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UNCOVERING THE RELATIONSHIP BETWEEN PROJECT STAKEHOLDER COLLABORATION AND THE DIGITAL TRANSFORMATION CONTEXT: A MIXED-METHOD APPROACH

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This thesis was presented to the Postgraduate Program in Project Management of Universidade Nove de Julho (UNINOVE) as a partial requirement for the Doctoral Degree.

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DEDICATION

I dedicate this thesis to my son, Pedro Paiva de Oliveira, hoping it inspires him to always seek knowledge, even if it means working on many, many weekends.

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I thank my friends and colleagues at Tribunal de Contas do Estado de São Paulo (TCESP), with whom I navigate the intricacies of Project Stakeholder Collaboration on a daily basis, delivering unique results and responding to challenges that are always new, complex, and "keep us on our toes".

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The only true wisdom is in knowing you know nothing.

Socrates

ABSTRACT

This thesis aims to characterize and empirically describe the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. It is grounded in the collaboration theory discussed in management and project research, and relevant studies on digital transformation. Supported by pragmatic epistemology, the investigation adopted a mixed-methods approach, to conduct three interconnected studies and to develop a technological product. The first study is theoretical; a systematic literature review aims to characterize the dimensions of Project Stakeholder Collaboration and the Digital Transformation Context. The initial theoretical investigation (Study 1) uncovered a conceptual five-dimensional model for Project Stakeholder Collaboration, which was adapted for project studies. Besides, it proposed a theoretical, unidimensional model for the Digital Transformation Context. As an additional theoretical contribution, this first study also clarified the duality of digital transformation in project studies: distinguishing between the digital transformation of project management processes (example: adoption of BIM) and the digital transformation that generates value through projects (example: delivering digitally enhanced products or new business models). Building on this foundation, the second study is empirical, a quantitative and exploratory investigation aims at examining the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. Study 2 developed scales for both constructs, refining the theoretical model for Project Stakeholder Collaboration into three interconnected factors: Relational Norms, Focus on Shared Outcomes, and Stakeholder Engagement. This second research provided empirical evidence of a significant positive correlation with a strong effect size between the level of Project Stakeholder Collaboration and the degree of Digital Transformation Context. It also suggested that agile and hybrid project management methodologies are linked to higher levels of both collaboration and digital transformation. Deepening this understanding, the third study is also empirical, a qualitative investigation to describe how formal collaborative practices and relational norms associate to fostering Project Stakeholder Collaboration and to drive Digital Transformation Success. Study 3 described successful formal collaborative practices and relational norms, yielding descriptive models for Project Stakeholder Collaboration (encompassing collaborative culture, formal collaborative practices, and shared value creation) and Digital Transformation Success

(characterized by dematerialization, collaborative digital strategy, and digital competencies). The main theoretical contribution of this third research was picturing vivid examples of the cyclical and mutually influential relationship between Project Stakeholder Collaboration and Digital Transformation Success. It demonstrated that while digital technologies provide a strategic environment for change, effective collaboration ensures the digital strategy drives technology and people toward a shared purpose and delivers measurable value. Finally, the findings of this thesis were synthesized into a technological product, the DigitalCollabInsights website, designed to guide practitioners toward leveraging their project management skills in the digital context. This practical contribution provides clear, actionable guidance on fostering effective project stakeholder collaboration, focused on shared value creation, and digital transformation success.

RESUMO

Esta tese tem como objetivo caracterizar e descrever empiricamente a relação entre a Colaboração entre Stakeholders do Projeto e o Contexto de Transformação Digital. Fundamenta-se na teoria da colaboração discutida na pesquisa em gestão e projetos, bem como em estudos relevantes sobre transformação digital. Apoiada em uma epistemologia pragmática, a investigação adotou uma abordagem de métodos mistos para conduzir três estudos interconectados e desenvolver um produto tecnológico. O primeiro estudo é teórico; trata-se de uma revisão sistemática da literatura que visa caracterizar as dimensões da Colaboração entre Stakeholders do Projeto e do Contexto de Transformação Digital. A investigação teórica inicial (Estudo 1) revelou um modelo conceitual pentadimensional para a Colaboração entre Stakeholders do Projeto, o qual foi adaptado para os estudos de projetos. Além disso, propôs um modelo teórico unidimensional para o Contexto de Transformação Digital. Como contribuição teórica adicional, este primeiro estudo também clarificou a dualidade da transformação digital nos estudos de projetos: distinguindo entre a transformação digital dos processos de gestão de projetos (exemplo: adoção de BIM) e a transformação digital que gera valor por meio de projetos (exemplo: entrega de produtos digitalmente aprimorados ou novos modelos de negócios). Com base nesse alicerce, o segundo estudo é empírico: uma investigação quantitativa e exploratória que visa examinar a relação entre a Colaboração entre Stakeholders do Projeto e o Contexto de Transformação Digital. O Estudo 2 desenvolveu escalas para ambos os construtos, refinando o modelo teórico de Colaboração entre Stakeholders do Projeto em três fatores interconectados: Normas Relacionais, Foco em Resultados Compartilhados e Engajamento dos Stakeholders. Esta segunda pesquisa forneceu evidências empíricas de uma correlação positiva significativa, com forte tamanho de efeito, entre o nível de Colaboração entre Stakeholders do Projeto e o grau do Contexto de Transformação Digital. Também sugeriu que metodologias ágeis e híbridas de gestão de projetos estão ligadas a níveis mais elevados tanto de colaboração quanto de transformação digital. Aprofundando esse entendimento, o terceiro estudo é também empírico: uma investigação qualitativa para descrever como as práticas colaborativas formais e as normas relacionais se associam para fomentar a Colaboração entre Stakeholders do Projeto e impulsionar o Sucesso da Transformação Digital. O Estudo 3 descreveu práticas colaborativas formais e normas relacionais bem-sucedidas, gerando modelos descritivos para a Colaboração entre Stakeholders do Projeto (abrangendo cultura colaborativa, práticas colaborativas formais e criação de valor compartilhado) e para o Sucesso da

Transformação Digital (caracterizado por desmaterialização, estratégia digital colaborativa e competências digitais). A principal contribuição teórica desta terceira pesquisa foi retratar exemplos vívidos da relação cíclica e de influência mútua entre a Colaboração entre Stakeholders do Projeto e o Sucesso da Transformação Digital. Demonstrou-se que, embora as tecnologias digitais forneçam um ambiente estratégico para a mudança, é a colaboração eficaz que assegura que a estratégia digital impulsione a tecnologia e as pessoas em direção a um propósito compartilhado e entregue valor mensurável. Por fim, os achados desta tese foram sintetizados em um produto tecnológico, o website *DigitalCollabInsights*, projetado para orientar profissionais a potencializarem suas habilidades de gestão de projetos no contexto digital. Esta contribuição prática fornece orientações claras e aplicáveis sobre como fomentar uma colaboração eficaz entre stakeholders do projeto, com foco na criação de valor compartilhado e no sucesso da transformação digital.

Palavras-chave: Gestão de projetos; Stakeholders; Colaboração; Transformação digital; Project Stakeholder Collaboration.

LIST OF ABREVIATIONS

4IR - Fourth Industrial Revolution

ANOVA - Analysis of Variance

AI - Artificial Intelligence

AVE - Average Variance Extracted

BCa - Bias-Corrected and accelerated

BI - Business Intelligence

BIM - Building Information Modeling

CAPES - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior

CFI - Comparative Fit Index

CFA - Confirmatory Factor Analysis

CI - Confidence Interval

DF - Degrees of Freedom

EFA - Exploratory Factor Analysis

EPM - Enterprise Project Management systems

ERP - Enterprise Resource Planning

ESG - Environmental, Social and Governance

GenAI - Generative Artificial Intelligence

I4.0 - Industry 4.0

IJPM - International Journal of Project Management

IoT - Internet of Things

IT - Information and Technology

KMO - Kaiser-Meyer-Olkin

KPI - Key Performance Indicator

KR - Key-Result

ML - Maximum Likelihood

MVP - Minimum Viable Products

OKR - Objective Key Results

PA - Parallel Analysis

PMI - Project Management Institute

RACI Matrix - Responsible, Accountable, Consulted, and Informed Matrix

RULS - Robust Unweighted Least Squares

RMSEA - Root Mean Square Error of Approximation

SDG - Sustainable Development Goals

SLR - Systematic Literature Review

S-W - Shapiro-Wilk test

TLI - Tucker-Lewis Index

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1. INTRODUCTION

Digital transformation has profound and far-retching effects on individuals, organizations, and society. For example, the COVID-19 pandemic accelerated virtual interactions, forcing rapid adjustments at all societal levels (Alstyne & Parker, 2021). Organizations also have been driven to reinvent their business models, processes, and project management governance to meet evolving client demands for superior products and services (Geurts & Cepa, 2023; Kapoor, 2022; Vial, 2019). Many businesses now offer information services integrated with their products, from elevators to marine equipment (Lerch & Gotsch, 2015; Paiva & Rabechini Jr., 2025; Tronvoll, Sklyar, Sörhammar, & Kowalkowski, 2020). Additionally, industries such as construction and manufacturing are transitioning toward integrated platforms for project design and implementation (Johansson, Kullström, Björk, Karlsson, & Nilsson, 2021; Shojaei, Oti-Sarpong, & Burgess, 2022).

A widely accepted definition of digital transformation describes it as a process where digital technologies disrupt traditional operations, prompting strategic organizational responses that reshape value creation pathways while requiring structural changes and the overcoming of organizational barriers (Vial, 2019). However, digital transformation goes beyond IT-enabled changes by redefining strategies and business models through data-driven platforms that facilitate interaction among diverse stakeholders (Piccoli, Grover, & Rodriguez, 2024). Its core objective is clear: to drive business improvements, enhance customer experience, or create innovative business models using advanced technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), cloud computing, and blockchain (Fitzgerald, Kruschwitz, Bonnet, & Welch, 2013; Warner & Wäger, 2019).

Digital transformation and the Fourth Industrial Revolution (Industry 4.0 or I4.0) are closely related phenomena that share fundamental commonalities as strategic drivers of change (Piccarozzi, Silvestri, Silvestri, & Ruggieri, 2024; Schwab, 2017; Vial, 2019; Warner & Wäger, 2019). Industry 4.0, a term originally coined in the German manufacturing sector and later popularized by the World Economic Forum, is fundamentally concerned with integrating digital technologies into production and enabling the intelligent networking of machines and processes through Cyber-Physical Systems (Kagermann, Wahlster, & Helbig, 2013; World Economic Forum & McKinsey & Company, 2019). Correspondingly, digital transformation is defined by the use of new digital technologies, such as the IoT, AI, cloud computing, and blockchain, to

enable major business improvements (Gillani, Chatha, Jajja, Cao, & Ma, 2024; Vial, 2019; Warner & Wäger, 2019). As the descriptions show, both phenomena aim to revolutionize the operations of organizations (Gillani et al., 2024; Piccarozzi et al., 2024).

The critical similarity is that both Industry 4.0 and digital transformation foster extensive connectivity among people, organizations, and machines, underpinned by the abundance of data and advancements in machine intelligence (Liu, Zeng, Papadonikolaki, Maritshane, & Chan, 2024; Piccarozzi et al., 2024; Schwab, 2017). The term industry 4.0 is more frequently applied when digital technologies are specifically employed to create smart, interconnected manufacturing systems capable of exchanging information, optimizing processes, and sometimes making autonomous decisions across the production and supply chain; however, management studies broadened this understanding employing it to different sectors (Moeuf, Lamouri, Pellerin, Tamayo-Giraldo, Tobon-Valencia, & Eburdy, 2019; Piccarozzi et al., 2024). Digital transformation is a broader, more holistic concept encompassing the necessary strategic organizational renewal, cultural changes, and replacement or refreshment of the business model needed to align with the adoption of digital technologies (Gillani et al., 2024; Vial, 2019).

Both phenomena also promote data abundance that fuels decision-making and advances machine intelligence, driving digital transformation across businesses and society (Gillani et al., 2024; Liu et al., 2024). Given that digital transformation and the Fourth Industrial Revolution are closely related phenomena - both fostering connectivity among people, organizations, and machines while being underpinned by technological innovation, data availability, and machine intelligence (Schwab, 2017; Vial, 2019; Warner & Wäger, 2019), this thesis adopts the term digital transformation to describe these changes. The goal is to contribute to a deeper understanding of this significant and evolving phenomenon, which remains only partially comprehended (Carvalho, Reis, Larieira, & Pinochet, 2021).

Researchers investigating the digital transformation context emphasize the significance of collaboration (Papadonikolaki, van Oel, & Kagioglou, 2019; Schwab, 2017; Tronvoll et al., 2020; Warner & Wäger, 2019). Collaboration facilitates the recombination of knowledge (Sjödin, 2019; Tronvoll et al., 2020), broadens perspectives for effective problem-solving (Camarinha-Matos, Fornasiero, Ramezani, & Ferrada, 2019; Ylinen, 2021), and enables organizations to supplement their capabilities (Moeuf et al., 2019; Weritz, Braojos, & Matute,

2020). In an environment characterized by rapid change and emerging opportunities, practitioners must adapt to uncertainty while continuously recombining knowledge to address new challenges (Agarwal, Seth, & Agarwal, 2022; Schwab, 2017).

This recombination of knowledge is often seen when different organizations propose to implement for example a collaborative business model, which require them to align their strategies (Agostini & Nosella, 2019; Han & Trimi, 2022; Tronvoll et al., 2020), while engaged professionals work together to solve problems and establish integrated processes (Ratzmann, Pesch, Bouncken, & Climent, 2018; Whitmore, Papadonikolaki, Krystallis, & Locatelli, 2020). In the Digital Transformation Context, stakeholders - organizations, professionals, and customers – influence projects and are impacted by them, such as the development of collaborative business models and the implementation of smart processes (Aaltonen & Kujala, 2016; Cleland, 1986; Freeman, 1984). Stakeholders are classified as either primary stakeholders – those with formal, contractual, or official relationships with the project - or secondary stakeholders – those outside the project's sphere of authority (Cleland & Ireland, 2007; Lehtinen & Aaltonen, 2020; Winch, 2017).

Primary stakeholders include individuals such as project managers, sponsors, team members, suppliers, customers, and end-users (Cleland & Ireland, 2007). These individuals actively collaborate throughout the project lifecycle (Papadonikolaki et al., 2019; Warner & Wäger, 2019; Whitmore et al., 2020). While secondary stakeholders – such as citizen associations or professional boards – may influence on large-scale or governmental projects (Cleland, 1986), this thesis focuses specifically on primary stakeholders as the actors of Project Stakeholder Collaboration. They are directly tied to project outcomes; hence, they share responsibilities and ownership to collectively defining goals and constructively solving problems (Bronstein, 2003; Papadonikolaki et al., 2019; Tronvoll et al., 2020).

To enhance the understanding of Project Stakeholder Collaboration in the Digital Transformation Context, this thesis draws on the theory of collaboration, which provides diverse perspectives on this complex phenomenon (Morris & Miller-Stevens, 2016). Gray's (1985) seminal study defines collaboration as a process in which two or more stakeholders pool resources to address a problem that cannot be solved independently. Similarly, Bronstein (2003) emphasizes that collaboration facilitates the achievement of goals which would be unattainable by individuals alone. Both studies highlight that collaboration enables stakeholders to achieve

objectives that cannot be reached independently, which is a concept intrinsically linked to the purpose of projects themselves, by delivering holistic solutions that are superior to those produced by single individuals (PMI, 2021).

Within project studies, collaboration is viewed as a combination of relational norms and formal collaborative practices to foster team integration and amplify mutual benefits (Kokkonen & Vaagaasar, 2018; Nikulina, Volker, & Bosch-Rekveldt, 2022). Ultimately, collaboration is realized through activities and interactions among two or more stakeholders working toward shared goals (Morris & Miller-Stevens, 2016).

1.1. RESEARCH PROBLEM

Given that digital technologies amplify integration among organizations and individuals, numerous studies exploring the Digital Transformation Context emphasize the role of collaboration (Brodeur, Pellerin, & Deschamps, 2022; Kagermann et al., 2013; Shojaei et al., 2022; Vial, 2019). However, while some researchers view collaboration as a facilitator of digital transformation (Ayala, Le Dain, Merminod, Gzara, Enrique & Frank, 2020; Warner & Wäger, 2019), others consider collaboration as a benefit resulting from transformations (Imran, Shahzad, Butt, & Kantola, 2021; Oke, Kineber, Al-Bukhari, Famakin, & Kingsley, 2021).

Shojaei et al. (2022), for instance, argue that collaboration is a critical enabler for leveraging digital integrated platforms and improving the efficiency of construction projects. They emphasize that successful organizations build effective communication and collaboration structures while partnering with supplier networks to foster collective learning (Shojaei et al., 2022). Similarly, Warner and Wäger (2019) highlight that digital transformation drives the creation of more customer-centric organizations. They advocate for structuring organizational units to promote collaboration within the organization and with customers – such as innovation labs – while collecting customer feedback and using it to refine products and services (Warner & Wäger, 2019).

Despite the recognized importance of Project Stakeholder Collaboration in the Digital Transformation Context, opportunities remain to deepen academic understanding of the phenomenon. A few studies, such as Papadonikolaki and colleagues (2019), have analyzed the processes involved in collaboration and highlight that collaborating stakeholders are interdependent and often work beyond their formal disciplines. However, no prior research has

developed a comprehensive analysis of the formal collaborative practices and relational norms influencing Project Stakeholder Collaboration in the Digital Transformation Context.

To address this gap, this thesis proposes a research question grounded on the significance of Project Stakeholder Collaboration in the Digital Transformation Context. *How do Project Stakeholder Collaboration and the Digital Transformation Context influence each other?*

1.2. RESEARCH OBJECTIVES

Guided by the research question, this thesis aims to systematically characterize and empirically describe the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. This research builds upon the findings of a masters dissertation (Paiva & Rabechini Jr., 2025), which qualitatively identified eight key factors linking collaboration to stakeholder management in Industry 4.0 manufacturing projects: (1) definition of shared goals, (2) information exchange, (3) joint problem-solving, (4) trust relationships, (5) long-term relationships, (6) top management support, (7) learning mindset, and (8) end-user centrality. These factors have been widely recognized as critical in project management research with focus on collaboration and stakeholder engagement (Fernandes, Dooley, O'Sullivan, & Rolstadås, 2021; Ika & Donnelly, 2017; Nidumolu, Ellison, Whalen, & Billman, 2014).

This thesis is supported by pragmatic epistemology, centered on the practical usefulness of knowledge and the outcomes of ideas (Brinkmann & Kvale, 2015; Saunders, Lewis, & Thornhill, 2019). It strives to bridge traditionally opposing distinctions like objectivism and subjectivism, facts and values, and varied contextual experiences. For pragmatists, reality is comprehended by the practical effects of ideas, and knowledge for its capacity to allow successful actions and resolve issues (Brinkmann & Kvale, 2015; Saunders et al., 2019).

Under this pragmatic perspective, research originates with a problem and is geared towards contributing practical solutions that can inform future practice (Brinkmann & Kvale, 2015; Saunders et al., 2019). Values and beliefs of the researcher are viewed as the engines of the reflective investigative process, which starts with doubt and re-establishes belief once the problem is uncovered (Brinkmann & Kvale, 2015; Saunders et al., 2019). Pragmatic epistemology embraces methodological pluralism, acknowledging that no single best approach

or method exists. Rather, the choice of methodology is dictated by the context of the research problem, and the study's probable consequences, with the goal of gathering data that is credible, well-grounded, dependable, and relevant (Brinkmann & Kvale, 2015; Saunders et al., 2019).

The pragmatic epistemology is the structure for the adoption of a mixed-method approach for the thesis. Specific research objectives are established and addressed sequentially, each contributing to the main research objective. These specific research objectives are:

- To characterize the dimensions of Project Stakeholder Collaboration in the Digital Transformation Context.

- To examine the relationship between Project Stakeholder Collaboration and the Digital Transformation Context.

- To describe the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success.

- To present an accessible assessment tool for practitioners to evaluate their level of Project Stakeholder Collaboration and Digital Transformation Success, enabling dissemination of academic results among project professionals.

1.3. REASONS FOR THE RESEARCH

Organizations have rapidly accelerated their digital transformation efforts in response to the COVID-19 pandemic, adopting new technologies and digital strategies to maintain operations and adapt to unprecedent disruptions (Gartner, 2022; World Economic Forum, 2023). This has included a shift toward digital customer value, remote work, and the adoption of collaborative technologies (McKinsey & Company, 2022; World Economic Forum, 2023). A survey of senior executives confirmed that organizations initially set short-term goals on improving operational efficiency, particularly to address challenges such as continued reliance on manual data collection (The Manufacturer & IBM, 2021). As digital transformation initiatives advance, organizations are increasingly prioritizing the alignment of their strategy with evolving customer needs while strengthening collaboration with stakeholders (Koehler, 2022; The Manufacturer & IBM, 2021).

To build effective customer-centric strategies in rapidly changing, data-driven environments, organizations must not only identify customer trends but also systematically

integrate these insights to capitalize on potential market opportunities (Koehler, 2022; Warner & Wäger, 2019). This collaborative engagement with customers serves dual purposes: it increases organizational responsiveness to market shifts while creating frameworks for sustained value co-creation through shared decision-making processes (Koehler, 2022; Tronvoll et al., 2020). Besides customer-centricity, successful digital transformation hinges on breaking down organizational silos between Information Technology (IT) and operational units, which requires intensified cross-functional collaboration (Gartner, 2022; The Manufacturer & IBM, 2021). Corroborating these ideas, the PMI (2021) identifies collaboration as a core principle for effective project decision and execution. Interdependent relationships, spanning external customer networks, business partners and internal operational synergies, collectively highlight the pivotal role of collaboration in the context of digital transformation (Gillani et al., 2024; Papadonikolaki et al., 2019).

While existing literature and practitioners recognize the relevance of Project Stakeholder Collaboration in the Digital Transformation Context, significant gaps persist in understanding the specific mechanisms and contextual factors that enable effective collaboration (Shojaei et al., 2022; The Manufacturer & IBM, 2021; Warner & Wäger, 2019; World Economic Forum, 2023). Alongside, despite the crescent number of publications on digital transformation, there are opportunities to contribute to its understanding, even more in project studies. Current research comprises mostly of theoretical research, and a few qualitative studies, none of them specifically focused on systematically describing, quantitative or qualitatively, the formal collaborative practices and relational norms influencing collaboration. Therefore, this study focuses on these opportunities to contribute to academic understanding and to offer accessible scientific knowledge to practitioners.

2. STRUCTURE OF THE THESIS

This thesis follows the framework proposed by Costa, Ramos, and Pedron (2019) to structure the research through multiple, interconnected studies. Utilizing a mixed-methods approach, this thesis aims to systematically characterize and empirically describe the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. To achieve this, the thesis comprises three distinct but interrelated studies, alongside the development of a technological product, as illustrated in Figure 1.

1 Study 1	**2** Study 2	**3** Study 3	**4** Technological Product
Systematic Literature Review	*Quantitative Scale Development*	*Qualitative In-depth Interviews*	*Software*
Project Stakeholder Collaboration and the Digital Transformation Context: Theoretical Models	Linking Project Stakeholder Collaboration to the Digital Transformation Context	Enhancing Project Stakeholder Collaboration and Digital Transformation Success: a Qualitative Study	The DigitalCollabInsights Website

Figure 1 *Research Framework*

Source: elaborated by the author

The research is supported by pragmatic epistemology, which prioritizes practical solutions by employing the most appropriate methods for the specific context and research problem (Brinkmann & Kvale, 2015; Saunders et al., 2019). A pragmatic philosophy is well-aligned with mixed-methods research utilizing sequential explanatory design, commencing with a quantitative data collection phase followed by a qualitative one.

The first study is theoretical in nature and consists of a systematic literature review conducted according to the methodological guidelines of Pollock and Berge (2018). It aimed to characterize the dimensions of Project Stakeholder Collaboration and of the Digital Transformation Context. One notable finding from Study 1 is that only a limited number of previous studies have thoroughly and systematically described the collaboration among project stakeholders in the context of digital transformation.

To deepen the analysis and find a suitable theoretical lens for collaboration, snowballing techniques (Wohlin, 2014) were employed, which led to relevant research in management studies and in the context of other types of projects. These additional studies supported the analysis of stakeholder collaboration in the digital transformation context. Study 1 provides two theoretical models: one for Project Stakeholder Collaboration and another for the Digital Transformation Context, which supported Studies 2 and 3 empirical works. Regarding its dissemination, Study 1 was revised after peer review feedback and will soon be submitted to another journal.

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Building on the theoretical model developed in Study 1, Studies 2 and 3 were empirical in nature. Study 2 adopts a quantitative approach aimed at examining the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. To enable this assessment, it previously developed two measurement scales: one for assessing Project Stakeholder Collaboration and another evaluating the Digital Transformation Context. Study 2 ascertained a positive correlation between collaboration and the digital transformation context, with strong effect size. Despite that, empirical models presented distinctions from the theoretical models, which motivated the following qualitative investigation in Study 3.

To contribute to a richer empirical understanding of both phenomena – Project Stakeholder Collaboration and the Digital Transformation Context, Study 3 adopts a qualitative approach. The objective is to describe the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success. By collecting and analyzing the perspectives of seasoned professionals, the study emphasizes how Project Stakeholder Collaboration and Digital Transformation Success influence each other.

Finally, this research produces software as its technological product, which is designed to present key empirical findings clearly and accessible to practitioners, thereby approximating academic research with industry practice.

To summarize the connections between the interlinked study, the author follows the recommendations of Costa, Ramos, and Pedron (2019), presenting a Tie-in Methodological Matrix (Table 1). Accordingly, the top section outlines the research question, main objective, and the reasons for the research. The second section explains the justification for distinguishing the interconnected studies while highlighting their interdependence. The third section provides a detailed overview of the three related studies that form the core of this thesis. Finally, the technological product is described and classified according to CAPES (2020) criteria.

Table 1: Tie-in Methodological Matrix

Central Research Question

How do Project Stakeholder Collaboration and the Digital Transformation Context influence each other?

Research Objective

This thesis aims to describe and quantify how Project Stakeholder Collaboration and the Digital Transformation Context influence each other.

Reasons for the Research

This research addresses a critical gap in literature by systematically identifying the formal collaborative practices and relational norms that enable effective Project Stakeholder Collaboration and foster Digital Transformation Success, a theme that has been acknowledged as important but not yet described in detail.

Justification for the Distinction of Studies	Justification for the Interdependence of Studies
Study 1 systematically reviews previous studies on collaboration among project stakeholders in the digital transformation context. It also deepens the systematic examination of collaboration in management studies and other project types.	Study 1 identified elements characterizing Project Stakeholder Collaboration and the Digital Transformation Context. These inputs enabled the proposition of two theoretical models to measure both constructs: Project Stakeholder Collaboration and the Digital Transformation Context.
Study 2 examines the relationship between Project Stakeholder Collaboration and the Digital Transformation Context, after developing scales to measure both constructs.	The theoretical models proposed in Study 1 supported the collection and examination of empirical data in Study 2. Employing Exploratory Factor Analysis, the research developed two scales to measure Project Stakeholder Collaboration and the Digital Transformation Context. It verified distinctions between theoretical and empirical models.
Study 3 brings a deeper understanding about the constructs by describing the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success.	
Finally, software constitutes the technological product. It offers an simplified assessment of collaboration and digital transformation to practitioners in an accessible manner, enabling broad dissemination among project professionals.	Study 3 employed the empirical models developed in Study 2 as theoretical lenses aimed to describe formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive digital transformation success.

Title	Research Question	Main Objective	Type of Study	Research Method	Data Collection Techniques	Data Analysis Techniques	Publication Status
Study 1: Project Stakeholder Collaboration in the	What dimensions characterize Project Stakeholder	The aim is to characterize the dimensions of Project	Theoretical	Systematic Literature Review	Previous articles were selected from the Scopus	Content analysis	To be resubmitted.

Digital Transformation Context: A Theoretical Model	Collaboration in the Digital Transformation Context?	Stakeholder Collaboration in the Digital Transformation Context.			and Web of Science databases. Snowballing techniques assembled other collaboration studies.		
Study 2: Linking Project Stakeholder Collaboration to the Digital Transformation Context	What is the relationship between Project Stakeholder Collaboration and the Digital Transformation Context?	This study aims to examine the relationship between Project Stakeholder Collaboration and the Digital Transformation Context.	Empirical	Quantitative	Online questionnaire	Exploratory Factor Analysis, with polychoric correlation, Parallel Analysis and oblique rotation.	Submitted to the International Journal of Project Management (IJPM)
Study 3: Enhancing Project Stakeholder Collaboration and Digital Transformation success: a Qualitative Study	How do formal collaborative practices and relational norms intermingle to foster Project Stakeholder Collaboration and drive Digital Transformation Success?	The objective is to describe the formal collaborative practices and relational norms that foster Project stakeholder collaboration and drive digital transformation success.	Empirical	Qualitative	In-depth interviews	Content analysis	To be submitted

Technological Product	Type	Description	Adherence	Impact	Applicability	Innovation	Complexity
The DigitalCollabInsights Website	Software	Using accessible language, the website introduces the core concepts of Project Stakeholder Collaboration and Digital Transformation	It adheres to the research theme of "Innovation in Project Management", and specifically, it is aligned with the	While the work has significant potential to help practitioners improve their formal collaborative	The applicability of the technological article is high, as the assessment of collaboration and digital	This research is highly innovative, because it stems from novel knowledge.	The assessment is based on a rigorous, multi-stage process required to develop the scales

Success, offers a preliminary assessment tool and provides the scales for further data collection.	research project: "Project Management: developing the foundations of the knowledge frontier in the pursuit of results".	practices and relational norms, its actual impact depends on the adoption of its findings.	transformation is suitable for different types of projects and various economic sectors.	that supports the software.

Source: elaborated by the author, following the recommendations of Costa, Ramos, and Pedron (2019)

This thesis is deliberately structured into three distinct studies, each with a unique objective and methodological approach designed to investigate different facets of the central research question. Study 1 is purely theoretical, employing a systematic literature review to define and characterize the foundational constructs of Project Stakeholder Collaboration and the Digital Transformation Context. In contrast, the subsequent two studies are empirical. Study 2 adopts a quantitative approach, using an online questionnaire and statistical analysis to examine the relationship between the two constructs. Finally, Study 3 utilizes a qualitative approach, conducting semi-structured interviews and content analysis to describe the formal collaborative practices and relational norms that foster collaboration, thereby providing a rich, contextualized understanding that quantitative data alone could not capture.

Despite their distinct purposes, the three studies are highly interdependent, forming a logical and sequential progression of inquiry. The theoretical models proposed in Study 1 serve as the essential groundwork, providing the conceptual framework and initial measurement scales that enable empirical investigation in Study 2. In turn, Study 2 takes these theoretical propositions and statistically develops them into scales. These empirically robust models are then not just a conclusion but a critical input for Study 3, where they function as the initial coding system for analyzing the qualitative interview data. This direct lineage ensures that the deep, contextual insights from the final study are firmly grounded in the theoretical and quantitative findings that precede them.

The synergy between the distinct and interdependent stages creates a comprehensive and robust research design. This mixed-method approach allows the thesis to move from a broad theoretical characterization (Study 1) to empirical development and relationship testing (Study 2), and finally to a deep, practical description of formal collaborative practices and relational norms (Study 3). This structured progression ensures that each phase informs the next, culminating in a well-supported framework.

The practical culmination of this integrated process is the development of The DigitalCollabInsights Website, a technological product classified as a software and accepted by the CAPES Administration Branch (CAPES, 2019, 2020). It synthesizes the findings from all previous academic studies into an accessible format for practitioners, demonstrating how the combined insights work together to address the central research question.

3. STUDY 1 - PROJECT STAKEHOLDER COLLABORATION AND THE DIGITAL TRANSFORMATION CONTEXT: THEORETICAL MODELS

ABSTRACT

To address the under-researched role of stakeholder collaboration in digital transformation, this paper characterizes the core dimensions of both Project Stakeholder Collaboration and the Digital Transformation Context. Based on a systematic literature review of 85 articles, the study adapts to project studies a theoretical five-dimensional model of collaboration, comprising interdependence, flexibility, reflection on the process, collaborative outcomes, and collective ownership of goals, and systematically proposes a model for the digital transformation context. The analysis also highlights the duality of digital transformation manifestation in projects: the transformation of project processes versus the transformation by digital outcomes. Together, these findings provide a robust conceptual framework for future research and an actionable guide for practitioners navigating complex digital initiatives.

Keywords: Project management; Stakeholders; Collaboration; Collaborative factors; Digital transformation.

3.1.   INTRODUCTION

Organizations today navigate a turbulent environment characterized by technological innovation, intensified market competition, and the demands of hyperconnected customers (Schwab, 2017; Warner & Wäger, 2019). In response, they are compelled to fundamentally rethink their strategies, operations, and value propositions in a phenomenon known as digital transformation (Fitzgerald et al., 2013; Vial, 2019). Far more than the simple adoption of new digital tools, digital transformation represents a profound and continuous rewiring of an organization aimed at creating new value by deploying technology at full scale (Liu et al., 2024; Piccoli et al., 2024). It is a disciplined strategic process of redesigning business models, operations, and customer experiences by embedding digital technologies across the entire enterprise (Vial, 2019; Warner & Wäger, 2019). This reorientation targets various core domains, including business and operating models, internal processes, products, and both employee and customer experiences, to improve efficiency, enhance agility, and foster innovation (Imran et al., 2021; Piccoli et al., 2024).

The discourse surrounding digital transformation is often dominated by its technological enablers, such as AI, IoT, and cloud computing (Piccarozzi et al., 2024; Warner & Wäger, 2019). However, a purely technology-centric view is insufficient to explain its outcomes (Liu et al., 2024; Vial, 2019). High rates of failure in digital transformation initiatives are frequently attributed not to technological shortcomings but to significant human and organizational challenges, including cultural resistance, a lack of stakeholder buy-in, and inadequate change management (W. Abdalla, Suresh, & Renukappa, 2020; Gillani et al., 2024). This reveals a critical socio-technical gap, where the potential of technology is unlocked only through commensurate shifts in organizational culture and practice (Piccoli et al., 2024; Warner & Wäger, 2019). Consequently, digital transformation demands a cultural change that requires organizations to continually challenge the established knowledge, experiment, and become comfortable with failure as a prerequisite for learning (W. Abdalla et al., 2020; Tronvoll et al., 2020). This study addresses this gap by focusing on the human and social aspects of digital transformation, positing that effective stakeholder collaboration is not a peripheral soft skill but an indispensable capability for navigating this complex landscape.

The strategic ambitions of digital transformation are not realized through abstract mandates but are operationalized through the execution of discrete, focused initiatives: projects

(Fitzgerald et al., 2013; Piccoli et al., 2024). Projects serve as the primary vehicles through which organizations implement new technologies, re-engineer processes, and launch digitally enhanced products and services (Paiva & Rabechini Jr., 2025; Papadonikolaki, Krystallis, & Morgan, 2022). To capture this dynamic, this paper establishes two streams of investigations about digital transformation in project studies. The first stream, the digital transformation *of* projects, concerns the digital transformation of project management processes themselves, affecting how project work is planned, executed, and controlled (Brodeur et al., 2022; Papadonikolaki et al., 2019). The second stream, the digital transformation *by* projects, focuses on projects that deliver a digitally transformed product, service, or business model as their primary outcome (Tronvoll et al., 2020; Warner & Wäger, 2019). Both streams are fundamental to organizational adaptation, and both demand the ability of diverse stakeholders to collaborate effectively.

In any complex undertaking, collaboration is essential (Huxham & Vangen, 2005; Nikulina et al., 2022). Foundational theory defines collaboration as an iterative process where autonomous stakeholders, sharing rules and structure, work together to solve problems or deliver solutions that are beyond their individual capabilities (Gray, 1985; Mattessich & Monsey, 1992). This involves a deep integration of varied parties, including employees, customers, suppliers, and regulators, to align diverse interests and achieve shared objectives.

In the digital transformation context, the importance of collaboration is not merely increased; its fundamental nature is altered and amplified (Papadonikolaki et al., 2019; Warner & Wäger, 2019). Uncertainty and complexity typical of digital transformation mean that no single entity possesses all the requisite knowledge, skills, or resources to ensure success (Piccoli et al., 2024; Tronvoll et al., 2020). This necessitates a shift in the modality of collaboration. For instance, the abundance of data in the digital transformation context transforms collaboration from simple information sharing into a more sophisticated process of collective sense-making (Gillani et al., 2024; Shojaei et al., 2022). Likewise, the high degree of market and technological uncertainty means collaboration must evolve from aligning stakeholders around a fixed, predefined scope to establishing flexible, adaptive governance structures that can accommodate continuous change (Imran et al., 2021; Tronvoll et al., 2020). Digital tools may facilitate this by eliminating geographic barriers and enabling more frequent, asynchronous communication, but they are only effective within a supportive environment that fosters trust and encourages

experimentation through trial and error (Ayala et al., 2020; Michel-Villarreal, Vilalta-Perdomo, Canavari, & Hingley, 2021).

The academic and practitioner literature frequently acknowledges an intrinsic link between stakeholder collaboration and the development of digital transformation (Gartner, 2022; Warner & Wäger, 2019). Some scholars argue that collaboration enables digital transformation (Imran et al., 2021; Warner & Wäger, 2019), while others contend that digital transformation and its associated technologies facilitate collaboration (Gillani et al., 2024; Han & Trimi, 2022). Despite this recognition, the relationship can be further systematically deconstructed and analyzed.

This leads to a research gap in project studies literature. While the importance of collaboration in digital transformation is accepted, investigations that develop a systematic analysis of it are scarce. This scarcity inhibits a theoretically grounded understanding of what constitutes effective collaboration in this unique context. Without a systematic model, practitioners lack a clear framework for diagnosing collaborative weaknesses and fostering the specific behaviors required, and researchers lack a solid foundation for empirical investigation.

To address this critical research gap, this study is guided by the following research question: *What dimensions characterize Project Stakeholder Collaboration and the Digital Transformation Context?*

The primary objective of this paper is therefore to characterize the dimensions of Project Stakeholder Collaboration and of the Digital Transformation Context through a systematic literature review amplified with snowballing techniques. This study makes two primary contributions. First, it develops a theoretically grounded, multi-dimensional model of Project Stakeholder Collaboration, based on previous studies (Bronstein, 2002; Gray, 1985; Nikulina et al., 2022), and specifically adapted for the demands of project studies. Second, it provides a systematic theoretical characterization of the Digital Transformation Context also regarding project studies. Together, these contributions offer a conceptual framework that can guide future empirical research and provide actionable insights for managers leading complex transformation initiatives.

The remainder of this paper is structured as follows. Section 2 outlines the methodology employed for the systematic literature review. Section 3 presents the findings related to the characterization of Project Stakeholder Collaboration and the Digital

Transformation Context. Section 4 discusses the interplay between these two constructs and proposes theoretical scales for measurement. Finally, Section 5 concludes the paper by summarizing its contributions, acknowledging its limitations, and outlining avenues for future research.

3.2.   METHODOLOGY

This research conducted a Systematic Literature Review (SLR), a method that relies on detailed protocols to ensure reproducibility (Pollock & Berge, 2018), to characterize the dimensions of Project Stakeholder Collaboration and the Digital Transformation Context. Studies that simultaneously discussed digital transformation, projects, and stakeholder collaboration were searched in September 2022 and critically evaluated. Subsequently, the research corpus was updated in August 2025.

This SLR was guided by the six key stages described by Pollock and Berge (2018): (1) define the research objective, (2) register the protocol, (3) collect scientific data, (4) assess study quality, (5) synthesize the evidence, and (6) interpret the findings. However, this process proved iterative rather than strictly linear. Upon first reaching Stage 5, "synthesize the evidence", it became clear that the initial research corpus was insufficient. The corpus had to be amplified to adequately characterize Project Stakeholder Collaboration, as there was a lack of studies systematically studying this phenomenon in the digital transformation context.

To deepen and amplify the research corpus, this research complemented the SLR with snowballing techniques (Greenhalgh & Peacock, 2005; Wohlin, 2014). Analyzing the references of the research corpus, this study selected a set of core articles that described the collaboration in significant depth. Their reference list (backward snowballing) and citing documents (forward snowballing) were analyzed (Greenhalgh & Peacock, 2005; Wohlin, 2014) aiming to find other studies contributing to the understanding of collaboration.

Therefore, this study followed a 7-stage SLR framework (Figure 2). This hybrid methodology combines the structuring stages from Pollock and Berge (2018) with the snowballing techniques recommended by Greenhalgh and Peacock (2005) and Wohlin (2014). The specific steps for each stage are formally registered in the protocol.

