. De Erva Mate Ltda Vescovi Agro Ind. Erva-mate Ltda Agroind. De Erva Mate Ouro Mate Ltda Ervateira Marsango Ltda JD Ind. Com. de Erva Mate Ltda Agroindustria de Erva Mate Potência do Mate Ltda Agroind. De Erva Mate de Pariz Ltda ME Agroind. De Erva Mate Gomes do vale Ltda Agroind. De Erva Mate Sulriograndense Agroind. De Erva Mate Valentina Ltda ME Artemate Agroindústria Ltda ME Ind. de Erva Mate Ilomate Ltda ME Ind. de Erva Mate Meneghetti Ltda ME Agroind. Erva Mate São Francisco Ltda Inovamate Ind. e Com. de Erva Mate Ltda Pagliarini Agroindústria e Comércio de Erva Mate Ltda Indústria de Erva-mate Rosset Ltda Agroind. De Erva Mate Dall Acua Ltda Agroindústrial Erva Mate Alba Ltda Agroind. De Erva Mate Signor Ltda Marivanea Gehlen ME (Diamantina) Indl. Do Mate Lago Verde – EPP Edeomar Antonio Marsano – ME Agroindustria Potencia do Mate (Baldo)	Ilópolis	30
Ervateira Sassi Ltda Industrial do Mate CMG Ltda ME	Itapuca	2
Ximango Ind de Erva Mate Ltda – Filial	Lajeado	1
Barão - Indústria e Comércio de Erva Mate e Chás S.A. Seiva Sul Indust. Com. Alimentos Ltda Indústria de Erva-mate Fonseca EIRELI	Machadinho	3

Ervateira Liebig Ind. e Com. de Erva Mate Ltda	Marcelino Ramos	1
Ervateira Godoy Ltda	Mato Castelhano	1
Finomate Ind. Ervateira Ltda Dresler Ind. e Com. de Prod. Aliment. Suprema Agroindustrial Ltda	Mato Leitão	3
Ervateira Prenda e Peão Ltda Ervateira Tradição do Sul Ind. Com. Erva Mate Nelson de Almeida Rodrigues ME Pedro A. O. Brizolla	Novo Barreiro	4
Irineu Armindo Menegazo (Colonial) Bruno Mafalda Ribeiro – MEI Paulo M. S. da Cruz (Gurizinho) Ervateira Prenda Sul	Palmeira das Missões	4
Ervateira Portão Ltda Indústria de Bebidas Brasão Verde EIRELI	Portão	2
Agro Ind. Campo Alto Ltda	Protásio Alves	1
Ervateira Putinguense Ltda Ind. e Com. de Erva Mate Gradagnin Ervateira Super Erva Ltda Agroin. De Erva Mate Euro Verde Ltda Ervateira Lider do Mate Ltda A C Cenci Ltda Gallas Indústria do Mate Ltda Sabor e Tradição Ind. de Erva Mate ME	Putinga	8
Paulo J. M. Nunes	Restinga Seca	1
Vier Ind. e Comércio do Mate Ltda	Santa Rosa	1
Industria e Com de Erva Mate Santiago Ltda	Santiago	1
Ervateira Tomeleiro Ltda	Santo Augusto	1
JAP Camara & Cia Ltda (Realeza)	Seberi	1
Chá Prenda do Brasil Ind. Com. Ltda	Senador Salgado Filho	1
Coop. Mista dos Agric. De Toropi Ltda – Coomat	Toropi	1
Industria e Com. De Erva Mate Ideal Ltda	Três Arroios	1
Wedor	Tuparendi	1
Agroindustrial Elacy Ltda Madrugada Alimentos Ltda De Campos Ind. Ervateira Ltda Alfredo Scherer & Cia Ltda (Rainha dos Pampas)	Venancio Aires	4

Souce: Yerba Mate Committee/Secretary of Agriculture of Rio Grande do Sul

TOTAL = 149

APPENDIX E

Table of articles (Systematic literature review)