STAGE				
STAGE 1 DEFINE THE RESEARCH OBJECTIVE	Search string was designed.			
STAGE 2 RESEARCH PROTOCOL REGISTERED				
STAGE 3 DATA COLLECTION IN SCIENTIFIC DATABASES	Documents were extracted from Scopus and Web of Science.	NO time limit was defined for the documents.	Only peer reviewed articles were selected.	**226 article**s were obtained 118 (Scopus) and 108 (Web of Science - WOS).
STAGE 4 QUALITY OF THE STUDIES ASSESSED	Deduplication considering Scopus and WOS (71 duplicates were excluded).	Intermediate list with **155 articles** was obtained.	Authors were listed alphabetically 7 articled excluded **(148 articles)**	
	Relevance checked. 47 articles excluded **(101 articles)**	Language and accessibility exclusion 12 articles Excluded **(89 articles)**	**Full reading of 89 articles** Coding of relevant aspects	20 articles did not contribute to the research **(69 articles)**
STAGE 5 SNOWBALLING COLLECTION OF STUDIES	10 other articles were selected for snowballing analysis.	Backward and forward snowballing added 6 studies **(16 studies)**	16 studies analyzed to identify an adequate theoretical lens for collaboration	Bronstein (2002, 2003) was selected as the theoretical lens
STAGE 6 EVIDENCE SYNTHESIS	Deductive content analysis of collaboration based on Bronstein (2002, 2003)	Inductive analysis of digital transformation		
STAGE 7 FINDINGS INTERPRETATION	Theoretical models proposed: Project Stakeholder Collaboration and Digital Transformation			

Figure 2 Research Protocol for the Systematic Literature Review

Source: elaborated by the author as a hybrid protocol based on Pollock and Berge (2018) with the snowballing techniques recommended by Greenhalgh and Peacock (2005) and Wohlin (2014).

Stage 1 involved defining the research objective and developing an effective search string. Initial tests in Scopus and Web of Science (April 2022) revealed that a string using the term "stakeholder" was too narrow, returning fewer than 50 documents. Consequently, the strategy was broadened to capture any studies connecting "collaboration" and "digital transformation", even if they omitted the term "stakeholder". This trade-off, however, also required the manual exclusion of off-topic results, such as those concerning collaborative robots or human-machine collaboration, which did not align with the research objective.

To ensure reproducibility, the research string was designed to find the intersection of three key subjects. The first subject is project studies, which includes research on both predictive (project* AND manag*) and agile (agil* OR scrum OR kanban) management. The second is collaboration (collab*) and the third is digital transformation, which was purposely extended to comprise "fourth industrial revolution" studies due to the similarities between the phenomena ("digital transform*" OR "four* indust* revol*"…). This logic resulted in the following final search string: ((project* AND manag*) OR (agil* OR scrum OR kanban)) AND collab* AND ("digital transform*" OR "four* indust* revol*" OR "industr* 4*" OR " 4* indust* revol*").

In Stage 2, this study registered the research protocol for reproducibility and in Stage 3, this investigation collected data by applying the search string to the Scopus and Web of Science databases. The focus was exclusively on peer-reviewed articles and set no time limit, given the recent nature of the field. The dataset, collected in April 2022 and updated in August 2025 contained 226 articles (118 from Scopus and 108 from Web of Science).

In Stage 4, this research assessed the quality of the studies, beginning with deduplication. The Scopus and Web of Science files were combined into a single spreadsheet. An initial comparison identified and removed 71 articles present in both databases. The remaining list of 155 articles (using the Scopus list as a base and incorporating unique Web of

Science documents) was then organized alphabetically by author. This second step allowed us to spot and exclude 7 additional duplicates that had slightly different titles, resulting in a final list of 148 unique articles.

Following de-duplication, this study prepared for the relevance screening. An inclusion criterion was established: only documents that simultaneously explored all three subjects (digital transformation, stakeholder collaboration, and project studies) would be further analyzed. To ensure this screening was reproducible, three columns were inserted into the spreadsheet to document the keep-or-eliminate decision for each study.

Abstract screening of the 148 abstracts led to sets of exclusions: 47 were eliminated for not exploring all three subjects, and 12 were removed due to inaccessibility or language barriers. This left 89 articles for a full-text review. These articles were subjected to content analysis and inductive open coding (Bardin, 2015; Bryant, 2017), a process supported by Nvivo. This in-depth analysis revealed two things: first, that 20 articles did not contribute to the research question, which were then excluded; and second, that the remaining 69 articles lacked systematic descriptions of collaboration, its enablers, barriers and processes. This critical gap prompted the decision to employ snowballing to find a more robust theoretical lens for the analysis.

In Stage 5, this research initiated snowballing analysis by selecting 10 "seed" articles, chosen for their in-depth discussion of collaboration. Both backward (reference list) and forward (citing documents) snowballing were performed, which yielded 6 additional relevant articles. This set of 16 articles (the 10 seed + 6 new) was then subjected to content analysis and inductive open coding (Bardin, 2015; Bryant, 2017). The goal was to identify a robust theoretical lens for analyzing the entire corpus (now 85 articles). This research adopted Bronstein's model (2002, 2003) as this lens, as it provided a suitable scale for future research and showed high convergence with other key collaboration studies.

In Stage 6, the final list of 85 articles was analyzed employing content analysis (Bardin, 2015; Bryant, 2017). Examples of coding are presented in APPENDIX 1 – STUDY 1 – EXAMPLE OF CODING. While the corpus was synthesized deductively, supported by Bronstein models (2002, 2003), it was also synthesized inductively to identify relevant aspects of digital transformation. In Stage 7, this research interpreted the findings.

3.3. RESULTS

This section is organized into three subsections. The first summarizes research on collaboration in management studies and other types of projects, the second describes the digital transformation context, and the third characterizes the theoretical construct of project stakeholder collaboration.

3.3.1. COLLABORATION IN MANAGEMENT AND PROJECT STUDIES

Collaboration gained relevance in management research with Gray's (1985) seminal work, as a means to address complex challenges in inter-organizational contexts. This process, often catalyzed by uncertainty and crisis, involves two or more stakeholders combining resources to tackle problems beyond individual capabilities (Gray, 1985; Wood & Gray, 1991). Scholars have noted that collaborative efforts often result in enhanced solutions because stakeholders unite forces and compromise (Bronstein, 2003; Gray, 1985; Mattessich & Monsey, 1992; Nikulina et al., 2022). By collaborating, stakeholders amplify how they analyze a problem and this frequently leads to higher-quality outcomes (Mattessich & Monsey, 1992). However, they must make adjustments to their individual processes to achieve collaborative synergy (Mattessich & Monsey, 1992).

In project studies, collaboration develops throughout the project lifecycle, aimed at reaching specific outcomes (Nikulina et al., 2022). While collaboration is often equated with partnering, it is present in intraorganizational or interorganizational projects, involving various functional teams within a single organization or multiple institutions (Nikulina et al., 2022). Notably, while organizations make the decision to collaborate, the professionals engage in formal collaborative practices that ultimately influence the achievement of collaborative results (Kokkonen & Vaagaasar, 2018).

To comprehend what collaboration entails researchers generally decompose it into dimensions, processes, or elements (Bronstein, 2002; Gray, 1985; Mattessich & Monsey, 1992; Mellin, Bronstein, Anderson-Butcher, Amorose, Ball, & Green, 2010; Morris & Miller-Stevens, 2016; Nikulina et al., 2022). However, the theory of collaboration has not reached consensus around which elements comprise it (Mattessich & Monsey, 1992; Morris & Miller-Stevens, 2016; Nikulina et al., 2022; Thomson, Perry, & Miller, 2009). For instance, Morris and Miller-Stevens (2016) highlight nine interrelated elements of a collaborative arrangement:

communication, collective decision-making, diverse stakeholders, goals, leadership, shared resources, shared vision, social capital, and trust.

Some elements provided by Morris and Miller-Stevens (2016) corroborate formal collaborative practices and relational norms pinpointed by Nikulina et al. (2022), even though both perspectives are not completely overlapped. Nikulina et al. (2022) argue that project collaboration is structured by the interconnection between formal collaborative practices and relational norms. The formal collaborative practices highlighted by the author are governance, administration, support, and joint work activities, while the relational norms are win-win philosophy, commitment, transparency, shared vision, and trust (Nikulina et al., 2022).

Considering this varied landscape of the theory of collaboration, this research analyzed available models and scales of collaboration in different management fields to select which could be adequately employed or adapted as a theoretical model for Project Stakeholder Collaboration (Table 2). Investigated models and scales are presented in, which also shows a summary of their dimensions and characteristics.

Table 2: Collaboration Scales in Management Studies

Study	Constitutive Elements	Qualitative Model or Quantitative Scale
Gray (1985)	Twelve conditions: recognition of interdependence, identification of a requisite number of stakeholders, perceptions of legitimacy among stakeholders, legitimate/skilled convenor, positive beliefs about outcomes, shared access power, coincidence of values, dispersion of power among stakeholders, high degree of ongoing interdependence, external mandates, redistribution of power, influencing the contextual environment	Qualitative model to investigate collaboration in three process phases: Problem-setting, Direction-setting and Structuring.
Mattessich and Monsey (1992)	Six dimensions: environmental, membership, process / structure, communication, purpose and resources	Qualitative model to investigate collaboration.
Bronstein (2002, 2003)	Five dimensions: interdependence, flexibility, reflection in the process, newly created professional activities and collective ownership of goals	Quantitative scale to measure interprofessional collaboration.
Huxham and Vagen (2005)	Eighteen themes: Common aims, learning, membership structures, working processes, resources, communication and language, compromise, commitment and determination, identity, culture, trust, power, leadership, accountability, social capital, democracy and equality and risk.	Qualitative model to investigate collaboration.

Thomson (2009)	Five dimensions: governance and administration (structural), mutuality and norms (social capital), and organizational autonomy (agency).	Quantitative scale to measure interorganizational collaboration
Mellin et al. (2010)	Four dimensions: reflection on process, professional flexibility, newly created professional activities, and role interdependence.	Quantitative scale to measure interprofessional team collaboration.
Chiocchio, Grenier, O'Neill, Savaria, & Willms (2012)	Teamwork communication, synchronicity, coordination and individual level configurations	Quantitative scale to measure team collaboration.
Morris and Miller-Stevens (2016)	Nine themes: communication, collective decision-making, diverse stakeholders, goals, leadership, shared resources, shared vision, social capital, and trust.	Qualitative model to study the theory of collaboration.
Bohnstedt and Wandahl (2019)	Eight dimensions: knowledge and use of strengths, direct motivation, satisfactory payment, mutuality and basic needs, shared goals, harmonized actions, norming, corresponding obligations and expectations.	Quantitative scale to measure collaboration in construction projects.
Nikulina et al. (2022)	Two themes: formal integrative practices (governance, administration, support, and joint work activities) and relational norms (win-win philosophy, commitment, transparency, shared vision, and trust).	Qualitative model to investigate collaboration in project studies.
Paiva e Rabechini Jr. (2025)	Eight elements: definition of shared goals, information exchange, joint problem-solving, trust relationships, long-term relationships, top management support, learning mindset, and end-user centrality.	Qualitative model to explore collaboration in industry 4.0 manufacturing projects.

Source: developed by the author

These models and scales have many convergent dimensions, themes and elements. Thus, considering that the scale developed by Bronstein (2003) measures interprofessional collaboration, the unit of analysis of this broad research project, additionally, that it highly converges with other investigated models and it was developed based on adequate scale development methodology, this research selected it to be further adapted to measure Project Stakeholder Collaboration. Following, the dimensions of Bronstein's scale (2003) are described on the third subsection of these results. They emphasize elements discussed in the studies about collaboration in management, project studies and in the context of digital transformation.

3.3.2. THE DIGITAL TRANSFORMATION CONTEXT

Research on digital transformation and the fourth industrial revolution has gained academic relevance during the last decade (Fitzgerald et al., 2013; Schwab, 2017; Vial, 2019). Enabled by digital technologies, it affects products, processes, organizational structure, and business models (Gillani et al., 2024; Hess, Matt, Benlian, & Wiesbock, 2016). These technologies drive the autonomous exchange of information and the interconnection of value

networks, facilitating smart products and new business models to flourish (Kagermann et al., 2013; Warner & Wäger, 2019). In project studies, two distinct streams of research discuss digital transformation: one investigates the digital transformation of projects, when it affects project management processes, and the other explores the digital transformation by projects when they implement digitally enhanced products and processes (Papadonikolaki, Ahola, Zhang, Badi, & Narayanan, 2025; PMI, 2021). Table 3 summarizes the elements discussed in the reviewed articles related to the Digital Transformation Context.

Table 3: Elements of the Digital Transformation Context

Elements	Definition
Strategic guidelines, continuous improvement, and process evolution	The processes of digital transformation must align closely with the overarching organizational strategy to guide a systematic journey of incremental changes and continuous improvement adapted to the rapid pace and the abundance of data in the digital landscape (Piccoli et al., 2024; Warner & Wäger, 2019).
Improvements to business processes and business models	The structural and operational benefits resulting from digital transformation involve the redesign of existing business processes and the innovation of business models, creating value (Liu et al., 2024; Tronvoll et al., 2020).
Smart and customized processes, products a/or services	The digitally enhanced outcomes of digital transformation leverage data and communication capabilities to enable customization, deeper integration, and new functionalities for enhanced value delivery (Liu et al., 2024; Porter & Heppelmann, 2014).
Data availability and sharing	Data is abundant in digital transformation, continuously generated by intelligent sensors and digital systems, demanding a technical structure to capture, store, and analyze it, enabling the creation of intelligence and value for organizations and customers (Gillani et al., 2024; Tronvoll et al., 2020).
Professionals with digital competencies	The necessity for human capital to possess professional knowledge, skills, and expertise, in digital technologies, data analysis, and strong soft skills (e.g., flexibility, trustfulness) to collaborate within cross-functional teams (Gillani et al., 2024; Tronvoll et al., 2020).
Continuous improvement of business processes	An operational discipline focused on continually enhancing business processes and operational efficiency, driven by the need to reach benefits (Andrade & Gonçalo, 2021; Whitmore et al., 2020).
Improvements to organization sustainability or ESG perspectives (Environmental, Social and Governance)	The specific goal of using digital transformation to enhance transparency and promote sustainability around environmental, social, and governance perspectives (Kagermann et al., 2013; Piccarozzi et al., 2024).
Market and technological uncertainties	The volatile external environment where digital transformation takes place with continuous technological innovation, intensified market

	competition, and changing customer requirements (Tronvoll et al., 2020; Warner & Wäger, 2019).
Digital technologies usage	Adoption of technologies like IoT, AI, cloud computing, blockchain, RFID, and 3D printing facilitate the autonomous exchange of information and the interconnection of value networks enabling value creation (Gillani et al., 2024; Papadonikolaki et al., 2019).

Source: elaborated by the author based on the reviewed articles

Digital transformation initiatives should align closely with organizational strategy to guide a systematic journey of incremental changes (Paiva & Rabechini Jr., 2025; Robu & Lazar, 2021). A clear, well defined strategy drive the adoption of digital technologies, enabling deeper process changes and increasing associated benefits (Elwart & Carugo, 2020; Papadonikolaki, 2018). However, organizations face challenges in adapting traditional strategic planning approaches to the data abundance and rapid pace of markets undergoing digital transformation (Piccione, 2021; Warner & Wäger, 2019). This requires embracing emergent strategies and iterative processes (Piccione, 2021; Warner & Wäger, 2019).

This shift toward iterative, emergent strategies is often realized through new, data-driven business models built on deep collaboration (Tronvoll et al., 2020; Warner & Wäger, 2019). For example, by working closely with ship owners, ship designers, and crews, the organization developed in-depth knowledge of their needs and established trustworthy relationships, which were essential to build a digital and collaborative business model (Tronvoll et al., 2020). Besides, digital models can integrate construction projects to asset operational management, positively impacting operation and maintenance processes (Brunet, Motamedi, Guénette, & Forgues, 2019). For example, Warner and Wäger (2019) illustrated how organizations shifted from a product-based approach to a more data driven, service-based, and customer-centered model. One notable case is an energy company that transitioned from relying on commodity products to prioritizing the delivery of customized services. This transformation was supported by predictive maintenance and advanced digital technologies, such as cloud computing and IoT (Warner & Wäger, 2019).

These advanced technologies, like IoT and cloud computing, are the foundational components of a smart economy (Piccarozzi et al., 2024; Porter & Heppelmann, 2014). Indeed, smart products, services, cities, and business models drive digital transformation, reshaping how organizations operate and innovate (W. Abdalla et al., 2020; Han & Trimi, 2022; Warner & Wäger, 2019). Smart digital platforms extend beyond mere technological frameworks for

project planning and execution by enabling stakeholders to transform their collaborative processes (Papadonikolaki et al., 2019). Through the collection and generation of data, smart products and services revolutionize consumer interactions, creating opportunities to redesign business models (Schwab, 2017). For instance, organizations can deepen customer relationships by providing ongoing support and analyzing operational data following equipment installation (Tronvoll et al., 2020). Furthermore, the ability to track product lifecycles and add features based on usage enhances the value proposition of these products, driving innovation and customer satisfaction (Camarinha-Matos et al., 2019).

A fundamental characteristic of these smart products and services is the massive volume of information they produce (Gillani et al., 2024; Porter & Heppelmann, 2014). As such, data is abundantly available in organizations pursuing digital transformation (Tronvoll et al., 2020). It is continuously generated by intelligent sensors (Fukuzawa, Sugie, Park, & Shi, 2022) and it supports the optimization of processes and services (Traganos, Grefen, Vanderfeesten, Erasmus, Boultadakis, & Bouklis, 2021). However, there is a need for a technical structure to capture, store, and share this data (Shojaei et al., 2022). Data scientists, in collaboration with professionals who understand business needs, face challenges in extracting valuable information (Kayabay, Gökalp, Gökalp, Erhan Eren, & Koçyiğit, 2022; Piccione, 2021). To focus organizational efforts, it is crucial to identify concrete uses for the available data (Piccione, 2021). Therefore, digital project managers should be skilled in data analytics (Marnewick & Marnewick, 2021).

This need for data analytics skills extends beyond managers and requires a broader organizational response, including new talent and team structures (Liu et al., 2024; Tronvoll et al., 2020). To handle the increased volume of data, organizations hire people with skills to acquire and analyze it, working in non-siloed teams and aiming to extract solutions from the available data (Tronvoll et al., 2020). On their digital transformation path, a manufacturing company organized a specific digital team, while attempting to transform their culture, by becoming less hierarchical and empowering their professionals (Imran et al., 2021). Parties must develop together their IT capabilities around the project management platform, avoiding difficulties in communication and delays (Ayala et al., 2020). Professionals with the right skills can analyze the vast amounts of available data to identify opportunities for improving digital products developed through projects (Tronvoll et al., 2020), while working together in cross-functional teams to deliver digital improvement.

The integration of these new, cross-functional teams and their data-centric skills alters established procedures (Gillani et al., 2024; Tronvoll et al., 2020). Consequently, project management processes have changed, and keep changing, with the introduction of digital technologies, for example, with the use of digital platforms for design and build (Aibinu & Papadonikolaki, 2020; Nassereddine, Veeramani, & Hanna, 2022), augmented reality (Kruachottikul, Cooharojananone, Phanomchoeng, & Kovitanggoon, 2021), or cloud computing (Oke et al., 2021). However, the use of digital technologies in a single project does not automatically turn project management processes digitally transformed. It rather requires the development of a digital strategy (Elwart & Carugo, 2020; Papadonikolaki, 2018) and a set of capabilities like strong task coordination (Aibinu & Papadonikolaki, 2020; Brodeur et al., 2022), open information exchange (Kruachottikul et al., 2021; Ylinen, 2021), and trustful relationships (Michel-Villarreal et al., 2021; Shojaei et al., 2022).

When foundational capabilities like open information exchange are established, digital technologies can deliver profound outcomes (Gillani et al., 2024; Papadonikolaki et al., 2022). Specifically, they enhance the transparency and sustainability of project processes. For example, when RFID tags are embedded in precast components, a digital model can guide their positioning during construction (Brandín & Abrishami, 2021). The abundance of available data facilitates monitoring and decision-making, leading to more transparent operations (Camarinha-Matos et al., 2019). Furthermore, digital transformation promotes sustainable and circular operations, where stakeholders' actions impact one another (Bag et al., 2021).

While these projects create opportunities for sustainable operations, they must be executed within a highly volatile environment (Gillani et al., 2024; Piccarozzi et al., 2024). Changing customer requirements, emergent technologies, and intensified market competition trigger uncertainties in digital transformation settings (Warner & Wäger, 2019). For instance, the rise of cloud computing has disrupted traditional IT infrastructure providers, making digital solutions more accessible and introducing new competitors like Microsoft and Amazon into the market (Warner & Wäger, 2019). To navigate these challenges effectively, organizations must learn to sense upcoming trends and respond promptly (Muntés-Mulero et al., 2019). Adaptative strategies can be enhanced through collaboration with external partners (Rocha, Quandt, Deschamps, Philbin, & Cruzara, 2021) and by maintaining close proximity to customers (Warner & Wäger, 2019). The uncertain context of digital transformation and the benefits of

collaboration in supplementing capabilities and amplifying digital readiness were described by Warner and Wäger (2019) and Schwab (2017).

This strategic emphasis on collaboration is often operationalized through shared digital models and platforms (Papadonikolaki et al., 2019; Tronvoll et al., 2020). For instance, when the development of the digital model is viewed as a crucial project feature, it fosters closer collaboration among stakeholders, leading to improved task coordination, customer satisfaction, and information exchange (Nassereddine et al., 2022; Papadonikolaki et al., 2019). Conversely, when the digital model is imposed due to external pressure, it fails to effectively enhance project management processes (Papadonikolaki, 2018). During business case definition, extended discussions ensured the establishment of clear goals (Ayala et al., 2020). However, accessed by the involved business partners, a shared project management platform can facilitate information exchange (Ayala et al., 2020).

3.3.3. PROJECT STAKEHOLDER COLLABORATION IN THE CONTEXT OF DIGITAL TRANSFORMATION

This subsection describes the constituent elements of Project Stakeholder Collaboration according to Bronstein's (2002) theoretical model: interdependence, flexibility, reflection on the process, collaborative outcome, and collaborative ownership of goals.

3.3.3.1. INTERDEPENDENCE

Interdependence describes the necessity for stakeholders to work together to complete their work and achieve goals (Bronstein, 2002; Mellin et al., 2010). This involves negotiating personal interests in favor of shared compromise objectives (Gray, 1985; Mellin et al., 2010), and potentially sacrificing some autonomy to sustain the collaboration (Mattessich & Monsey, 1992; Valkokari, Paasi, Nysten-Haarala, Nuottila, & Hurmerinta-Haanpää, 2024). It also involves establishing formal information channels and fostering informal networks (Bonanomi, Hall, Staub-French, Tucker, & Talamo, 2019; Brunet et al., 2019). Interdependence relies on establishing stakeholder management activities to identify and engage a varied and adequate group of key stakeholders boosting the collaborative effort (Aibinu & Papadonikolaki, 2020; Tronvoll et al., 2020). Table 4 summarizes the elements discussed in the reviewed articles related to the interdependence, dimension of Bronstein (2003).

Table 4: Elements of Interdependence

Items	Definition
Cross-functional teams and non-siloed organizations	Collaboration is facilitated in cross-functional teams and non-siloed organizations (Bonanomi et al., 2019; Johansson et al., 2021; Mattessich & Monsey, 1992). Such teams work interdependently to supplement capabilities (Aibinu & Papadonikolaki, 2020; Nikulina et al., 2022).
Information Exchange and Communication	Effective collaboration requires robust information exchange and communication (Brunet et al., 2019; Michel-Villarreal et al., 2021). Digital technologies facilitate seamless exchange of information (Michel-Villarreal et al., 2021; Warner & Wäger, 2019).
Informal networks	Collaboration operates through both formal and informal channels, with informal networks contributing to the overall relationship dynamics (Bonanomi et al., 2019; Papadonikolaki, 2018).
Customer Centrality	Customer centrality requires firms to keep customer needs at the center of transformations (Schwab, 2017). This orientation is essential for aligning value propositions and achieving greater agility (Sagarna Garcia & Pereira Jerez, 2019; Warner & Wäger, 2019).
Professionals must be technically competent and able to develop relationships, including Digital Expertise	Staff expertise includes professional knowledge, skills, and expertise, specifically digital expertise (Shojaei et al., 2022; Ylinen, 2021), as well as relational skills (Brodeur et al., 2022; Papadonikolaki, 2018).
Stakeholder identification, early involvement and engagement	Involvement should start early in the project lifecycle for key participants, which involves carefully identifying and inviting those with control over relevant issues to become partners (Aibinu & Papadonikolaki, 2020; Fernandes et al., 2021).

Source: elaborated by the author based on the scale by Bronstein (2003)

A diverse array of stakeholders work together in *cross-functional and interdependent collaborative teams* (Bronstein, 2003; Gray, 1985). In the context of digital transformation, visual and digital artifacts facilitate the development of solutions by multifunctional stakeholders (Cooney, Korsten, & Marshall, 2021; Papadonikolaki et al., 2019). A collaborative culture that fosters interdependency also mitigates siloed perspectives (Piccione, 2021; Whitmore et al., 2020). Overall, in the context of digital transformation, organizations tend to become more horizontally integrated, fostering the exchange of ideas and information among departments and across hierarchies (Camarinha-Matos et al., 2019; Piccione, 2021).

Communication is central in collaborative endeavors, as stakeholders establish informal and formal channels to ensure frequent exchange of information, healthy dialogue, and feedback (Bronstein, 2003; Nikulina et al., 2022). In the context of digital transformation, platforms that integrate project planning and execution facilitate progress monitoring while

keeping track of historical communication (Kruachottikul et al., 2021). Emphasizing the relational aspects of communication, transparent information exchange facilitates trust building (Agarwal et al., 2022; Michel-Villarreal et al., 2021) and enhance shared accountability (Camarinha-Matos et al., 2019). While informal interactions facilitate informal communication; formal reporting and regular status meetings ensure that stakeholders agree on formal decisions, even those less involved with day-to-day activities (Mattessich & Monsey, 1992; Nikulina et al., 2022).

Informal communication can establish networks across different departments and business partners promoting innovation and facilitating the adoption of integrated platforms (Papadonikolaki, 2018). It is important to understand the role of these networks in driving digital transformation, as champions can emerge through them (Bonanomi et al., 2019). On the other hand, informal specialists may feel overloaded or choose to leave the organization if they are not adequately recognized (Bonanomi et al., 2019).

By *enhancing customer centrality,* smart products tend to promote customer experience (Schwab, 2017). Supported by a continuous flow of data, organizations can improve product features, implement customization, and propose additional items (Schwab, 2017). With the promise of further benefits, this approach strengthens the connection between organizations and customers (Imran et al., 2021; Tronvoll et al., 2020). Specifically during project development, projects should frequently gather inputs from end-users and customers to improve stakeholder satisfaction with the final product (Johansson et al., 2021; Meng, 2019; Traganos et al., 2021). However, involving customers and end-users in project decisions can increase personnel, time, and cost requirements (Sagarna Garcia & Pereira Jerez, 2019).

In the digital landscape, *professionals must be technically competent and able to develop relationships* (Shojaei et al., 2022). To promote digital literacy, organizations should hire digital specialists, promote continuous learning, and the exchange of knowledge and experiences among different functional areas (Demartini, Benussi, Gatteschi, & Renga, 2020; Warner & Wäger, 2019). One effective approach is pairing young digital professionals with seasoned experts who possess in-depth business knowledge, facilitating knowledge transfer and bridging generational gaps (Koseoglu, Keskin, & Ozorhon, 2019; Tronvoll et al., 2020). As digital organizations increasingly rely on data to make decisions, professionals must develop data analysis skills to extract meaningful insights from complex datasets (Tronvoll et al., 2020).

Furthermore, to complement technical proficiency, organizations should prioritize critical thinking, adaptability, and collaboration skills (Imran et al., 2021).

Engaging stakeholders in project activities enables them to take part in the decisions and to raise concerns as early as possible (Aibinu & Papadonikolaki, 2020). Rework is avoided when stakeholders are involved with project decisions early in the lifecycle (Aibinu & Papadonikolaki, 2020). It facilitates the alignment of digital transformation goals with stakeholders interests and motivations (Koseoglu et al., 2019). By prioritizing stakeholder satisfaction and fostering a culture of continuous improvement, projects significantly enhance their chances of success (Meng, 2019). By identifying and delivering quick wins, projects maintain stakeholder engagement (Kayabay et al., 2022).

3.3.3.2. FLEXIBILITY

Flexibility describes professionals that are open to adapt their roles and develop relationships (Bronstein, 2003; Mellin et al., 2010). When stakeholders develop trusting relationships (Nikulina et al., 2022; Oliveira & Rabechini, 2019), this facilitates the commitment to common goals and how the group works together, (Johansson et al., 2021; Piccione, 2021). They adapt their processes to the partnership and to technical changes (Imran et al., 2021; Mattessich & Monsey, 1992; Warner & Wäger, 2019). In the context of digital transformation, stakeholders must structure shared decision-making based on agility (Warner & Wäger, 2019; Whitmore et al., 2020) to define, develop, and reach collaborative objectives (Bronstein, 2002; Mattessich & Monsey, 1992; Nikulina et al., 2022). Stakeholders, for instance, employ innovation labs and prototypes to get closer to customers and foster an innovation culture that is open to mistakes and sees faults as improvement steps (Papadonikolaki, 2018; Warner & Wäger, 2019; Whitmore et al., 2020). These elements are part of a supportive and collaborative culture (Shojaei et al., 2022; Warner & Wäger, 2019). Table 5 summarizes the elements discussed in the reviewed articles related to the flexibility, dimension of Bronstein (2003).

Table 5: Elements of flexibility

Elements	Definition

Investment in relationships	It refers to the time and attention needed to develop and maintain strong relationships across organizational boundaries (Meng, 2019; Papadonikolaki et al., 2019).
Committed, entrepreneurial, and empowered professionals	Empowerment grants individuals a high degree of ownership and autonomy to innovate, enabling professionals with relevant knowledge to make decisions quickly, thereby speeding up the overall decision process (Piccione, 2021; Tronvoll et al., 2020).
Flexibility and adaptability	Professionals rapidly adapt in response to changes in the market and in environmental conditions (Imran et al., 2021; Schwab, 2017).
Trust and long-term relationships	Trust is a foundational relational norm, critical for collaborative efforts, as it structures the basis for agreements and is key to multi-actor partnership (Oliveira & Rabechini, 2019; Papadonikolaki, 2018).
Decision-making agility	Decision-making is agile, with decision processes adjusted flexibly and quickly whenever needed, allowing firms to seize competitive market opportunities (Johansson et al., 2021; Whitmore et al., 2020).
Experimentation, innovation labs, iterations, and prototyping	It is a cultural mindset involving trial, calculated risk-taking, and open-mindedness, actively cultivated within an organization to boost agile decision-making (Piccione, 2021; Whitmore et al., 2020).
Collaborative culture	It serves as a significant driver for organizational behavior, promoting cross-functional interaction, and a shared vision (Shojaei et al., 2022; Warner & Wäger, 2019).

Source: elaborated by the author based on the scale by Bronstein (2003)

Stakeholders that *invest in relationships* tend to amplify digital transformation outcomes, reduce waste, and increase value delivery (Meng, 2019; Papadonikolaki et al., 2019). For instance, construction firms can leverage their contractors' networks to enhance the long-term use of integrated digital platforms (Papadonikolaki, 2018; Shojaei et al., 2022). The benefits brough by digital technologies are amplified when stakeholders interact, discuss ideas and solve problems together (Brodeur et al., 2022).

Empowered and committed individuals with the right technological and data related competences can identify business opportunities and tackle challenges to target improved project outcomes (Piccione, 2021). Because when project teams are given the responsibility for decision-making, the process becomes more efficient (Johansson et al., 2021). Empowerment not only accelerates decision-making but also enhances employee commitment fostering a sense of shared ownership (Shojaei et al., 2022; Whitmore et al., 2020). That is why organizations increasingly value entrepreneurial individuals (Warner & Wäger, 2019), who apply their analytical skills (Vial, 2019) to operate at the interface of business and technology (Piccione, 2021). These professionals are instrumental in implementing modular and iterative solutions that aim to create and capture value (Tronvoll et al., 2020).

Flexible leaders who can adapt and challenge their operating models drive successful change (Schwab, 2017). As markets and technologies keep shifting, organizations must continuously and quickly adapt to remain competitive (Imran et al., 2021; Warner & Wäger, 2019). This ability is also enhanced when organizations collaborate with business partners and customers (S. Abdalla & Nakagawa, 2021).

When stakeholders invest in relationships they *cultivate trust*, which facilitates knowledge sharing and reduces opportunism fostering formal collaborative practices (Camarinha-Matos et al., 2019). Ideally, they share perspectives and solve problems together, building a trusting relationship (Papadonikolaki, 2018). Conversely, lack of trust can negatively impact the success of collaborative projects, as stakeholders fail to recognize the common benefits (Ylinen, 2021). Digital platforms can serve as integrated element when supported by an environment that values relational stability, which can enhance platform usage and diffusion and consequent benefits (Papadonikolaki, 2018). Relational norms like mutual respect and trust facilitate interaction and the construction of shared solutions (Nikulina et al., 2022).

Decision-making agility and the ability to react swiftly to changes equip organizations to navigate digital transformation uncertainties (Whitmore et al., 2020). An innovative culture that encourages experimentation and rapid failure recover pairs with the technical capability of digital technologies to scale operations up or down (Warner & Wäger, 2019). Besides, a decision-making that foster professionals to be empowered and search for opportunities in the abundance of available data supports the inception of meaningful projects (Piccione, 2021). Moreover, a no-blame and experimentation culture promotes trust (Nikulina et al., 2022).

Experimentation and iteration are decisive for ensuring project value delivery in an environment where bold ideas are explored, tested and improved throughout the project lifecycle (Whitmore et al., 2020). This principle also applies to project management processes, which must be continuously reevaluated to adapt to integrated digital technologies and amplify formal collaborative practices (Papadonikolaki, 2018). Besides, experimentation should include feedback from users and customers who can use or visualize prototypes generating engagement and proposing improvements (Nassereddine et al., 2022). However, experimentation only flourishes in a culture that is tolerant of errors and uses them as learning tools (Piccione, 2021).

The *collaborative culture* significantly influences the degree of collaboration across digital and integrated platforms (Suescún-Monsalve, Pardo-Calvache, Rojas-Muñoz, &

Velásquez-Uribe, 2021; Whitmore et al., 2020). As Warner and Wäger (2019) explain, cultural change involves getting people to think about the same things from different perspectives, rather than thinking with the same perspective about different things. This shift fosters the sharing of ideas and viewing failures as opportunities for learning, which amplifies collaboration (Agarwal et al., 2022). Therefore, in digital transformation, considerable effort is dedicated to fostering cultural change and increasing employee engagement (Koseoglu et al., 2019; Shojaei et al., 2022).

3.3.3.3. REFLECTION ON THE PROCESS

Reflection on process involves collaborators actively considering and discussing their working dynamics and relationships (Bronstein, 2003; Nikulina et al., 2022; PMI, 2025). They use feedback to optimize effectiveness and strengthen collaborative ties (Bronstein, 2003; Mellin et al., 2010). Table 6 summarizes the elements discussed in the reviewed articles related to the reflection on the process, dimension of Bronstein (2003).

Table 6: Elements of Reflection on the Process

Items	Definition
Assessment and evaluation mechanisms	Assessment and evaluation keep stakeholders responsive to required changes while promoting continuous improvement (PMI, 2025; Saukko, Aaltonen, & Haapasalo, 2021).
Improve solutions and processes with feedback	Feedback is used to optimize effectiveness and strengthen collaborative ties, leading to adjusting processes whenever needed (Kruachottikul et al., 2021; Saukko et al., 2021).

Source: elaborated by the author based on the scale by Bronstein (2003)

Constantly assessment of collaboration optimizes working relationships and enhances overall effectiveness (PMI, 2025; Saukko et al., 2021). Assessment requires teams to capture existing gaps and new opportunities throughout the project cycle (Castilla, 2025; Kayabay et al., 2022). By remaining responsive to user and stakeholder input before, during, and after implementation, organizations show them that their contributions count and can lead to updates and improvements (Cooper, 2024; Robu & Lazar, 2021). This ongoing analysis, which may involve a multiplicity of assessment methods and markers of success, helps to optimize solutions tailoring them to user needs (Ramakrishnan, 2024). Therefore, management processes should be continuously assessed, either qualitative or quantitatively, to identify gaps and

opportunities for improvement (Aibinu & Papadonikolaki, 2020; Suescún-Monsalve et al., 2021).

Feedback is used to adapt business processes and strengthen their effectiveness (Kruachottikul et al., 2021; Saukko et al., 2021). In complex projects like collaborative R&D, successive iterations and continuous assessment are necessary to sustain the effort, adapt to contingencies, set realistic goals, and manage moving targets over time (Mattessich & Monsey, 1992). This improvement process is fostered by trusting relationships among project stakeholders, as they become more comfortable to evaluate and improve how they work together, enabling collaboration to advance (Bronstein, 2002; Morris & Miller-Stevens, 2016; Nikulina et al., 2022). Furthermore, timely provision of evaluation results also facilitates learning environments, enabling participants to analyze the root causes of mistakes and accumulate experience from their peers (Y. F. Zhang, 2024). Additionally, end-user or customer feedback before, during and after implementation improves project outcomes incrementally and iteratively (Robu & Lazar, 2021). Corroborating the power of continuous improvement, the use of digital collaborative project platforms, such as Building Information Modeling (BIM), is significantly enhanced in sequenced projects (Papadonikolaki, 2018).

3.3.3.4. COLLABORATIVE OUTCOMES (NEWLY CREATED PROFESSIONAL ACTIVITIES)

Collaborative stakeholders define concrete and attainable goals that cannot be achieved singularly (Bronstein, 2003; Nikulina et al., 2022). They understand their roles and acknowledge they depend on their partners to produce the desired outcome (Mellin et al., 2010; Morris & Miller-Stevens, 2016). While they work together, stakeholders share knowledge and learn with each other (W. Abdalla et al., 2020; Rocha et al., 2021). They deliver efficiency and performance improvement, creating value to all parties involved (Koseoglu et al., 2019; Tronvoll et al., 2020; Vial, 2019). Table 7 summarizes the elements discussed in the reviewed articles related to the newly created professional activities, dimension of Bronstein (2003).

Table 7: Elements of Collaborative Outcomes (Newly Created Professional Activities)

Items	Definition

Knowledge sharing and learning	Stakeholders share knowledge and learn while working together and collaborating (Cooney et al., 2021; Rocha et al., 2021).
Efficiency, performance, and competitive advantage	Improved efficiency and performance are reached when stakeholders are guided by shared goals (Koseoglu et al., 2019; Traganos et al., 2021).
Value creation and cocreation	When collaboration is well managed and guided by strategy, it tends to create value to stakeholders (Tronvoll et al., 2020; Vial, 2019).

Source: elaborated by the author based on the scale by Bronstein (2003)

Knowledge sharing and continuous learning are fostered through partnerships with other businesses or universities, supplementing capabilities from an external perspective (Gotz, 2019; Rocha et al., 2021). This mindset can also be promoted internally, as continuous learning keeps professionals engaged with project outcomes (Cooney et al., 2021). However, the adoption of digital integrated platforms for project planning and execution needs to be aligned with the team's learning curve (Koseoglu et al., 2019). This is important because some loss of productivity is expected during the transition (Aibinu & Papadonikolaki, 2020).

The benefits brough by collaborative projects encompass *improved efficiency, performance, competitive advantage, and corporate reputation* (Traganos et al., 2021; Tronvoll et al., 2020). Investments in digital technology promise increased competitive advantages; however, these benefits are realized only when technologies are fully integrated into organizational systems (Traganos et al., 2021). Likewise, project management activities become more efficient with digital platforms integrating design and build stages (Aibinu & Papadonikolaki, 2020; Koseoglu et al., 2019). Corroborating the enlarged value creation, Koseoglu et al. (2019) reported that larger and more complex projects can be delivered within shorter schedule, as integrated digital platforms facilitate error diagnosis before the building stage, leading to time and cost savings.

Value creation is not produced solely by digital technologies (Vial, 2019). It requires that data driven business work closely with customers to enhance their service offerings and consequently value creation (Tronvoll et al., 2020). This collaboration establishes an optimal context for creating value for customers and organizations (Camarinha-Matos et al., 2019). Moreover, in this ever-changing landscape, value creation must guide project governance and decision-making (Whitmore et al., 2020). Value should be delivered incrementally throughout the project lifecycle (Piccione, 2021). When resources and risks are shared between business partners, they not only develop collaborative capabilities but also tend to achieve better outcomes together (Camarinha-Matos et al., 2019).