Nº	SOURCE	SECTOR	FRAMEWORK	FACTORS EXPLORED	ORGANIZATIONAL FINDINGS (OF)
1	Guan, Ding, Zhang, Venry, and Hao, (2023).	Chinese firms	TOE	SC factors: SC collaboration, information sharing, trust in trading partners, trading partners' power, and Guanxi with trading partners. **T:** relative advantage, technology compatibility, and technology complexity. **O:** organizational readiness, firm size, and perceived cost. **E:** competitive pressure, market dynamics, and legal and regulatory uncertainty.	Organizational readiness has a significant influence in BTA.
2	Boakye, Zhao, Coffie, and Asare-Kyire, (2023).	SCF in Ghanaian SMEs	TOE	**T:** relative advantage, and complexity. **O:** SME manager/owner support, and cost. **E:** market dynamics, and competitive pressure.	Cost significantly influences the BTA in SC finance in SMEs.
3	Hashimy, Jain, and Grifell-Tatje, (2022).	Spanish firms	Integrated TAM and TOE	**T:** relative advantage, and complexity. **O:** TMS, and competence **E:** competitive pressure. TAM: intention to adopt.	Competence and TMS had a positive impact on BTA
4	Chittipaka, Kumar, Sivarajah, Bowden, and Baral, (2022).	SCM in India	TOE	**T:** relative advantage, trust, compatibility, and security. **O:** firm's IT resources, higher authority support, firm size, and monetary resources. **E:** rivalry pressure, business partner pressure, and regulatory support.	Firm's IT resources, higher authority support, firm size, monetary resources had a significant influence on the decision of BTA.
5	Park (2020).	SCM in logistic industry	Integrated UTAUT and TOE	UTAUT: performance expectancy, effort expectancy, social influence, and facilitating conditions. **T:** availability, and characteristics. **O:** formal and informal linking structures, communication process, size, and slack.	1) Formal and informal linking structures, communication process, size, and slack exerted significant influence on attitude and the sustainable usage intention on BTA. 2) Successful BTA is influenced by a firm's level of technological capability and

				Conceptual model: attitude and sustainable usage intention of Blockchain	organization-wide support.
5	Ganguly (2022).	Logistics SC in India	TOE	**T:** infrastructure, complexity, compatibility, and risk. **O:** organizational innovativeness, organizational resources, internal stakeholder, and organizational size. **E:** customer, competitor, government regulation, and location.	1) Organizational innovativeness: organizational strategy, adoption strategy, top management, and digital culture. 2) Organizational resources: financial resources, and cost savings. 3) Internal stakeholder: organization structure, knowledge management, and employee motivation. 4) Organization size: organization size, and expert team.
7	Malik, Chadhar, Vatanasakdakul, & Chetty (2021).	Australian organizations	Extended TOE	**T:** perceived benefits, compatibility, perceived information transparency, and perceived disintermediation. **O:** organization innovativeness, organizational learning capability, and TMS. **E:** competition intensity, government support, trading partners readiness, and standards uncertainty. Extended model: perceived risk	1) Innovativeness and organization learning capability were found to be significant to the BTA. 2) Without the TMS, the organizational BTA is less likely.
8	Lustenberger, Malesevic, & Spychiger (2021).	Employees from C-level and management across all industries within the DACH-region (Germany, Austria and Switzerland).	TOE and an extended Blockchain Adoption Model (namely BAM)	**T:** relative advantage, compatibility, complexity, trialability, and observability. **O:** organizational readiness, organizational size, senior management support, and organizational age. **E:** competition intensity, external pressure, regulatory uncertainty, collaboration, and scope of ecosystem.	Organizational age was the only significant construct within the organizational context.
9	Wang, Liu, Liu, and Huang (2022).	Construction industry	Integrated TAM and TOE model	TAM: perceived usefulness, perceived ease of use and intention to use. **T:** relative advantage, compatibility, technological	1) Organizational readiness had an impact on BTA in the construction industry through perceived