3.3.3.5. COLLECTIVE OWNERSHIP OF GOALS

Collective decision-making should take place in multiple layers where stakeholders share responsibilities, through joint problem-solving, for developing and reaching collaborative goals (Bronstein, 2003; Kokkonen & Vaagaasar, 2018). Some organizations decide to structure a dedicated unit to guide strategy development and digital transformation (Shojaei et al., 2022; Warner & Wäger, 2019). They champion the common goals that guide stakeholders towards a shared vision, reinforcing commitment and incentives to work together (Bronstein, 2003; Morris & Miller-Stevens, 2016). Influencing goal-setting and collective behavior, formal and informal leadership are frequently shared to coordinate task execution (Kokkonen & Vaagaasar, 2018; Morris & Miller-Stevens, 2016; Nassereddine et al., 2022; Wood & Gray, 1991). To target collaboration improvements and consequent benefits, leadership develops strategies to make relationships more cohesive (Kokkonen & Vaagaasar, 2018), and establish the project governance (Nikulina et al., 2022; Saukko et al., 2021). Table 8 summarizes the elements discussed in the reviewed articles related to the collective ownership of goals, dimension of Bronstein (2003).

Table 8: Elements of Collective Ownership of Goals

Items	Definition
Definition of common goals, shared vision, and mutual benefits	Common goals guide stakeholders towards a shared vision, reinforcing commitment and incentives to work together (Kruachottikul et al., 2021; Piccione, 2021).
Joint problem-solving, negotiation, and compromise solutions	Stakeholders solve problems together, negotiate, and find compromise solutions when guided by shared goals (Papadonikolaki et al., 2019; Traganos et al., 2021).
Leadership and digital experts support	Leadership and digital experts, both formal and informal, influence goal-setting and collective behavior (Imran et al., 2021; Shojaei et al., 2022).
Coordination of tasks	By coordinating tasks, leaders organize sequential and interdependent activities to optimize resource allocation and efficiency (Ezzeddine & García de Soto, 2021; Nassereddine et al., 2022).
Collaborative governance and project management: a predictive or agile approach	This refers to the formal control procedures and management style adopted by the collaborative project (Ayala et al., 2020; Whitmore et al., 2020).
Structure, incentives, rules, and collocation	Centralized structures promote integration, while shared rules establish collaborative governance (Brodeur et al., 2022; Warner & Wäger, 2019).

Source: elaborated by the author based on the scale by Bronstein (2003)

A *collective shared vision* guide stakeholders through ongoing communication and decision-making iterations, which is even more relevant in the complex and rapidly changing digital transformation context (Hossfeld & Ackermann, 2018; Kruachottikul et al., 2021; Tronvoll et al., 2020). By connecting digital goals with technical feasibility turns them concrete (Piccione, 2021). When objectives are clearly stated upfront alignment is facilitated (Harrington & Srai, 2016). Therefore, companies with aligned visions are more likely to achieve consistent outcomes (Papadonikolaki, 2018). Shared benefits are likely to arise from technological integration and continuous interaction among stakeholders (Tronvoll et al., 2020). These interactions and the belief that collaboration is in their self-interest, foster the development of mutual respect, understanding, and dialogue among stakeholders (Kokkonen & Vaagaasar, 2018; Morris & Miller-Stevens, 2016; Nikulina et al., 2022).

Stakeholders that *solve problems together* not only learn together but create common knowledge and strengthen their relationship (W. Abdalla et al., 2020). Facilitated by integrated management platform, as knowledge is distributed among stakeholders, projects benefit from intense collaboration (Ayala et al., 2020). These platforms function as boundary objects, linking different stakeholders and allowing them to interact, creating collaborative meanings and solutions (Aibinu & Papadonikolaki, 2020).

Effective leadership promotes collaboration among professionals from diverse backgrounds and expertise (Imran et al., 2021). By doing so, leaders enhance professional's ability to anticipate emerging trends and navigate the challenges of digital transformation (Schwab, 2017). To reinforce this shift, some companies appoint a digital transformation champion to oversee implementation and communicate the transformation vision throughout the organization (Shojaei et al., 2022). These champions engage with professionals across various departments and hierarchies, fostering negotiation and seeking common ground (Tronvoll et al., 2020).

Stakeholders must *coordinate their tasks* while executing concurrent and sequential activities (Aibinu & Papadonikolaki, 2020; Nassereddine et al., 2022). This need for coordination is amplified when working within an integrated platform, which requires the development of effective communication, well-defined workflows, and processes (Ezzeddine & García de Soto, 2021; Papadonikolaki, 2018). Occasionally, tasks may not align perfectly in a digitally integrated environment, requiring teams to span organizational boundaries and

assign the correction of errors to appropriate professionals, thereby preventing rework (Johansson et al., 2021; Papadonikolaki et al., 2019). Overall, lack of coordination poses a significant challenge for integrated digital processes (Brunet et al., 2019; Ding, 2018).

Driven by clear and shared goals and managed through a modular adaptive approach, *project management* can deliver relevant outcomes to stakeholders (Whitmore et al., 2020). An iterative implementation cadence, based on strong collaboration with customers and end-users, facilitates continuous improvement of project management processes (Whitmore et al., 2020). While project management systems improve coordination between different stakeholders (Ayala et al., 2020), digital integrated models can reduce rework (Brunet et al., 2019). Specifically, digital technologies can significantly enhance progress monitoring by automatically collecting and processing geospatial information (Karmakar & Delhi, 2021).

Structural changes that foster collaboration are recognized in the digital transformation context, as organizations become less hierarchical through cross-functional allocation of resources (Imran et al., 2021). They integrate stakeholders that share resources, including structures, rules, funds, technical expertise, and social norms (Morris & Miller-Stevens, 2016; Nikulina et al., 2022; Wood & Gray, 1991). By structuring central units to guide and drive innovation, organizations promote communication and collaboration among various stakeholders (Shojaei et al., 2022; Warner & Wäger, 2019). This could be supported by digital platforms that help reduce geographic distances, enabling stakeholders from different sites to simulate scenarios and analyze options (Brodeur et al., 2022). However, internal motivations should drive the transformations, because anticipated benefits are likely to diminish when exterior motivations compel the adoption of digital technologies and platforms (Papadonikolaki, 2018).

3.4. DISCUSSION

This study characterizes the dimensions of Project Stakeholder Collaboration and the Digital Transformation Context from a theoretical perspective. The research conducted a systematic literature review in management and project studies discussing stakeholder collaboration. After selecting an adequate theoretical lens to further investigate collaboration, the scale developed by Bronstein (2002, 2003), this research focused the analysis on articles discussing the phenomenon in the digital transformation context. Table 9 shows an adaptation

of Bronstein's scale (2003) to the field of project studies, which was previously developed for the field of social work.

Table 9: Proposed Theoretical Scale to Measure Project Stakeholder Collaboration

Dimensions of Project Stakeholder Collaboration	Proposed Item to Measure Project Stakeholder Collaboration
Interdependence	I worked cooperatively with my coworkers.
	Clients and/or end-users participated in the project discussions that concerned them.
	My project colleagues and I communicated frequently.
	My project colleagues and I established informal communication (like chats and coffee breaks).
	Our project organized regular meetings to facilitate dialogue.
	Our project identified its key stakeholders from the beginning.
	Our project produced written documents to record relevant information shared verbally.
	I would check my understanding when my project colleagues informed me of relevant information.
	Our project involved its key stakeholders in project discussions.
	My project colleagues did not treat me as an equal.
	Our project included professionals with unique knowledge, skills, or attitudes.
	My colleagues tried to create a positive climate for our project.
Flexibility	I maintained relationships with my project colleagues, despite external changes inside or outside the organization.
	Decisions were made by listening to diverse perspectives from the team's professionals.
	I was optimistic about my project colleagues' ability to work with me to solve problems.
	My project colleagues were not committed to working together.
	My project colleagues participated in the implementation of the project's solutions.
	I was willing to take on tasks outside of my job descriptions when it seemed important.
	My project colleagues strictly followed their job descriptions.
	I trusted my project colleagues to communicate in good and bad situations.
	I trusted that my project colleagues would do their best to achieve the project's outcomes.
Reflection on the Process	I consistently gave feedback to other professionals in our project environment.
	My project colleagues and I discussed ways to improve our working relationships.

	My project colleagues and I talked about our competencies and roles.
	My project colleagues and I did not evaluate our work together.
	I discussed with my project colleagues the extent to which each of us should be involved in specific project situations.
	Creative results that I could not have foreseen on my own emerged from our work together.
	My interactions with my project colleagues occurred in a climate where there was freedom to be different and to disagree.
	My project colleagues and I talked about ways to involve other professionals in our work together.
	My project colleagues and I shared knowledge to design improved solutions for the project.
Collaborative Outcomes	The shared work with my project colleagues led to outcomes we could not have achieved alone.
	New solutions emerged from the collective work of project colleagues from different disciplines.
	My colleagues believed they could not perform their work as well without the help of their peers.
	Our project aimed to produce results while also developing the professionals involved.
Collective Ownership of Goals	I was willing to sacrifice a certain degree of autonomy for the sake of joint problem-solving.
	There was coordination among my colleagues from different disciplines.
	My project colleagues and I shared a vision for our project's outcomes.
	My project colleagues and I mutually benefited from our project.
	I believe our project brought benefits to those who were involved with it.
	Teamwork with other project professionals was not important for my ability to deliver project results.
	My project colleagues clearly understood the distinction between my role and theirs.
	My project colleagues made proposals that improved our ability to meet client needs.
	My project colleagues discussed conflict situations with the goal of resolving them.
	I helped my project colleagues resolve conflicts with other professionals.
	My colleagues and I shared the risks and rewards of our project.

Source: developed by the author based on Bronstein (2003)

In the digital transformation context, stakeholders collaborate closely, leveraging digital technologies to update business processes, improve customer experience, and pursue market opportunities. These projects rely on cross-functional teams that utilize data insights to amplify value creation. Grounded in mutual respect and trust, team members adapt their roles

and negotiate compromises to achieve shared objectives. This collaborative model extends to customers as organizations cocreate value by inviting them to participate in pilot projects. Even though collective work fosters ownership, defining shared objectives from the beginning is an essential prerequisite. This initial alignment ensures all key stakeholders are united, mitigating the risk that conflicting goals jeopardize the overall outcomes.

Goal setting drives projects toward shared outcomes, while formal information channels and informal networks ensure continuous adaptation. They enable teams to implement trajectory changes in an environment of uncertainty. Consequently, stakeholder management must continuously identify and engage key partners to support the collaborative endeavour. By clearly articulating challenges, continually reviewing processes, and evaluating benefits, organizations rally this support. This process fosters the experimentation and entrepreneurial culture required when introducing digital project models or establishing new, customer-centered business models. As stakeholders acknowledge their mutual benefits, they learn to work together more effectively.

While these enablers are highlighted by previous research on collaboration (Papadonikolaki et al., 2019; Tronvoll et al., 2020; Warner & Wäger, 2019), systematically assessing them required the adaptation of an established scale (Bronstein, 2002; Gray, 1985; Nikulina et al., 2022; Thomson et al., 2009). To measure the digital transformation context, no previous scales was found; hence, this study proposes a new scale derived directly from literature (Table 10).

Table 10: Proposed Theoretical Scale for the Digital Transformation Context

Theoretical Dimension	Proposed Item to Measure the Digital Transformation Context
The Digital Transformation Context	Our project changed the way customers interact with our organization.
	Our project enhanced the availability of data within the involved organizations.
	Our project generated and/or consumed data to improve decision-making.
	Smart products, services, processes, cities, and/or business models were implemented.
	Our project included professionals with digital knowledge, skills, and/or abilities.
	Our project was aligned with our organization's digital strategy.

My project colleagues and I were dedicated to continuously improving our organization's digital processes.

Our project improved transparency in how our organization is managed.

Our project improved environmental, social, and/or governance (ESG) sustainability.

Our project took place in an environment of uncertainty.

Our project utilized new technologies, such as cloud computing, the Internet of Things, and artificial intelligence.

Source: developed by the author based on studies about the Digital Transformation Context

Project stakeholders in the digital transformation context collaborate to deliver smart products, services, and business models, leveraging integrated data and collaborative platforms. When well-managed, these innovations drive organizational efficiency, competitive advantage, and more sustainable and transparent operations. This integration creates new opportunities for value cocreation with business partners and customers. In this process, leadership plays an essential role by assembling the right cross-functional teams and blending digitally literate with business experienced professionals who understand their mutual interdependence.

However, these projects must navigate significant technical uncertainty, which demands a reliance on partners to supplement capabilities and on customers for iterative feedback. This context reinforces a central notion: while digital technologies can amplify collaboration, they do not create it. To fully realize the collaborative potential, stakeholders must still adhere to foundational principles. This includes defining shared goals and mutual benefits, ensuring open communication and early stakeholder involvement, fostering trust, and effectively managing interdependent teams.

These collaborative principles are applied across two distinct contexts identified by this review: the digital transformation of projects, which involves the digital transformation of project management processes, and the digital transformation by projects, which refers to projects that deliver digitally transformed products or services. In the case of transforming projects themselves, studies in the construction sector and megaprojects often refer to the adoption of BIM. This technology acts as a central collaborative platform, connecting stakeholders and integrating their work. Other tools, like augmented reality for physical inspections and cloud computing for sustainable implementation, are also noted. A key finding, however, is that for such technologies to be effective, their adoption must be driven by internal motivation, not external pressure.

While technologies like BIM provide the platform, the review also outlines the crucial managerial and methodological enablers that ensure digital success. These include incentives, such as the ability to negotiate better prices by sharing project outcomes, which can spur innovation. Which, in turn, demands new governance models for shared strategic decisions and better daily communication. Finally, this study suggests that agile and hybrid project management approaches are better suited to the digital transformation context. As their adaptive techniques are designed to manage rapid change and boost customer-centricity, which are central in digital transformation.

Collectively, these examples - from integrated platforms like BIM to managerial approaches like shared governance models - illustrate that success is not guaranteed by technology alone. The successful digital transformation of projects requires a culture commensurate with the technological changes, facilitating communication and collaboration. (Ayala et al., 2020; Fukuzawa et al., 2022; Nassereddine et al., 2022; Papadonikolaki, 2018).

Different to this internal focus on project processes, digital transformation of project outcomes centers on business model innovation. Various studies discuss how organizations transform their traditional product-sales models into service-centered models. By nurturing strong customer relationships, organizations obtain and analyze data from installed equipment, creating value for all involved parties. As business partners and customers continuously share data, the structural connection facilitates identification of additional opportunities possibly deepening the mutual benefits.

The same smart technologies that enable these external innovations also drive both internal changes and deeper integration with external organizations. Internally, organizations often appoint digital transformation champions and structure specific units to promote less hierarchical structures, non-siloed, and adaptive approaches. Externally, this improved collaboration can benefit areas like supply chain management; however, this relies on the definition of common goals and effective communication.

In summary, these examples illustrate how digital outcomes and data abundance provide the means to amplify collaboration. Whether collaborating among different departments, with customers, or with business partners, data abundance and smart processes are likely to boost the digital maturity of organizations in a strategic, evolutionary process. (Agarwal et al., 2022; Tronvoll et al., 2020; Warner & Wäger, 2019).

3.5. CONCLUSIONS

While research frequently links stakeholder collaboration to digital transformation, how this connection works and what collaboration actually entails remains poorly understood. Furthermore, digital transformation has rarely been systematically analyzed within the context of project studies, despite the growing body of literature. Therefore, this study addresses these critical gaps by characterizing the dimensions of Project Stakeholder Collaboration and the Digital Transformation Context. To do so, this research conducted a systematic literature review, amplified by snowballing techniques, resulting in a final analysis of 85 articles. From this analysis, the study provides two primary theoretical scales: one to measure Project Stakeholder Collaboration (adapted to project studies from Bronstein's model (2002, 2003)) and a second scale to measure the Digital Transformation Context (extracted inductively from previous studies).

The theoretical scale for Project Stakeholder Collaboration highlights five critical dimensions. The necessity for stakeholders to work together to complete tasks is captured by "interdependence", which involves prioritizing shared goals over personal interests. This requires both structural support and active stakeholder management to identify and engage the right partners. This reliance on interconnected teams, coupled with the uncertainty inherent in the digital transformation context, demands "flexibility", requiring professionals to adapt their roles, negotiate compromises, and cultivate trustful relationships. The flexibility dimension emphasizes decision-making agility and the fostering of a collaborative culture that encourages experimentation and is tolerant of errors, recognizing them as opportunities for learning and improvement.

Furthermore, continuous adaptation is ensured through "reflection on the process", where collaborators actively assess and discuss their working dynamics, using consistent feedback to optimize effectiveness and iteratively strengthen collaborative ties. Successful collaboration yields "collaborative outcomes (or newly created professional activities)", which result in shared knowledge, improved organizational efficiency, and the cocreation of value through smart products or enhanced services that stakeholders could deliver on their own. Finally, achieving these shared benefits relies on the "collective ownership of goals", emphasizing the importance of defining a clear shared vision, mutual benefits, and establishing strong, coordinated project governance to facilitate joint problem-solving and task coordination

among diverse stakeholders. These five dimensions structure the human and social aspects of collaboration that are essential to leveraging digital technologies and accelerating an organization's digital maturity.

The systematic literature review also led to the development of a theoretical scale to characterize the Digital Transformation Context itself. This model establishes that this construct is defined by factors grounded in technological integration and strategic alignment. Central to this context is the implementation of smart products, services, processes, cities, and/or business models, which reshape how organizations operate and innovate. These advancements are intrinsically linked to data availability and sharing, with data generated and used to improve decision-making. Furthermore, the context mandates the effective utilization of digital technologies, such as cloud computing, IoT, and AI. However, technology alone is insufficient as digital success depends on aligning a strategic process to guide this continuous improvement journey.

Operating within the digital environment, characterized by high market and technological uncertainties, requires specific organizational capabilities. For instance, success hinges on ensuring projects are staffed with professionals with digital competencies who possess the necessary knowledge and analytical skills to navigate data abundance. When managed effectively, the digital transformation context enables organizational benefits, including improved transparency and better fulfillment of transparent ESG perspectives. These factors structure the technological, human and strategic aspects of the digital transformation context.

Besides, the analysis further revealed that digital transformation connects with collaboration across two distinct project perspectives: the transformation of projects and the transformation by projects. Investigating the digital transformation of projects, focused on digitally transforming project management processes, involves for instance studying the adoption of BIM or other integrated digital platforms. While technologies like BIM, augmented reality, and cloud computing serve as central collaborative tools, the successful transformation of these processes requires critical managerial enablers, including new governance models, collaborative incentives, daily communication, and agile or hybrid project management approaches. Additionally, the success of transforming project processes is commensurate with an adequate culture that fosters relationships and actively facilitates collaboration.

Conversely, digital transformation by projects centers on implementing business model innovation and delivering digitally enhanced products or services. This involves obtaining and analyzing data from installed equipment to shift from traditional product-sales models to data-driven service models, thereby increasing value cocreation with customers. This process strengthens relationships through the continuous sharing of data, establishing structural links that facilitate the identification of additional opportunities. Such outcomes, including smart products, services, and new business models, are unique results that depends on effective stakeholder collaboration. Therefore, both the transformation of management processes and the delivery of digital outcomes depend fundamentally on applying the five critical dimensions of stakeholder collaboration to accelerate an organization's digital maturity.

This study offers theoretical and practical contributions. From the theoretical perspective, it highlights four significant contributions, first by identifying a research gap of systematic studies investigating collaboration in the digital transformation context. Second, this research improves the theoretical understanding of Project Stakeholder Collaboration by characterizing its enabling dimensions. Third, the study also improves academic knowledge about Digital Transformation Context. These last theoretical developments provide a rigorous framework for future empirical investigation of collaboration in project studies and its relationship with technology-driven environments.

On its fourth theoretical contribution, this research clarifies the duality through which digital transformation interacts with the project domain, recognizing digital transformation *of* projects and digital transformation *by* projects. The transformation *by* projects focuses on the implementation of digitally transformed unique outcomes, such as smart products, services, or business models. Conversely, the transformation *of* projects centers on the digital modification of project management processes, frequently cited through the adoption of integrated platforms like BIM. By distinguishing these two critical streams, the study provides a structure for understanding how collaboration could adapt based on whether the project goal is to change internal methodologies or to deliver external, digitally enhanced value to the market. Both project dimensions rely fundamentally on the identified collaborative dimensions to manage uncertainty and fully leverage digital technologies.

On the other hand, from a practical perspective, this research provides practitioners with insight into the environment of digital initiatives and a clear roadmap for fostering

successful collaboration within them. First, the study informs practitioners about the unique and relevant aspects of the Digital Transformation Context influencing project success. These aspects include the necessity of implementing smart products, services, processes, cities, and/or business models as project outcomes; the abundance of data that must be captured and consumed to improve decision-making; and the alignment of projects with a strategic, evolutionary process of continuous improvement. Understanding these contextual elements allows practitioners to better structure their organizational strategy and resource allocation to navigate the technological uncertainties of digital transformation.

Second, the study provides tangible guidance on how to foster genuine collaboration between project stakeholders, grounded in the five theoretical dimensions. To harness the full potential of digital technologies, leaders must actively acknowledge the interdependence of roles and foster cross-functional teamwork, ensuring that key stakeholders are identified and involved early in the project lifecycle to avoid rework. Leaders must oversee communication channels, leveraging digital tools for frequent and asynchronous exchange of information. It is essential to promote a shared vision and define common goals to be achieved through a collaborative governance model. Establishing dedicated structures, such as digital transformation champions, helps coordinate tasks and negotiate common ground. By focusing on these collaborative behaviors, which include promoting trust and flexibility, leaders can create the supportive culture necessary for teams to experiment, adapt roles quickly, and effectively co-create value through digitally enhanced outcomes.

As with any academic research, this study has limitations. First, this investigation acknowledges digital transformation and the Fourth Industrial Revolution (4IR) as similar phenomena, based on the fact that other studies use both terms interchangeably. However, theoretical knowledge may evolve to regard these concepts as distinct in the future. Second, this study recognizes that collaboration within teams of a single organization presents similarities with the construct of teamwork. However, this term was not considered as a synonym in the data collection stage. Finally, this research acknowledges that collaboration between business partners to develop innovation is broadly recognized as "open innovation". This study did not specifically consider the similarities between collaboration between project stakeholders and open innovation, which might have amplified the number of studies discussing the phenomenon and further enriched the analysis.

Building upon these theoretical findings, future research should prioritize empirical work to move the field forward. A critical next step is to gather quantitative data to formally develop and refine the theoretical scales for Project Stakeholder Collaboration and the Digital Transformation Context. This development is necessary to formally test the theoretical relationship between the dimensions of collaboration and the distinct characteristics of the digital environment, allowing researchers to systematically analyze if and how digital transformation and collaboration are connected. Additionally, future research could gather rich qualitative data to improve the understanding of collaboration in the digital transformation context. Such qualitative studies, focusing on in-depth case analyses, are essential to explore the nuanced human and social aspects of collaboration in complex and uncertain digital contexts, thereby grounding these theoretical models in practical reality.

4. STUDY 2 - LINKING PROJECT STAKEHOLDER COLLABORATION TO THE DIGITAL TRANSFORMATION CONTEXT

ABSTRACT

Digital transformation enhances connectivity among organizations and professionals; however, its impact on the complex dynamics of Project Stakeholder Collaboration remains unclear. This paper examines the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. With 413 responses to questionnaires from project professionals, a factorial structure for Project Stakeholder Collaboration was uncovered: Relational Norms, Focus on Shared Outcomes, and Stakeholder Engagement. Focusing on professionals with digital transformation experience, a model of the Digital Transformation Context was also developed. Our findings revealed a positive correlation between Project Stakeholder Collaboration and the Digital Transformation Context with strong effect size. This article provides empirical evidence of a cyclical relationship between collaboration and digital transformation. It is suggested that hybrid and agile project management approaches can enhance collaboration and digital transformation. Methodologically, a contribution to the research on project studies is made by developing a scale, combining exploratory factor analysis (EFA) and Parallel Analysis (PA).

4.1.   INTRODUCTION

Digital technologies and the abundance of data have revolutionized entire industries, including entertainment, manufacturing, and construction (Geurts & Cepa, 2023; Warner & Wäger, 2019). Organizations now connect directly and continuously with customers and business partners, driving significant transformations in business models, organizational structures, and project management processes (Papadonikolaki et al., 2019; Warner & Wäger, 2019). Internally, a business process can be seamlessly integrated, enhancing efficiency and fostering a comprehensive view of the organization (Paiva & Rabechini Jr., 2025; Whitmore et al., 2020). Digital transformation involves the utilization of emerging technologies, such as artificial intelligence, cloud computing, and blockchain to enable business improvements, enhance customer experience, or create novel business models (Fitzgerald et al., 2013; Vial, 2019).

The ongoing processes of digital transformation are reshaping industries and transforming work practices, with effects on society as a whole (Rocha et al., 2021; Tronvoll et al., 2020). In this context, project stakeholders deliver innovative solutions that would be unattainable through individual action, implementing projects that serve as catalysts for digital transformation (Tronvoll et al., 2020; Warner & Wäger, 2019). These stakeholders either adopt predictive (Papadonikolaki et al., 2019) or agile (Warner & Wäger, 2019) project management methodologies to guide their initiatives. Through collaborative partnerships, these semi-autonomous stakeholders work iteratively to address specific challenges (Gray, 1985; Nikulina et al., 2022).

A study of Danone's digital transformation shows the power of collaboration, beginning with the identification of potential value improvements at each site and progressing through effective implementation via tailored, locally driven plans across its 40 manufacturing facilities (World Economic Forum & McKinsey & Company, 2023). Despite its frequent association with digital transformation, few studies explore the complexities of collaboration in the context of digital transformation from a theoretical perspective (Papadonikolaki et al., 2019).

Over the years, management studies have identified various dimensions and processes that constitute collaboration (Bronstein, 2002; Gray, 1985; Mattessich & Monsey, 1992; Morris & Miller-Stevens, 2016). Notably, these elements share commonalities, such as the

understanding that collaboration involves diverse stakeholders working together toward a specific outcome (Bronstein, 2002; Morris & Miller-Stevens, 2016). They also converge on the importance of establishing formal communication channels and fostering informal exchange among the parties (Mattessich & Monsey, 1992; Morris & Miller-Stevens, 2016). Moreover, they emphasize the development of relational norms between stakeholders, such as a commitment to a shared vision, trust, and reciprocity that facilitates day-to-day technical discussions (Bronstein, 2002; Morris & Miller-Stevens, 2016).

Despite these commonalities, there is not yet a consensus on the constituent elements of a theoretical framework of collaboration (Bronstein, 2002; Morris & Miller-Stevens, 2016). Mattessich and Monsey (1992) have outlined six categories that influence the success of collaboration: membership, purpose, process/structure, resources, communication, environment. From an individual perspective, Bronstein (2002) developed and validated a scale to measure interdisciplinary collaboration, including: interdependence, flexibility, reflection on the process, collaborative outcomes (new professional activities), and collective goal ownership. Expanding on the interorganizational model, Morris and Miller-Stevens (2016) identified nine interconnected elements: communication, collective decision-making, diverse stakeholders, goals, leadership, shared resources, shared vision, social capital, and trust.

These studies concur that collaboration involves committed stakeholders working together and sharing responsibilities to achieve a specific outcome (Bronstein, 2002; Mattessich & Monsey, 1992; Morris & Miller-Stevens, 2016). However, they differ in their terminology. While referring to the same concept, Mattessich and Monsey (1992) identified one of the constitutive elements as purpose, Bronstein (2002) identified two elements - collaborative outcomes (new professional activities) and collective goal ownership, and Morris and Miller-Stevens (2016) identified two other elements - goals and shared vision.

Within project management, research exploring the complexities of collaboration also share commonalities with the broader management landscape, such as the focus on collaborative outcomes, the implementation of formal collaborative practices to structure collaboration, and the development of relational norms to amplify the interdependence among stakeholders (Nikulina et al., 2022; Valkokari et al., 2024). While some studies emphasize the relational norms in collaborative projects (Ali & Haapasalo, 2023; Manata, Garcia, Mollaoglu, & Miller, 2021), others highlight the necessary formal collaborative practices (Eriksson, 2015;

Helbrough, 1995). A third stream of research recognizes that these aspects are complementary (Kokkonen & Vaagaasar, 2018; Nikulina et al., 2022).

Prior project studies on digital transformation have predominantly discussed collaboration from a qualitative perspective, with few investigations into the theoretical complexities of the phenomenon (Papadonikolaki et al., 2019; Tronvoll et al., 2020). Therefore, this research has identified a gap by exploring the direct relationship between collaboration and digital transformation. Accordingly, the following research question is posited: *What is the relationship between Project Stakeholder Collaboration and the Digital Transformation Context?* That Project Stakeholder Collaboration and the Digital Transformation Context are positively correlated and that their dynamics are influenced by the project management approach employed, whether predictive, agile, or hybrid is hypothesized.

Supported by a postpositivist epistemology, a quantitative methodological approach was adopted to collect empirical data from project professionals. The factorial structure of both new constructs was assessed: Project Stakeholder Collaboration and Digital Transformation Context, resulting in the development of two measurement scales. Subsequently, the correlation between them was explored. Additionally, the differences between Project Stakeholder Collaboration and Digital Transformation Context were examined based on the project management approach (predictive, agile, and hybrid).

Theoretical contributions are offered by introducing new scales for measuring Project Stakeholder Collaboration and the Digital Transformation Context. Evidence is also provided of a positive correlation between them. Methodologically, scale development procedures from psychology are employed to improve analytical rigor in project studies research. Additionally, practical contributions are provided by informing practitioners about three key factors for enhancing collaboration in projects: focusing on shared outcomes, developing relational norms, and structuring stakeholder engagement practices. It is also suggested that hybrid and agile project management approaches can enhance collaboration and digital transformation by promoting adaptability.

This study is structured as follows: the literature review is presented, covering the main concepts. The methodology is then described, followed by the presentation and discussion of the results. Finally, the conclusion is presented, highlighting the main contributions, limitations, and suggestions for future work.

4.2. LITERATURE REVIEW

4.2.1. PROJECT STAKEHOLDER COLLABORATION

Collaboration research gained prominence in management studies following Gray's (1985) pioneering work, which introduced an inter-organizational framework to address intricate issues. This collaborative process, frequently triggered by uncertainty and crisis, involves the pooling of resources by two or more stakeholders to confront challenges that surpass individual capacities (Gray, 1985; Mattessich & Monsey, 1992). By facilitating a more comprehensive examination of opportunities, collaboration leads to outcomes of superior quality (Mattessich & Monsey, 1992). Nevertheless, the pursuit of synergy in collaborative efforts necessitates modifications to the individual processes of the stakeholders (Mattessich & Monsey, 1992).

Within project management, collaborative governance evolves throughout the project's duration, with a primary focus on achieving defined objectives (Nikulina et al., 2022; Valkokari et al., 2024). Although often linked with partnering (Eriksson, 2015; Meng, 2012), alliancing (Ali & Haapasalo, 2023; Galvin, Tywoniak, & Sutherland, 2021) or integrated project delivery (Manata et al., 2021; Zhang, Cao, & Wang, 2018), collaboration extends beyond these concepts. It is present in a broader scope of projects (Ika & Donnelly, 2017; Valkokari et al., 2024), including interactions between functional teams within a single organization or collaboration among multiple institutions. Considering that agile project management emphasizes individuals and interactions over processes, customer collaboration over formal contracts, such projects tend to achieve higher levels of stakeholder satisfaction (Serrador & Pinto, 2015).

Researchers often decompose collaboration into processes or elements to better understand its components (Bronstein, 2002; Gray, 1985; Mattessich & Monsey, 1992; Morris & Miller-Stevens, 2016; Nikulina et al., 2022). Although these elements share similarities, there is no consensus on which ones definitely characterize collaboration (Morris & Miller-Stevens, 2016; Nikulina et al., 2022). For instance, Nikulina et al. (2022) suggest that project collaboration is shaped by formal collaborative practices which, in turn, foster relational norms like trust and a win-win philosophy. Similarly, Morris and Miller-Stevens (2016) identify both formal collaborative practices and relational norms as interconnected elements of collaboration

including communication, collective decision-making, social capital, and trust. Relational norms refer to behaviors expected within the relationships that parties intend to maintain (Macneil, 1980).

From the field of social assistance, Bronstein (2002) highlights five key dimensions for collaboration: interdependence, flexibility, reflection on the process, collaborative outcomes (new professional activities), and collective goal ownership. Bronstein's (2002) model shares significant commonalities with the influential studies in management (Gray, 1985; Morris & Miller-Stevens, 2016) and project management (Nikulina et al., 2022; Valkokari et al., 2024), which also examine collaboration. Importantly, Bronstein's (2002) model was methodologically developed as a measurement scale, making it a suitable foundation for constructing a scale to assess Project Stakeholder Collaboration. Thus, Bronstein's (2002) model was adopted to analyze the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. In the following paragraphs each dimension of the model will be described, highlighting similarities with other prominent studies in the literature on collaboration.

The dimension of interdependence posits that parties understand their role while acknowledging their dependence on partners to produce collaborative outcomes (Bronstein, 2002; Nikulina et al., 2022). In accordance, Mattessich and Monsey (1992) explain that collaborative organizations recognize that the benefits gained through collaboration are balanced against a loss of autonomy. To navigate this constant interdependency, collaborative professionals communicate frequently and openly (Bronstein, 2003; Nikulina et al., 2022). While interactions and co-location facilitate informal communication, formal reporting and regular status meetings ensure that all, including those less involved in day-to-day activities, are engaged (Mattessich & Monsey, 1992; Nikulina et al., 2022).

Flexibility is another relevant dimension of collaboration (Bronstein, 2003). While acknowledging their own and their partners' roles, collaborative professionals blur role boundaries flexibly when necessary (Bronstein, 2002). Structurally, collaborative projects rely on an array of stakeholders with the appropriate capabilities (Mattessich & Monsey, 1992; Nikulina et al., 2022) who can negotiate compromise solutions (Bronstein, 2002; Nikulina et al., 2022). Notably, mutual respect and trust facilitate interactions between collaborating parties (Mattessich & Monsey, 1992; Nikulina et al., 2022).

The dimension of reflection on the process emphasizes the importance of frequent evaluation of the formal collaborative practices, incorporating enhancement feedback (Bronstein, 2002; Nikulina et al., 2022). While Mattessich and Monsey (1992) do not explicitly address this evaluative process, they highlight that collaborating entities share responsibility for how the group adapts its processes as needed. In accordance, Nikulina et al. (2022) assert that the success of collaborative teams must be evaluated continuously to foster improvement. At a relational level, transparency, characterized by two-way communication and feedback across all hierarchical levels, enables this reflective process (Nikulina et al., 2022).

The dimension collaborative outcomes, previously termed newly created professional activities, encompasses the results, activities, and programs achieved through collaboration (Bronstein, 2003; Nikulina et al., 2022). Mattessich and Monsey (1992) emphasize that collaborative effort enhances, rather than merely replicates, individual achievements. Collaborative teams define attainable goals and share a vision to guide their efforts (Mattessich & Monsey, 1992; Nikulina et al., 2022). This shared vision involves compromising on a direction to achieve collaborative outcomes (Nikulina et al., 2022).

The dimension of collective ownership of goals encompasses shared responsibility in defining, developing, and achieving collaborative objectives through effective governance and joint problem-solving (Bronstein, 2002; Nikulina et al., 2022). By establishing multi-layered decision-making structures with clear roles, stakeholders share a stake in both processes and outcomes, while maintaining flexibility to adapt to changing conditions (Mattessich & Monsey, 1992; Nikulina et al., 2022). Effective collaborative governance fosters joint work activities for problem-solving and continuous improvement (Nikulina et al., 2022). When actively involved, stakeholders tend to share a sense of ownership, thus improving their commitment to the outcomes (Bronstein, 2002; Nikulina et al., 2022).

4.2.2. THE DIGITAL TRANSFORMATION CONTEXT

Organizations navigate an environment of uncertainties driven by technological innovation, market competition, and hyperconnected customers (Papadonikolaki et al., 2019; Schwab, 2017). Attuned to opportunities, they develop new business models, improve operations, and revise project management governance, leveraging technology and abundant data (Schwab, 2017; Vial, 2019), in a phenomenon known as digital transformation. In the

following paragraphs the relevant perspectives of the Digital Transformation Context are described highlighting similarities with prominent studies in the digital transformation literature.

Digital technologies are the tools that create disruptions and prompt strategic responses from organizations (Vial, 2019). These responses reshape value creation pathways and require managing structural changes and overcoming organizational barriers (Vial, 2019). Since digital transformation is not yet fully understood and follows diverse implementation pathways, the use of digital technologies to enhance value creation remains challenging (Carvalho et al., 2021).

The alignment of digital transformation initiatives with organizational strategy is fundamental to achieving meaningful outcomes (Papadonikolaki, 2018; Vial, 2019). Digital transformation is not merely a technological endeavor but a strategic process that fosters reshaping business models (Tronvoll et al., 2020; Warner & Wäger, 2019). A strategic approach to digital transformation enables organizations to: embrace emergence and iterative processes (Piccione, 2021), develop digital competencies (Liu et al., 2024; Tronvoll et al., 2020), allocate resources effectively (Johansson et al., 2021), and drive improvement continuously (W. Abdalla et al., 2020; Tronvoll et al., 2020).

The implementation of smart products and business models is linked to digital transformation, enabling companies to create new value propositions and enhance customer experiences (Geurts & Cepa, 2023; Vial, 2019). Real-time data collection and analysis enable self-diagnosis, predictive maintenance, and user customization (Camarinha-Matos et al., 2019; Paiva & Rabechini Jr., 2025). These features not only improve operational efficiency but also inspire the emergence of the service-enhanced products and collaborative ecosystems that drive servitization - a shift from selling physical products to offering integrated product-service solutions (Jiao, Commuri, Panchal, Milisavljevic-Syed, Allen, Mistree, & Schaefer, 2021; Tronvoll et al., 2020). Digital platforms enable connectivity and allow companies to adapt dynamically to changing customer needs while exploring new revenue streams (Porter & Heppelmann, 2014; Warner & Wäger, 2019).

Another item indicating digital transformation is the abundance of data, which motivates organizations to reimagine their operations and value propositions (Tronvoll et al., 2020; Vial, 2019). Data, once expensive to generate and restricted to organizational silos, is

now continuously produced through mobile devices, IoT sensors, and digital platforms (Rogers, 2016; Vial, 2019). Specifically, cloud computing has made data storage and processing more accessible and cost-effective, democratizing the use of big data tools across organizations of all sizes (Rogers, 2016). Advanced analytics and AI-driven decision-making transform raw data into actionable insights to optimize operations, enhance customer engagement, and innovate business models (Tronvoll et al., 2020; Warner & Wäger, 2019).

Workforce digital capabilities are also relevant in digital transformation, enabling organizations to successfully navigate the complexities of advanced technologies (Imran et al., 2021; Tronvoll et al., 2020). Adaptability and collaboration complement technical expertise in areas such as data analytics and software development (Imran et al., 2021; Liu et al., 2024). Lifelong learning is also critical to address the evolving nature of job roles required in cross-functional integration (Imran et al., 2021; Liu et al., 2024). Organizations must prioritize structured training programs and mentoring initiatives to build digital capabilities while addressing skill gaps through partnerships and external expertise (Imran et al., 2021; Liu et al., 2024).

Process improvement and enhanced operational transparency drive digital transformation across industries (Imran et al., 2021; Kagermann et al., 2013). To meet evolving demands, organizations reshape business processes, enabling greater efficiency and adaptability (Imran et al., 2021; Warner & Wäger, 2019). By leveraging integrated technologies, organizations can introduce well-defined workflows that minimize errors and reduce rework, ultimately improving process quality (Aibinu & Papadonikolaki, 2020; Brunet et al., 2019). Furthermore, digital tools enhance project performance and customer satisfaction (Meng, 2019; Nassereddine et al., 2022). Consequently, digital transformation creates a foundation for resilient and formal collaborative practices (Imran et al., 2021; Tronvoll et al., 2020).

4.3.   METHODOLOGY

A quantitative approach with a non-probabilistic sampling was adopted to examine the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. Using reflective digital scales, how project professionals perceived a group of variables was assessed through a digital 5-point Likert questionnaire (Field, 2017). Project

Stakeholder Collaboration is a latent construct that characterizes professionals' behavior and formal collaborative practices (Field, 2017). Similarly, the Digital Transformation Context is also a latent variable, involving the use of new technologies to enhance business processes, improve customer experience, or implement new business models (Fitzgerald et al., 2013; Warner & Wäger, 2019).