				maturity, and perceived cost of adoption. **O:** organizational readiness, and competitive pressure. **E:** policy.	usefulness or perceived ease of use. 2) Organizational readiness had a negative effect on perceived usefulness.
10	Kulkarni and Patil (2020).	Banking services in India	TOE	**T:** relative advantage, perceived compatibility, perceived security, and perceived cost. **O:** firm scope, learning culture, and top management. **E:** customer readiness, competitive pressure, and government policies.	Firm scope, learning culture, and TMS, are significant factors that affect the BTA in banking services.
11	Suwanposri, Bhatiasevi, and Thanakijsombat (2021).	Financial and SC organizations in Thailand	TOE	**T:** data integrity, data security, and operational efficiency. **O:** organizational readiness, suitable application, employee readiness, and TMS. **E:** supportive governmental policies and regulations, stakeholders' cooperation, and network effect.	1) Suitable application is a newly emerged OF, and those sectors weigh environmental factors differently due to naturally different goals and the business model of each sector, which ultimately guides the future adopters in BTA. 2) Not only is organizational readiness significant, but also a firm's credibility. Firm credibility and firm size should also be included in organizational readiness as they are also considered to be important for adopters to start up a BT network that their partners can join in. 3) Suitability of BT is the key determining a firm's need for BT. 4) Communications and change management are important processes when firms adopt BT. A positive mindset toward change along with knowledge of BT is important.
12	Kamble, Gunasekaran, Kumar,	SC	Integrated TAM and TOE	TAM: perceived usefulness, and perceived ease of use.	1) The training & education had a positive and significant influence

	Belhadi and Foropon (2021).			**T:** relative Advantage, information security, technical know-how, perceived financial benefit, compatibility, and complexity, **O:** organizational readiness, top management support, and training & education. **E:** partner readiness, and competitive pressure.	on perceived ease of use and perceived usefulness. 3) Perceived usefulness may be influenced by the TMS to use BT; however, this may not be translated in BTA by the organization. Therefore, the TMS is limited in developing perceived usefulness and does not have an indirect influence on BTA.
13	Laaraj, Nakara, and Wamba (2022)	Companies: Accenture, Boston Consulting Group, PricewaterhouseCoopers (PWC), Wavestone, Deloitte, Consensys, Capemini, CGI, and Kapalt.	Integrated DOI and TOE	**T:** perceived benefits, complexity, compatibility, data security, smart contract coding maturity, relative advantage, disintermediation permissions (public vs private), architecture, scalability, and trust. Hesitation to convert to new systems, security challenge, access to technology, hesitation to adopt blockchain due to negative public perception, immutability challenge, and immaturity. **O:** financial resources, organizational readiness, TMS, organizational size, business model readiness, technology readiness, innovativeness, participation incentives, and BT knowledge. Financial constraints, lack of management commitment and support, lack of organizational policies for using technology, lack of knowledge and expertise, and lack of tools for BTA. **E:** regulatory environment, market dynamics, industry pressure, government support, business use cases, trading partner support/pressure, inter-organizational trust, competitive pressure, and	1) Barriers: lack of understanding, lack of knowledge, high resource demand, purpose washing, transition issues, and stereotypes. 3) Catalysis: unconscious adoption, education, high level of knowledge, high level of technique, and management commitment.

				critical user mass. Lack of customers' awareness, problems in collaboration, communication and coordination, challenge of information disclosure policy between partners, cultural differences, lack of governmental policies, market competition and uncertainty, lack of external stakeholders'' involvement, lack of industry involvement, and lack of rewards and encouragement programs	
14	Gokalp, Gokalp, and Coban (2020).	SCM	Developed TOE	**Γ:** relative advantage, complexity, compatibility/Interoperability, standardization, trust, and scalability. **O:** organizations' IT resource, TMS, organization size, and financial resources. **E:** competitive pressure, trading partner pressure, government policy & regulations, and inter-organizational trust.	1) Environment-related determinants are more critical than technology-related or organization-related determinants. 2) Organizations' IT resources and financial resources had comparably high local weights followed by TMS.
15	Orji, Kusi-Sarpong, Huang, and Vazquez-Brust (2020).	Freight logistics Industry	Based on TOE	Γ: availability of specific blockchain tools, complexity, ease of being tried and observed, perceived benefits, infrastructural facility, compatibility, and security and privacy. O: presence of training facilities, TMS, firm size, capability of human resource, perceived cost of investment, and OC. E: government support and policy, competitive pressure, institutional-based trust, market turbulence, and stakeholder's pressure.	1) Training facilities was ranked the highest. 2) TMS is ranked second and is a critical factor that influences the BTA. 3) Firm size is ranked third in this main context and has a huge influence on the BTA. 4) Capability of human resources and perceived costs of investment indicate that the availability of huge capital for the enormous investment influence BTA. 5) OC is the least ranked factor.
16	Boakye, Zhao, and Ahia (2022).	Ghana - SCs of the Agriculture & Agro-processing sector, the flow	TOE	**Γ:** infrastructural availability for blockchains, existing technology compatibility, issues of complexity, issues	TMS, human resource capability, OC and perceived costs are crucial to BTA.