The research of Slavec and Drnovšek (2012) and Carpenter (2018) guided the methodological steps necessary to develop a scale. Slavec and Drnovšek (2012) structure the development of a scale into three stages: (A) theoretical construct assessment; (B) data collection representativeness; and (C) statistical validation. On a different interpretation, Carpenter (2018) outlines ten steps for developing scales. Our methodological approach combined insights from both these studies (Figure 3).
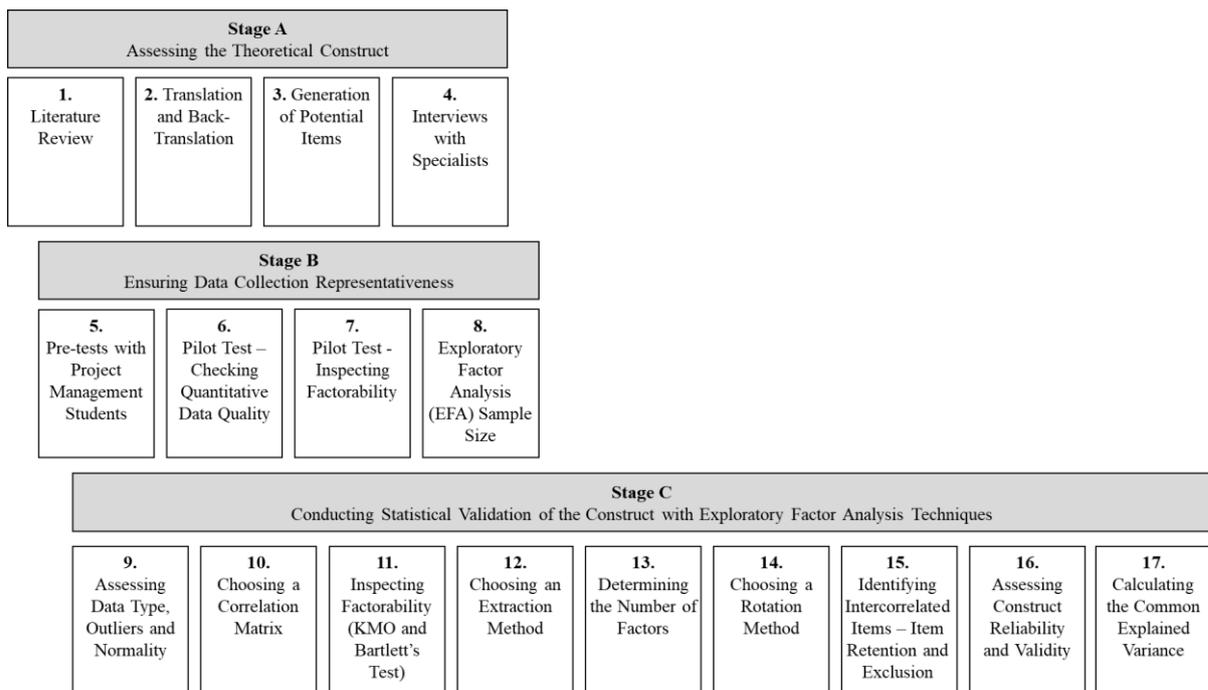
Figure 3 *Scale Development: A Methodological Approach*

Source: by the authors, from Slavec and Drnovšek (2012) and Carpenter (2018)

4.3.1. STAGE A: THEORETICAL CONSTRUCTS ASSESSMENT

Assessing the theoretical constructs was the start of this literature review (Figure 3, Step 1) (Carpenter, 2018; Slavec & Drnovšek, 2012). A translation and back translation of

Bronstein's (2002) items from English to Portuguese (Step 2) (Slavec & Drnovšek, 2012) was prepared. The items were then adapted from their original use to the project management context, which involved the inclusion and exclusion of items. Items were generated from the literature to assess the Digital Transformation Context (Step 3) (Carpenter, 2018; Slavec & Drnovšek, 2012). A larger pool of items was originally proposed, considering that they typically decrease to one-third of the initial pool during scale development (Carpenter, 2018).

Following this, seven semi-structured interviews were conducted with specialists in project management and digital transformation (Step 4), to enhance the instrument's face and content validity (Hardesty & Bearden, 2004). Despite the number of specialists evaluating questionnaires varying, an average of ten specialists per construct is ideal (Hardesty & Bearden, 2004). An interview protocol was designed (APPENDIX 2 – STUDY 2 - PROTOCOL - INTERVIEW WITH SPECIALISTS) (Carpenter, 2018), and the interviews were recorded, transcribed, and analyzed. The items were adjusted based on the suggestions, improving readability and clarity (Carpenter, 2018). Specifically, it was decided to exclude reverse-scored items that could complicate data interpretation.

Project professionals are our unit of analysis. They were invited to answer the questionnaire on Project Stakeholder Collaboration and to indicate whether they had experience in the Digital Transformation Context. A preliminary question verified whether the respondent worked with projects, thereby screening out unsuitable professionals. The questionnaire was organized into three sections (APPENDIX 3 – STUDY 2 - ONLINE QUESTIONNAIRE): (1) to measure the Digital Transformation Context, (2) to measure Project Stakeholder Collaboration and (3) to gather the demographic profile. The collection was randomized within each section of the questionnaire (Krosnick, 1999) to mitigate primacy/recency effects. The section on the Digital Transformation Context was only responded to by professionals with experience in this environment. Respondents with no experience in digital transformation answered the section on Project Stakeholder Collaboration directly. By the end of the questionnaire, all respondents answered 6 profile questions. Project professionals working in the Digital Transformation Context answered a total of 82 questions.

4.3.2.   STAGE B: DATA COLLECTION REPRESENTATIVENESS

To ascertain the quality of the data collection, a pre-test was initiated (May/2024) with a group of project management specialists (Step 5) (Carpenter, 2018; Slavec & Drnovšek, 2012). 51 complete responses were collected, which gathered suggestions to improve the questionnaire. The suggestions were listed but it was decided not to apply them; therefore, the pre-test data could be incorporated into the quantitative pilot test.

In field conditions, the quality of the collected data was evaluated, leading to database cleaning (Step 6) (Carpenter, 2018). A response was considered valid when the questionnaire was fully completed, and the attention statement correctly answered. A pilot test that anticipates an Exploratory Factor Analysis (EFA) should reach 50–100 respondents (Carpenter, 2018). 149 valid responses were collected to evaluate the structure of our largest section with 50 items. It represented a 73% successful collection rate, excluding incomplete or non-attentive responses.

The Kaiser-Meyer-Olkin (KMO) indicator and Bartlett's Test of Sphericity were calculated for both sections (Step 7). A KMO > 0.6 points to distinct factors, with compact correlation patterns (Carpenter, 2018; Field, 2017). Bartlett's Test of Sphericity < 0.05 ensures a correlation matrix sufficiently different from an identity matrix (Carpenter, 2018; Field, 2017).

Project Stakeholder Collaboration reached a KMO of 0.83302 (good) and a Bartlett's Test of 1502.4 (DF = 1225; p < 0.01), while the Digital Transformation Context presented a lower KMO of 0.66401 and a Bartlett's Test of 665.8 (DF =78; p < 0.01). As the latter derived straight from the literature and had a smaller number of statements, it was expected that it would be less stable than the Project Stakeholder Collaboration, which could explain its lower indicators. Preliminarily, these indices ensure the existence of common variance among the data (Field, 2017).

Despite the recommendation to review the questionnaire after the pilot test, it was decided not to make any radical changes but excluded the questions collecting suggestions. Therefore, data from the pilot tests could be used as part of the overall collection.

To ensure population representativeness and that inferences could be drawn, the sample size for the EFA (Step 8) (Carpenter, 2018; Slavec & Drnovšek, 2012) was determined. The minimum sample size is equivalent to 5:1, but the most appropriate is around 10:1 (Hair, Babin, Anderson, & Black, 2019). Devellis and Thorpe (2021) recommend that researchers should aim for a sample of 10:1 and/or 200–300 respondents. The ratio of 20:1 question is

optimal, while 5:1 is the minimum standard ratio (Carpenter, 2018). Considering the various rules of thumb regarding the sample size for an EFA, our aim was to reach 300 responses (Devellis & Thorpe, 2021), corresponding to a 6:1 response rate.

4.3.3. STAGE C: STATISTICAL VALIDATION

Two EFAs using FACTOR Software to assess the two constructs separately were conducted: Project Stakeholder Collaboration and the Digital Transformation Context. As previously mentioned, the scale for Project Stakeholder Collaboration was inspired by Bronstein's scale (2002) with consistent modifications. Diversely, the scale for the Digital Transformation Context was developed from the literature. Therefore, EFA was chosen, as it is more suitable for exploratory approaches, rather than Confirmatory Factor Analysis (CFA).

The dimensionality, reliability, and construct validity were verified through appropriate statistical methods (Slavec & Drnovšek, 2012). Prior to assessing data type, outliers and normality (Step 9), the database was cleaned (Step 6). It was acknowledged that the 5-point Likert scale data was ordinal. 3 respondents were excluded as outliers by comparing the multivariate mean of each respondent to the overall mean.

To verify normality, Mardia's test (1970) was run, detecting multivariate asymmetry (skewness) and kurtosis (peakedness) (Step 9). The empirical data showed significant skewness and kurtosis; hence, further methodological choices took non-normal data distribution into consideration. To assess the correlation between items, a polychoric matrix was used instead of a Pearson correlation matrix (Step 10), this is recommended when the univariate distribution of ordinal items is asymmetric or show excess kurtosis (Muthén & Kaplan, 1985). Further, the factorability of both datasets (Step 11) was analyzed using two classic tests: KMO and Bartlett's Test of Sphericity (Carpenter, 2018; Field, 2017).

The Robust Unweighted Least Squares (RULS) method (Step 12), which transforms the data from a variable to a factor space while verifying the correlation and covariation among the items (Carpenter, 2018) was chosen to extract the factors. Li (2016) developed simulation studies comparing the performance of EFA extraction methods, verifying that Robust Diagonally Weighted Least Square and RULS perform well for ordinal and non-normal data.

The number of factors in each scale was determined using Parallel Analysis (Step 13) (Carpenter, 2018). Various techniques can be used to measure the variance of each factor:

Eigenvalue, visual scree test, parallel analysis, and minimum average partial (Carpenter, 2018). Despite being commonly applied in scale development studies, the Eigenvalue > 1 criteria has been questioned in recent research (Carpenter, 2018). Considered a stronger technique, Parallel Analysis uses Monte-Carlo simulation to compare the Eigenvalues of the factors observed to the Eigenvalues of various simulated matrixes (Timmerman & Lorenzo-Seva, 2011). The number of factors with Eigenvalues larger than the ones obtained from the simulation data, indicates the number of factors to be retained (Timmerman & Lorenzo-Seva, 2011). To obtain greater reliability of the results , bootstrapping was performed (1,000 resamples; 95% BCa CI) (Haukoos & Lewis, 2005).

The aim of factor rotation is to improve factor interpretation by accentuating loads in one of the factors and diminishing them in others (Step 14) (Field, 2017). Two types of rotation methods - orthogonal and oblique rotation – are chosen considering whether the factors correlate or not among themselves (Carpenter, 2018). As social sciences factors normally intercorrelate, an oblique rotation was selected, rather than an orthogonal varimax rotation (Carpenter, 2018). Specifically, the Promax rotation (Carpenter, 2018; Hendrickson & White, 1964) was applied.

Each section was analyzed separately to identify correlated items with high loads in specific factors (Step 15) (Carpenter, 2018). A minimum factor loading of 0.30–0.40 is advised to ascertain correlation between items and a factor (Carpenter, 2018; Hair et al., 2019). The cutoff point of 0.45 was adopted and ascertained items had no cross-loading (Carpenter, 2018). Factor loading and cross-loading were assessed with the loading matrixes (Carpenter, 2018), leading to item exclusion in an iterative process (Field, 2017).

To measure different aspects of a latent construct accurately, each factor is comprised of at least three items (Carpenter, 2018). When items represent a factor, they correlate to each other but do not correlate to a different group of items representing another factor (Field, 2017). By assessing which factors showed common variance to both constructs, their dimensionality was verified (Carpenter, 2018; Hair et al., 2019; Slavec & Drnovšek, 2012).

Construct reliability and validity (Step 16) was assessed. Construct reliability evaluates the extent to which the same results are expected for repeated trials (Hair et al., 2019; Slavec & Drnovšek, 2012). While construct validity assesses the extent to which a scale represents the construct it aims to measure precisely. Construct reliability was checked using

three distinct indices: Cronbach's alpha (Hair et al., 2019), H-index (Ferrando & Lorenzo-Seva, 2018) and Composite Reliability (Valentini & Damásio, 2016). Cronbach's alpha (> = 0.6) is calculated for each factor to verify its reliability based on two measurements - the variance and covariance of the item in relation to other items (Field, 2017). H-index assessed factor replicability, high H-values (> 0.80) suggest a likely stable variable across studies (Ferrando & Lorenzo-Seva, 2018). (Ferrando & Lorenzo-Seva, 2018). Composite Reliability > 0.7 evaluates the sum of the factor loadings against the sum of the residual variance (Fornell & Larcker, 1981; Valentini & Damásio, 2016). It is considered an improved indicator compared to Cronbach's alpha, because it recognizes factor loadings as distinct measures (Sijtsma, 2009; Valentini & Damásio, 2016).

The indices for model fit adjustment: Chi-square ($\chi2$), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI) were calculated to verify construct validity. According to Brown (2015), $\chi2$ should not be significant, and the rate $\chi2/DF < 5$ or, preferably, < 3, RMSEA < 0.06, with a confidence interval < 0.10, and CFI and TLI values > 0.90, but preferably > 0.95. They indicate construct validity alongside item loadings, the number of factors and the correlation among the factors.

Lastly, common explained variance for each construct (Step 17), which expresses if the latent construct share variance was calculated. It is commonly analyzed through the Average Variance Extracted (AVE), with an average AVE of 40% indicating adequate convergence for psychological and social science studies (Fabrigar, Wegener, MacCallum, & Strahan, 1999; Smedslund, Arnulf, & Smedslund, 2022).

4.4.   RESULTS

In order to measure Project Stakeholder Collaboration, 413 valid responses were collected, specifically, 305 valid responses were from professionals working in a Digital Transformation Context. Multivariate normality was evaluated using Mardia's test (Cain, Zhang, & Yuan, 2017; Mardia, 1970), which indicated significant skewness and kurtosis for both datasets (Table 11).

Table 11: Mardia's Test for Multivariate Normality

	Number of Variables	Skewness*		Kurtosis*	
		b	z	b	z
Project Stakeholder Collaboration	50	764.2852	52,608.2962	3,430.5666	117.0356
Context of Digital Transformation	13	43.93872	2,233.55137	267.00729	31.83934

Note: *data is significant to $p < 0.05$

Source: Elaborated by the authors using the Factor Software and https://webpower.psychstat.org/models/kurtosis/

Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity (Table 12) (Carpenter, 2018; Field, 2017) were calculated.

Table 12: Factorability Inspection

	KMO (Bootstrap 95% CI)	Bartlett's Test
Project Stakeholder Collaboration	0.91271 (0.831 - 0.957)	4,637.8 (DF = 300; $p < 0.05$)
Digital Transformation Context	0.83951 (0.737 - 0.852)	726.5 (DF = 28; $p < 0.05$)

Source: Elaborated by the authors using FACTOR Software

KMO and Bartlett's Test of Sphericity indicated that the polychoric matrixes were suitable for factor analysis. Using Parallel Analysis, the number of factors to be retained (Table 13) was determined.

Table 13: Factors to be Retained

Variable	Collaboration among Project Stakeholders		Context of Digital Transformation	
	% Variance in Real Data	% of Variance in Mean of Random Data	% Variance in Real Data	% of Variance in Mean of Random Data
1	40.7122*	8.1905	55.4173*	25.539
2	8.2335*	7.592	13.908	21.3302
3	7.5724*	7.1527	12.1689	17.6171
4	4.3895	6.7493	8.9615	14.0632

5	3.89	6.3984	7.2663	10.5817
6	3.6627	6.0812	1.988	7.1784
7	3.2421	5.7739	0.2899	3.6904
8	3.05	5.468		
9	2.7546	5.1815		
10	2.5874	4.8813		
11	2.5447	4.5798		
12	2.2753	4.2832		
13	2.2282	3.9851		
14	2.1087	3.699		
15	1.8824	3.3897		
16	1.7449	3.0961		
17	1.3972	2.7881		
18	1.3615	2.4811		
19	1.0312	2.184		
20	1.0087	1.8729		
21	0.9434	1.5583		
22	0.707	1.2263		
23	0.5003	0.8804		
24	0.1721	0.5072		

Note: * Factors with larger variance in real data compared to simulations

Source: by the authors using FACTOR Software

Project Stakeholder Collaboration can be measured by three factors and the Digital Transformation Context by a unidimensional factor. The next subsections will demonstrate the factorial structure of these two constructs.

4.4.1. SCALE FOR PROJECT STAKEHOLDER COLLABORATION

Project Stakeholder Collaboration occurs through three distinct factors: Relational Norms, Focus on Shared Outcomes, and Stakeholder Engagement (Table 14).

Table 14: Loading Correlation Matrix – Project Stakeholder Collaboration

	Items	Relational Norms	Focus on Shared Outcomes	Stakeholder Engagement
C12	My project colleagues tried to create a positive environment for our project.	0.929	-0.219	-0.043
C16	My project colleagues were committed to working together.	0.884	-0.15	0.006
C22	My project colleagues did the best they could for us to reach the project results.	0.821	-0.075	-0.074
C43	My project colleagues and I shared a vision about our project.	0.636	0.089	0.104
C15	I was optimistic about my colleagues' ability to work with me to solve problems.	0.624	0.14	-0.097
C20	My project colleagues communicated in good situations.	0.54	0.086	0.003
C10	My colleagues considered my opinions.	0.535	0.163	0.024
C47	My project colleagues understood well the distinction between my role and theirs.	0.509	-0.094	0.183
C49	My project colleagues discussed conflicting situations with the aim of resolving them.	0.457	0.114	0.189
C42	There was coordination between my colleagues from different areas of knowledge.	0.456	0.226	0.067
C41	I was willing to sacrifice a certain degree of autonomy in favor of delivering shared results.	-0.167	0.753	-0.103
C18	I was open to taking on tasks outside of my job description when it seemed important.	-0.274	0.686	0.041
C35	The collaborative work with my project colleagues led to results we could not achieve alone.	0.175	0.651	-0.133
C36	New solutions emerged from the collective work of project colleagues from different areas of knowledge.	0.165	0.6	-0.012
C31	Creative solutions emerged from our teamwork.	0.278	0.552	-0.078
C48	My project colleagues made proposals that improved our capability to meet customer needs.	0.298	0.512	-0.058
C38	Our project aimed to produce results for the organizations involved.	0.049	0.494	0.287
C40	Our project aimed to produce results that satisfied customers and/or end users.	-0.051	0.493	0.295
C34	My project colleagues and I shared knowledge to design improved solutions for the project.	0.3	0.472	-0.025
C09	Our project engaged its key stakeholders in the project discussions.	0.033	-0.129	0.789
C06	Our project identified its main stakeholders from the beginning.	0.105	-0.127	0.606
C23	I consistently gave feedback to other professionals in the context of the project.	0.098	-0.11	0.603
C02	The clients and/or end-users participated in the project discussions related to them.	-0.107	0.162	0.503
C08	When my colleagues brought relevant information, I asked questions to check my understanding.	-0.055	0.169	0.487

C07	Our project recorded relevant verbal information for sharing.	-0.022	0.107	0.464
	Cronbach Alpha	0.85	0.776	0.68
	Composite Reliability	0.8788	0.8216	0.7515
	H-Latent	0.919	0.879	0.822
	H-Observed	0.833	0.803	0.752
	Cumulative Variance	40.71%	48.94%	56.52%

Source: the authors using FACTOR Software

Table 14 shows factor loadings > 0.45 (Hair et al., 2019). To reach this structure, items were excluded due to low loadings, cross-loadings, or model overfitting (Kline, 2016). Table 4 also shows reliability indices: Cronbach's alpha and Composite Reliability are adequate. Score reliability (H-indices) are mostly adequate, with a slightly lower H-Observed for Factor 3 = 0.752; however, H-Latent > 0.80 (Ferrando & Lorenzo-Seva, 2018). The cumulative variance of 56.52% is satisfactory (Fabrigar et al., 1999; Smedslund et al., 2022).

CFI is 0.996 and TLI is 0.995, showing excellent adjustment. RMSEA is 0.024, with a 95% confidence interval of 0.023-0.027. Despite c2 being significant (χ^2 = 284.059; DF = 228; $p < 0.05$), the ratio χ^2 /DF is < 3, which indicates a plausible model.

4.4.2. SCALE FOR THE DIGITAL TRANSFORMATION CONTEXT

The Digital Transformation Context is a unidimensional construct (Table 15).

Table 15: Loading Correlation Matrix – Digital Transformation Context

	Items	Factor Loadings
TD05	Our organization established digital strategic guidelines.	0.681
TD03	We implemented smart products/services/processes as a result of the digital transformation project.	0.671
TD04	Our project had professionals with digital competencies.	0.650
TD07	My project colleagues and I were dedicated to continually improving the business processes of the organization that was undergoing digital transformation.	0.611
TD06	Our project was aligned with our organization's strategic guidelines.	0.606
TD01	Our project changed the business processes of the organization undergoing digital transformation.	0.598
TD24	Our project used digital technologies that connect the real and digital worlds.	0.558

TD02	Our project amplified the use of data to generate information in the organization in digital transformation.	0.527
	Cronbach alpha	0.749
	Composite Reliability	0.8284
	H-Latent	0.734
	H-Observed	0.833
	Cumulative Variance	55.42%

Source: by the authors using FACTOR Software

Table 15 shows factor loadings > 0.45 (Hair et al., 2019). To reach this structure, items were excluded due to low loadings or cross-loadings. It also presents reliability indices: Cronbach's alpha and Composite Reliability are adequate. Score replicability (H-index) is slightly lower, H-Observed = 0.734, despite this the H-Latent is > 0.80.

Fit indices indicate the model is plausible. CFI is 0.977 and TLI is 0.968 (close). RMSEA is 0.068, with a 95% confidence interval of 0.065-0.081. χ^2 is significant ($\chi^2 = 48.303$; DF = 20; $p < 0.05$), and the ratio χ^2 /DF is 6.04, slightly higher than 5. The cumulative variance of 55.42% indicates adequate convergence (Slavec & Drnovšek, 2012).

4.4.3. LINKING PROJECT STAKEHOLDER COLLABORATION AND THE DIGITAL TRANSFORMATION CONTEXT

Once the instruments to measure Project Stakeholder Collaboration and the Digital Transformation Context were developed, the data normality for both constructs was assessed using the Shapiro-Wilk test. Both scores did not show a normal distribution: Project Stakeholder Collaboration (S-W (305) = 0.940, p<0.001) and the Digital Transformation Context (S-W (305) = 0.953, p<0.001).

The Pearson correlation was calculated with bootstrapping (1,000 resamples; 95% BCa CI) (Haukoos & Lewis, 2005) to obtain results with greater reliability and correct deviations from normality. Project Stakeholder Collaboration and the Digital Transformation Context showed a significant correlation of 0.538 (CI 95% 0.411–0.641; p<0.01) and a strong effect size of 28.9% (Cohen, 2013).

4.4.4. DIFFERENCES IN PREDICTIVE, AGILE AND HYBRID PROJECT MANAGEMENT APPROACHES

A one-way analysis of variance (ANOVA) was performed to explore the differences in the levels of Project Stakeholder Collaboration and the Digital Transformation Context between professionals working under different project management approaches (predictive, agile, and hybrid).

Prior to analyzing Project Stakeholder Collaboration, data normality was checked using the Shapiro-Wilk tests. It demonstrated a normal distribution for the predictive group [predictive, S-W (58) = 0.964], but a non-normal distribution for the agile and hybrid groups [hybrid, S-W (135) = 0.947; p<0.001; agile, S-W (111) = 0.909; p<0.001]. Another prior ANOVA verification uses Levene's test to evaluate homogeneity of variance, which was verified (Levene (2, 301) = 1.187, p>0.05).

To correct deviations from normality and adjust differences between group sizes, ANOVA was calculated with bootstrapping (1,000 resamples; 95% BCa CI) (Haukoos & Lewis, 2005). The ANOVA results demonstrated differences between the groups [F (2, 35.962) = 8.242, p<0.001; Partial $\eta2$= 0.052], indicating a small effect size (0.01-0.06).

Post-hoc evaluation used Hochberg's GT2, considering the differences in group sizes (Field, 2017). Hochberg's GT2 with bootstrapping showed significant differences in the levels of Project Stakeholder Collaboration between predictive and hybrid groups (medium effect size, Hedge's G = 0.41) and between predictive and agile groups (medium effect size, Hedge's G = 0.65). Finally, it did not show significant differences between hybrid and agile project management [ΔM = -0.50, 95% CI BCa (-0.99-0.00)].

Following this, the Digital Transformation Context was assessed in predictive, agile, and hybrid projects. Shapiro-Wilk normality did not show a normal distribution for the Digital Transformation Context for any of the groups [predictive, S-W (58) = 0.945; p<0.001; agile, S-W (111) = 0.899; p<0.001; hybrid, S-W (135) = 0.961; p<0.001]. Levene's test showed homogeneity of variance among groups (Levene (2, 301) = 0.943, p>0.05). The ANOVA results demonstrated differences between the groups [F (2, 4.825) = 7.239, p<0.001; Partial $\eta2$= 0.046], indicating a small effect size (0.01-0.06).

Post-hoc Hochberg's GT2 test with bootstrapping exhibited significant differences in the Digital Transformation Context between predictive and hybrid groups (small effect size, Hedge's G = 0.38) and between predictive and agile groups (medium effect size, Hedge's G = 0.63). Finally, it did not show significant differences between the hybrid and agile groups [ΔM = -0.18, 95% CI BCa (-0.40 -0.04)].

4.5.   DISCUSSION

The relationship between Project Stakeholder Collaboration and the Digital Transformation Context was analyzed in this study. First, an empirical and quantitative model was developed to measure Project Stakeholder Collaboration, it was tailored to project studies research and based on Bronstein's (2002) Interdisciplinary Index of Collaboration. Items were added and removed to better fit this context. While Bronstein's (2002) original index comprised five dimensions, the resulting Project Stakeholder Collaboration (Figure 4) consolidates into three interrelated dimensions:

Relational Norms. An adaptation of the original flexibility dimension, renamed to reflect its broader scope encompassing the relational aspects of collaborative work.

Focus on Shared Outcomes. It aggregates two original dimensions - newly created professional activities (collaborative outcomes) and the collective ownership of goals.

Stakeholder Engagement. An adaptation of the original interdependence dimension, it was renamed due to strong factor loadings related to stakeholder identification and engagement.
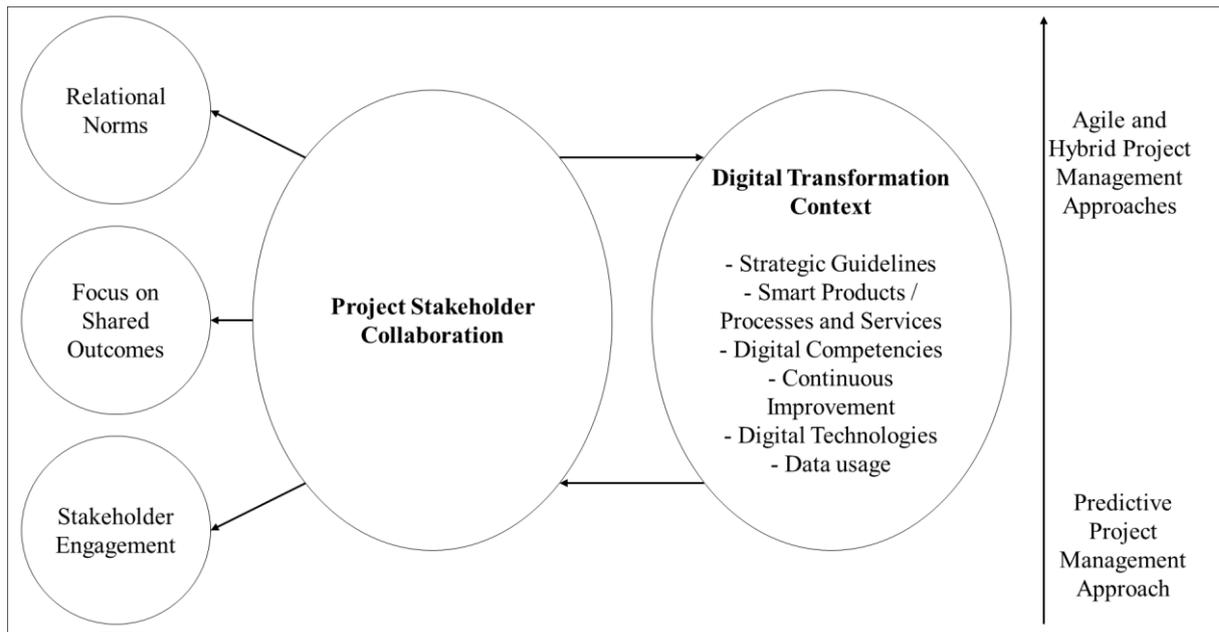
Figure 4 *Linking Project Stakeholder Collaboration to the Digital Transformation Context*

Source: develop by the author

The relational norms factor captures the efforts of project stakeholders to cultivate a positive work environment grounded in mutual understanding. It shows the importance of fostering an atmosphere of trust and openness, where team members feel valued and are motivated to achieving shared goals, as other scholars have previously emphasized (Kokkonen & Vaagaasar, 2018; Mattessich & Monsey, 1992; Nikulina et al., 2022; Wood & Gray, 1991). In the Digital Transformation Context, which involves high levels of uncertainty and interdependence, relational norms are even more critical to strengthen collaboration.

The focus on shared outcomes factor reaffirms that collaborative projects should be driven by shared goals, where professionals recognize that working together can produce superior results - even if it means relinquishing some degree of autonomy. This factor merges two original dimensions that represent complementary perspectives on shared outcomes: (1) better results are more likely when stakeholders take collective ownership of the processes leading towards their goals, as previous scholars have highlighted (Bronstein, 2002; Gray, 1985; Kokkonen & Vaagaasar, 2018; Mattessich & Monsey, 1992; Nikulina et al., 2022); (2) collective outcomes and mutual benefits are reached when stakeholders solve problems that

cannot be addressed alone. Additionally, the needs of customers and end users should guide the development of solutions.

The stakeholder engagement factor underscores the importance of identifying and interacting with key stakeholders from the beginning and throughout the project's lifecycle. It emphasizes that end-users and other critical stakeholders should be included in relevant discussions to provide feedback. Furthermore, it highlights the value of knowledge management by documenting and sharing important verbal information. It ensures that key parties are not only identified but also meaningfully engaged, fostering an environment where information flows openly and effectively.

This research also developed a unidimensional model to measure the Digital Transformation Context within organizations (Figure 4). It includes the: alignment with digital strategy, commitment to continuous improvement, increased use of data, workforce's digital competencies, adoption of digital technologies, and implementation of smart products, services, or processes.

When organizations establish clear digital guidelines, they demonstrate their dedication to a purposeful transformation approach (Koseoglu et al., 2019; Papadonikolaki, 2018; Robu & Lazar, 2021). They cultivate an innovative organizational culture by committing to continuous improvement and amplifying the use of digital technologies and data. Successful digital transformation also depends on professionals with strong digital competencies to effectively deliver smart products, services, or processes. These findings align with the existing literature addressing key themes in the Digital Transformation Context, including: data abundance (Piccione, 2021; Tronvoll et al., 2020), continuous improvement (Koseoglu et al., 2019; Whitmore et al., 2020), the workforce's digital skills (Ayala et al., 2020; Papadonikolaki, 2018), and the deployment of smart products, services, and processes (Schwab, 2017; Warner & Wäger, 2019).

Effective Project Stakeholder Collaboration is relevant in other projects (Ali & Haapasalo, 2023; Nikulina et al., 2022), but it becomes even more critical in initiatives undertaken within a Digital Transformation Context. Based on the perceptions of project professionals, a positive correlation between the level of Project Stakeholder Collaboration and the degree of Digital Transformation Context may be confirmed. Considering that shared goals drive Project Stakeholder Collaboration, organizations embarking on digital transformation

journeys should develop clear strategic guidelines to steer collaborative projects, as Rocha et al. (2021) highlighted. Stakeholders work together to facilitate the implementation of smart products, services, and processes, leveraging data availability. Stakeholders should foster an environment of mutual respect and trust to maximize digital transformation benefits, as Papadonikolaki (2018) argued. This collaborative approach enhances the potential for innovation, enabling organizations to adapt to rapid changes in the Digital Transformation Context.

As hypothesized, significant differences in the levels of Project Stakeholder Collaboration between predictive project management approaches and those using agile or hybrid methodologies were revealed (Figure 4). The levels of Project Stakeholder Collaboration in predictive projects were significantly lower than in agile or hybrid projects. Agile and hybrid approaches are inherently more adaptable to change, fostering experimentation and enabling collaborative refinement of goals (Paiva & Rabechini Jr., 2025; Warner & Wäger, 2019). Project Stakeholder Collaboration highlights the customers' needs, which should guide the development of collaborative solutions – a core principle of agile project management.

Furthermore, this research identified significant differences in the levels of Digital Transformation Context between predictive project management approaches and hybrid or agile methodologies. In predictive project management, stakeholders demonstrated lower levels of Digital Transformation Context compared to those participating in agile or hybrid approaches. The rapid evolution of consumer expectations, technological advancements, and market competition demands that digital solutions be implemented swiftly. These dynamics foster opportunities for incremental delivery, iterative processes, and continuous improvement, as Warner and Wäger (2019) have highlighted. The findings suggest that agile and hybrid methodologies might be more suited to achieving higher levels of both Project Stakeholder Collaboration and Digital Transformation Context, likely due to their inherent flexibility and iterative nature.

4.6.   CONCLUSIONS

This research examined the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. The literature review revealed a growing number of articles linking collaboration, project studies, and digital transformation, notably, qualitative

studies (Tronvoll et al., 2020; Warner & Wäger, 2019). However, few studies have investigated this relationship from a broader, quantitative perspective. Furthermore, by reaffirming the link between Project Stakeholder Collaboration and the Digital Transformation Context, it emphasizes the importance of shifting from traditional hierarchical structures to collaborative partnerships in order to advance digital transformation initiatives.

An exploratory and quantitative approach was selected, which collected online data from project professionals (413). Initially, the factorial structure of Project Stakeholder Collaboration was explored, and three interconnected dimensions were identified: (1) relational norms, (2) focus on shared outcomes, and (3) stakeholder engagement. A unidimensional model, focusing on a subset of professionals working within the Digital Transformation Context (305), was developed to characterize this context. While exploring the relationship between Project Stakeholder Collaboration and the Digital Transformation Context a significant positive correlation was revealed (Figure 4).

The relationship between Project Stakeholder Collaboration and the Digital Transformation Context is cyclical, with each fostering the advancement of the other. Without effective Project Stakeholder Collaboration, organizations cannot fully harness the potential of emerging technologies. By incorporating cutting-edge technologies into collaborative processes, companies uncover opportunities to accelerate innovation and deepen digital transformation. Collaboration enriches problem-solving by aggregating a variety of perspectives, thereby enhancing risk anticipation. Supported by intelligent data analysis, the benefits of collaborative projects are amplified. This synergy between Project Stakeholder Collaboration and the Digital Transformation Context cultivates a culture of continuous improvement and adaptability – both essential for thriving in the digital age.

Theoretical, practical, and methodological contributions are offered to the field of project studies. From a theoretical standpoint, three contributions are made. First, a novel scale for measuring Project Stakeholder Collaboration is introduced, which identifies three factors: relational norms, focus on shared outcomes, and stakeholder engagement. It emphasizes the multifaceted nature of collaboration and provides a foundational framework for future project studies research to explore the interplay between collaboration and various themes such as competencies and project success. The study also develops a concise, literature-derived scale to measure the Digital Transformation Context, which encompasses relevant elements

including alignment with digital strategy, commitment to continuous improvement, increased data utilization, adoption of digital technologies, digital competencies, and the implementation of smart products, services, or processes. The scale can be employed in studies that aim to enhance the understanding of this emerging phenomenon.

Second, it illuminates the relationship between Project Stakeholder Collaboration and the Digital Transformation Context, as empirical evidence supporting the argument that collaboration enables digital transformation is presented. However, it is also proposed that this relationship is synergetic, suggesting that higher degrees of Digital Transformation Context also promote enhanced Project Stakeholder Collaboration. This understanding of the bidirectional relationship between these two constructs offers a more comprehensive perspective on their interplay in organizational contexts.

Third, it suggests that organizations that adopt hybrid and agile project management approaches demonstrate higher levels of both Project Stakeholder Collaboration and the Digital Transformation Context. It posits that adaptability is crucial for professionals and organizations pursuing collaborative initiatives or digital transformation advancements. The inherent design of agile and hybrid project management, aimed at achieving valued outcomes through a more adaptable and iterative trajectory, aligns with collaborative initiatives that rely on committed parties to discuss and define the best way forward. It also supports advances in digital transformation by enabling projects to respond to rapidly evolving needs of consumers, technological advancements, and market competition effectively. The synergy between these flexible project management methodologies and the dynamic nature of the Digital Transformation Context and Project Stakeholder Collaboration underscores their potential to drive successful outcomes.

From a practical standpoint, two main contributions are offered. First, three critical factors that project professionals should prioritize in collaborative initiatives are revealed: focusing on shared outcomes, developing relational norms, and structuring stakeholder engagement practices. This approach provides project managers with a framework to improve Project Stakeholder Collaboration, potentially leading to more successful project outcomes and stronger relationships. Second, key variables that project organizations should focus on to advance their digital transformation journey are revealed: alignment with digital strategy, commitment to continuous improvement, increased data utilization, adoption of digital

technologies, development of the workforce's digital competencies, and implementation of smart products, services or processes. This approach emphasizes the importance of both strategic direction and bottom-up innovation for effective and data-driven digital transformation.

Additionally, it makes an important methodological contribution, by introducing procedures from psychology to the field of project studies. Rigorous scale development procedures were employed, utilizing EFA with a polychoric correlation matrix to assess relationships between ordinal non-normal items. The number of factors to retain was determined by using Parallel Analysis, which has demonstrated superior performance compared to Eigenvalue criterion. Furthermore, acknowledging the interconnected nature of collaborative factors, an oblique Promax rotation was adopted, which departs from the conventional orthogonal varimax approach. These choices represent an advancement in the analytical rigor applied to project studies research, potentially setting a new standard for future research.

This research acknowledges limitations in its scope and findings. Specifically, the findings are constrained by using a convenience sample rather than a target population. Although the invitation was disseminated via social media, the lead researcher observed higher response rates when contacting professionals directly, which may have introduced sample bias.

Another limitation relates to the questionnaire's design, which lacked descriptions for the key concepts under investigation. This omission could have resulted in varied interpretations among professionals with differing expertise in project management and digital transformation. Finally, a second data collection phase to perform a CFA on empirical models is not included. Consequently, the proposed factorial structure remains unconfirmed, which is also an opportunity for future research.

While this research offers meaningful theoretical and managerial contributions, several aspects of Project Stakeholder Collaboration within the Digital Transformation Context remain unexplored, presenting opportunities for future studies. From a quantitative perspective, the validated scale on Project Stakeholder Collaboration would have increased value by obtaining empirical data that links it to constructs such as project success, value creation, and psychological safety. Similarly, the validated scale addressing the Digital Transformation Context could be integrated into emerging research areas, including artificial intelligence, BIM development, and organizational readiness.

From a qualitative perspective, in-depth research could uncover nuanced aspects of Project Stakeholder Collaboration in the Digital Transformation Context. Such studies might shed light on common barriers, governance structures, or the longitudinal processes that underpin advancements in digital transformation.

5. STUDY 3 – ENHANCING PROJECT STAKEHOLDER COLLABORATION AND DIGITAL TRANSFORMATION SUCCESS: A QUALITATIVE STUDY

ABSTRACT

The systematic understanding of Project Stakeholder Collaboration and Digital Transformation Success can be further amplified, despite the crescent number of publications discussing the emergent digital context and its connection with collaboration among stakeholders. This research aims to describe the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success. A qualitative methodological approach directed data collection through 27 semi-structured interviews with project professionals. Project Stakeholder Collaboration (built on culture, formal collaborative practices, and shared value) and the Digital Transformation Success (characterized by dematerialization, a collaborative digital strategy, and digital competencies) are deeply interrelated, with digital transformation providing the environment for change where collaboration strives, and effective collaboration ensuring that a digital strategy drives technology and people towards shared purpose and delivers measurable value. As a main theoretical contribution, the study highlights the key points of connection between collaboration and digital transformation success, demonstrating how these constructs are interlinked and mutually influential. As a practical contribution, this study guides managers to move beyond task completion to delivering tangible outcomes using frameworks like Objectives and Key Results that align teams by translating vision into measurable results.

5.1.   INTRODUCTION

Digital transformation continually grows year after year, motivated by the development of new technologies, such as the recent wave of Generative Artificial Intelligence (GenAI) (Papadonikolaki et al., 2022; Ramakrishnan, 2024). This phenomenon immediately transforms the society we live in, organizations, and how professionals behave (Bonanomi et al., 2019; Vial, 2019). In an increasingly connected society, people use digital technologies to interact more frequently, and this intuitively presupposes more collaboration (Fitzgerald et al., 2013; Kapoor, 2022). The premise that more integration automatically leads to more collaboration is reflected in most academic research exploring the context of digital transformation (Camarinha-Matos et al., 2019; Koseoglu et al., 2019). Nevertheless, few studies empirically describe both phenomena (Paiva & Rabechini Jr., 2025; Papadonikolaki et al., 2019; Warner & Wäger, 2019) and are dedicated to substantiating this assertion with empirical evidence.