		of activities in the Mining & Minerals processing sector (in terms of local procurement, logistic contract execution, and supply chain efficiencies), and loan application process for SMEs in the Finance sector.		of privacy and security, and perceived benefits. **O:** TMS, human resource capacity, OC, and perceived investment costs. **E:** governmental support, competitive pressure, social trust, and market dynamism.	
17	Leong, et al. (2023).	SMEs that are listed by the Companies Commission of Malaysia	Extended TOE framework	T: relative advantage, complexity, and compatibility. O: technological readiness, TMS, and organization size. E: regulatory environment, competitive pressure, and regulatory support. Extended model: technology competence (T) and OC (O).	Organization size, TMS, technological readiness and OC are the core OF that drive SMEs to BTA.
18	Clohessy and Acton (2019).	Irish organizations	TOE	**O:** TMS, organizational size, and organizational readiness.	TMS and organizational readiness are enablers for BTA. Large companies are more likely to BTA than small to medium-sized enterprises (SMEs).
19	Ameyaw and de Vries (2022).	Ghana's land sector.	Extended TOE	**T:** technological readiness, technological complexity, technology asset, technology compatibility, relative advantage of the technology, privacy, and security issues. **O:** organizational structure, management's behavior and attitude, employee, IT experience, organizational readiness, and innovativeness among others. **E:** the availability or absence of essential service providers in support of the technology adoption, supportive partners for the intended technology to be	Organizational structure, communication channels, power dynamic, organizational acceptability, employees' technical orientation and experience, and financial sufficiency influence BTA.

				adopted, the regulatory environment within which the adoption takes place, government interactions, support infrastructure for technology, and industry dynamics. Socio-cultural elements	
20	Kanchanaratanakor and Chutima (2022).	Online gaming company in Thailand.	TOE	**T:** poor user experience, blockchain technology complexity, sustainability issues of blockchain-based games, traditional games still have an advantage over blockchain-based games, lack of technological knowledge to distinguish different blockchain networks, absence of successful development and implementation of blockchain-based games in Thailand, limitations of blockchain technology, data storage issues, and blockchain as the underlying technology of online games. **O:** uncertain investor risk, unconvincing return on investment, high switching costs, lack of proper resources and capabilities, business process transformation, new governance models, current business models are still profitable, lack of full control over the content, and lack of understanding by top management. **E:** regulatory uncertainty and legal considerations, lack of education or understanding of blockchain-based games. low social acceptance of blockchain based games, public relations and the possibility of community backlash, lack of policy framework, lack of investment incentives, and	Uncertain investor risk, unconvincing return on investment, current business models are still profitable, lack of understanding by top management, high switching costs, new governance models, and lack of proper resources and capabilities, influenced BTA.