Although most studies argue that collaboration and digital transformation are interconnected and grow together, this positive relationship is conditional upon the existence of a series of social and managerial factors (Imran et al., 2021; Liu et al., 2024). While digital technologies are the elements that provide the integrative layer, these elements alone do not guarantee Digital Transformation Success or Project Stakeholder Collaboration; professionals and organizations competent and committed to the changes are essential (Morin & Romero-Torres, 2024; Rocha et al., 2021). Among other factors, organizations must foster a collaborative mindset capable of embedding technology within strategy and generating maximum value from it (Piccarozzi et al., 2024; Vial, 2019). Considering that effective collaboration is supported by a collaborative culture that values long term relationships, trust and transparency, this would be difficult to achieve unintentionally in an environment of rapid and potentially mechanical interactions (Nikulina et al., 2022; Papadonikolaki, 2018). Therefore, this study argues that to generate value from Digital Transformation organizations and professionals should reinforce their collaborative agency.

From a managerial perspective, collaboration requires active leadership to design and implement digital strategies, to structure flexible and decentralized governance and to select the appropriate project management approach to suit project context and outcomes (Diniz et al., 2024; Imran et al., 2021). In an environment of constant change, which characterizes digital

transformation, it is important that organizations commit to the strategic pathway maintaining agility and flexibility to reach subsidiary benefits and to timely apply changes when needed (Fitzgerald et al., 2013; Warner & Wäger, 2019). Strategy acts as a blueprint to govern project and portfolio management and to ensure efforts are aligned with broader business objectives, rather than isolated and task based (Gartner, 2022; Piccoli et al., 2024). Hybrid and agile project management are directed by guidelines that support continuous adaptation while focusing on the main objective (Nassereddine et al., 2022; Tronvoll et al., 2020). These approaches also champion team empowerment and regular input from end-users, who must assess deliverables and sway project decisions (Gartner, 2022; Meulen, 2024). Many projects within a transformation context are adequately suited by agile and hybrid management approaches (Warner & Wäger, 2019; Whitmore et al., 2020). Nevertheless, they are not universally applicable, since projects with a clearly defined scope, like civil construction or large-scale automation, can benefit from the concentrated application of a predictive approach (Morin & Romero-Torres, 2024; Sagarna Garcia & Pereira Jerez, 2019).

Stakeholder collaboration is motivated by shared values and outcomes, as key stakeholders must perceive the gains of participating in the project and that results would be limited if pursued individually (Gartner, 2022; Paiva & Rabechini Jr., 2025). To ensure that the project satisfies their needs, stakeholders must get involved in discussions and take part in project decisions (Cooper, 2024; Sagarna Garcia & Pereira Jerez, 2019). One of the primary challenges of digital transformation is value creation, as merely adopting technologies is insufficient (Imran et al., 2021; Warner & Wäger, 2019). Many digital transformation studies describe value creation as efficiency gains generated by the effective and well-applied adoption of technologies (S. Abdalla & Nakagawa, 2021; Gillani et al., 2024). Additionally, some digital transformation studies highlight the centrality of users and customers in the digital evolutionary process, improved by data usage and the ability to predict customer needs (Gillani et al., 2024; Kapoor, 2022). Therefore, this research aligns with studies that argue that digital transformation success and stakeholder collaboration are intertwined and positively connected (Tronvoll et al., 2020; Warner & Wäger, 2019).

Despite the crescent academic interest in digital transformation and the common linkage with stakeholder collaboration (Papadonikolaki et al., 2019; Warner & Wäger, 2019), few studies delve into these phenomena to investigate in detail how they occur and how they interrelate. Considering that collaboration has been recently characterized by the

interconnection of relational norms and formal integrative mechanisms (Nikulina et al., 2022), this study acknowledges this contribution and intends to build over it. Driven by the need to improve the understanding of collaboration, specifically linking it to the emergent digital transformation phenomenon, which constitutes a research gap, this investigation puts forward a research question to guide the empirical investigation. *How do formal collaborative practices and relational norms intermingle to foster Project Stakeholder Collaboration and drive Digital Transformation Success?*

From an exploratory and qualitative approach, this research aims to describe the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success. The study conducted 27 semi-structured interviews with project professionals from Brazil and Portugal with recognized experience in the developing and implementing projects in the context of digital transformation. The projects discussed in the interviews are the unit of analysis of this investigation, which enabled the development of two empirical and interrelated constructs - Project Stakeholder Collaboration and the Digital Transformation Success. Project Stakeholder Collaboration is supported by a collaborative culture; formal collaborative; and shared value creation and outcomes. Digital Transformation Success is based on dematerialization, collaborative digital strategy and digital competencies.

Among others, the main theoretical contribution of this investigation highlights the key points of connection between collaboration and digital transformation success, demonstrating how these constructs are interlinked and mutually influential. As a practical contribution, this study impels managers to deliver tangible outcomes using frameworks like Objectives and Key Results (OKRs) that make the strategical vision measurable and part of the operational routine by monitoring quantitative key results.

This paper is organized into six sections, including this introduction. The following section describes the background of literature with two distinct subsections. The third section describes the pragmatic and qualitative methodology selected for this investigation. Following, the fourth section describes both qualitative models for Project Stakeholder Collaboration and Digital Transformation Success. The fifth section discusses the results with three subsections, one describes the interrelation between the themes of Project Stakeholder Collaboration, another exposes the interrelation between the categories of Digital Transformation Success and

the last one connects both constructs. Finally, the sixth section establishes research conclusions, with theoretical and managerial contributions, limitations and future research opportunities.

5.2. BACKGROUND

5.2.1. PROJECT STAKEHOLDER COLLABORATION

The emergence of collaboration as a significant area of management studies can be traced back to the foundational work of Gray (1985). Gray's pioneering efforts established an interorganizational framework specifically designed to address complex problems. This collaborative process, often prompted by instances of uncertainty or crisis, necessitated the pooling of resources by two or more stakeholders to tackle challenges that exceeded the capacity of any single party (Bedwell et al., 2012; Gray, 1985).

Over the years, management studies identified various dimensions and processes that constitute collaboration. For example, Mattessich and Monsey (1992) outlined six key categories that influence collaboration success, emphasizing that synergistic efforts lead to outcomes of superior quality. Similarly, Bronstein (2002) contributed a methodologically developed scale to measure interdisciplinary collaboration, identifying five key dimensions including interdependence, newly created professional activities, flexibility, reflection on process, and collective goal ownership, a model later adapted for constructing a multidimensional scale to assess Project Stakeholder Collaboration (Study 2). Despite a lack of absolute consensus on constituent elements or terminology, these influential studies consistently share the understanding that collaboration involves diverse, committed stakeholders working together toward a specific shared outcome, necessitating formal and informal exchanges, and the development of relational norms such as trust and reciprocity (Huxham & Vangen, 2005; Mattessich & Monsey, 1992; Thomson et al., 2009).

Within project studies research, this centrality is translated into shared outcomes and benefits, implementing formal collaborative practices to guide common governance, and developing a relational infrastructure to strengthen stakeholder interdependence (Nikulina et al., 2022; Ogheri, Ahola, Locatelli, & Ståhle, 2025). Study 2 developed a scale to measure Project Stakeholder Collaboration, which this research adopts as a theoretical lens (Figure 5).
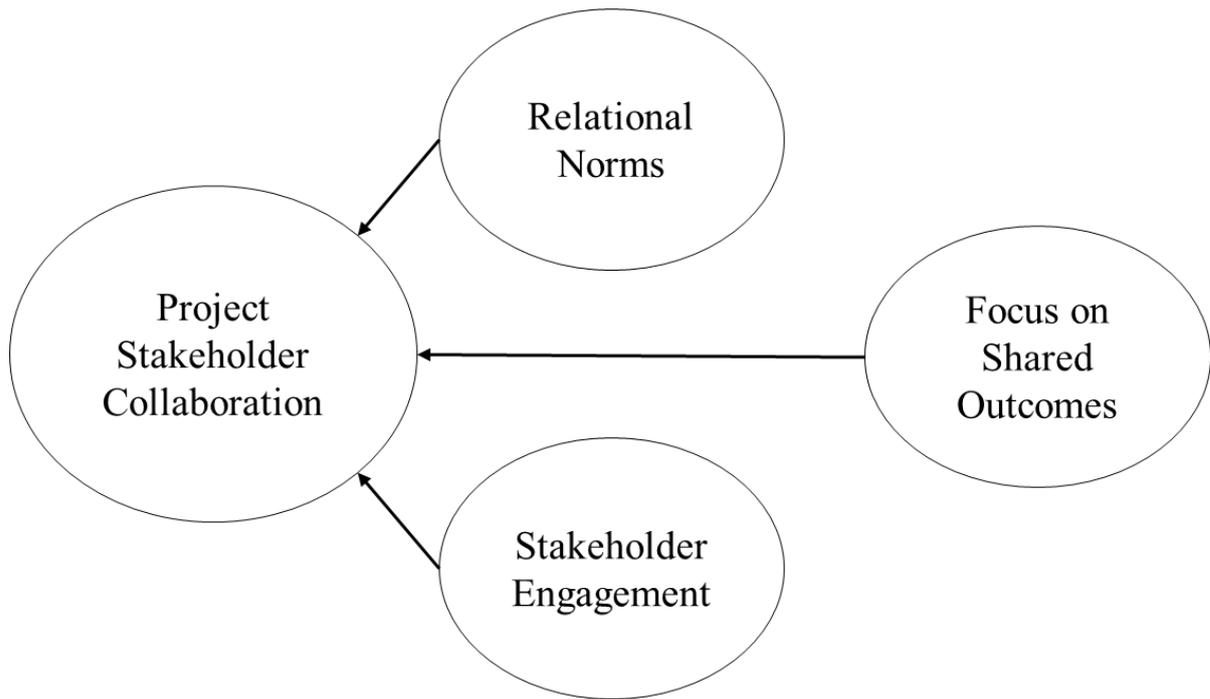
Figure 5 *Theoretical Model for Project Stakeholder Collaboration*

Source: developed by the author

The strategic foundation for effective stakeholder collaboration lies in adopting a value-centric perspective, compelling interdependent stakeholders to actively align on shared outcomes and benefits (Paiva & Rabechini Jr., 2025; PMI Germany, 2025). This view aligns with the novel perspective for project success, in which "a successful project is one that delivers value that is worth the effort and expense" (PMI, 2024). Project professionals do not simply manage scope, budget, and schedule but become strategic partners within their organization to create meaningful impact and deliver results for broader organizational objectives and that resonate with a wide range of stakeholders (Ogheri et al., 2025; PMI, 2025).

A positive collaborative environment, characterized by open communication, empathy, and mutual trust, is crucial for fostering successful joint activities and innovative outcomes in complex project settings (Abson et al., 2024; Suprapto et al., 2015). In such settings, stakeholders are encouraged to transcend formal roles and engage in flexible, results-driven teamwork, thereby overcoming friction and misalignment (Elwart & Carugo, 2020; Papadonikolaki, 2018). Relational attitudes, including a no-blame culture and transparency, create the necessary conditions for high-quality teamworking processes like coordination and mutual support (Abson et al., 2024; Imran et al., 2021). Trust is fundamental, acting as a key

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antecedent to the emergence of shared leadership, and must exist both among team members and between project teams and the wider organizational leadership to ensure individuals are willing to accept vulnerability and influence each other (Anshari & Hamdan, 2022; Diniz et al., 2024).

Collaboration thrives on collective ownership, requiring stakeholders to actively align on shared goals and assume joint accountability for the outcome, which moves success beyond mere task completion to holistic value delivery (Ali & Haapasalo, 2023; Warner & Wäger, 2019). Furthermore, discretionary behaviors such as helping spontaneously generate reciprocal obligations, acting as a hidden mechanism that influences social reality and demands that actors align their actions with the non-contractual status of giver or receiver of help (Klitgaard & Gottlieb, 2024). These relational dynamics are paramount because they enable project teams to achieve effective performance through coordination, communication, and affective trust, facilitating the management of formal collaborative practices (Nikulina et al., 2022; Tronvoll et al., 2020).

Smoothed by a culture that fosters collaboration, shared governance demands a shift from rigid processes toward adaptive, value-centric practices (Whitmore et al., 2020; Ylinen, 2021). Effective governance requires updating decision-making structures, which often move beyond traditional hierarchies toward models requiring consensus building (Tronvoll et al., 2020; Warner & Wäger, 2019). To address the intense pressure and dynamic complexity of modern projects, the adoption of agile and hybrid project management approaches has been highlighted, enabling teams to deliver solutions incrementally and respond quickly to change (PMI Germany, 2025; Tronvoll et al., 2020). These agile practices are critical tools for fostering collaboration by emphasizing iterative delivery, cross-functional teamwork, and incremental value delivery (Whitmore et al., 2020; Ylinen, 2021). They integrate prototyping and experimentation or "failing fast" as part of a learning mindset to overcome difficulties and innovate, which requires leaders to be tolerant of errors and encourage open-mindedness (Shojaei et al., 2022; Warner & Wäger, 2019).

Underpinning these technical frameworks, leadership is vital for establishing a supportive and nurturing environment, promoting transparency, and empowering employees to take on responsibility and ownership (Abson et al., 2024; Imran et al., 2021). This environment facilitates high-quality communication, as a cornerstone of project activity that must be open,

honest, and effective to reduce friction and build a trusting work environment (Aal, 2025; Nikulina et al., 2022). Finally, comprehensive stakeholder engagement and customer centricity align project delivery with strategic objectives and market needs, focusing on the goal of holistic value delivery rather than mere task completion, thereby ensuring that intended beneficiaries have a primary voice in defining success (Koseoglu et al., 2019; Paiva & Rabechini Jr., 2025).

Successful projects must deliver value that is worth the effort and expense, thereby moving success beyond mere task completion to holistic value delivery, which can be subjective and perceptual (PMI, 2024; Tronvoll et al., 2020). To assess alignment or discrepancies in value creation, a critical line of inquiry assesses the value subjectively perceived by end-users during output utilization (Ogheri et al., 2025; PMI, 2024). Effective collaboration requires proactively identifying and managing all relevant stakeholders, especially considering that the perception of end-users should carry more influence in the final determination of success, highlighting the importance of customer centricity (Paiva & Rabechini Jr., 2025; Sagarna Garcia & Pereira Jerez, 2019). This means integrating customer needs early into the project lifecycle to foster customer satisfaction, a highly relevant theme for determining project success (Imran et al., 2021; Tronvoll et al., 2020).

Furthermore, adaptive governance and execution are promoted with pilots, prototypes, and incremental delivery, which enable rapid validation and continuous adaptation (Warner & Wäger, 2019; Whitmore et al., 2020). These mechanisms help approximate projects and operation by reducing the commitment of extensive resources to uncertain ventures and allowing teams to "err small and correct fast" (PMI Germany, 2025; Warner & Wäger, 2019). To translate this value orientation into tangible results, measurement methodologies, such as OKRs and KPIs, enable continuous monitoring of the shared objectives through concrete, measurable and shared key-results (Fukuzawa et al., 2022; Ogheri et al., 2025).

5.2.2. DIGITAL TRANSFORMATION SUCCESS

Digital transformation has been regarded as an increasingly relevant phenomenon for both researchers and practitioners, fundamentally altering how society behaves, and how organizations and temporary organizations operate (Schwab, 2017; Whyte & Eshraghi, 2025). While the term is sometimes inconsistently used by leaders to describe various activities, digital

transformation is commonly defined as the adoption and integration of new digital technologies, such as AI, cloud computing, blockchain, and IoT, to enable deep business improvements (Piccoli et al., 2024; Warner & Wäger, 2019). This transformation involves significant advances to an organization's business model, professional workforce, organizational structures, or business processes (Fitzgerald et al., 2013; Gillani et al., 2024) (Figure 6).
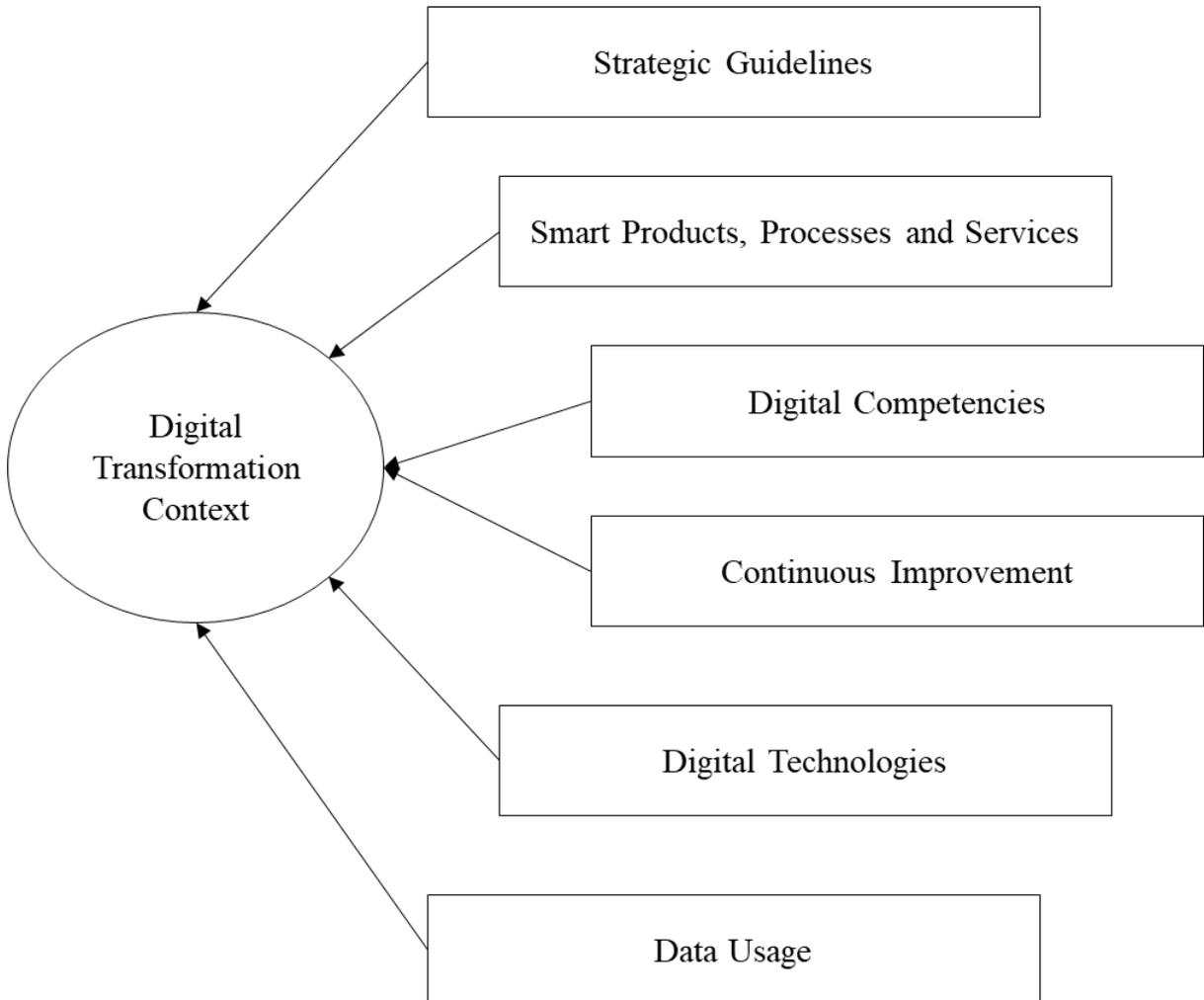
Figure 6 *Theoretical Model for the Digital Transformation Context*

Source: developed by the author in Study 2

When digital transformation is planned and driven by strategic decisions, new technologies and the abundance of data can maximize value creation to both organizations and their customers, improving customer experiences and maximizing business results (Piccoli et al., 2024; Warner & Wäger, 2019). Digital transformation is fundamentally a strategic

endeavor, not merely a technological one, requiring leadership to create value from innovations that optimize customer needs and experiences (Fitzgerald et al., 2013; Gillani et al., 2024). A sound digital strategy must act as a blueprint to govern the transformations arising from integrating digital technologies across operations, products, processes, and organizational aspects (Gillani et al., 2024; Warner & Wäger, 2019).

For instance, Tronvoll et al (2020) explains that a shipping company, Navarch, underwent a radical transformation in its self-perception, successfully redefining its identity as a "digital technology company" by pivoting its business model toward digital servitization and selling the outcomes of data analytics, moving beyond a product-centric mindset. Similarly, Warner and Wäger (2019) presented Drive, a company that refreshed its existing business model by strategically using digital platforms and mobile technology to introduce car-sharing services, thereby creating a supplementary multisided value proposition. Ultimately, this alignment ensures that the organization's digital transformation journey is an evolutionary process focused on continuous improvement.

Digital transformation produces smart processes, products, and services by strategically applying advanced digital technologies into regular analogic elements, fostering business improvements (Jiao et al., 2021; Porter & Heppelmann, 2014). The core mechanism involves embodying a digital thread throughout the product lifecycle, giving rise to smart and connected products that feature sensing, computing, and communication capabilities (Camarinha-Matos et al., 2019; Warner & Wäger, 2019). These smart products can communicate, convey customer needs, habits, and inspire the emergence of value-added business services (Jiao et al., 2021; Schwab, 2017). For example, Company W established a cloud-based IoT smart living platform focused on smart cities (Han & Trimi, 2022). This platform utilizes machine learning algorithms to predict dependent factors such as parking space availability, traffic flows, and pollution levels (Han & Trimi, 2022). This derived knowledge is then used to generate valuable recommendations, raise alarms, and inform municipalities, creating smart services based on real-time analytics (Han & Trimi, 2022).

The digital transformation journey is evolutionary and an ongoing commitment to strategic renewal, not a static destination, which makes continuous process improvement an essential element of this trajectory (Cooney et al., 2021; Piccoli et al., 2024). It requires organizations to focus on the transformation of products, processes, and organizational aspects,

demanding a continuous search for maximization of value (Gillani et al., 2024; Meng, 2019). Digital transformation is not simply implementing a solution to an inefficient process; if process improvement is planned and executed ahead automation can lead to increased value (Gillani et al., 2024; Whitmore et al., 2020). For example, Traganos et al (2021) described that the challenge of gaining a global overview of processes across all production areas was addressed by a management system encompassing all manufacturing processes. By modeling the processes, the system provided management with a systematic overview and real-time transparency, facilitating the detection of errors and systematic monitoring, thereby ensuring improved process management and quality (Traganos et al., 2021).

Digital technologies accelerate the organizational changes that are envisioned by digital strategy, even though the cultural and strategic challenges also need addressing (Andrade & Gonçalo, 2021; Gillani et al., 2024). Technologies like IoT, AI, cloud computing, and big data analytics enable major business improvements by incorporating digital capabilities - such as sensing, communication, and real-time data processing - into physical assets and business processes (Fitzgerald et al., 2013; Piccoli et al., 2024). The relevance of these tools is found in their ability to fuse together and transform entire systems, resulting in unprecedented speed of innovation and generating new, quantifiable value (Schwab, 2017; Tronvoll et al., 2020). For example, in industrial organizations, sensors connected to manufacturing equipment (IoT) provide real-time data on the product's operational status (Fukuzawa et al., 2022; Piccarozzi et al., 2024). Analyzing this continuous stream of data using AI allows the company to predict potential machinery failures and proactively offer condition-based monitoring services, thus transforming the business model from selling a product to selling the reliable outcome or utility of that product (Piccarozzi et al., 2024; Porter & Heppelmann, 2014).

Data is a central strategic asset in the digital transformation journey, which requires a transition toward data-centricity within organizations (Paiva & Rabechini Jr., 2025; Piccoli et al., 2024). The proliferation of technologies like IoT has caused a transformational shift from data scarcity to data abundance, as information is generated continuously and in real-time by sensors embedded in products and processes (Piccarozzi et al., 2024; Warner & Wäger, 2019). This massive and complex volume of data must be managed strategically and transformed into actionable insights via analytics and AI; the core challenge is utilizing this information to generate value, rather than merely storing it (Gillani et al., 2024; Rogers, 2016). For example, the industrial equipment manufacturer Navarch collected vast amounts of operational data from

its customers' fleets. Instead of selling the physical data itself, the firm strategically used predictive algorithms to analyze the information and provide valuable outcomes and insights, such as preemptive maintenance advice, thereby transforming its offerings into a core data-centric service (Tronvoll et al., 2020).

5.3. METHODOLOGY

This research is anchored in a pragmatic epistemology, which defines truth as what works in practice to solve a problem and accepts that there may be single or multiple realities open to empirical investigation (Brinkmann & Kvale, 2015; Saunders et al., 2019). To describe in detail the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success, a qualitative and exploratory methodological approach was used. This methodological choice is particularly suitable for describing *how* themes, concepts, and human experiences are understood, rather than quantifying them (Brinkmann & Kvale, 2015; Saunders et al., 2019). Specifically, the qualitative investigation was conducted through semi-structured interviews with project professionals working in the digital transformation context. This technique was chosen to help understand the Digital Transformation Success and Project Stakeholder Collaboration from the interviewee's own perspectives, thereby unfolding the meaning of their experiences and capturing diverse viewpoints.

Based on Brinkmann and Kvale (2015) and Bardin (2015), the methodological framework of this study was structured into six steps, as presented in Figure 7: (1) thematizing or defining the epistemological and methodological approach; (2) designing or planning empirical interventions and data analysis; (3) interviewing or collecting empirical data; (4) transcribing, processing empirical data and executing pre-analysis; (5) empirical data exploration, coding and categorization; and (6) treatment of results, inference, and interpretation.
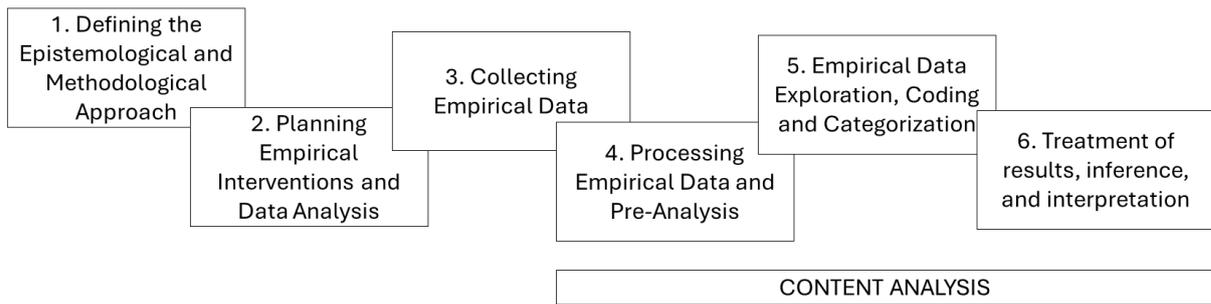
Figure 7 *Methodological Framework*

Source: Developed by the author, based on Brinkmann and Kvale (2015) and Bardin (2015)

This work is part of a larger research project that first identified a theoretical model to support empirical research on Project Stakeholder Collaboration and the Digital Transformation Success and then developed two empirical quantitative models to measure these constructs. To investigate differences between the theoretical and empirical models, this qualitative study adopts the framework of formal collaborative practices and relational norms proposed by Nikulina et al. (2022) to reveal specific nuances and deepen the understanding of how formal collaborative practices and relational norms intermingle to foster Project Stakeholder Collaboration within the Digital Transformation Success.

Considering that collaboration is a subject matter that concerns aspects of human experience (Brinkmann & Kvale, 2015), this research planned empirical interventions and data analysis, choosing to organize semi-structured interviews with Brazilian and Portuguese project professionals that had significant experience in the digital transformation environment (step 2). The intention was to understand themes of the Digital Transformation Success and Project Stakeholder Collaboration from the interviewee's own perspectives (Brinkmann & Kvale, 2015). An interview guide was developed and shared in advance with the invited participants (APPENDIX 4 – STUDY 3 - INTERVIEW GUIDE).

The empirical data was collected in 27 semi-structured interviews with project professionals with previous experience working in digital transformation (step 3). Data collection took place from December/2024 to February/2025, mostly performed virtually due to the recording and logistics facility. Table 16 presents the profile of interviewees, the project they described, and exhibits the interview's duration.

Table 16: Profile of Project Professionals with Experience in Digital Transformation

Interview	Sector	Country	Project	Experience (Years)	Duration (minutes)
I01	Government	Brazil	Centralized digital services	12	49
I02	Third Sector	Portugal	Systemic maps	25	51
I03	IT	Portugal	Smart parking	33	39
I04	IT	Portugal	Smart city 5g communications	33	44
I05	Civil Construction	Brazil	Bim projects	13	78
I06	Manufacturing	Portugal	Electric cars battery	25	30
I07	IT	Portugal	Quantum computing	50	51
I08	IT Startup	Portugal	Smart gym	12	62
I09	IT	Portugal	Hr automatization	25	59
I10	IT	Brazil	Digital Communication in Civil Construction	13	71
I11	IT	Portugal	Global purchase system	25	73
I12	Government	Brazil	Paperless administration	20	53
I13	IT	Portugal	Erp implementation	20	36
I14	Government	Brazil	Public wi-fi integrated login	20	84
I15	Government	Portugal	Smart transport ticket	16	50
I16	Government	Brazil	Smart environment monitoring	18	72
I17	Manufacturing	Portugal	Steer-by-Wire	14	62
I18	Government	Brazil	Plain Language in Judicial Decisions	15	68
I19	IT	Portugal	Hr success factor	20	44
I20	Telecomm	Brazil	Telecomm digital user experience	30	49
I21	Government	Brazil	HR chatbot	25	74
I22	Government	Brazil	Digital auditing input	18	68
I23	Consulting	Brazil	Trucks digital services	13	77
I24	Banking	Brazil	Reuse of Digital Features	21	48
I25	Government	Portugal	Municipal digital modernization	28	63
I26	Government	Brazil	Chat tribunal	18	53
I27	Government	Portugal	Creative city digital projects	19	42

Source: developed by the author

The study employed the qualitative software MaxQDA to register initial transcriptions, which were then carefully read and adjusted for minor inaccuracies. By transcribing empirical data, this research processed it and carried out pre-analysis (step 4). Transcription began concurrently with data collection, which allowed adjustments to the interview guide. APPENDIX 5 – EXAMPLE OF TRANSCRIPTS (INTERVIEW 6) and APPENDIX 6 – EXAMPLE OF TRANSCRIPTS (INTERVIEW 24) show two examples of these transcripts (from I6 and I24). Taking the necessary time to manually transcribe the data allowed researchers to explore it, to delve into the rich content described by each interview and to carry out pre-analysis (Bardin, 2015). Considering that the overall meaning of the interviews converged with the scales proposed in Study 2, this research opted to employ the quantitative items for Project Stakeholder Collaboration and Digital Transformation Success as theoretical codes, deductively defined, to which assign the highlighted unit of analysis.

The empirical data exploration commenced in MaxQDA, where interview transcripts were analyzed and coded (step 5). During this process, relevant fragments were identified as units of analysis, transforming raw data into an organized dataset. The coding process was iterative: researchers first attempted to assign units to established theoretical codes (Bardin, 2015). If a unit could not be assigned, a new emergent code was inductively created, or an existing theoretical code was broadened to accommodate the new perspective. Finally, to ensure consistency before categorization, all codes were reviewed against their corresponding meaning.

The process of categorization was central to the exploration of the material, aiming to transform the long list of codes into an organized and meaningful system that revealed the cores of meaning of the Project Stakeholder Collaboration and the Digital Transformation Success. This analysis employed a mixed methodological approach, specifically iterating between inductive (a posteriori) and deductive (a priori) methods. The categorization began deductively with fitting codes into the existing theoretical dimensions. This deductive fitting utilized the broad established framework of formal collaborative practices and relational norms proposed by Nikulina et al. (2022), and specifically the items developed in Study 2. The deductive categorization process was iteratively changed inductively to find improved categories that fit

the whole coding system. Therefore, supported by a pragmatic epistemology, categorization comprised deductive and inductive analysis (step 5).

The final step of the analysis (step 6), dedicated to the treatment of results, inference, and interpretation, transformed raw data into meaningful knowledge. Initially, the treatment of results consolidated the findings from the exploratory phase through the development of summary tables and conceptual diagrams, which allowed for a clear visualization of the categories and relationship between them. Subsequently, the inference process was kept controlled, focusing on direct and less in-depth deductions, thereby serving as a logical bridge to interpretation. During interpretation, the study analyzed the qualitative findings with the theoretical framework from Study 2. It explored the themes of Project Stakeholder Collaboration and Digital Transformation Success.

5.4. RESULTS

This investigation aims to describe how formal collaborative practices and relational norms associate to foster Project Stakeholder Collaboration and to drive Digital Transformation Success. As key findings, the study successfully identified two interconnected models: one describing Project Stakeholder Collaboration and another outlining the Digital Transformation Success.

5.4.1. PROJECT STAKEHOLDER COLLABORATION

The proposed model is structured across three interconnected themes that map the path from foundational culture to tangible results. It begins with the human and cultural aspects, which establishes relational foundation, a collaborative mindset, and key behaviors. It enrichens the comprehension of the relational norms factor developed in Study 2. Building upon this cultural structure, the formal collaborative practices theme outlines the practical aspects of collaboration, detailing the concrete governance structures, engagement strategies, and operational tools used to facilitate the work. Also, it amplifies the understanding of the stakeholder engagement factor of Study 2, adding other formal collaborative practices supporting Project Stakeholder Collaboration. Finally, the effective integration of the human and practical dimensions culminates in the theme of value creation and outcomes, which captures the ultimate purpose of the collaboration by measuring the shared value and successful

results generated for all stakeholders (Figure 8). It deepens the comprehension of the focus on shared value factor of Study 2, presenting other aspects discussed in the interviews.

PROJECT STAKEHOLDER COLLABORATION

Collaborative Culture

Relational Foundation
- Trust
- Empathy
- Transparency
- Interpersonal relationships
- Positive environment

Collaborative Mindset
- Shared vision
- Continuous learning
- Knowledge sharing
- Commitment to collective success
- Experimentation

Key Behaviors
- Ownership
- Resilience
- Frequent and free communication
- Feedback

Formal Collaborative Practices

Leadership and Governance
- Effective leadership
- Agile and predictive project management approaches
- Decision-making

Stakeholder Engagement
- Early identification of stakeholders
- Regular meetings and information sharing
- Ensuring top management support
- Customer participation

Execution and Tools
- Coordination of tasks
- Agility
- Pilots, prototypes and incremental delivery
- Digital tools

Shared Value Creation and Outcomes
- Tangible outcomes and value creation for organizations
- Value-creation for customers and end-users
- Mutual benefits for stakeholders
- Measurable shared outcomes

Figure 8 *Proposed Model for Project Stakeholder Collaboration*

Source: developed by the author

Project Stakeholder Collaboration is a multifaceted construct, represented by three central and interconnected themes: collaborative culture, formal collaborative practices, and shared value creation and outcomes.

5.4.1.1. COLLABORATIVE CULTURE

The collaborative culture theme serves as the foundational pillar of the Project Stakeholder Collaboration model, composed of three distinct yet interconnected categories: relational foundation, collaborative mindset and key behaviors.

5.4.1.1.1. RELATIONAL FOUNDATION

The relational foundation is grounded in fundamental human values like trust, empathy, and transparency. These values foster strong interpersonal relationships and create a positive environment where team members feel safe and valued.

Trust is the foundation of any meaningful relationship, as it allows people to rely on one another, share transparently, and collaborate with confidence. When trust is present, individuals feel safe to take risks, express ideas, and grow together. I6 expresses how trust relates to safe environments where people take risks and sometimes make mistakes: *"Anything related to fear must be avoided. People should be allowed to make mistakes. It's all about trust. These behaviors are linked to how people carry themselves, whether they are leaders or not."* It could be undermined by unfulfilled promises, evasive responses, or unclear communication about challenges, as mentioned by I10: **"***The team needs to be aware of the problems, because if they are not, they can feel deceived. Transparency is fundamental to guaranteeing trust at all levels of project management***".**

Empathy is the ability to understand and care for the feelings of others. It creates deeper connections by fostering compassion and respect. In professional settings, empathy helps build inclusive environments where everyone feels seen and valued. I17 describes how to create a positive culture in the team: *"Within a specific team, it's possible to cultivate a culture of open and positive communication, active listening, mindfulness, and empathy."* It involves actively listening to others' perspectives to identify their needs and motivations, as voiced by I8: **"***I try my best to put myself in my client's shoes. It's about trying to understand how their daily life is, what their personality is like, and what motivates them***".

Transparency means being honest, open, and clear in communication and actions. It builds credibility and reduces misunderstandings. When people are transparent, they create a culture of accountability and mutual respect. I17 expresses his beliefs about transparency: *"No matter how tough it is, I never withhold information from my teams. If I am dealing with an issue, I'm transparent about the reason for my actions. This has fostered significant team loyalty, which is critical for us to work together effectively."* I14 describes how they bring stakeholders closer by sharing difficulties and asking for help: *"Saying to the stakeholders, 'Look, I'm having such and such a problem. Couldn't we perhaps broaden the project to address this issue? What do you think about us placing this person even closer to you?' I think it brings them inside. It gives them news, it gives transparency."*

Cultivating interpersonal relationships and fostering human connection, especially through in-person interactions, is crucial for strengthening team bonds and promoting a safe environment where people feel at ease expressing opinions and even disagreeing constructively. I7 argues: *"It's important for people to get to know each other better, because in remote interaction, the tendency is to be more tense and demanding. When someone meets face-to-face, or has already had a beer together, there's a better understanding. Responses are no longer rough and unreflective; one perceives a context there. It normally works well."*

Creating a positive environment is essential for the development of an effective collaborative culture in project management. This environment is demonstrated by a relaxed climate and the promotion of employee welfare, which incentivizes them to feel integrated and valued. I4 underscores the importance of attending to people's well-being through the creation of spaces for socializing and by providing flexibility to enhance their quality of life: *"I'm very concerned with the well-being of others. It is crucial to perceive body language to understand the person. We now have additional space for this Christmas; we opened a lounge area [...]. We created it for people's well-being. We can´t compete with the industry in terms of higher or even equivalent salaries. Therefore, we must give people alternatives, be it well-being or flexibility in all things, such as hours and ways of participating."* I3 stresses the necessity of giving team members time for social interaction and mutual acquaintance, even outside of a strictly professional context, to fortify bonds and alleviate tension: *"We encourage our teams to meet periodically in the same workspace, not just for project work but also for social activities like lunch or sports. I believe that enabling people to build relationships outside of a purely professional context is a key differentiator, as it fosters a deeper sense of closeness and connection."*

5.4.1.1.2. COLLABORATIVE MINDSET

Building upon the relational foundation, the collaborative mindset represents the shared cognitive framework that fosters a unified direction through shared vision, continuous learning mindset, shared knowledge, experimentation. Stakeholders are committed to collective success and willing to sacrifice some autonomy for the shared outcomes.

Shared vision means that all project participants are committed to a unified direction, deeply understanding the collective objectives and the broader impact of the project on the

entire organization, rather than solely focusing on their individual tasks. This approach cultivates a sense of 'shared construction' where every stakeholder feels a personal investment and responsibility for the project's success. I19 corroborates this finding: *"I think it's about sharing the vision. Everyone needs to be very clear on the objective, on where we want to go and what impact that will have on the organization. I've noticed that when people buy in and understand the importance of their work, they perform in a completely different way than when you just say to them: 'Do this activity. Go from A to B,' without them having any context for why they're doing it or the importance it holds."* It moves beyond mere task execution to a collective understanding of why the work is being done and what value it aims to deliver, thereby aligning efforts and motivations. I3 states his belief in projects that genuinely improve clients' businesses: *"No one destroys what they helped to build. The moment they feel the project belongs to them; they show an intention to collaborate. If the project is just something their boss imposed on them, it doesn't work. But the moment they feel and perceive the value the project brings to the organization, the contribution they can make, and the added value they bring—that's when everything changes.*

Continuous learning mindset is nurtured through consistent knowledge sharing, training initiatives, and open dialogues about both successes and failures. This mindset necessitates humility, an open approach to new ideas, and adaptability to technological advancements and evolving project contexts. I23 *"Everyone who participated also learned something new. The entire cycle—from idea and project to squad formation, prioritizing projects, investment, and reinvestment—worked out well because everyone wanted to learn something new. They wanted to be relevant, to deliver something meaningful to the company, and in turn, to become relevant themselves through successful projects. People realize that the moment they start teaching, they begin to learn. And the collective pool of knowledge grows much larger the more collaborative you are."* It is fundamental for growth and innovation. I6 emphasizes: *"Teams need to be competent, but not necessarily to do the same thing, because the world and challenges are changing. Learning and embracing other challenges without fear and understanding errors as a path to innovation are important."*

Knowledge sharing enables teams to continuously improve solutions and adapt to new challenges. Organizations foster this through various mechanisms, including formal online and in-person training sessions covering technical skills, service quality, and even negotiation. I8 states: *"We do our best to prevent people from working in isolation. Instead, we try to have*

people with diverse backgrounds and experiences involved in the work. This is rooted in our strong focus on quality control, which includes code reviews, a formal testing process, and peer programming. In other words, working on a project is not a solitary act - it's also a learning experience". Regular meetings to share experiences have enhanced collaboration, as argued by I18: "*We established bi-weekly sessions, each led by a different project manager who would 'share a lesson'. We used the key learnings from their own projects as the material for them to teach the rest of the team. This approach significantly enhanced collaboration during that period.*"

Commitment to collective success is essential to producing creative solutions, even if the means sacrificing some autonomy for the shared outcomes. In dynamic landscapes, it involves questioning bureaucratic limits and conventional methods, as explained by I12: "*The new President used the SEI (Electronic Information System) to sign a document and requested it be rolled out to the entire government. He didn't know what he really wanted. He thought he requested an improvement to an administrative procedure, but we worked on digitalizing the administration, with a primary focus on the citizen*". Projects implemented in the digital transformation context often involve extensive negotiation, where parties make concessions to achieve common goals, especially when integrating different organizational bodies or functions. I12 emphasized "*It's also a matter of unity, of knowing that my work is not more important than that of others, of listening to diverse opinions. We are talking about a team, and diverse teams will have diverse opinions.*". Similarly, I24 described "*Dependencies arise when I depend on someone to build something for me to deliver my product. We have a method for that, which we call 'engagements'. How does it work? The bank works in quarterly releases, and for each release, you must deliver a KR (Key-Result). So, if I have a dependency, I'll start negotiating with that team right away; I'll open an 'engagement' and allocate hours for them to develop it. Then, that team either accepts or rejects this engagement.*"

Experimentation and the belief that failure is a step for improvement is a mindset that encourages an environment where errors are quickly corrected, mistakes are learned from, and solutions are iteratively tested through pilots, prototypes, and incremental deliveries. I18 argues: "*I realize I can get real collaboration from a partner when I see they are open to new things, when they tolerate mistakes. Because new things involve a lot of mistakes.* This approach minimizes blaming and instead focuses on process review and continuous enhancement. I14 advocates: "*Professionals must err fast and correct fast; I sometimes intentionally provoke 'no-*

go' situations during homologation phases to encourage teams to reflect on their time management and seek improvements."

5.4.1.1.3. KEY BEHAVIORS

The collaborative mindset and relational foundation are translated into tangible actions within the key behaviors, which includes the observable habits - such as ownership, resilience, frequent and free communication and the belief that feedback improve formal collaborative practices and relationships – bringing the collaborative culture to life in the daily project environment.

Ownership is critical for fostering autonomy and proactive engagement, encouraging professionals to take full responsibility for their tasks, and ensuring transparency in progress and deliverables. This behavior is linked to pride in one's work and a willingness to transparently address challenges rather than hide them, thereby strengthening trust and collaborative spirit within the team. I4 describes this: *"Any professional needs a core characteristic. That main characteristic is to have professional pride in your work. This means doing whatever you do to the best of your ability, no matter the profession, and that's what truly makes a difference. Proactivity is also key because it shows that partners are willing to collaborate. When it comes to copromotional projects, we deal with partners who we must be the ones to reach out and invite them, and there are others who take the initiative."* When individuals feel empowered to own their work and make decisions within their scope, they become more invested, responsive, and accountable. I13 states: *"It's about putting everything in its proper place and making it clear to people what each of them must do. But with autonomy, because I'm a firm believer in the principle of 'maximum responsibility, and maximum freedom.' So, people have the autonomy, but they also have the responsibility that comes with it."*

Resilience involves adapting to new challenges, being flexible, and maintaining an open mind toward continuous change. This includes being open to working outside one's defined role and adjusting to evolving contexts and new technologies. I27 argues that *"I think you need a certain degree of openness and some intelligence to be humble enough to say, 'I know nothing about this, but I'm going to try.' Someone like me, who doesn't come from a tech background, must be very open to understanding. You don't have to grasp everything, but you do have to be very open to learning. You have to be willing, and you have to really dedicate*

yourself to understanding the technology itself." It is important that individuals are critical enough to alter their own working methods in pursuit of a common objective. I9 corroborates this understanding: *"Change is a constant risk that must be embraced naturally. Organizations are becoming more self-critical and thus better prepared to adapt and change"*.

Communicating frequently and freely fosters an environment of transparency and mutual understanding. I2 argues that: *"Active and deep listening, where individuals strive to understand not just words but also the context, emotions, and background of others, is crucial for creating a safe, fun, and light environment for people to exchange and disagree healthily"*. Clear, honest, and continuous dialogue, whether formal or informal, is fundamental for sharing visions, managing expectations, and ensuring that all stakeholders feel empowered to contribute to their perspectives, leading to better outcomes. I4 adds that collaboration is not possible without communication and interaction: *"There is only collaboration if there is interaction. If people are not responsive, collaboration is not possible. This also entails not hiding problems and a willingness to talk and try to understand others to adjust situations."*

Giving feedback fosters continuous learning, allows for the swift correction of errors, and drives innovation within projects. I26 explains: *"I hold feedback meetings with the whole team—permanent staff, contractors, everyone involved. And it's not just a one-way street; I also ask for feedback on my performance and anything they feel needs to change"*. When feedback is provided constructively and openly, it helps prevent issues from escalating. I6 states this: *"Open criticism from leaders should be moderated or avoided, especially when it's aggressive and teams are immature. Otherwise, you simply kill innovation."*

5.4.1.2. FORMAL COLLABORATIVE PRACTICES

The theme of formal collaborative practices represents the practical dimension of the model, operationalized through three categories that cascade from strategic oversight to daily execution: leadership and governance, stakeholder engagement and executions and tools.

5.4.1.2.1. LEADERSHIP AND GOVERNANCE

The leadership and governance establishes the project's formal framework, defining effective leadership, agile and predictive project management approaches, and decision-making to ensure governance and strategic alignment.

Effective leadership is expected to provide clear vision, guidance, and support, while also mediating conflicts and enabling their teams to perform effectively. They should focus on inspiring enthusiasm and removing impediments. I7 *"Leadership should keep perspectives open, discuss different approaches, and then conclude. Empathy and visionary leadership are fundamental. A clear vision of what you want to achieve is crucial, as it allows you to persuade others to align with that vision."* A leader's ability to transition collaboration from informal interactions to formal planning is also important. It is vital for leaders to avoid aggressive criticism, particularly with less experienced teams, as this can hinder innovation. Ideally, a good leader empowers their team to the extent that direct intervention becomes unnecessary, fostering autonomy and responsibility. I17 argues: "*A leader has three main roles, whether they are the project manager or not: coach, decision-maker, or expert. Depending on the timing and the type of decision, one of these roles must be employed.*"

Agile and predictive project management approaches promotes stakeholder collaboration, with the selection largely depending on the project's characteristics and context. Agile methodologies, known for their short cycles (sprints), rapid responses, and adaptability, are favored for projects marked by high uncertainty and swift changes, such as frontend developments or broader digital transformation initiatives. This approach prioritizes continuous feedback and adjustments. I20 expresses his experience: *"Take the issue of transforming the customer experience within an app. The traditional (predictive) methodology isn't a good fit because the customer experience is constantly changing, and the competitive landscape is constantly changing."* In contrast, predictive approaches, with structured and detailed planning, are more appropriate for stable projects like Enterprise Resource Planning (ERP) and construction projects where requirements are clearly defined from the outset. I11 argues "*We implemented ERP to run the Backoffice, and in these projects we adopted a waterfall (predictive) approach. For projects related to the frontend, it was only scrum. There was no way to use waterfall because it's a much faster business. The cycles are fast, requiring changes based on what competitors launch*".

Decision-making should be agile, guiding projects toward delivering shared value, particularly in complex environments with diverse stakeholders. This necessitates a structured approach that incorporates multiple perspectives, aims for consensus, and clearly defines roles and responsibilities. I13 summarizes this: *""From the outset of the projects, we defined the various management layers that the project has within the governance model."* Critically,

identifying the pros, cons, risks, and timelines for various alternatives is vital before making any crucial decision. I8 explains how they make decisions in the startup: "*I try to instill this mindset in everyone I work with: 'What do you think? What makes sense?' It's about having a discussion to try and find a solution, but often it's not possible to find a uniform solution. When it's not uniform, there must be someone with the responsibility to make the decision based on what has been discussed*".

5.4.1.2.2. STAKEHOLDER ENGAGEMENT

Building on the strategic structure for leadership and governance, stakeholder engagement details the systematic processes for actively involving and maintaining dialogue with all relevant parties, ensuring that information flows effectively and key players remain committed and engaged. It encompasses identifying key stakeholders from the beginning, organizing frequent meetings and sharing relevant information, ensuring top management support and assuring that customers participate in project discussions.

Identifying key project stakeholders from the beginning ensures alignment and involves mapping diverse individuals and groups to understand what they need and how to involve them in the decision-making processes. I2 states *"You must consider the diversity of people involved in the project. Stakeholder mapping is essential to bring the most relevant parties to the table."* This initial phase also entails clearly defining stakeholder involvement in contracts and establishing escalation rules for unresolved issues. It is during this early stage that uncommitted individuals, particularly those at top management levels, must be identified and actively won over to prevent future project derailment. I13 reaffirms: *"The worst scenario is uncommitted top management. If they aren't committed, their teams won't be either. This must be identified and discussed from the outset in the project's steering committees, particularly on large projects, to identify those people and bring them into the fold."*

Organizing regular meetings and registering information for sharing supports the communication flow. Meetings serve as relevant forums for reporting developments, gathering contributions from internal and external clients, and making important decisions, thereby maintaining project cadence. I26 reports their formal collaborative practices: *"We adopt daily meetings and every day we get together for 15 minutes. Sometimes people get excited and stretch it for an hour. It is an agile practice, which was meant to be done standing up, but we*

do it on the computer.” By sharing relevant information, projects contribute to aligning stakeholders with decisions, making them accountable and committed to project success. I19 mentions that documented information is made widely accessible. *“For large projects, we have a monthly newsletter that presents the latest developments. It summarizes what happened in that period, what improvements we implemented, and this is beneficial because even those who didn't participate in the meetings, have a summary of what happened”.*

Ensuring top management support must be priority for project leaders, as their buy-in is directly linked to a project's potential for success and utilization. Top management must be convinced of the added value of new technologies and understand the strategic imperative for change, as their lack of commitment can undermine the efforts of other teams. This is clearly highlighted by I1: *“It's essential that the leadership - whether it's the Secretary or the President of the entity - is aligned with the project, because without that, the combined efforts of our team are at risk of being wasted, as the service may fail to be adopted.”* This requires frequent and consistent communication, through regular meetings, workshops, and open status updates, to keep the project agenda visible and secure their ongoing sponsorship and support. I6 summarizes this: *“Engagement efforts must be constant. You must always reach out and stay present.”*

Customers must participate in project discussions to implement solutions that are grounded in real needs and ensure that initiatives deliver value, are adopted by users, and contribute to long-term organizational success. Understanding and addressing the clients' actual needs and pains is critical to developing solutions that will be utilized and appreciated. I8 argues: *“The ideal approach is to always identify the customers' problem before proposing solutions, because sometimes they don't even have a problem and just want something because a competitor has it. It's necessary to truly understand the problem for the solution to make sense.”* Without this direct involvement, there is a significant risk that projects, even if technically sound, will fail to meet user expectations or face cultural resistance, leading to wasted effort and underused solutions. I22 explains how they developed a digital tool with the help of the engineers who would use it: *“They are civil engineers who ultimately specialize in the oversight of these kinds of contracts. This is the team that uses the tool to analyze project's execution. The concept was developed collaboratively: they established the rules while one of our teams handled the programming, and the digital auditing division also joined the effort to help coordinate the project.”*

5.4.1.2.3. EXECUTION AND TOOLS

Execution and tools addresses tactical, on-the-ground activities, encompassing the specific methods for coordinating tasks, agility, using pilots, prototypes and incremental delivery to facilitate project implementation and the use of digital tools to facilitate communication and project management.

Coordination of tasks involves clearly defining roles and responsibilities to ensure that everyone understands their contribution to the collective objective. As I2 states: *"It's crucial to define which is the RACI Matrix (Responsible, Accountable, Consulted, and Informed Matrix), what are the roles and responsibilities of those involved in a certain project and what is our understanding of the problem. Thorough initial understanding of the problem and objectives, along with defined responsibilities, makes project management easier later."* Regular monitoring through reports and 'traffic light' indicators also facilitate coordination and allows for timely adjustments. Leaders, acting as 'maestros', are vital in orchestrating this coordination, ensuring a holistic understanding of what is happening, anticipating problems, and facilitating decision-making, particularly when consensus is elusive. I20 *"Once you have any reasonable performance indicators—and each company has its own methodology for them—you start to get a clear sense of direction as to whether or not the results are achieved and if they are within the originally predicted timeframe."*

Agility is achieved through adaptable processes, rapid decision-making, and swift redirection of efforts. I6 emphasizes *"Speed is everything in innovation cycles, covering design, prototyping, and certification, to quickly bring solutions to market. The cycle of experimentation and rapid execution with cross-functional teams is designed to achieve agility. I'm a strong advocate for deciding quickly, without procrastinating or going in circles in search of the 'perfect' solution, as delays are counterproductive. I prefer to decide and, if it goes wrong, change course and try something else."* In the digital era, the focus has shifted from long, sequential project cycles to quickly validating value and feasibility to avoid expending time and effort on unviable initiatives. This agility is a key driver for shared decisions and outcomes in dynamic environments. I24 stresses *"Nothing needs to be perfect and finished for implementation; the priority is quick validation of value. Cycles are very short and very different now. In the past, when we worked with project management, a project at the bank would very commonly take one, two, or three years. It was sequential and long because you*

went into detail on things; you had to document everything very well. But now, those things don't have as much value because what you want is a quick response".

The use of pilots, prototypes and incremental delivery enables rapid validation, mitigating risks, and fostering continuous adaptation. This approach minimizes the commitment of extensive resources to uncertain ventures, as explained by I3: "*When there's a high degree of uncertainty, we recommend that our clients build an MVP (Minimum Viable Products). This allows us to take a smaller step and validate that we're on the right track".* Interviewees highlighted the importance of testing techniques and choosing the best one, even with prototypes in pursuit of excellence. I6 highlights this iterative process: "*Sometimes we just use prototypes or a PowerPoint to explain the product, because the risk and investment of building the wrong thing are too high. So yes, there is an experimentation phase*". Furthermore, incremental deliveries, such as 'small sprints' or 'quick wins', serve to segment projects, allowing for early exposure to the end-user and gathering feedback, which is important for maintaining the team's enthusiasm and ensuring top decision-makers remain aligned. I8 describes their plans: "*The objective is to go to market—to this specific gym—and pilot the model as quickly as possible, to get the gym to start using this application. From the moment the model is tested, we'll begin to look at expanding the product to other gyms and other customers".*

Digital tools enhance project management by improving communication, coordination, and tracking across dispersed teams. Tools such as Trello, Jira, DevOps, GitHub, and EPM systems (Enterprise Project Management) provide centralized platforms for shared task management, progress monitoring, and document repositories. These tools facilitate the standardization of formal collaborative practices, improve reporting, and enable quicker identification and resolution of problems. I19 states: "*We have a series of new tools for test automation, which require a keen eye from the project manager, because it can reduce time.*" Furthermore, digital communication platforms like Teams, Zoom, Slack, and WhatsApp enhance frequent and clear communication among stakeholders, overcoming geographical barriers and enabling real-time collaboration. I11 corroborates this view: "*Nowadays it's a lot easier because of messaging channels like Skype, WhatsApp, or Teams. If someone needs something, they just ping the person and solve the problem right away. Back in the day, when I started working, we had to rely on the phone or face-to-face contact. We'd have to schedule a meeting to get things sorted".*

5.4.1.3. SHARED VALUE CREATION AND OUTCOMES

The theme of shared value creation and outcomes captures the tangible and multi-faceted results that arise when the human and practical dimensions are effectively integrated. Tangible outcomes are delivered to organizations, value is created for organizations, customers and end-users, and overall stakeholders mutually benefit from the project. Shared outcomes must be measurable to systematically monitor project progress and the delivery of benefits.

Tangible outcomes and value creation are delivered to organizations such as increased sales, achieving cost savings, or improving service quality, ensuring that technology investments translate into tangible business improvements. I3 *"I believe in projects that improve our clients' businesses. It might be because they'll increase their revenue, because they'll achieve cost savings, or because the service they provide to their own customers will improve in quality: With this technology, you will be able to sell x percent more, you will save this amount of money, or you will provide a higher quality of service to your customers."* One example is the digital platform implemented by the Brazilian federal government, as told by I12: *"Implementing a single sign-on was a strategic bet for us, because it is impractical for users to manage multiple logins. What we didn't foresee was how quickly it would scale. Today, we have approximately 100 million registered users, reaching the system integration with the private sector. It has become the standard for digital signatures."*

Value-creation for customers and end-users directly drives the adoption, value realization, and long-term success of the initiatives. Identifying and addressing the client's core problems, or 'pains', is essential for developing solutions that deliver real value and ensuring that these solutions are adopted. I8 states: *"It's important to always maintain this perspective: the solution must deliver value to the client. Companies want to work with us because we genuinely want to create something that delivers value. We will be able to better capitalize on our relationships with our partners and clients if we are bringing value to their businesses."* This approach ensures that developed features are welcomed and even become indispensable to users, such as digital ticketing systems that users 'won't let you take away' once implemented. I15 tells his experience: *"Quick-wins secure buy-in from top decision-makers, preventing them from walking back on their decisions. They ensure that once users are exposed to something new, like with digital ticketing, that exposure is maintained. Once you open that door for the user, they won't allow that functionality to be rolled back."*

Stakeholders must mutually benefit from the project to ensure commitment and long-term engagement. This mutual benefit extends beyond mere financial incentives to encompass intrinsic motivation, professional growth, and a sense of shared ownership. Professionals are often motivated by the opportunity to do something new and by intrinsic recognition of their work. I8 highlights: *"We didn't have to pull a lot of people together to advance the smart gym project. It was easy because everyone was excited by the situation, because it was seen as an opportunity."* When projects are perceived as opportunities for learning and development, such as mastering low-code tools or participating in significant strategic discussions, individuals gain new skills and increased visibility within the organization. I21 corroborates: *"They started to play with low-code and no-code tools, which are very user-friendly, almost like a game. As we conducted the training, people started to really enjoy it, and the associated learning turned into benefit. 'I'm learning something that I can actually use.' They saw the value, and I believe that feeling was even more powerful than the final deliverable itself."*

Measurable shared outcomes emphasizes the need of defining tangible shared objectives and implementing robust measurement methodologies, such as OKRs and Key Performance Indicators (KPIs), to effectively track progress. I24 describes this: *"I think it's about everyone being aligned on the same objective. Everyone needs to have buy-in on that same goal. The target is the same for everyone when we're all working with the same key driver. I think that's the most important thing. Nowadays, at the bank, we track the results that stem from those objectives. For example: did customer satisfaction increase?"* These metrics, which are often numerical and collectively monitored, provide a crucial 'north' for assessing whether results are being achieved within projected timelines and foster a cohesive team environment rather than fragmented individual efforts. As I8 explains, OKRs are the compass that drives organizations and professionals' efforts: *"Our company's OKRs are a mix of top-down and bottom-up. Every quarter, we define the team's OKRs, outlining what we want the company to achieve."*

5.4.2. DIGITAL TRANSFORMATION SUCCESS

Digital Transformation Success is structured across three distinct themes: dematerialization, collaborative digital strategy, and digital competencies (Figure 9).
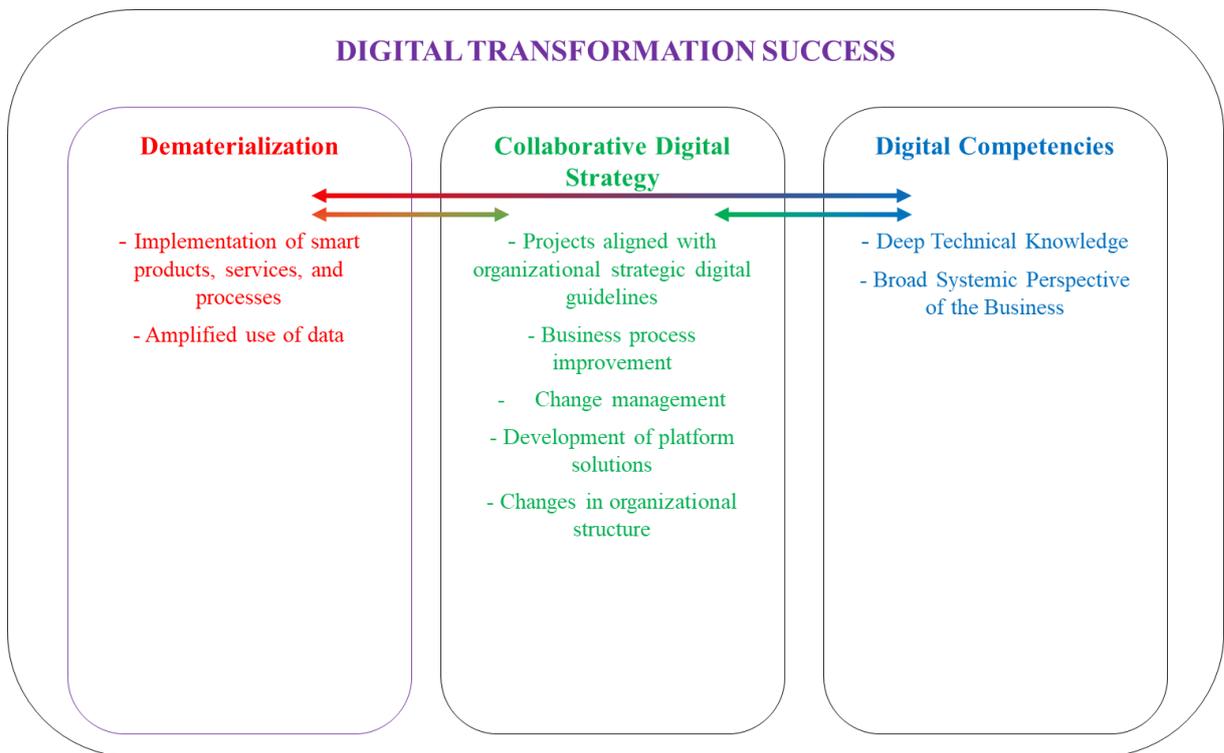
Figure 9 *Proposed Model for Digital Transformation Success*

Source: developed by the author

5.4.2.1. DEMATERIALIZATION

Dematerialization represents the foundational technological shift. It describes the core activity of moving from analog or physical processes to digital ones. This is achieved by implementing smart products and services, amplifying the use of data as a strategic asset, and adopting new digital technologies as the building blocks for change.

The implementation of smart products, services, and processes leads to self-correcting and efficient solutions. I20 corroborates this *"In product development, we must aim for smart solutions because the market demands it. It's a reality. Data is advancing rapidly, as is the application of AI. Technology itself is more user-friendly, adapted for people who aren't tech experts. You need intelligent solutions that can, for instance, self-correct to generate efficiency, and even apply that intelligence to create a better solution for the end client, whether*

B2B or B2C. If you're not thinking this way, you're already falling behind, because someone out there is." Driven by market demand smart products deliver solutions that facilitate customers' experience. I8 explains: *"The gym had a mobile app for the users, that worked very poorly. People were frustrated because they couldn't sign up for classes or the app was always crashing. We understood this flaw and made a project proposal that was accepted. It's a simple application that's integrated with the gym's information system, with their CRM. Their management system can be greatly optimized in a way that provides added value for gym users.*

The amplified use of data enables organizations to create smart processes with embedded analytics and to target objectives based on real-time information, removing subjectivity from their analyses. I4 explains a project: *"The goal was to develop systems for smart cities, using communications as a service to enhance worker safety, calculate optimal vehicle routes, and manage pollution issues via sensors."* I21 also illustrates this: *"My department oversees our entire data ecosystem, which includes data from databases, systems, devices, trains, everything. We handle the collection and channel it into our data engineering pipeline, or 'data factory,' to be used by our solutions. Once processed, we use analytical tools to make it available. Consequently, when I ask the chatbot for a payment statement, it's already consuming this refined data, whether via traditional Business Intelligence (BI) or a generative Artificial Intelligence (AI) tool."*

5.4.2.2. COLLABORATIVE DIGITAL STRATEGY

Collaborative digital strategy covers the strategic guidelines and continuous improvement from Study 2. It goes beyond the technology itself to address how business processes are improved, the importance of change management, i.e. managing the human side of change, how projects must align with digital strategic guidelines. Platform solutions and adjustments to organizational structure can facilitate digital transformation success.

Projects should align with organizational digital strategic guidelines to structure the path toward this common direction. I20 argues: *"Technology is the means, and increasingly, technology and business are intertwined. Technology investment decisions have been made more by business units than by technology departments. When it's time to decide on an investment, a company might hire a business consultancy firm, because technology has become a core component of the business; it's no longer an isolated department like it was 20 years*

ago. And yet, there are companies in Brazil that still operate in a more siloed way today." Projects aligned to strategic guidelines are essential to ensure efforts are not isolated and contribute to broader digital transformation goals, often transitioning into standardized services for efficiency. I25 describes this: *"Innovation is a path that one does not walk alone, is made when we are all together. We developed our Municipal Digital Strategic Plan, and I don't recall a plan that had encompassed as many entities as this one did. We listened to the community and developed truly participatory initiatives for the plan. Next week it will be a public presentation of this document, and we invited everyone who participated in the consultation processes and the workshops, because we also want them to be involved in the implementation."*

Business processes are improved. They can be made more intelligent, through reengineering and dematerialization of administrative processes, with digital transformation aiming for efficiency, automation, and reduced errors. I2 states: *"Our projects are completely digital, but they are constantly evolving. When you talk about digital transformation, in a way, you're talking about automating processes and making activities more autonomous and efficient."* I19 also describes it: *"The new people management system streamlined and standardized all human resources processes globally. Previously, it wasn't like that, because each country had its own tools and workflows. Now everyone operates the same way."*

Change management involves managing the human side of change and is vital for successfully integrating new technologies and methodologies, requiring clear communication of benefits to overcome resistance and cultural barriers. I2 establishes: *"In a business context, there's also the aspect of how you create processes to make it easier for people to adopt new technologies. I've seen many cases where the use of a new system was imposed on people, without any training or enablement. But you need to give people time to learn how to use the new tool and think about how to embed its use into their daily workflow."* I16 argues that communicating the change is essential to ensure the common drive: *"I believe the most important thing is the ability to clearly communicate what's waiting on the other side of the river, after the transformation is complete. Any transformation involves a cost: leaving your comfort zone, retraining, and changing habits and behaviors, all of which creates discomfort. To ensure the transformation is successful, you must communicate a clear message."*

The development of platform solutions, such as centralized citizen service platforms (e.g., GovBR) and intelligent urban management platforms, favors the sharing economy and

often reduces costs. I14 describes an ongoing project: *"We're working on a new state-wide product for municipalities to offer public services to city governments through a single state platform. The services are offered for citizens, delivered by the cities, but using a unified platform that makes the system much more resilient. We have more than 600 municipalities in our state, and 80% of them are small in terms of population and resources. This is key to provide services to the population at a much lower cost."* I1 mentions: *"The Digital Transformation Secretariat works to digitalize services for the citizens. The state government website was already operational, but they incorporated other services from various other agencies. We act as a digital transformation hub, that liaises with other agencies and the technology department to enable the transformation of services."*

Changes in organizational structure drive organizations to customer-centricity, multidisciplinary team formation (e.g., Spotify-inspired squads), and the establishment of dedicated digital transformation units. I24 tells how a bank reorganized its structure into purposed squads: *"The bank has gone through a massive transformation. Our functional structures were siloed by business lines and products, like credit or renegotiation. Now, the whole bank is reorganized based on customer needs. For instance, if a customer has a need to build wealth, the bank assembles a squad to address it. They are multidisciplinary teams of about 9 to 12 people with multiple specialties and focused on a single objective. They function as cells, as they work physically together to solve a specific problem or manage a digital product."* I1 tells how a Brazilian state recently created a unit to manage digital transformation: *"The Secretariat of Digital Transformation didn't exist, and these projects were managed within the technology department and ad hoc by the Sub-secretariat of Modernization. In 2023, the Secretariat of Digital Transformation was formally established as an independent body, and the whole team from the Sub-secretariat of Modernization was brought over to build this new department.*

5.4.2.3. DIGITAL COMPETENCIES

Digital competencies focus on the crucial human capital required to execute the digital strategy. It highlights the need to acquire and train the right people with a specific blend of skills: deep technical knowledge and a broad systemic perspective of the business to ensure technology solves the right problems. It amplifies the understanding about which digital competencies are required in the digital transformation context investigated in Study 2.

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It also **requires professionals with technical knowledge** including roles such as data scientists, designers, prompt programmers, bot programmers, and system architects. These individuals must be agile, technologically proficient, committed to continuous learning, and capable of adapting to new tools and methodologies, often through partnerships. I20 reckons: *"You need data scientists, designers, and functional architects to handle the technical system architecture. You need agile methodology specialists on the ground. You also need roles like copywriters and prompt engineers for bots, and a top-notch tech person."* I1 *"Having some tech knowledge is essential to be part of the conversation, even if you don't have a technical background."* I3 argues: *"Passion for the tech industry and a willingness to learn, because it's an industry that is constantly evolving. So, you either must be prepared to keep up, or it becomes difficult – you quickly feel you are behind, clinging to technology that's no longer in use. It's about having passion for what we do and a desire to grow, evolve, and learn."*

This requires **professionals with business systemic perspectives**, who can understand the entire system, connect technology with business needs, and manage the broader impact of projects. I7 argues: *"I think critical thinking is the most important skill people can have. It's the ability to look at a problem, break it down logically into subproblems, and plan, focusing on one problem at a time. The basic principle is simple. The overall issue is complex, but it's built from increasingly simple subproblems. Therefore, it's the basic rule of modularization. It's complex, but we break it down into simpler problems. These are fundamental principles that are still used today."* I13 describes the relevance of systematically understanding the business processes: *"A person working to implement a financial ERP, they won't talk about ERPs with the company's finance director, they'll talk about financial processes and administration, cash flow maps, to get these processes translated into a computer system, the ERP. This involves functional and transformational consulting because they must understand business processes. A project department that doesn't perceive the client's business processes won't be able to add much value. Ultimately, the project manager ends up being the conductor who must lead the orchestra. For that, I must understand what is happening - I must understand the client's business processes."*

5.5. DISCUSSION

5.5.1. INTERRELATION BETWEEN THE THEMES OF PROJECT STAKEHOLDER COLLABORATION

The three themes of Project Stakeholder Collaboration are closely interconnected, with each theme enabling the other. Collaborative culture is structured over a relational foundation built on trust, empathy, and transparency, which foster a collaborative mindset with shared vision, continuous learning and experimentation. This culture also promote behaviors like ownership, resilience and continuous communication. These three aspects of collaborative culture provide a relational structure for establishing and enhancing formal collaborative practices. These formal collaborative practices comprise leadership and governance practices as well as stakeholder engagement, enhanced by digital tools, agility, and the use of pilots, prototypes and incremental delivery. Overall culture and formal practices drive shared value creation and outcomes.

A culture of trust, empathy and transparency rely on effective leadership practices and employ agile and predictive project management approaches as well as multi-level decision-making to foster a sense of ownership among team members, encouraging accountability and promoting a shared vision. This ensures stakeholders are aligned with the outcomes and project value creation. Projects rely on professionals' ownership and accountability to achieve continuous improvement and deliver planned shared outcomes through prototypes and incremental delivery. Leadership-driven alignment and ownership strengthen a resilient environment, supported by trust, where teams are empowered to experiment, treat failures as steps for improvement, and innovate without fear of aggressive criticism (Imran et al., 2021; Warner & Wäger, 2019).

Ownership is a key behavior that shapes formal collaborative practices, moving professionals from passive participants to proactive drivers of project success. Leadership and governance can foster this sense of ownership by granting teams autonomy to solve problems without micromanagement. This transforms stakeholders into 'owners' proactive behaviors, such as tackling issues outside one's formal role and transparently addressing problems instead of hiding them. Governance mechanisms, such as clear decision-making and defined escalation paths, provide the structure for this autonomy to thrive, ensuring that when conflicts arise or key personnel are unavailable, the project momentum is maintained without depending on specific individuals. When formal collaborative practices empower stakeholders to cocreate value, their sense of ownership drives the project to deliver superior, shared value (Brunet et al., 2019; Yin & Qin, 2019).

To foster a culture where experimentation can flourish, regular meetings and information sharing are formal practices to manage expectations and ensure stakeholders are aligned. A transparent trustful environment encourages open dialogue and feedback, where professionals feel safe to share bad news frankly and ask questions without fear of judgment. This openness helps prevent misunderstandings and allows for early resolution of problems, consequently fostering agility, which is more effective than addressing issues that have grown due to lack of oversight. Frequent interactions, both formal and informal, strengthen interpersonal relationships, which is vital for team cohesion and navigating the complexities of a project (Agarwal et al., 2022; Mattessich & Monsey, 1992).

When professionals do not feel a sense of ownership and communication flows inadequately, projects face significant difficulties, leading to delays, rework, and a decline in collaborative spirit. Professionals restrict themselves to their specific roles, hesitating to take initiative, or waiting for others to solve problems, which is particularly detrimental in interdependent teams where one delay causes a cascade effect. Poor communication exacerbates these issues by creating misunderstandings and preventing the early detection of problems. In such an environment, decisions are delayed, rework becomes common due to unaddressed issues, and consequently the project may fail to benefit from the collective intelligence and proactive problem-solving that define a truly collaborative effort (Ezzeddine & García de Soto, 2021; Papadonikolaki, 2018).

To overcome these communication failures and foster proactive problem-solving, digital tools have fundamentally reshaped collaboration, enabling communication, coordination, and the creation of shared value. Platforms like Microsoft Teams, Slack, WhatsApp, and Jira have become essential for both synchronous and asynchronous interactions, breaking down geographical barriers and allowing teams distributed across the globe to work together seamlessly. This enhanced connectivity accelerates problem-solving and decision-making, as what once required a physical meeting or a long email chain can now be resolved with a quick message (Ayala et al., 2020; Michel-Villarreal et al., 2021). Digital tools also standardize project management processes, creating centralized repositories for information, tracking progress, and ensuring that all stakeholders, including clients and senior leadership, have visibility into a project's status.

This improved collaboration translates into better project outcomes and value creation for both organizations and customers. Digital technologies, such as BIM, allow teams to create detailed 3D models as prototypes of the construction, identifying issues before execution and leading to significant cost and time savings (Brunet et al., 2019; Meng, 2019). Similarly, platforms designed to manage project issues, like CF, centralize communication and create a registered history of decisions, which is critical for accountability and preventing rework, especially in long-cycle projects. By automating routine tasks and leveraging AI to analyze data and even generate content, these tools free up professionals to focus on more strategic, creative, and value-added activities. This not only boosts organizational efficiency but also enhances customer experience by enabling the delivery of smarter services and products.

While digital tools provide the infrastructure for this efficiency, formal governance provides the strategic direction. Governance and stakeholder engagement are crucial for balancing the inherent tensions within the OKR framework, which blends top-down strategic direction with bottom-up team contributions. Leaders create an environment where strategic, top-down objectives can be openly discussed and refined with innovative, team-driven ideas (Nikulina et al., 2022; Tronvoll et al., 2020). This approach avoids a purely directive style, where goals are simply imposed, and instead fosters teams responsible over the final OKRs. By doing so, collaborative projects ensure that the company's high-level and top-down goals are realistically grounded in the team's insights, resulting in OKRs that are both ambitious and achievable, thereby maximizing the creation of shared value (Doerr, 2018).

The absence of a shared vision or a collaborative culture can derail projects, leading to wasted effort. Without a clear, top-down strategic alignment, teams may operate in silos, creating fragmented work plans that fail to connect and may lead to redundant efforts where multiple people unknowingly work on the same task. This lack of a unified purpose fosters a culture where individuals are not collectively committed to the project's success, viewing it merely as an imposed task rather than a collective goal. Worse is when top management is uncommitted, as it creates a cascade effect on teams with lack engagement. When initiatives are not aligned with real organizational needs or customer value, it could lead to the delivery of products or services that may fail to be adopted by users (Fukuzawa et al., 2022; Johansson et al., 2021).

In direct contrast to such failures, shared value creation and outcomes are inextricably linked to a strong collaborative culture. Shared value creation and outcomes are directly linked to a collaborative culture. The relational foundation of trust, empathy, and transparency creates an environment where teams openly discuss ideas and challenges. Collaborative mindset further strengthens this link by aligning all participants around a shared vision, ensuring that every effort is focused on delivering tangible business improvements and addressing the real 'pains' of customers. A project environment grounded in this collaborative culture ensures that outcomes are mutually beneficial, driven by measurable shared outcomes not only for the organization and its customers but also providing professional growth and a sense of purpose for the professionals involved (Papadonikolaki et al., 2019; Tronvoll et al., 2020).

The OKR framework provides a concrete mechanism for translating a collaborative culture into measurable shared value and outcomes. The Objective "O" is the qualitative expression of a shared vision; it shows the north that aligns the entire team on a unified goal and ensures everyone understands where they are going and why (Koseoglu et al., 2019; Nikulina et al., 2022). To achieve the objective, the team must deliver on the "KRs" (Key Results), which are the tangible measures of success (Harrington & Srai, 2016; Ylinen, 2021). Key behaviors like ownership and resilience become critical again. While ownership empowers team members to make autonomous decisions to advance their part of the collective goal, resilience is necessary for navigating the inevitable setbacks and failures that occur during execution, requiring teams to adapt and continuously improve their approach. In practice, a virtuous cycle is structured: the shared vision defines the objective, ownership drives the achievement of key results, and the transparent measurement of these KRs indicates that the collaborative effort is leading the team towards the objectives and value.

5.5.2. INTERRELATION BETWEEN THE CATEGORIES OF THE DIGITAL TRANSFORMATION SUCCESS

Digital Transformation is a holistic evolution driven not just by technology, but by a fundamental shift in strategy, competencies, and culture. It's more a revolution of customs, where users and society often become digital before organizations do. The three core themes of Digital Transformation Success are deeply interconnected - dematerialization, collaborative digital strategy, and digital competencies - reinforcing each other.

Dematerialization, the shift from analog to digital, is driven by the implementation of smart products and the amplification of data (Kagermann et al., 2013; Tronvoll et al., 2020). However, this technological shift is only effective when guided by a collaborative digital strategy that aligns projects with clear business objectives and customer needs. A robust strategy ensures that the adoption of new technologies translates into tangible business improvements, such as enhanced operational efficiency, new platform-based business models, or improved customer experiences (Imran et al., 2021; Warner & Wäger, 2019). This shift requires significant change management to overcome cultural resistance and adapt organizational structures. The success of both dematerialization and strategy hinges on digital competencies - the crucial human element. Professionals need a combination of technical knowledge and a business-systemic perspective to implement new tools and ensure that they solve real problems and deliver value. As digitally competent teams engage with new technologies, they uncover further opportunities for strategic innovation, restarting the cycle of transformation.

Dematerialization involves implementing smart products and services, such as digital ticketing systems or construction project management platforms and amplifying the use of data as a strategic asset. By changing organizational structures organizations ensure that digital initiatives are linked to digital strategic guidelines (Imran et al., 2021; Vial, 2019). For instance, the creation of a specific Digital Transformation Unit is a strategic move to ensure that digital projects are managed cohesively and to maintain contact with other agencies, rather than concentrating purely on technical activities. This strategic framework ensures that dematerialization efforts, like adopting BIM or moving from paper-based to digital workflows, translate into tangible value, such as cost savings, increased efficiency, and improved customer experience. The strategy provides the objective, while dematerialization provides the means, and their synergy drives successful and sustainable digital transformation.

As the successful shift from physical to digital processes depends on the skills and mindset of the professionals driving it, dematerialization and digital competencies are interconnected. Implementing dematerialization, through smart products and services and data leverage as a strategic asset, requires a workforce with a sophisticated blend of technical and business-systemic skills (Jiao et al., 2021; Tronvoll et al., 2020). Professionals must use modern digital tools like BIM, AI, and data analytics platforms to create, manage, and interpret digital assets. This includes data scientists who can extract valuable insights from large datasets,

designers who can create user-friendly interfaces, and architects who can build robust digital infrastructures. However, technical proficiency alone is insufficient. Professionals also need a deep business-systemic perspective to understand why a certain technology is being implemented and how it connects to the broader organizational goals and customer needs (Imran et al., 2021; Whitmore et al., 2020). This systemic view enables them to ask the right questions, anticipate problems, and ensure that digital solutions solve real business challenges rather than just automating flawed processes. A successful digital transformation, therefore, requires a culture of continuous learning and adaptation, where organizations invest in upskilling their teams and often blend internal business experts with external digital specialists to bridge competency gaps.