				environmental impact of blockchain technology.	
21	Dehghani, Kennedy, Mashatan, Rese, and Karavidas (2022).	General North American organizations.	TOE	**T:** interoperability, technological volatility, and data quality. **O:** lack of technological knowledge. **E:** perceived regulatory uncertainty, perceived standardization uncertainty, and perceived network enhancement.	The perceived lack of technological knowledge had a negative effect on BTA.
22	Tasnim, Shareef, Baabdullah, Hamid and Dwivedi (2023).	SCM of manufacturing industries in Bangladesh (electronics, chemical, textile, food, machinery and hardware, and pharmaceuticals).	TAM and TOE integrated model	TAM: perceived usefulness, perceived ease of use, and intention to adopt. **T:** relative advantage, complexity, and technological readiness. **O:** TMS, organizational readiness, and employees' knowledge. **E:** trading partners' pressure, competitive pressure.	1) TMS and employees' knowledge have a positive and significant influence on perceived usefulness. 2) Organizational readiness is an important predictor for perceived ease of use but non-significant for perceived usefulness.
23	Mohammad and Vargas (2022).	Higher Education Institutions - Administrative and academic staff from the European Union and Canada.	TOE	**T:** immaturity; poor usability, security issues, privacy, lack of scalability, limited interoperability and standardization, integration complexity, security, privacy, immutability, and lack of flexibility; and data unavailability. **O:** lack of adequate skills, financial barriers, and lack of management commitment and support. **E:** legal issues and lack of regulatory compliance, the market and ecosystem readiness, and sustainability concerns.	Adequate skills, financial barriers, and a lack of management commitment and support.
24	Xu, Tatge, Xu, and Liu (2022).	German automotive industry	TOE	**T:** technological maturity, digital systems integration, technology security, and standardization of blockchain systems. **O:** intra-industry cooperation, bootstrapping problem, and stakeholder recognition. **E:** governance conditions such as laws, regulations, the	Intra-industry cooperation, bootstrapping problem, and stakeholder recognition are challenges on BTA.

				general investment environment, and legal framework.	
25	Rijanto (2020).	Agroindustry.	TOE and the theory of "mindfulness of adoption"	**T:** availability and characteristics **O:** formal & informal linking structure, communication processes, size, and slack. **E:** industry characteristics and market structure, technology support infrastructure, and government regulation.	Formal & informal linking structure, communication processes, size, and slack influence BTA.
26	Lin (2023).	Maritime industry	Developed TOE	**T:** perceived relative advantage, perceived complexity, and perceived insecurity. **O:** TMS, organizational readiness, and knowledge absorption capacity. **E:** trading partner influence, and regulatory support.	1) Knowledge absorption capability is the most important enabler of BTA. 2) TMS had a significant determinant of BTA. 3) Organizational readiness had a positive effect on BTA.
27	Fernando, Rozuar, and Mergeresa (2021).	Manufacturing firms	TOE	**T:** technology competence, and compatibility. **O:** TMS, and size. **E:** competitive pressure.	Size had a positive and significant relationship with BTA.
28	Bhardwaj, Garg, and Gajpal (2021).	Indian SMEs – Supply chain	Integration of TAM, TOE, and DOI	Innovation characteristics: relative advantage, technology compatibility, and complexity of technology. Individual characteristics: perceived usefulness and perceived ease of use. **T:** technology readiness. **O:** TMS, security concerns, and cost concerns. **E:** government support, and vendor support. Adoption intention.	1) TMS had a positive influence on BTA. 2) Cost concerns act as an inhibitor on BTA.
29	Li, Zhang, and Xu, (2022).	Chinese construction industry	TOE	**T:** relative advantage, compatibility, complexity, cost, and trialability. **O:** TMS, organizational readiness, and firm size. **E:** competitive pressure, trading partner pressure, and regulatory support.	TMS, organizational readiness, and firm size significantly influence BTA.
30	Mulaji and Roodt (2022).	Blockchain - based Distributed Identity Management	TOE - BDIDM model	**T:** BDIDM characteristics, BDIDM readiness, and infrastructure & competences. **O:** organization characteristics, organization	1) BT types are associated with organizations' adoption behavior toward

		(BDIDM) – South Africa		readiness, and organization size. **E:** industry & market environment, support environment, and regulatory environment.	BDIDM and, on the other hand, refuted the notion that organization sizes are not associated with the behavior. 2) Organization characteristics, organization readiness, and organization size influenced BTA
31	Fernando, Tseng, Wahuyni-TD, Srouf and Mohd-Zailani (2022).	Association of Malaysian Manufacturers	Integration of DOI and TOE	**T:** relative advantage, complexity, and compatibility. **O:** TMS, and firm size. **E:** competitive pressure and regulatory support. Smart contract. Adoption of blockchain	Firm size significantly affects energy efficiency.
32	Yadlapalli, Rahman, and Gopal (2022).	Consultant and software developing organizations in India	Integration of TOE and DOI	**T:** compatibility, complexity, relative advantage, trialability, and observability. **O:** TMS, technical know-how, financial resources, and firm size. **E:** industry structure, security provided by the technology service provider, and regulatory environment. Interorganizational relationships challenge: partner's power, information sharing, privacy, and trust.	TMS issues related to insufficient understanding of how technology fits with the organization's policy and benefits offered by the technology a critical challenge is.
33	Nath, Khayer, Majumder and Barua (2022).	Industries in Bangladesh	Integration of TOE and DOI	**T:** compatibility and relative advantage (transparency and security). **O:** TMS, absorptive capacity, and information sharing and collaboration culture. **E:** trading partners' influence and regulatory support. Perceived trust and supplier development for sustainability.	Supplier firms' intention to BTA in SCs is influenced by TMS, and absorptive capacity.
34	Bag, Rahman, Gupta, and Wood (2022).	SMEs in South Africa	Integration of the resource-based view (RBV) perspective and TOE	**T:** relative advantage, compatibility, and complexity. **O:** TMS, and organizational readiness.	1) TMS, and organizational readiness significantly influence BTA. 2) The artificial neural network results showed

				E: competitive pressure, external support from vendors, and regulations & legislations. BTA and financial performance. BTA and market performance.	that TMS is the most critical predictor of SMEs' BTA.
35	Yadav, Shweta, and Kumar (2022).	COVID-19 vaccine SC in North India	Integration of TOE and Delphi and fuzzy Decision-Making Trial and Evaluation Laboratory (DEMATEL) techniques.	**T:** data privacy & security issues, data storage issue, latency interoperability and scalability issues, Immutable nature of BT, lack of technical expertise to correlate BT in vaccine distribution, and requirement of robust IoT infrastructure for cold chains. **O:** organizational structure, requirement of huge development cost, uncertainty of potential outcome against complexity involved, ownership and accountability of stored data, linking all the stakeholders of vaccine SC with upgraded technology, lack of collaboration and trust for freely data sharing, lack of standardized data in immunization programs, and lack of awareness about BT opportunities in SC. **E:** narrowing flexibility, lack of public trust, lack of government policy and legal framework to counter conflict, energy consumption/environment issues, and insufficient research and development on blockchain and its validation.	1) Organizational structure is the most prominent barrier. 2) Complexity and lack of standards influence BTA.
36	Deng, Shi, Wang, and Gaur (2022).	Chinese micro, SMEs	TOE	**T:** complexity, relative advantage, uncertainty, cost saving, and compatibility. **Micro, small, and medium enterprises' organizational context:** technological readiness, financial readiness, and TMS.	TMS positively affects BTA.

				E: SC cooperation, government support, competitive pressure.	
37	Wong, Leong, Hew, Tan, and Ooi (2019).	SMEs in Malaysia	TOE	**Γ:** relative advantage, and complexity. **O:** cost, and TMS. **E:** regulatory support, competitive pressure, and market dynamics. Behavioral intention.	Cost significantly impacts BTA.
38	Malik, Chadhar, Chetty, and Vatanasakdakul (2022).	Decision-makers and senior IT people from the blockchain adopter and potential adopter organizations in Australia	TOE	**Γ:** perceived benefits. perceived compatibility, perceived information transparency, and perceived risks. **O:** organization context, organization innovativeness, and organization learning capability. **E:** standards uncertainty, and competition intensity.	1) Organizational innovativeness and organizational learning capability were found to be positive to the BTA. 2) Organizations that can acquire new knowledge, storing, and applying that new knowledge and learn from it, open to new ideas, and are ready to take risks are more likely to the BTA.
39	Faasolo and Sumarliah (2022).	SC of SMEs in the Kingdom of Tonga.	TOE	**Γ:** complexity, and relative advantage. **O:** upper management support, and cost. **E:** regulatory support, and competitive pressure.	Cost significantly affects BTA.
40	Wu *et al.* (2023).	Construction industry	Integration of TOE and fuzzy DEMATEL approach.	**Γ:** scalability, smart contracts' security, immutability challenge of smart contracts, and interoperability. **O:** lack of awareness and understanding of BT, resistance in changing the original management process, financial constraints, lack of sufficiently skilled people, and negative attitudes towards data privacy issues and data disclosure. **E:** lack of collaborative culture, lack of mature policy environments, and industry concerns about technological maturity	1) Lack of awareness and understanding of BT has a high influential impact. 2) Financial constraints are a barrier.
41	Kajla, Sood, Gupta, Raj and Singh (2023).	Managers/officers in the banking sector	Integration of TOE and fuzzy Analytic	**Γ:** relative advantage, complexity, compatibility, standardization, scalability, and trust.	1) IT resources and financial resources are considered the primary factor in the BTA.