A collaborative digital strategy and digital competencies are also codependent; because a strategy cannot be executed without the right skills, and skills are directionless without a guiding strategy. The strategic framework for digital transformation involves managing significant changes, aligning projects with clear business objectives and sometimes altering the entire business model to remain competitive in a landscape of constant disruption (Vial, 2019; Warner & Wäger, 2019). This strategic layer relies entirely on digital competencies. Professionals must possess a hybrid skillset, blending deep technical knowledge with a broad, systemic business perspective. Project managers, for instance, cannot simply track timelines; they must act as maestros who understand customer business processes to effectively orchestrate the project and add value. This business-systemic view allows teams to move beyond merely executing tasks to proactively identifying opportunities, questioning assumptions, and ensuring that technological solutions genuinely address core business problems. Besides, a continuous learning mindset is essential for professionals to stay updated with rapidly evolving technologies like AI and to adapt to new methodologies. The strategy defines the objectives of the transformation, while digital competencies enable teams to translate high-level vision into tangible value and outcomes.

5.5.3. LINKING PROJECT STAKEHOLDER AND THE DIGITAL TRANSFORMATION SUCCESS

Project Stakeholder Collaboration and Digital Transformation Success are interconnected with one influencing the other (Figure 10). Digital Transformation Success, characterized by dematerialization, a collaborative digital strategy, and digital competencies,

provides the technological and strategic foundation upon which effective Project Stakeholder Collaboration is built. In turn, a collaborative culture, formal collaborative practices, and a focus on shared value creation and outcomes promote the right environment for digital transformation success. As organizations advance in their digital maturity, they enhance their capacity for collaboration, which then accelerates further transformation.
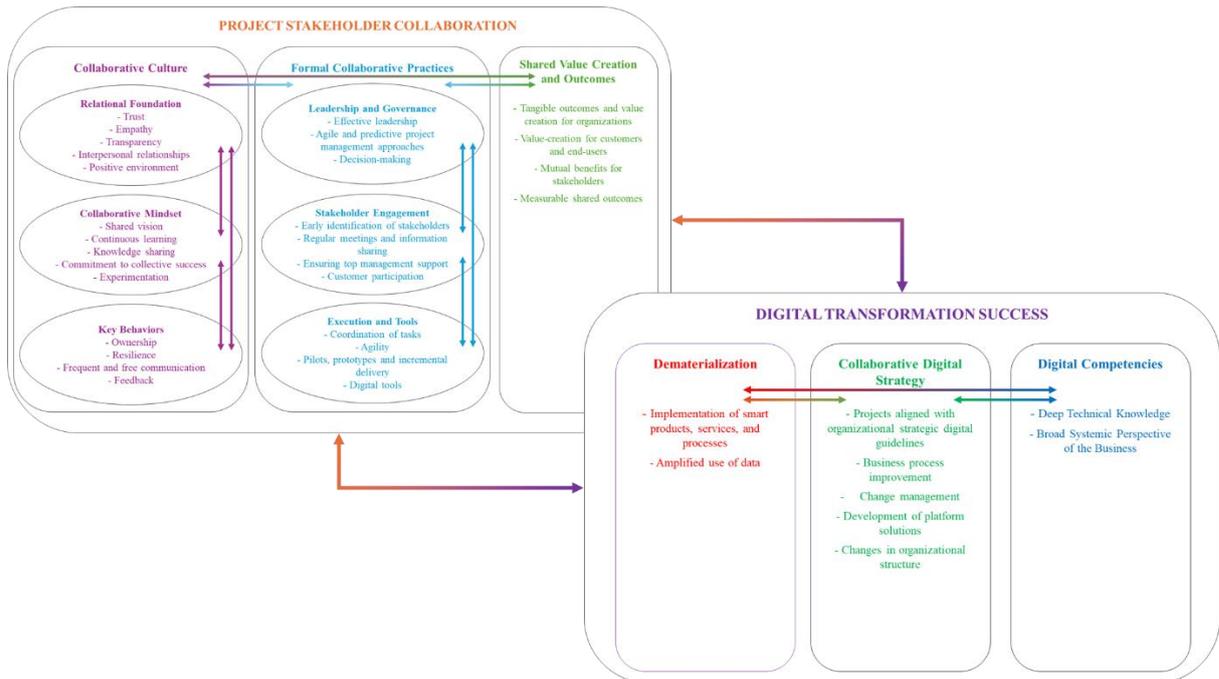
Figure 10 *Driving Project Stakeholder Collaboration and Digital Transformation Success*

Source: developed by the author

For example, dematerialization, the shift from analog to digital, goes beyond the technical change; it requires a collaborative culture where professionals feel empowered to propose and learn new tools (Tronvoll et al., 2020; Warner & Wäger, 2019). A collaborative digital strategy ensures this technology is applied to solve strategic business problems and deliver value, which only happens when stakeholders are integrated into the project, sharing a vision and co-creating solutions. This process hinges on digital competencies; professionals with both technical expertise and a business-systemic perspective who can bridge the gap between technology and strategic goals (Imran et al., 2021; Papadonikolaki et al., 2019). Therefore, collaboration brings digital transformation to life by ensuring that technological

shifts are driven by a shared purpose, guided by inclusive practices, and focused on creating measurable value for the organization, its customers, and its professionals.

Leadership intentionally bridges the gap between a collaborative culture and a clear digital strategy, as specific behaviors overcome organizational inertia (Piccione, 2021; Tronvoll et al., 2020). For instance, leaders with business-systemic perspective translate high-level strategic goals into a compelling vision that fosters commitment and a sense of shared ownership among teams. This involves not just sponsoring projects but actively shaping the environment by promoting transparency and ownership, managing expectations, and ensuring top management alignment. Leaders who champion a no-blame culture and treat failures as learning opportunities create an environment necessary for teams to experiment with new technologies and processes without fear. By actively removing bureaucratic impediments and ensuring resources are available, they empower their teams and demonstrate commitment to both collaboration and digital progress.

The evolution of project management to drive Digital Transformation Success is fundamentally linked to a deeper, more agile form of collaboration, moving away from rigid, traditional structures toward more fluid, outcome-driven approaches (Imran et al., 2021; Whitmore et al., 2020). This shift is characterized by a change in mindset where projects are increasingly seen as integral parts of a larger product lifecycle, inspired by models like Spotify's, with cross-functional "squads" and "tribes" organized around customer needs rather than departmental silos (Kniberg & Ivarsson, 2012). This structural change demands a more horizontal and adaptive management style, where the focus moves from simply controlling scope, time, and cost to delivering continuous value and quickly validating hypotheses through experimentation. The tolerance for error increases, with failures seen as learning opportunities that fuel rapid, iterative improvements.

Digital tools have been a critical enabler of this evolution, profoundly changing how teams collaborate and manage their work (Michel-Villarreal et al., 2021; Papadonikolaki, 2018). Digital messaging apps like WhatsApp, Jira and Teams facilitate synchronous and asynchronous communication, breaking down geographical barriers and reducing formality, allowing for quicker problem-solving and decision-making. This enhanced connectivity supports the adoption of agile and hybrid methodologies, which are better suited to navigating the uncertainty inherent in digital transformation. Besides, the increased availability of data,

combined with analytical tools, has elevated the importance of outcome-oriented frameworks like OKRs, allowing teams to measure their impact and align their efforts with broader strategic goals in a more transparent and data-driven manner. Technology enhances collaboration, which in turn accelerates the delivery of value-driven digital outcomes.

Agile and hybrid project management approaches are suitable for the dynamic and uncertain nature of the Digital Transformation Success, particularly when projects involve evolving customer experiences and technological complexity (Warner & Wäger, 2019; Whitmore et al., 2020). These methodologies prioritize adaptability and rapid validation, allowing teams to deliver value incrementally through short cycles, sprints, and prototypes. This iterative process is crucial for navigating environments where requirements and market conditions change quickly, as it allows teams to "err small and correct fast", reducing the risk of significant rework. By breaking down complex initiatives into manageable increments or "quick wins", teams can deliver tangible results sooner, which maintains stakeholder engagement and secures buy-in from top management, especially in politically sensitive public sector projects.

However, the suitability of these approaches is not universal and depends on the project's specific context. For initiatives with clearly defined scope and low complexity, such as implementing a standard ERP system or a straightforward construction project, a more predictive or waterfall-style approach can be more efficient. In these cases, the extensive upfront planning of traditional methods provides a stable path to completion. Many professionals, therefore, adopt a hybrid approach, combining the structured governance of traditional methodologies with the flexibility of agile frameworks like Scrum. This pragmatic blend maintains rigorous control over aspects like budget and stakeholder management while adapting to the fluid, iterative nature of digital product development, thereby leveraging the strengths of both worlds to deliver successful outcomes.

Effective collaboration hinges on integrating customers and end-users directly into the project lifecycle. This can be achieved through practices like pilots, prototypes, and incremental deliveries, which create continuous feedback loops. By involving users in workshops, usability tests, and even informal WhatsApp groups, teams can validate ideas, correct trajectories quickly, and co-create solutions that are genuinely useful and well-adopted. This iterative engagement ensures that digital tools and processes are designed with empathy for the users'

context, avoiding the pitfall of creating technologically impressive but practically useless solutions. When customers are treated as active partners, their insights drive a more agile and adaptive collaborative process, ensuring that the final outcomes of digital transformation are not only efficient but deeply relevant and valuable.

Customer participation is strongly linked to successful digital transformation and a catalyst for genuine collaboration, shifting the focus from internal efficiency to external value creation (Rogers, 2016; Warner & Wäger, 2019). Sustainable, long-term digital transformation is centered on two key indicators: customer experience and the return for the organization. This customer-centric approach ensures that digital initiatives are guided by clear and engaging purposes, such as improving citizens' quality of life or solving a client's real-world problems, which is far more motivating for teams than financial goals like cost reduction.

5.6.   CONCLUSIONS

The study aimed to describe the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success. Despite the acknowledged relevance of collaboration among project stakeholders, particularly in the Digital Transformation Success, only few investigations have detailed the relational norms and formal collaborative practices that comprise Project Stakeholder Collaboration. This research addresses this gap by not only exploring Project Stakeholder Collaboration through the experiences of seasoned professionals but also seizing the opportunity to identify and illuminate real-life cases. Besides, the study shines light on a timely multifaceted construct the Digital Transformation Success which is implemented through projects. It reinforces and deepens the comprehension on how Project Stakeholder Collaboration and the Digital Transformation Success influence each other.

Supported by a pragmatic epistemological approach in which reality is shaped by the practical effects of ideas, this research adopts a qualitative methodology through 27 semi-structured interviews. The study builds upon existing literature and a prior quantitative study, which demonstrated a correlation between the level of Project Stakeholder Collaboration and Digital Transformation Success. Divergences between theoretical model provided by Study 1 and the empirical model developed in Study 2 motivated this in-depth investigation of the constructs. Data collected in the interviews with project professionals working in the Digital

Transformation Success from Brazil and Portugal enabled a detailed understanding of both interconnected constructs.

Project Stakeholder Collaboration and Digital Transformation Success are deeply interrelated, with each influencing and reinforcing the other. Digital Transformation Success, characterized by dematerialization, a collaborative digital strategy, and digital competencies, provides the essential technological and strategic foundation for effective collaboration. For instance, the shift from analog to digital processes (dematerialization) requires a collaborative culture where stakeholders feel empowered to learn and adapt to new tools. A collaborative digital strategy ensures technology solves real business problems, which is only possible when stakeholders are integrated and share a common vision. In turn, effective collaboration, through culture, formal collaborative practices, and focus on shared value, is what brings digital transformation to life, ensuring technology is guided by a shared purpose and delivers measurable value.

Other factors advance this reciprocal relationship. Leadership plays a relevant role in bridging culture and strategy by promoting transparency, managing expectations, and fostering a no-blame culture that encourages experimentation with new technologies. The evolution of project management from rigid, traditional structures to more fluid, agile, and hybrid approaches enables the continuous value delivery required in a digital context. Digital tools like Teams, Jira, and even WhatsApp enhance this evolution by breaking down communication barriers, promoting informal relationships, and supporting faster decision-making. Furthermore, integrating customers directly into the project lifecycle through pilots and prototypes creates continuous feedback loops, ensuring that digital solutions are not only technologically sound but also relevant and valuable to end-users.

Theoretically, this study makes three contributions to the field of project management. First, the research highlights the key points of connection between collaboration and digital transformation, demonstrating how they are interconnected and mutually influential. For instance, how digital communication tools have facilitated collaboration and value delivery and how the collaborative focus on shared value and outcomes increases the effectiveness of strategic objectives boosting Digital Transformation Success. Second, the research underscores the role of agile and hybrid approaches in digital project management, showing how their adaptability and focus on incremental delivery are well-suited for the uncertainty inherent in

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digital transformation and are supported by effective collaboration. Finally, it introduces the OKR framework into the project studies discourse, illustrating how it translates a collaborative culture's shared vision into measurable, shared outcomes, thereby bridging strategic goals with tangible value creation.

This study offers three practical contributions for project managers and organizations. First, it highlights the importance for practitioners to focus on the relational foundation and key behaviors that promote a collaborative culture. By actively cultivating trust, empathy, and transparency, managers can create a safe environment where teams feel empowered to communicate openly and take ownership of their work. Second, the study provides a clear focus for management on the specific formal collaborative practices that enable collaboration focused on shared value and outcomes. This includes adopting agile or hybrid project management approaches suited to the project's context, establishing clear governance for decision-making, systematically engaging stakeholders through regular meetings and transparent communication and the use of frameworks like OKRs to help translate a shared vision into measurable results that align the entire team on a common goal. Finally, the study offers practical guidance for navigating digital transformation by focusing on dematerialization, the definition of a collaborative digital strategy, and the development of digital competencies, providing a roadmap for aligning technological shifts with strategic business objectives and the necessary human skills.

This study has certain limitations that should be acknowledged. First, cultural and social perspectives of the experienced project professionals interviewed as well as the researchers may have introduced inherent bias to the proposed models. A second limitation is also an opportunity for future research: the fact that the empirical models, Project Stakeholder Collaboration and Digital Transformation Success, have not yet been empirically validated.

Addressing these limitations opens several avenues for future research. A key opportunity lies in the empirical validation of the proposed models to analyze their applicability across different organizational settings. These findings can be further analyzed in different economic sectors to identify particularities.

6. TECHNOLOGICAL PRODUCT – THE DIGITALCOLLABINSIGHTS

DigitalCollabInsights is a website, and it constitutes the practical application of this research, designed to bridge academic findings with industry practitioners. It aims to present an accessible assessment tool for practitioners to evaluate their level of Project Stakeholder Collaboration and Digital Transformation Success, enabling dissemination of academic results among project professionals. Hence, using accessible language, it introduces the core concepts of Project Stakeholder Collaboration and Digital Transformation Success and offers a preliminary assessment tool. This tool uses a small set of questions extracted from the complete empirical scales to provide a simplified real-time diagnostic.

While this initial evaluation serves as a quick indicator to engage users, it is not a substitute for a comprehensive psychometric diagnosis. Therefore, the website also provides access to the full scales for both constructs. Practitioners who complete the detailed questionnaire receive a robust statistical analysis based on the scales developed in Study 2. For the research, this facilitates the continuous collection of empirical data, which will be essential for running a Confirmatory Factor Analysis and validating the scales provided by Study 2 in the future.

The next section presents the website layout showing how this research plans to present both constructs to practitioners: Project Stakeholder Collaboration and the Digital Transformation Success. The website also shows a section that invites practitioners to assess construct via the complete survey questionnaires, which will allow researchers to gather information to validate the scales.

Additionally, APPENDIX 7 – TECHNOLOGICAL PRODUCT - WEBSITE PROPOSAL IN PORTUGUESE presents the website translated to Portuguese language aiming to reach Brazilian practitioners. As the scales for Project Stakeholder Collaboration and Digital Transformation Context were empirically developed in Portuguese, CFA should adopt the same language.

6.1. WEBSITE: DIGITALCOLLABINSIGHTS

Digital transformation and stakeholder collaboration are mutually dependent: one does not work well without the other.

Think of it this way: digital transformation provides the setting—the digital systems and the abundance of data that necessitate strategic change. However, it is effective collaboration that acts as the engine, ensuring that this complex technology is actually used to solve real customer problems and not just to automate old tasks. When teams share trust and a unified purpose, they ensure that the digital strategy delivers measurable value, such as trackable results via the methodological tool of Objectives and Key Results (OKRs), instead of merely completing tasks.

Simply put, the more digital an organization becomes, the more collaboration it needs to maintain focus and accelerate success.

6.1.1. PROJECT STAKEHOLDER COLLABORATION

Project Stakeholder Collaboration is a social and strategic process in which two or more parties—organizations, groups, or individuals—pool their resources and knowledge to address complex problems that they could not resolve individually.

Stakeholders choose to collaborate, as this relationship brings them closer to achieving superior quality results and mutual benefits.

In collaboration, professionals work interactively, sharing responsibilities and, when necessary, adjusting their individual processes to achieve the collective objective. Figure Figure 11 shows the website layout, specifically the section on Project Stakeholder Collaboration.

Figure 11 Project Stakeholder Collaboration on the website DigitalCollabInsights

Source: developed by the author

6.1.1.1. Why is stakeholder collaboration important in projects?

Basically, collaboration shifts the team's focus. Instead of people focusing only on "delivering their individual tasks," they start working together to "deliver real value" to the customer and the company.

6.1.1.2. Pillars of Project Stakeholder Collaboration

For this to work, stakeholder collaboration relies on three interconnected pillars:

- **Collaborative Culture (The Human Side):** This is the relational foundation. It's about creating an environment of trust, mutual understanding, transparency, and having a common goal (shared vision). Stakeholders feel valued and motivated to achieve shared goals, so they strive to work together.

- **Engagement Practices (The Practical Side):** A good environment isn't enough if there's no organization. This pillar defines how the work gets done. It highlights the importance of identifying and interacting with key stakeholders from the beginning and throughout the project lifecycle. It also includes having clear rules and using efficient coordination to deliver the results.

- **Value Creation (The Final Goal):** This is the result of combining the two previous pillars. It's *what* is gained from collaboration. When the people (culture) and the processes (practices) are aligned, the project delivers what really matters: satisfied customers, motivated team, and concrete results for the company, such as cost savings or increased sales. Stakeholders recognize that teamwork can produce superior results, even if it means renouncing a certain degree of autonomy.

6.1.1.3. Simplified x-Ray for Project Stakeholder Collaboration

Fill out 12 questions to understand the level of stakeholder collaboration in your project:

- I was open to taking on tasks outside of my expertise when they seemed important. (value creation)
- I was willing to sacrifice a certain degree of autonomy in favor of shared results. (value creation)
- There was coordination between my colleagues from different areas of knowledge. (engagement practices)
- My colleagues and I shared a vision about our project. (collaborative culture)
- My colleagues were committed to working together. (collaborative culture)
- My colleagues tried to create a positive environment for the project. (collaborative culture)
- Our project involved key stakeholders in the discussions. (engagement practices)
- Our project identified key stakeholders from the beginning. (engagement practices)
- Our project aimed to produce results for the organizations involved. (value creation)
- Our project aimed to produce results for clients and end-users. (value creation)
- The collaborative work with my colleagues led to results we could not achieve alone. (value creation)
- Clients and end-users participated in project discussions related to them. (engagement practices)

After practitioners answer the quick questionnaire, they will be shown a simplified graphic x-ray of their level of Project Stakeholder Collaboration, as presented in Figure 12 x-Ray Graphic for Project Stakeholder Collaboration.
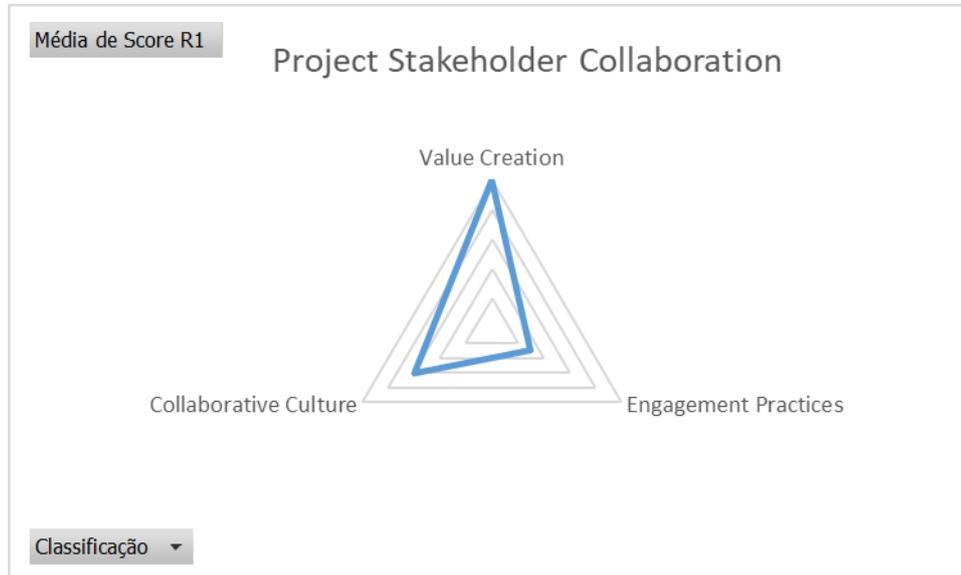
Figure 12 *x-Ray Graphic for Project Stakeholder Collaboration*

Source: developed by the author

6.1.2. DIGITAL TRANSFORMATION SUCCESS

Digital transformation success is achieved by an integrated ecosystem that modernizes the organization, based on a deliberate and customized strategy, professionals with digital competencies and the dematerialization of products and processes. Figure 13 Digital Transformation Success on the website shows the website layout, specifically the section on Digital Transformation Success.

Figure 13 Digital Transformation Success on the website DigitalCollabInsights

Source: developed by the author

6.1.2.1. Why is digital transformation important for organizations?

Digital transformation isn't just about buying new tech; it's a "revolution of customs" that helps your organization keep up with a society that is often already digital.

It's a strategic way to make deep business improvements by adopting new technologies to create smarter products and processes. When planned well, this transformation helps maximize your business results, improve the efficiency of your operation, and create much better experiences for your customers.

6.1.2.2. Pillars of Digital Transformation Success

A collaborative digital strategy uses technology and data to solve an organization's biggest challenges. This change is only possible with skilled professionals who understand both the technology and the business goals.

- **Dematerialization**: This is the shift from physical and analog processes to digital formats, using new technologies and employing data to generate intelligence.
- **A Collaborative Digital Strategy**: This is the "map" that aligns projects and the company's structure with digital strategy and objectives, that is customized for the organization needs and maturity level.
- **Digital Competencies**: This is having people with the talent and skills (both technical and business-related) necessary to execute the transformation.

6.1.2.3. Simplified x-Ray for Digital Transformation Success

Fill out 4 questions to understand the level of digital transformation of your project:

- Our project had professionals with digital competencies (digital competencies).
- Our project was aligned with our organization's strategic guidelines (collaborative digital strategy).
- Our project used digital technologies that connect the real and digital worlds (dematerialization).
- Our project amplified the use of data to generate information in the organization in digital transformation (dematerialization).

After practitioners answer the quick questionnaire, they will be shown a simplified graphic x-ray of their level of Digital Transformation Success, as presented in Figure 14.
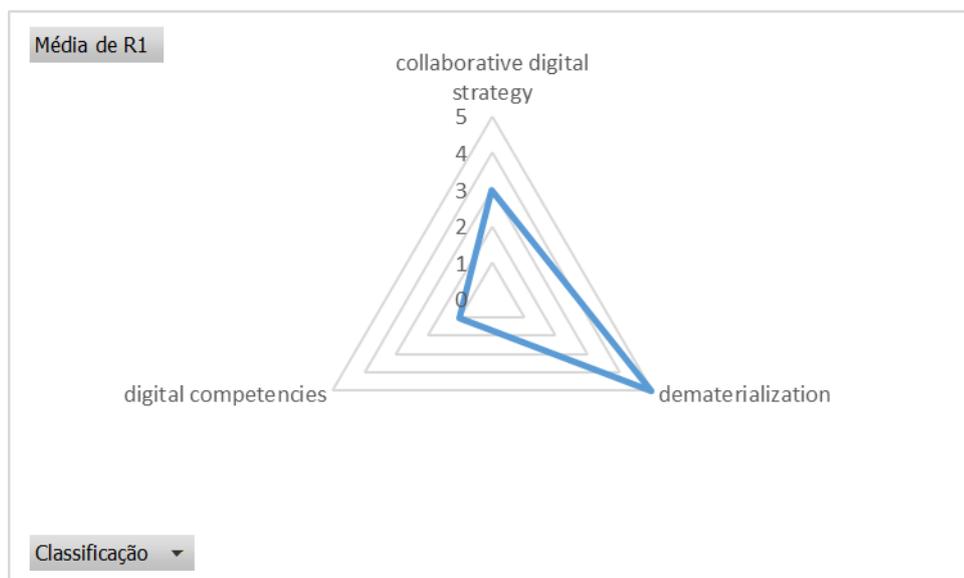
Figure 14 x-Ray Graphic for Digital Transformation Success

Source: developed by the author

6.1.3.   DETAILED DIAGNOSTIC OF DIGITAL PROJECT COLLABORATION

If you want to get a detailed diagnostic of Project Stakeholder Collaboration and Digital Transformation Success, please answer the questionnaire on the link below:

https://docs.google.com/forms/d/1sv7bCtJLuYix32PivGfdHohFfARc6rjcEqywgJgb94M/edit

Once you finish answering, a full diagnostic of the level of both Project Stakeholder Collaboration and Digital Transformation Success will be e-mailed to you, showing your strengths and weaknesses, highlighting areas with suggestions for improvement.

6.2.   EVALUATION OF THE TECHNOLOGICAL PRODUCT

The DigitalCollabInsights website, the primary technological output of this research, is classified as Software in accordance with the Technical and Technological Product guidelines established by CAPES (2020). To validate its contribution, the platform is evaluated against the four dimensions required by CAPES (2019): adherence, applicability, innovation, and complexity. The following paragraphs provide a detailed assessment of the software for each of these dimensions.

The adherence of this technological product to the supervisor's line of research is clear. The software relates directly to the theme "Innovation in Project Management", as it provides an innovative tool to measure Project Stakeholder Collaboration and "Digital Transformation Success". Furthermore, the product is specifically aligned with the research project "Project Management: developing the foundations of the knowledge frontier in the pursuit of results". This connection is justified by the empirical evidence that connects the level of stakeholder collaboration to project results to organization, engaged professionals, and customers. Also, by the evidence that links project stakeholder collaboration and digital transformation success.

The technological product, the DigitalCollabInsights website, is highly applicable. As a software, it can be successfully applied to measure Project Stakeholder Collaboration and Digital Transformation Success. Its replicability is also considered high, as its underlying scales

were developed upon robust statistical techniques. Regarding the impact on practitioners, the tool has significant potential to help practitioners improve formal collaborative practices and digital transformation evolution. While the actual impact is currently limited because it has not been published, its proven applicability and high replicability suggest a strong potential for wider influence.

In terms of innovation, the technological product is classified as highly innovative. Its high degree of innovation stems from novel knowledge, comprised of the empirical scales developed for Project Stakeholder Collaboration and Digital Transformation Success.

Regarding its complexity, the product is considered highly complex. This assessment is based on the rigorous, multi-stage process required to develop the scales that underpin the software. It involved preliminary literature review, followed by interviews with specialists, data collection with hundreds of project management practitioners, and lengthy statistical analysis to develop the empirical scales.

7. CONCLUSIONS

This thesis aims to characterize and empirically describe the relationship between Project Stakeholder Collaboration and the Digital Transformation Context. Table 17 summarizes the three interlinked studies that constitutes this research, with associated results, theoretical contributions, limitations and opportunities for future research.

Table 17: Tie-in Contributory Matrix

Central Research Question

How do Project Stakeholder Collaboration and the Digital Transformation Context influence each other?

Research Objective

This thesis aims to describe and quantify how Project Stakeholder Collaboration and the Digital Transformation Context influence each other.

Specific Objectives

- To characterize the dimensions of Project Stakeholder Collaboration in the Digital Transformation Context.
- To examine the relationship between Project Stakeholder Collaboration and the Digital Transformation Context.
- To describe the formal collaborative practices and relational norms that foster Project Stakeholder Collaboration and drive Digital Transformation Success.
- To present an accessible assessment tool for practitioners to evaluate their level of Project Stakeholder Collaboration and Digital Transformation Success, enabling dissemination of academic results among project professionals.

Title	Research Results	Theoretical Contributions	Limitations	Opportunities for Future Studies
Study 1 Project stakeholder collaboration and the digital transformation context: Theoretical models	The study adapts to project studies a theoretical five-dimensional model of collaboration and systematically proposes a model for the digital transformation context.	The importance of collaboration in digital transformation is accepted, investigations that develop a systematic analysis of it are scarce. The analysis also highlights the duality of digital transformation in projects: the transformation of projects versus the transformation by projects.	This research's limitations involve its conceptual scope: it treated Digital Transformation and 4IR as synonymous and did not differentiate collaboration from "teamwork." Additionally, the study did not incorporate the related literature on "open innovation," which could have enriched the analysis.	Future research should focus on empirical analysis, using quantitative data to develop and refine the proposed theoretical scales in order to formally test the relationship between the constructs. Additionally, qualitative studies, such as in-depth case analyses, are needed to explore the practical human and social aspects of stakeholder collaboration.
Study 2 Linking project stakeholder collaboration to the digital transformation context	This research provided a factorial structure for Project Stakeholder Collaboration and the Digital Transformation Context, ultimately revealing a strong	This article empirically demonstrates a cyclical relationship between collaboration and digital transformation, suggesting that	The study's findings are constrained by potential sampling bias from its convenience-based data collection and by varied	Future research opportunities include validating the developed scales and quantitatively linking them scales to constructs like project success, AI, and BIM, as

	positive correlation between the two constructs.	agile and hybrid approaches enhance both. Methodologically, it also contributes to new scales for project studies, which was developed using Exploratory Factor Analysis (EFA) and Parallel Analysis (PA).	respondent interpretations due to the questionnaire's lack of key concept definitions. Additionally, the proposed factorial structure remains unconfirmed, as a Confirmatory Factor Analysis (CFA) was not conducted.	well as qualitatively exploring nuanced aspects such as common barriers, governance structures, and the longitudinal processes of collaboration.
Study 3 Enhancing project stakeholder collaboration and digital transformation success: a Qualitative Study	The study's results show that Project Stakeholder Collaboration and Digital Transformation Success are deeply interrelated and mutually reinforcing. Digital transformation provides the environment for collaboration to thrive, while effective collaboration ensures that the digital strategy successfully drives technology and people toward measurable value.	The study's main theoretical contribution is highlighting the key points of connection between collaboration and digital transformation success, for example through digital communication tools and a focus in shared value and outcomes.	This study's limitations include the potential for inherent bias from the researchers and the interviewed professionals, as well as the lack of empirical validation for the proposed models.	Future research should empirically validate the proposed models to test their applicability across diverse organizational settings and economic sectors.

Technological Product	Type	Description	
The DigitalCollabInsights website	Software	DigitalCollabInsights is a website designed to bridge academic findings with industry practitioners, introducing core concepts of Project Stakeholder Collaboration and Digital Transformation Success. It offers a preliminary assessment tool for a simplified, real-time diagnostic and also provides access to the full empirical scales, returning a robust statistical analysis to practitioners who complete them.	

Source: elaborated by the author

7.1.   MAIN RESULTS

The overarching goal of this thesis was to characterize and empirically detail the intrinsic connection between Project Stakeholder Collaboration and the Digital Transformation Context. Study 1, a systematic literature review, established the theoretical scaffolding for this analysis. It defined Project Stakeholder Collaboration through a five-dimensional model — encompassing Interdependence, Flexibility, Reflection on the Process, Collaborative Outcomes, and Collective Ownership of Goals — while characterizing the Digital Transformation Context as a state grounded in technological integration, data availability, and strategic alignment. Besides, this conceptual analysis clarified the dual manifestation of digital transformation in projects: either transformation of project management processes (e.g., BIM adoption) or transformation by projects (delivering new digital business models).

The empirical groundwork was laid by Study 2, a quantitative investigation of 413 project professionals, which validated the central hypothesis. The results demonstrated a significant positive correlation, categorized with a strong effect size, between the level of Project Stakeholder Collaboration and the degree of the Digital Transformation Context. Study 2 refined the Project Stakeholder Collaboration theoretical model into three empirically robust factors: Relational Norms, Focus on Shared Outcomes, and Stakeholder Engagement. Besides, the study developed a unidimensional model for Digital Transformation Context. Furthermore, the analysis provided evidence suggesting that agile and hybrid project management methodologies are better positioned than predictive approaches to achieve simultaneously higher levels of both collaboration and digital transformation. This evidence supports the concept of a cyclical and mutually reinforcing relationship, where collaboration is vital for leveraging digital technologies, and technology, in turn, amplifies the benefits of collaborative project work.

Depending on understanding, Study 3 adopted a qualitative approach to describe the formal collaborative practices and relational norms that drive collaboration toward Digital Transformation Success. This phase described detailed models for Project Stakeholder Collaboration — focused on Collaborative Culture, Formal Collaborative Practices, and Shared Value Creation and Outcomes — and for Digital Transformation Success, characterized by Dematerialization, a Collaborative Digital Strategy, and Digital Competencies. The synthesis confirmed that Digital Transformation Success provides the necessary technical and strategic

environment, while professionals with right technical, business and collaborative competencies act as the essential human mechanism, ensuring that technology is purposefully guided by people toward a shared vision and the delivery of measurable value. The culmination of these insights was the development of the DigitalCollabInsights website, a tool designed to translate the academic findings into practical, actionable guidance for practitioners.

The three interconnected studies converge on the premise that Project Stakeholder Collaboration and the Digital Transformation Context are intrinsically linked in a significant, positive, and mutually influential relationship. Study 1 established theoretical groundwork, defining shared outcomes as the driver of collaboration, and digital transformation as a strategic change dependent on technology, data, collaborative approach and continuous evolution. This foundation was empirically validated in Study 2, which demonstrated a strong positive correlation between the constructs and refined the Project Stakeholder Collaboration model corroborating the drive of shared outcomes (Focus on Shared Outcomes) and establishing other two factors based on behaviors (Relational Norms) and formal collaborative practices (Stakeholder Engagement). Finally, Study 3 qualitatively deepened this convergence, keeping Project Stakeholder Collaboration model driven by shared outcomes (Shared Value Creation and Outcomes) and reliant on relational norms (Collaborative Culture) and practices (formal collaborative practices).

The qualitative perspective in Study 3 reinforces the quantitative results of Study 2 with a collaboration model driven by shared outcomes and value. Besides, it enriches the comprehension of the relational aspects of collaboration, bringing light to other relevant behaviors like empathy, transparency, trust, shared vision, openness to experimentation and continuous learning. Moreover, Study 3, amplifies the understanding of the formal collaborative practices supporting collaboration, highlighting the role of leadership, decision-making, iterative and incremental deliveries, and proactive stakeholder engagement.

7.2. THEORETICAL AND METHODOLOGICAL CONTRIBUTIONS

This thesis offers various and multifaceted theoretical contributions, spanning conceptual development, empirical scale development, qualitative empirical refinement, and methodological advancement within project studies and the digital transformation domain.

The first key area of contribution is conceptual development, primarily driven by Study 1. This research identified a significant gap regarding the systematic analysis of collaboration within the digital transformation context. To address this, Study 1 enhanced theoretical understanding by characterizing the required dimensions of Project Stakeholder Collaboration and systematically proposing a unidimensional model for the Digital Transformation Context. The research also clarified the duality of digital transformation within the project domain: recognizing transformation of projects (digital modification of project management processes, with virtualization and integrated platforms) and transformation by projects (implementation of digitally transformed unique outcomes like smart products, services, or new business models).

The second major contribution stems from the empirical validation in Study 2 and the qualitative refinement in Study 3. Study 2 introduced a novel scale for measuring Project Stakeholder Collaboration, which refined the theoretical five-dimensional model into three empirically supported factors: relational norms, focus on shared outcomes, and stakeholder engagement. Concurrently, it developed a concise, literature-derived scale to measure the Digital Transformation Context, encompassing elements like alignment with digital strategy, commitment to continuous improvement, increased data utilization, digital competencies, and the implementation of smart products. Beyond developing these scales, Study 2 provided empirical evidence supporting the argument that Project Stakeholder Collaboration and Digital Transformation Context share a positive, synergetic, and bidirectional relationship, where higher degrees of the Digital Transformation Context promoted enhanced Project Stakeholder Collaboration, and vice versa. This empirical analysis also suggested that organizations adopting hybrid and agile project management approaches demonstrate higher levels of both Project Stakeholder Collaboration and Digital Transformation Context, emphasizing the necessity of adaptability in this context.

Study 2 also makes methodological contributions, particularly for advancing the rigor of quantitative research within the field of project studies. It involves rigorous scale development procedures, which introduced advanced statistical techniques derived from psychology to assess relationships between ordinal, non-normal items. Specifically, this included utilizing Exploratory Factor Analysis (EFA) in conjunction with a polychoric correlation matrix. The polychoric matrix adapts to the inherent non-normality and ordinal nature of the Likert scale data collected from the project professionals. Furthermore, the

determination of the number of factors to retain was achieved using Parallel Analysis, a technique recognized for superior performance compared to traditional Eigenvalue criteria. Finally, recognizing the highly interconnected nature of collaborative constructs in social science, the study adopted an oblique Promax rotation, departing from the conventional orthogonal varimax approach, to more accurately model the correlation among the resulting factors. These methodological choices collectively represent an important advancement in the analytical rigor applied to project studies research, potentially setting a higher standard for future scale development and statistical validation efforts.

From a qualitative and deepened perspective, Study 3 refined the models for Project Stakeholder Collaboration (collaborative culture, formal collaborative practices, shared value creation/outcomes) and for Digital Transformation Success (dematerialization, a collaborative digital strategy, and digital competencies). This phase highlighted the specific key points of connection between collaboration and digital transformation success, demonstrating their mutual influence, for instance, how digital communication tools enhance value delivery. Finally, Study 3 also introduced the OKR (Objectives and Key Results) framework into the project studies discourse, illustrating its role in translating a shared vision into measurable, manageable, and shared outcomes.

7.3.   PRACTICAL AND SOCIAL CONTRIBUTIONS

This research provides senior leaders with a clear roadmap and framework for analyzing and enhancing two interconnected factors critical for modern business success: Project Stakeholder Collaboration and the Digital Transformation Context. From a strategic perspective, practitioners gain insight into the unique elements influencing successful digital initiatives, specifically the necessity of implementing smart products, services, or business models, and the need to capture and utilize abundant data for better decision-making. Empirical evidence emphasize that digital transformation is not merely a technical adoption but a strategic, evolutionary process requiring focused attention on dematerialization, defining a collaborative digital strategy, and developing the workforce's digital competencies. Understanding these contextual elements allows organizations to better structure their overall strategy and resource allocation to navigate technological uncertainties.

In the digital context, the findings reveal three critical factors project professionals should prioritize to cultivate effective collaboration: focusing on shared outcomes, developing strong relational norms, and structuring engagement practices. Leaders are advised to foster a supportive culture grounded in trust, empathy, and transparency, enabling teams to take ownership, experiment, and adapt their roles quickly. This cultural foundation must be supported by practical management mechanisms, including establishing clear collaborative governance, using dedicated structures like digital transformation champions, and adopting project management approaches, such as agile or hybrid methodologies, which are better suited to managing the fluid and uncertain nature of digital change. Furthermore, managers are advised to shift focus beyond simple task completion towards delivering measurable value for the organization and its customers, utilizing frameworks like Objectives and Key Results (OKRs) to translate a shared vision into actionable and manageable metrics.

These practical insights and the underlying empirical scales are synthesized into the DigitalCollabInsights website, the research's primary technological product. This software serves as an accessible tool designed to bridge academic findings with industry practice by offering an initial assessment derived from a small set of empirical questions for a quick, real-time diagnostic of an organization's level of Project Stakeholder Collaboration and Digital Transformation Success. The platform also offers access to the comprehensive scales developed through rigorous statistical analysis in Study 2, allowing practitioners to conduct a detailed self-assessment and receive actionable suggestions for improvement, thereby facilitating the continuous collection of empirical data for future validation.

Regarding the social contributions of the thesis, interconnected studies and technological product provide a vital socio-technical framework that implicitly contributes to several Sustainable Development Goals (SDG), transforming the Project Stakeholder Collaboration framework into a core mechanism for implementation of SDG 17 that strengthen the means of implementation and revitalize the global partnership for sustainable development. SDG 17 is organized around five key areas and is paramount in achieving 2030 Agenda. The focus areas of SDG 17 are: finance, which focuses on mobilizing all sources of funding (public, private, and blended); technology, to promote the development and sharing of environmentally sound innovations; capacity-building, to enhance the skills and resources of developing countries; trade, to foster a universal, fair, and equitable global trading system; and systemic

issues, which addresses the overarching need for policy coherence, effective multi-stakeholder collaboration, and high-quality data to monitor progress.