			Hierarchy Process (AHP)	**O:** IT resources, TMS, size of the organization and financial resources. **E:** clientele pressure, government policy and regulations, and inter-organizational trust.	2) Size of the organization. 3) The lack of TMS becomes a hindrance in BTA.
42	Wang, Zhang, Li, Yu and Li (2023).	Circular SCF experts	TOE, UTAUT, Interpretive structural modeling (ISM) analysis, and DEMATEL analysis.	**T:** technical complexity, compatibility, and comparative advantage. **O:** management commitment, resource adequacy, flexible organization, and cultural compatibility. **E:** SC partner adoption, industry adoption, government policy, and BT service providers. Performance Expectation: degree of users' perceived performance enhancement from BTA.	1) Management commitment is one of the highest degrees of importance in the overall system, which determines that it is located at the center of the decision-making system. 2) Resource adequacy influences the BTA.
43	Ali, *et al.* (2023).	Halal food SMEs in Malaysia	TOE and DOI	**T:** relative advantage, compatibility, ease of use, certainty and security, trialability, and observability. **O:** TMS and organizational readiness. **E:** external support, competitive pressure, and government regulation.	TMS positively impacted the intention of BTA.
44	Yap, *et al.* (2023).	Vietnamese fruit SC	TOE	**T:** traceability, trust, and disintermediation. **O:** business performance, compliance, OC, cost, and resistance to change. **E:** market competitive pressure, pricing of traceability-enabled products/services, regulatory support, and governance of data privacy and security. Behavioral intention.	OC and cost are perceived barriers to BTA.
45	Jackson and Allen (2023).	Accounting managers in Australia and parts of South-East Asia	TOE	**T:** security concerns, cost savings, relative advantage, compatibility, and technology competenc**e.** **O:** TMS, staff support, organizational support, and technology orientation. **E:** competitive pressure and regulatory support.	TMS. More emphasis on the operation involved in BTA rather than on strategy on the management level.

46	Kabra (2023).	Healthcare industry in India	TOE	**T:** compatibility and security and privacy concerns. **O:** TMS, organizational readiness, and organization size. **E:** competitive pressure and government support.	TMS, organizational size, and organizational readiness have a positive impact on BTA.
47	Baral, Chittipaka, Pal, Mukherjee and Shyam (2023).	Food retail SCM in India	TOE	**T:** perceived benefits, cost, relative advantage and security. **O:** TMS, organizational readiness, and BT knowledge. **E:** competitive pressure, regulatory environment, government support and intention to adopt the technology.	TMS, organizational readiness, and BT knowledge are important factors to BTA.
48	Nyazabe, Hwang and Manyole (2023).	Democratic Republic of the Congo higher education system	TOE framework and TAM model	**T:** relative advantage and transparency & data integrity. **O:** TMS and readiness. **E:** competitive pressure and government support. TAM: perceived ease of use and perceived usefulness.	

ANNEXES

ANNEX A

OCAI original version

1. Dominant Characteristics	**Now**	**Preferred**
A The organization is a very personal place. It is like an extended family. People seem to share a lot of themselves.		
B The organization is a dynamic and entrepreneurial place. People are willing to stick their necks out and take risks.		
C The organization is very results oriented. A major concern is with getting the job done. People are very competitive and achievement oriented.		
D The organization is a very controlled and structured place. Formal procedures generally govern what people do.		
Total	100	100

2. Organizational Leadership	**Now**	**Preferred**
A The leadership in the organization is generally considered to exemplify mentoring, facilitating, or nurturing.		
B The leadership in the organization is generally considered to exemplify entrepreneurship, innovation, or risk taking.		
C The leadership in the organization is generally considered to exemplify a no - nonsense, aggressive, results - oriented focus.		
D The leadership in the organization is generally considered to exemplify coordinating, organizing, or smooth - running efficiency.		
Total	100	100

3. Management of Employees	**Now**	**Preferred**
A The management style in the organization is characterized by teamwork, consensus, and participation.		
B The management style in the organization is characterized by individual risk taking, innovation, freedom, and uniqueness.		
C The management style in the organization is characterized by hard - driving competitiveness, high demands, and achievement.		

3. Management of Employees	**Now**	**Preferred**
A The management style in the organization is characterized by teamwork, consensus, and participation.		
B The management style in the organization is characterized by individual risk taking, innovation, freedom, and uniqueness.		
D The management style in the organization is characterized by security of employment, conformity, predictability, and stability in relationships.		
Total	100	100

4. Organization Glues	**Now**	**Preferred**
A The glue that holds the organization together loyalty and mutual trust. Commitment to this organization runs high.		
B The glue that holds the organization together commitment to innovation and development. There is an emphasis on being on the cutting edge.		
C The glue that holds the organization together the emphasis on achievement and goal accomplishment.		
D The glue that holds the organization together formal rules and policies. Maintaining a smoothly running organization is important.		
Total	100	100

5. Strategic Emphases	**Now**	**Preferred**
A The organization emphasizes human development. High trust, openness, and participation persist.		
B The organization emphasizes acquiring new resources and creating new challenges. Trying new things and prospecting for opportunities are valued.		
C The organization emphasizes competitive actions and achievement. Hitting stretch targets and winning in the marketplace are dominant.		
D The organization emphasizes permanence and stability. Efficiency, control, and smooth operations are important.		
Total	100	100

6. Criteria of success	**Now**	**Preferred**
A The organization defines success on the basis of the development of human resources, teamwork, employee commitment, and concern for people.		
B The organization defines success on the basis of having unique or the newest products. It is a product leader and innovator.		
C The organization defines success on the basis of winning in the marketplace and outpacing the competition. Competitive market leadership is key.		
D The organization defines success on the basis of efficiency. Dependable delivery, smooth scheduling, and low - cost production are critical.		
Total	100	100

ANNEX B

OCAI Permission letter

MICHIGAN
ROSS SCHOOL OF BUSINESS

OCAI – STUDENT PERMISSION LETTER

Updated 2023

Dear Laura Kohlrausch,

Thank you for your inquiry regarding the Organizational Culture Assessment Instrument (OCAI). Professor Cameron copyrighted the OCAI in the 1980s. Hundreds of other culture assessment instruments have been created based on this instrument and research.

The instrument may be used free of charge for student research purposes only. As a student, you may use it free of charge.

If the instrument is to be used by consulting firms, companies, or other organizations for monetary gain, a fee must be charged. Please contact Sherry Slade at Behavioral Data Services (734-663-2990, Sherry.Slade@b-d-s.com) for pricing and a full list of services. BDS can distribute the instrument on-line, tabulate scores, and produce feedback reports for a fee. These reports include comparison data from approximately 10,000 organizations--representing many industries and sectors, five continents, and approximately 100,000 individuals. Professor Cameron is also able to provide additional consulting services, such as analyzing and presenting to your organization virtually or in person.

Please be sure all surveys and your research include the appropriate copyright information (© Kim Cameron). Professor Cameron appreciates you sharing your results with him when you finish your study. Please send your results to austinsc@gmail.com.

Best wishes,