This research core findings that Project Stakeholder Collaboration and Digital Transformation Success share a cyclical, and mutually reinforcing relationship directly addresses the need for effective multi-stakeholder collaboration and high-quality data emphasized in systemic issues. The model of Digital Transformation Success, through its focus on dematerialization, explicitly advocates for the implementation of smart products and services that can enhance organizational sustainability and fulfill ESG perspectives. However, this success is contingent on substantial capacity-building, requiring professionals to acquire digital competencies that combine technical expertise, for example in data analytics, and AI, with essential business systemic knowledge and relational skills, from the model for stakeholder collaboration (trust, empathy, and continuous learning) to effectively translate high-level strategy into valuable outcomes. Furthermore, the emphasis on measurable shared outcomes and value creation provides a relevant guideline to finance and trade targets; measuring value through frameworks like OKRs ensures that projects deliver tangible results, such as cost savings and increased sales, thereby justifying and mobilizing necessary investment. Finally, the DigitalCollabInsights website serves as a concrete, capacity-building tool to help organizations assess their readiness and improve their practices for implementing ODS-aligned projects.

This research also demonstrates that achieving technological goals related to SDG 9 - Industry, Innovation, and Infrastructure, as well as SDG 11 - Sustainable Cities and Communities is dependent on investments in human capital (SDG 4 – Quality Education and SDG 8 - Decent Work and Economic Growth). For managers navigating SDG 9 initiatives, the study clarifies the duality of digital transformation, distinguishing between the transformation of project management processes (like BIM adoption) and transformation by projects (delivering new digital products or business models), and proposes the Project Stakeholder Collaboration model as the necessary collaborative solution to overcome human and organizational barriers to implementation.

7.4. RESEARCH LIMITATIONS

The findings and models presented in this thesis are subject to several inherent limitations. In Study 2, a key constraint is the reliance on non-probabilistic convenience sampling in the quantitative investigation, where the lead researcher's direct contact with professionals led to higher response rates, potentially introducing bias. Furthermore, the questionnaire used in Study 2 lacked definitions for the key concepts under investigation, which may have resulted in varied interpretations among professionals with differing levels of expertise in project management and digital transformation. Additionally, the empirical factorial structures derived from this study, while plausible, remain unconfirmed because a second data collection phase for a Confirmatory Factor Analysis was not included, leaving the proposed structures unvalidated.

The limitations also extend to the scope and depth of the analysis in the qualitative and theoretical phases. The systematic literature review (Study 1) acknowledged a potential theoretical limitation by treating digital transformation and the Fourth Industrial Revolution (4IR) as similar phenomena, though future knowledge may regard them as distinct. Additionally, the qualitative analysis (Study 3), which structured the final descriptive models for Project Stakeholder Collaboration and Digital Transformation Success, acknowledges that cultural and social perspectives of interviewed professionals as well as the researchers may have introduced inherent bias to the proposed models. Additionally, the empirical qualitative models can be further applied and empirically validated.

7.5.   OPPORTUNITIES FOR FUTURE RESEARCH

The synthesis of opportunities for future research derived from this thesis focuses on empirical validation, theoretical extension, and methodological refinement across the three studies.

A critical next step is the empirical validation of the measurement instruments developed in the thesis. Specifically, a key opportunity is to conduct a second data collection phase to perform CFA on the empirical models developed in Study 2. This CFA is necessary to formally validate the proposed factorial structure for both Project Stakeholder Collaboration and the Digital Transformation Context constructs. Furthermore, future research should empirically evaluate the proposed qualitative models derived from Study 3 to analyze their applicability across different organizational settings and economic sectors.

From a quantitative perspective, the validated scale for Project Stakeholder Collaboration offers opportunities for further analysis by formally linking it to other critical constructs, such as psychological safety, value creation, and overall project success. Similarly, the scale addressing the Digital Transformation Context could be integrated into emerging research areas, including organizational readiness, Building Information Modelling (BIM) development, and artificial intelligence (AI).

Research can also explore the distinctions and convergences between the duality of digital transformation within the project domain, namely the transformation of projects (digital modification of project management processes, with virtualization and integrated platforms) and the transformation by projects (implementation of digitally transformed unique outcomes like smart products, services, or new business models). It provides a refined theoretical structure for analyzing how collaboration adapts based on the project's digital goal.

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APPENDIX 1 – STUDY 1 – EXAMPLE OF CODING

Assessment and evaluation mechanisms
Reflection on process refers to collaborator attention to their process of working together. This (85. Bronstein 2002 - Index of interdisciplinary collaboration)
A set of measures were identified to emphasize user adoption and participation, efficiency and quality, engagement and satisfaction. (72. Robu 2021 - Digital Transformation Designed to Succeed)
Capability for continuous management and the adaptation of integration and collaboration Learning investments and continuous reflection are essential for integration capability creation, whereas continuous reflection and a philosophy of continuous improvement are integral to collaborative projects. (Saukko (2021). Defining integration capability dimensions)
collaborative processes for decision-making. (76. Kokkonen & Vaagaasar 2018 - Managing collaborative space in multi partner projects)
Continuously evaluate – evaluate what you do, capture gaps and opportunities. (72. Robu 2021 - Digital Transformation Designed to Succeed)
CS platform evaluation – all the input provided by users was collected in an optimization list and during the first year of implementation, we addressed 40 bugs and improvements (72. Robu 2021 - Digital Transformation Designed to Succeed)
Does the project continue to have a strategic fit with the enterprise's mission? • Is there anything that should be done that is not being done? • Are the project "stakeholders" comfortable with the results of the project? • Is the customer happy with the way things are going? Questions of this type can be used during regularly scheduled project review meetings to motivate discussions among the project team members, and to encourage them to think retrospectively about the project. Such thinking will prompt the team members to evaluate the project. (Cleland 1985)
Finally, implement processes that frequently alert you to potential future chal-lenges that could affect the successful functioning of your talent management strategies and procedures in your organization. Accordingly, regularly reassess and reevaluate each of the prior steps. Because suc-cess criteria may change over time, and because tech-nology, organizational practices, and labor markets are highly dynamic, Step 1 is very relevant in that it allows you to reassess and validate additional skills, abilities, merits, or talents that are necessary for hir-ing and, later, for promotions, as well as for reward-ing top performers fairly. (Castilla, E. J. (2025, setembro 9). A Data-Driven Approach to Advancing Meritocracy.)
Stay Continually Alert and Monitor Results Regularly. Finally, implement processes that frequently alert you to potential future challenges that could affect the successful functioning of your talent management strategies and procedures in your organization. (Castilla, E. J. (2025, setembro 9). A Data-Driven Approach to Advancing Meritocracy)
the analysis of the markers of success continuously informed us what the users needed to optimize in their flow of work. (72. Robu 2021 - Digital Transformation Designed to Succeed)
Collaborative culture
History of collaboration or cooperation exists in the community and offers the potential collaborative partners an understanding of the roles and expectations required in collaboration and enables them to trust the process. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)
(c) Organizational culture is a significant driver to organizational behavior and success and is the primary enabler of strategy implementation; (d) Cultural transformation establishes the foundations for success and defines the strategic initiatives needed to attain the company's future purpose; (e) Organizational cultural changes is a challenging task and efforts hardly reach their targets. Lack of attention to corporate culture is the key causes of failure; (48. Abdalla 2020 - Managing knowledge in the context

~le~ible hierarchies, new wa~s of measuring and rewarding performance, new strategies for attracting and retaining skilled talent will all become ke~ to organi~ational success. (80. Schwab 2017 - The Fourth Industrial Revolution)
19 factors that influence the success of collaborations formed by human service, government, and other nonprofit agencies. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)
25% of the participants viewed digital transformation as cultural change. MDT stated, 'It's more than tools and processes, it's really about mindset change.' GM also stated similar views: 'It's a mindset change and cultural change that is happening right now.' MDIT added, 'It's change of culture. We need to be faster and we need to have more services than products.' (46.Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
A convener's personal preferences or biases may actually contribute to the convener's familiarity with the issue and not interfere with the collaborative process, as long as the convener is perceived by all parties as fair and open-minded. (84. Wood and Gray 1991 - Toward a comprehensive theory of collaboration)
A capacity for agility will be as much about employee motivation and communication as it will be about setting business priorities and managing physical assets. (80. Schwab 2017 - The Fourth Industrial Revolution)
a closed organizational structure with a lack of integration and limited knowledge sharing among subsidiaries, and also between the subsidiary and its headquarters; (41. Rocha 2021 - Collaborations for Digital Transformation Case Studies of Industry 4.0 in Brazil)
A culture that embraces digitalization. What makes Ergon different from most other refiners is not only the specialty aspect of its business, but also its tightly woven, family-oriented corporate culture. (70. Elwart 2020 - Ergon refining A digital transformation story)
A question that arises from these findings therefore relates to our understanding of what a "digital culture looks like" (Kane et al., 2016:9). A common theme across studies points to the need for firms to cultivate a willingness to take risks and to experiment (Fehér and Varga, 2017) with digital technologies on a small scale before scaling these successful experiments to the rest of the organization (Dremel et al., 2017). (78. Vial 2019 - Understanding digital transformation)
Collaborative governance and project management: a predictive or agile approach
(Brand, et al., 2019) identifies that there are three key concepts that are required to 157 embrace Digital Business Agility. Recent experience in the United States of America (USA) and the United Kingdom (UK) suggests these same concepts enable successful digital innovation in a Megaproject environment (63. Whitmore 2021 - Are Megaprojects Ready for the 4IR)
one such example is the recent collaboration between the industrial giant Siemens, which spends around $☐ billion a year in research and development, and A~asdi, an innovative machine-learning company and Forum Technology pioneer founded at Stanford University in 2000. (80. Schwab 2017 - The Fourth Industrial Revolution)
'earlier we had yearly goals, but now we have adopted a more agile way than that. So, we can change goals during the year by analyzing the changing environment.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'I have a team of 35 people; I have instructed all of them to report to one person, and that one person reports to me.' Similarly, GM added, we are working on becoming less and less hierarchical all the time, especially for digital transformation. But it goes hand-in-hand with company culture as well.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'It means that there is no more strategic planning or yearly plans, there is no more project linear execution. It's always about being able to adopt the change, based on the new information, changing markets, (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'we have created acceleration centers where we are pulling people from different parts of the organization to work together…because everyone tends to work in their silos because of their profit-and-loss responsibilities.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

'we need to have speed in our actions in order to answer the expectations of a younger workforce.' He further said, 'agility is one basic change in our way of working, as we have been a waterfall company.' SMDT explained, I would say that's the concept of how you work in an agile way. I'm not talking about adopting any specific methodology of agility, but what really are the principles of the agile way of working and being able to adopt them at a certain level that makes sense for your organization is a must.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'we should adopt an agile working environment where we can utilize cross-functional resources. Currently, people are allocated to certain positions by function or organization, and cross-utilization of competencies is not very high.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'we're looking into partnerships because we don't think that we can do all of it (digital transformation) ourselves. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'when we do some project, we have some gate models, we have decision-making points on how we have to make decisions. When we have to make a decision, it should be based on those points and what the decision should be.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
Committed, entrepreneurial and empowered professionals
project-led innovation is encouraged, with teams and individuals recognized for their contributions to improving the business. (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)
'the corporate structure actually defines that you cannot do things without approval. And approval can have several layers. Still, I would say that we, as a company, have quite a good focus on empowering people.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
"The 'on-boarding' sessions, in which corporate values are presented, are rather important. On boarding takes place during a one week stretch in Barcelona. There is a 3-day training session where the incoming workers are rotated through each department to see how their peers' function. They are introduced to the rest of the employees and get invited to absorb the Infojobs culture. Moreover, each new employee is assigned a mentor who accompanies her during the first months. (. . .) The entry of each employee is carefully monitored, and at the 90-day mark, they are asked for feedback on their first three months and whether they need anything." (35. Moreno Romero 2020 - The Path towards Evolutionary—Teal Organizations)
• The project director and functional managers talk about 'doing it together' in meetings and townhalls, act openly and collaboratively, daily walk across the project floor to talk to the team members, keep their office doors open, and ask if any help is needed (O) • In the execution phase, project managers from all partners walk the site to check performance, safety, etc. All managers can comment on unsafe behavior of any workers, regardless of the company they work for (I). (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
• The team sticks to joint actions and problem solving in situations where things do not go as planned – e.g., when the client announces tender for the next phase, the team continues to work with the counterparts, daily meetings, etc. to deliver the design, schedule, and cost estimate (O). If one of the parties underperforms in the coalition, all managers discuss what can be adjusted in their work and what extra resources can be brought in to help this subcontractor (I). • All executives meet and visit the project site regularly. Each company executive visits the site regularly and explains what behavioral changes are needed and why – talking to managers, supervisors, and blue-collar workers (I). (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
A series of workshops was held to illustrate the potential and the diversity of the area, at Roche sites as well as at external organizations. For this phase, an exploratory team was put together, primarily composed of people with a certain affinity (and often experience) for the topic including several line managers, ensuring empowerment for decisions and follow-through. (60. Piccione 2021 - Realistic interplays between data science and chemical engineering in the first quarter of the 21st century, part 2)

A vibrant portfolio starts with the identification of digital projects. An active, ongoing initiation hinges on the existence and energy of individuals with enough knowledge of natural science and engineering to understand the subject matter relevant prior art, and enough digital savvy to see how computer methods and tools could be used. Such translators are rare and must be empowered to pose questions and obtain data scientist resource for prototyping. (60. Piccione 2021 - Realistic interplays between data science and chemical engineering in the first quarter of the 21st century, part 2)

About self-management, there are indications that the group is making an effort to introduce it, but they are presently far from applying as considered in the Teal model. The organizational structure is clearly defined, with a defined hierarchy and fixed work positions, but they are flexibly interpreted, and people in the organization are listened to. There is a fair degree of employee empowerment: they can negotiate with their manager about objectives, work hours, and the option of teleworking, (35. Moreno Romero 2020 - The Path towards Evolutionary—Teal Organizations)

Adequate time and resources must be devoted to developing ownership among all participants in a collaborative effort. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)

Allowing decisions within project teams – decisions made by project teams speed up the decision process and allows people with relevant knowledge to decide (C) (52. Johansson 2020 - Digital production innovation projects – The applicability of managerial controls under high levels of complexity and uncertainty)

Coordination of tasks

'collaboration' is commonly interchanged with 'cooperation' and 'coordination.' By contrast, the majority of scholars distinguish among cooperation, coordination, and collaboration. Cooperation is characterized by informal relationships that exist without any commonly defined mission, structure or planning effort. Information is shared as needed, and authority is retained by each organization so there is virtually no risk. Resources are separate as are rewards. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)

A BIM-enabled DB (design and build) project is more integrated and in the absence of IPD project case study, DB procurement approach could support BIM coordination, by creating an environment that fosters concurrent interactions among team members and tasks. Using a single in-depth DB case study, this study examines effort distribution among seven tasks during design, and by that means conceptualizes the interdependences among them, (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)

According to Malone and Crowston (1994) simultaneity constraints is a form of dependency where tasks need to occur at the same time or where they cannot occur at the same time. Thompson (2003) refers to this as "sequential interdependence". In BIM, some activities may occur concurrently while others cannot (Engwall 2012). (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)

All of the interviewees are part of the INA BIM Management Team, and they are all responsible for delivering the project by facilitating communication between all project parties by providing and maintaining the coordinated BIM models. (16. Koseoglu 2019 - Challenges and enablers in BIM-Enabled Digital Transformation)

although individual firms had strong external or internal BIM motivations and visions to adopt BIM innovation, the project networks rarely coordinated to support BIM implementation. (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))

An understanding of effort distribution among BIM tasks should facilitate the monitoring of producer–consumer relationship dependency across the BIM life cycle. (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)

approaching BIM as an evolving domain from a historical view (Table 1) was an effort to acknowledge that it has emerged from a collaborative setting between industry and policy, and although its associated technologies are old, its novelty lies in the need for processes, coordination, and well-defined workflows (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))

As the Trade Partners work interdependently and share the same space, it is important for each user to visualize the scope of work of other trades. This process increases coordination, validates the sequence, increases transparency between trades, and creates a common understanding. (20. Nassereddine 2022 - Design, Development, and Validation of an Augmented Reality-Enabled Production Strategy Process)

Basically, I am the linking pin in the communication among the parties, signalling errors and ensuring that errors are assigned to the right person for further processing. (07. Papadonikolaki, van Oel and Kagioli 2019 - Organizing and Managing boundaries (BIM))

Because of the high level of task interdependences work pressure at DD (design development phase) stage can impact a project and influence efficiency if not well planned and managed. (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)

Cross-functional teams, non-siloed organizations, internal collaboration, teamwork, interdependent work and supplementation of capabilities

The company is eager to maintain their long-standing working relationships with their suppliers because they have built business trust with them. (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)

(1) a roadmap for the application of I4.0 technologies to enhance the collaboration capabilities of SMEs; (2) a structure for I4.0 standardization to develop and sustain trust among partners; and (3) an improved data science platform for systematizing big data to extract critical information for collaboration solutions for SMEs. Additionally, the solutions are evaluated based on an application case of a Greek SME, demonstrating their potentials for practical implementation. (50. Han 2022 - Towards a data science platform for improving SME collaboration through Industry 4.0 technologies)

(H2a and H2b), which tested for the effects of collaborative innovation with suppliers and customers on a SC's efficiency and adaptability. As shown in model 3, no effect on efficiency was detected (= 0.413 nonsignificant at $p<0.10$). Hence, H2a was not supported. In model 7, however, the moderation effect was significantly positive (= 0.518 significant at $p<0.10$). This result means that collaborative innovation with suppliers and customers reinforces the impact of digital transformation on adaptability, providing support for H2b. (53. Abdalla 2021 - The Interplay of Digital Transformation and Collaborative Interplay)

, long-term strategic networks are characterized as strategic alliances created to act as source or breeding environments for "goal-oriented networks", i.e., aimed at providing proper conditions and support environment for dynamic creation of goal-oriented networks whenever a business opportunity arises. (11. Camarinha-Matos 2019 - Collaborative networks A pillar of digital transformation)

. Compared to lean construction in isolation, lean construction with supply chain collaboration, especially with longterm supply chain collaboration, is more successful. The finding describes a stepwise improvement of lean construction following the development of supply chain collaboration. In order to improve lean construction, developing supply chain collaboration is particularly important. (12. Meng 2019 - Lean management in the context of construction supply chains)

operating in an increasingly complex and disruptive environment requires the intellectual and social agility of the fox rather than the fixed and narrow focus of the hedgehog. (80. Schwab 2017 - The Fourth Industrial Revolution)

'we are working on becoming less and less hierarchical all the time, especially for digital transformation. But it goes hand-in-hand with company culture as well.' As industrial organizations still possess a rigid hierarchy, formalization is also high in the case of organizations. The interviewees understand that they are still very process-oriented organizations. For example, SMD said, (we are) very much kind of a process-oriented company.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

'we should adopt an agile working environment where we can utilize cross-functional resources. Currently, people are allocated to certain positions by function or organization, and cross-utilization of competencies is not very high.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

"a central characteristic of loosely coupled networks is an inhouse capability for systems integration" (Brusoni and Prencipe 2001, p. 1033). Accordingly, the actors of the two foregoing described pairs could qualify as orchestrators of innovation, depending on the procurement routes and, essentially, their involvement. For example, a DB contract may provide the opportunity that the contractor to play a systems integrator role, following clients' prescriptions (Case C). (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
"Central to the delivery of T5 has been the concept of Buildings 2019, 9, 115 18 of 24 integrated teams" [71] indicates the enabler of the collaborative working environment. (16. Koseoglu 2019 - Challenges and enablers in BIM-Enabled Digital Transformation)
"Horizontal integration" refers to "networking along the whole value chain, from suppliers and business partners to customers" [1,10,19], bringing them into a "close working relationship with each other", i.e., "in order to achieve seamless and secure cooperation between enterprises" and towards the market [9,20–22]. Horizontal integration should be based on a reliable and secure infrastructure supporting the collaboration between manufacturing organizations and their partners in the supply chain. Through such support all actors and units involved can communicate changes and share information in real-time. (11. Camarinha-Matos 2019 - Collaborative networks A pillar of digital transformation)

Customer centrality
Building transparent, trust-based relationships with clients by offering reliable, professional advice about the use of BIM is also important. (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)
Uber's popularity in man~ cities starts with an improved customer experience—tracking of the car location via a mobile device, a description of the car standards and a seamless payment process, thus avoiding delays at the destination. (80. Schwab 2017 - The Fourth Industrial Revolution)
once a customer has established a track record of trust and confidence on the platform, it becomes easy for the digital provider to offer other products and services. (80. Schwab 2017 - The Fourth Industrial Revolution)
'digitalization is actually the realization of transferring all this into real customer perspective.' GM put it, 'It connects us with customers more closely. I think this is the biggest difference.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'even though we are focusing on digitalization within the company, the benefits will be reaped by the customers. Co-creation and co-innovation will be a standard process, and the new ways of working will show in everything we do, from sales to manufacturing.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'how I see the digitalization is that you start selling something that your customers don't even know that they need.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'my specific responsibilities include cyber security, all IT, all of the innovation, processes, and capabilities, including working with start-ups and all digital product development. All of that translates into "how do we drive value for customers through digital?"' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'you start selling something that your customers don't even know that they need.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
"[In terms of] customer collaboration – there we have gained trust; they know now how they can get things forward." (Consultant C) (74. Ylinen - 2021 - Incorporating agile practices in public sector)
"clients," and "collaborations" (40, 23, 28, and 20 occurrences, respectively) are also evident as relevant factors that facilitate the journey toward digital transformation in manufacturing. (41. Rocha 2021 - Collaborations for Digital Transformation Case Studies of Industry 4.0 in Brazil)

Data availability and sharing
"if BIM database is built early in SD phase before it is passed to us we should not be using too much effort in DD". (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)

"We have to hire people who have skills in data collection and analysis to cope with the increasing volume of data (…). We have never had that before, and it requires completely different skills than in our industry. (04. Tronvoll 2020 - Transformational shifts through digital servitization)
A project website hosted on the servers of the BIM managers was used as a Common Data Environment (CDE) to share project information using the BIM collaboration format (BCF) for model coordination and management of issues. (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)
A related mistake is the assumption that powerful algorithms can do wonders with data in insufficient amounts or of insufficient quality. Rather, the well-known "GIGO" principle (garbage in, garbage out) applies. Furthermore, if a process is very tightly controlled, even large amounts of historical data may be poor information. (60. Piccione 2021 - Realistic interplays between data science and chemical engineering in the first quarter of the 21st century, part 2)
Academia and industry have created process models to carry out data science and related data analytics and data mining projects to establish standards. Among these process models, the most successful methodology that emerged from academia (Moreira et al., 2018) is the Knowledge Discovery in Databases (KDD) (Fayyad et al., 1996). The KDD process proposes a sequence of nine steps with possible backtracks. The process starts with "learning the application domain" and ends with "using discovered knowledge in practice" (Moreira et al., 2018). (69. Kayabay 2022 - Data science roadmapping)
Additionally, lack of BIM understanding, training and software immaturity in terms of data exchange, quality and interoperability are considered as important barriers to adoption. (31. Brunet 2019 - Analysis of BIM use for asset management in three public organizations in Quebec, Canada)
Additionally, the evolution of Industry 4.0 improves the productivity of the pharma industry. The continuous production can reduce material utilization, energy consumption and GHG emission, which thus leads to greater contributions to environmental protection. Finally, the IoT, CPS and big data analytics enable supply chain managers to make decisions in more autonomous ways, especially for those staff who are working in healthcare sectors without adequate expertise on supply chain management and sustainable practices. (03. Ding 2018 - Pharma Industry 4.0 Literature review and research opportunities in sustainable)
All of the project teams deliver the project as one team by utilizing a seamless digital platform. One of the key enablers behind achieving this is the shortening of the BIM learning curves of the stakeholders by positioning a quick-learner young generation in facilitated workshops. (16. Koseoglu 2019 - Challenges and enablers in BIM-Enabled Digital Transformation)
and (3) an improved data science platform for systematizing big data to extract critical information for collaboration solutions for SMEs. (50. Han 2022 - Towards a data science platform for improving SME collaboration through Industry 4.0 technologies)
Another aspect of interoperability that should be addressed in further development of the HORSE reference architecture, is the extension of the framework by including an analysis phase, apart from the design and execution phases. Running systems, robots, and devices produce a lot of data that can be useful both in short and long-term for optimization of processes. (59. Traganos 2021 - The HORSE framework)
Decision-making agility
'It means that there is no more strategic planning or yearly plans, there is no more project linear execution. It's always about being able to adopt the change, based on the new information, changing markets, (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'we need to have speed in our actions in order to meet the expectations of a younger workforce.' He further said, 'agility is one basic change in our way of working, as we have been a waterfall company.' SMDT explained, 'I would say that's the concept of how you work in an agile way. I'm not talking about adopting any specific methodology of agility, but what really are the principles of the agile way of working and being able to adopt them at a certain level that makes sense for your organization is a must.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

"On that digital side, the strategy and processes are not the same as when you had a five-year strategy with a goal at the end—it no longer works that way. Now, you have to develop things faster, pilot things faster, so you have to be very agile—half a year or a year, and you have to be able to switch direction. It does not have to be entirely new, but you have to be agile—make small changes here and there. You have to create opportunities and understand them on the way." (Senior Vice President, Information & Control). (04. Tronvoll 2020 - Transformational shifts through digital servitization)
a need for an agile mindset and ways of working was found to be more imperative for digital servitization compared with "traditional" servitization. (04. Tronvoll 2020 - Transformational shifts through digital servitization)
Ability to respond to unpredictable changes quickly and gracefully [85]. (11. Camarinha-Matos 2019 - Collaborative networks A pillar of digital transformation)
According to Christopher and Peck,1 supply chain re-engineering, supply chain collaboration, agility, and supply chain risk management culture are required to create a resilient supply chain (Fig. 1). (56. Agarwal 2021 - Selecting Capabilities to Mitigate Supply Chain Resilience Barriers for an Industry 4.0)
Adjusting strategic and operational targets around shorter timelines—for example, setting one-year rather than five-year goals around digital services (04. Tronvoll 2020 - Transformational shifts through digital servitization)
Agile capabilities Refers to the level of visibility and the level of responsiveness of the supply chain. (56. Agarwal 2021 - Selecting Capabilities to Mitigate Supply Chain Resilience Barriers for an Industry 4.0)
agility is one of the most important topics of cultural change for digital transformation, as SMDT mentioned. The main reason behind it is that the case organizations had been operating on waterfall-model bases, where things moved very slowly. Now because of digital transformation, they are moving toward agility, which requires massive change in their culture, especially the ways of working. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
Agility: Initiating agility is one of the key tasks for cultural-change initiatives in incumbent organizations. We found that 83% of participants gave their views on how cultural change can create agility for the case organizations. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
Definition of shared goals, shared vision and mutual benefits
Collective Ownership of Goals, which refers to shared responsibility in the entire process of reaching goals, including joint design, definition, development, and achievement is necessary to facilitate the collaborative process. (Mellin, (2010). Measuring interprofessional)
is consistent and can be repeated across the firm; (68.Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)
Strong leadership is needed to design a robust digital strategy plan and to communicate the digital strategy and vision to employees. (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)
'earlier we had yearly goals, but now we have adopted a more agile way than that. So, we can change goals during the year by analyzing the changing environment.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
"The role of IT in supporting operations is to understand more about what their goals are and what challenges they have, so that we can partner together, collaborate together and help them create solutions that support their needs," says Ms. Branham. While it does require time and a concerted effort, this type of collaboration is a key component to any successful digital transformation approach. (70. Elwart 2020 - Ergon refining A digital transformation story)
"We are now mainly engaged in collaborative 3D modelling and the contact is intensifying. This is because subcontracting parties are increasingly involved in BIM. [Together with the contractor] we aim for integration with all other involved parties and to benefit from each other's contributions as to realize the best possible construction process" (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))

"We asked for co-authors to come on board for the white paper so that we were not the only authors—because then it would only be our idea, and change management means winning over as many people as possible. (…) (04. Tronvoll 2020 - Transformational shifts through digital servitization)

"we think it is important to select partners that recognize the value of BIM themselves" (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))

A 1980 study of inter-institutional collaborations among education, - employment and training organizations found that they worked best in settings where enlightened self-interest was present. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)

a digital transformation strategy with realistic objectives; (68.Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)

a positive aspiration and motivation for exchanging knowledge, the dominance of a good context in an organization, and reciprocal trust between personal factors would affect knowledge management positively. However, negative competition and unwillingness for sharing knowledge are among factors that affect KM adversely. Shared values are a crucial part of organizational culture. (48. Abdalla 2020 - Managing knowledge in the context)

Efficiency, performance, and competitive advantage

Part of the leadership strategy is to aim for external recognition through industry awards because it gives employees a boost, (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)

(at end of CD – working drawings production). At the CD phase with working drawings production, a higher-than-expected effort level for a BIM project can be observed, and it is unusual. 2D drawing activities was responsible for this second hump (Interviewees A/B/C/J/N) and it is very common in the current BIM practice, and it is an area needing greater efficiency in practice (Interviewee G/J/N). (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)

(H2a and H2b), which tested for the effects of collaborative innovation with suppliers and customers on a SC's efficiency and adaptability. As shown in model 3, no effect on efficiency was detected ($= 0.413$ nonsignificant at $p<0.10$). Hence, H2a was not supported. In model 7, however, the moderation effect was significantly positive ($= 0.518$ significant at $p<0.10$). This result means that collaborative innovation with suppliers and customers reinforces the impact of digital
transformation on adaptability, providing support for H2b. (53. Abdalla 2021 - The Interplay of Digital Transformation and Collaborative Interplay)

esta's study shows that these cities particularly succeed in finding creative ways to effect change outside of the formal policy arena, being open b~ default, and acting more like entrepreneurs (than bureaucrats). (80. Schwab 2017 - The Fourth Industrial Revolution)

new technologies will dramatically change the nature of work across all industries and occupations. (80. Schwab 2017 - The Fourth Industrial Revolution)

~ne challenging scenario for low-income countries is if the fourth industrial revolution leads to significant "re-shoring" of global manufacturing to advanced economies, something ver~ possible if access to low-cost labor no longer drives the competitiveness of firms. (80. Schwab 2017 - The Fourth Industrial Revolution)

One interesting development in this area is OpenAI, a nonprofit AI research company announced in December 2015 with the goal to "advance digital intelligence in the way that is most likely to benefit humanity as a whole, unconstrained by a need to generate financial return."61 The initiative— chaired b~ Sam Altman, president of Y Combinator, and Elon Musk, CE~ of Tesla Motors—has secured $1 billion in committed funding. (80. Schwab 2017 - The Fourth Industrial Revolution)

one of the key tasks the world faces as this revolution emerges is how to gather more and better data on both the benefits and challenges to community cohesion. (80. Schwab 2017 - The Fourth Industrial Revolution)

one primary argument focuses on the challenge of measuring inputs and outputs and hence discerning productivity. (80. Schwab 2017 - The Fourth Industrial Revolution)

for the people who are in the cloud, the main advantages reside in the freedom (to work or not) and the unrivaled mobility that they enjoy by belonging to a global virtual network. Some independent workers see this as offering the ideal combination of a lot of freedom, less stress and greater job satisfaction. (80. Schwab 2017 - The Fourth Industrial Revolution)

Experimentation, design thinking, innovation labs, iterations and prototyping

'leaders have to involve customers in piloting. It requires leaders to balance the speed of execution with the level of quality needed.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

"In Infojobs, at least in the Sales Dept., we have a set of objectives. You negotiate with your boss, but if you can't reach them, you aren´t penalized. We use the 'RAC' tool. Every 15 days, there is a team meeting where decisions are made; someone in the team is responsible for setting the agenda points that should be available on the previous Thursday (this task is rotated). (35. Moreno Romero 2020 - The Path towards Evolutionary—Teal Organizations)

"On that digital side, the strategy and processes are not the same as
when you had a five-year strategy with a goal at the end—it no longer works that way. Now, you have to develop things faster, pilot things faster, so you have to be very agile—half a year or a year, and you have to be able to switch direction. It does not have to be entirely new, but you have to be agile—make small changes here and there. You have to create opportunities and understand them on the way." (Senior Vice President, Information & Control). (04. Tronvoll 2020 - Transformational shifts through digital servitization)

• To produce a quality solution, a modular design is key. This enables features to be added throughout the design, construction and operational life cycle as they become available. (63. Whitmore 2021 - Are Megaprojects Ready for the 4IR)

25% of the participants viewed digital transformation as cultural change.
MDT stated, 'It's more than tools and processes, it's really about mindset change.' GM also stated similar views: 'It's a mindset change and cultural change that is happening right now.' MDIT added, 'It's change of culture. We need to be faster, and we need to have more services than products.' Two participants mentioned that digital transformation brings experimentation capabilities to the incumbent originations. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

A further topic illustrates and puts into practice innovative teaching methods as alternatives to the more classical front approach. Labs involve groups of teachers from each school complex and last one week. Teachers are supported to spread the content they learn among their colleagues at school to enhance the training process, in the first level of cascade training. (34. DeMartini 2020 - Education and Digital Transformation)

A prototype was developed in this research as a proof-of-concept to showcase and validate the impact of AR on the PSP. Throughout the development of the prototype, feedback from the construction industry, specifically from PSP subject matter experts was incorporated into the design to continuously furnish usability insights and to ensure the effectiveness of the software. (20. Nassereddine 2022 - Design, Development, and Validation of an Augmented Reality-Enabled Production Strategy Process)

A question that arises from these findings therefore relates to our understanding of what a "digital culture looks like" (Kane et al., 2016:9). A common theme across studies points to the need for firms to cultivate a willingness to take risks and to experiment (Fehér and Varga, 2017) with digital technologies on a small scale before scaling these successful experiments to the rest of the organization (Dremel et al., 2017). (78. Vial 2019 - Understanding digital transformation)

A strategic approach to scaling up. Ergon has chosen a balanced strategy: establishing itself as an early adopter of new automation technology but doing so in a way that has allowed the company to scale up solutions that work while remaining agile enough to try a variety of potential solutions until it finds the right fit for a given application. (70. Elwart 2020 - Ergon refining A digital transformation story)

After briefly putting scientific software development in context, the importance of ensuring the appropriate infrastructure is highlighted, followed by some best-practice elements of software development: the explicit adoption of a process model, iterative development, and the necessary decentralization to support such development. (60. Piccione 2021 - Realistic interplays between data science and chemical engineering in the first quarter of the 21st century, part 2)

Flexibility and adaptability

(H2a and H2b), which tested for the effects of collaborative innovation with suppliers and customers on a SC's efficiency and adaptability. As shown in model 3, no effect on efficiency was detected (= 0.413 nonsignificant at p<0.10). Hence, H2a was not supported. In model 7, however, the moderation effect was significantly positive (= 0.518 significant at p<0.10). This result means that collaborative innovation with suppliers and customers reinforces the impact of digital transformation on adaptability, providing support for H2b. (53. Abdalla 2021 - The Interplay of Digital Transformation and Collaborative Interplay)

for all the reasons already~ mentioned, we are at the threshold of a radical systemic change that requires human beings to adapt continuously~. (80. Schwab 2017 - The Fourth Industrial Revolution)

'there is one thing that is key, which is adaptability. You can also call it being agile or being flexible, but adaptability is basically strong change-leadership skills.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

Acollaborative group should keep itself aware of community trends,
other changes in the environment, and the directions pursued by its members. It should accommodate itself to these developments. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)

Adaptation is all about the project's ability to monitor not only risk, but also opportunity, and be able to act on information in a timely manner. Monitoring for opportunity and risk is best done by those closest to project implementation (Ika, L. A., & Donnelly, J. (2017). Success conditions)

Agility: Our results show that leadership has a key role in attaining organizational agility. We found that 50% of the participants gave their views on how leadership can play its role in attaining agility. A few of them related it to leadership competency, adaptability and flexibility. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

Among the three cases, Case B could be considered more responsive than Cases A and C because they did not have rigid BIM-based partner selection criteria; they were flexible regarding meetings and collocations (Table 6). (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))

By leveraging I4.0 technologies, a small and medium enterprise (SME) can increase its organizational agility, adaptability, and resilience to cope with today's competitive environment by becoming a valuable and innovative partner in the power dynamics with its large buyer counterparts. However (50. Han 2022 - Towards a data science platform for improving SME collaboration through Industry 4.0 technologies)

Capability of supply flexibility. Table 3. Capabilities required to become resilient for case company. Description. Ability to change outputs/inputs or the mode of receiving/delivering. Supply flexibility can be imparted through flexible suppliers and through °flexible supply contracts (56. Agarwal 2021 - Selecting Capabilities to Mitigate Supply Chain Resilience Barriers for an Industry 4.0)

Capability to adjust to changing work to ensure that changes caused by a disruptive event or customer demand can be handled successfully [85]. (11. Camarinha-Matos 2019 - Collaborative networks A pillar of digital transformation)

Improve solutions and processes with feedback

A series of post-workshop activities is necessary to develop a proper roadmap for the final review meeting. (Kerr et al., 2019). These activities include analyzing workshop data, synthesizing the roadmap draft, and iterating the roadmap with stakeholders' feedback. (69. Kayabay 2022 - Data science roadmapping)

behaviors whereby collaborators think and talk about their working relationships and process and where collaborators incorporate feedback about their process to strengthen collaborative relationships and effectiveness (85. Bronstein 2002 - Index of interdisciplinary collaboration)

The analysis of the usage of these tools assisted the team to optimize a solution based on user feedback (Step 10). (72. Robu 2021 - Digital Transformation Designed to Succeed)

Value of feedback to optimize – be responsive to user feedback before, during and after implementation; demonstrate through follow-up updates and improvements that their input counts. (72. Robu 2021 - Digital Transformation Designed to Succeed)

Improvements to business processes and business models

(4) Business Process Model and Notation (BPMN) (White, 2004) has been used to graphically represent the micro-level road mapping processes during the development and application of the framework. The modeling tools have enabled the tracking of all revisions and comments in a single place, leading to systematic method development. (69.Kayabay 2022 - Data science roadmapping)
• It is easier to detect errors in the AR-PSP than it is in the Traditional PSP (with a p-value of 0.0121). (20. Nassereddine 2022 - Design, Development, and Validation of an Augmented Reality-Enabled Production Strategy Process)
Advanced digital tools provide rapid access to real-time project data for different phases of the project (16. Koseoglu 2019 - Challenges and enablers in BIM-Enabled Digital Transformation)
After identifying the challenges encountered in the current PSP and exploring opportunities for integrating AR, an AR-enabled PSP is envisioned in which the BIM model is used as the guide and chief reference for production strategy development. BIM is thus a precursor to implementing AR-enabled PSP and AR allows the last planners not only to see the BIM model from different perspectives but also to become a participant in the process of virtual production. (20. Nassereddine 2022 - Design, Development, and Validation of an Augmented Reality-Enabled Production Strategy Process)
Among the four indicators of lean construction, emphasis on customer value receives 79.9% of positive responses (including the responses to both Very Positive and Positive); encouragement of learning and innovation receives 68.6% of positive responses; effort for waste minimization receives 77.7% of positive responses and commitment to continuous improvement receives 77.7% of positive responses. (12. Meng 2019 - Lean management in the context of construction supply chains)
Apart from technology, BIM is an innovation because it brings new workflows for innovative project delivery and deeply transforms the intra- and interorganizational settings. (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
approaching BIM as an evolving domain from a historical view (Table 1) was an effort to acknowledge that it has emerged from a collaborative setting between industry and policy, and although its associated technologies are old, its novelty lies in the need for processes, coordination, and well-defined workflows (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
Appropriate promotion of digitalization in factories will also make it possible to improve work efficiency, streamline production lines, and reduce defective products and inventories [37–59]. These will maximize the products and added value while minimizing the waste of parts and materials. As a result, the earth's limited resources will be effectively utilized, contributing to reducing the environmental load. (65. Fukuzawa 2022 - An Exploratory Case Study on the Metrics)
Automation of tasks, use of sensors, artificial intelligence and smart contracts reduces risk of human error. Certification/ verification of coding through DLT will provide quality assurance for construction projects [115]. (02.Li, Greenwood e Kassem 2019 - Blockchain in the built environment and construction industry)
Awareness of the status of all variables (products and environment) to minimize vulnerabilities, to make more informed and precise decisions in real time, predict issues, and self-optimize as problems occur [85]. (11. Camarinha-Matos 2019 - Collaborative networks A pillar of digital transformation)
Informal networks
'I have a team of 35 people; I have instructed all of them to report to one person, and that one person reports to me.' Similarly, GM added, we are working on becoming less and less hierarchical all the time, especially for digital transformation. But it goes hand-in-hand with company culture as well.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
"In the 'Santa@ Day', only celebrated at Infojobs, the company used to be closed, and everyone went out to have a good time, seeking leisure activities and to disconnect from work. It was a day organized by the employees, which brought people together. These days were theme-based, and there were teams of people that normally wouldn't be together at the firm." (35. Moreno Romero 2020 - The Path towards Evolutionary—Teal Organizations)
141 offices who play an informal role as sources of advice and information about digital technologies for other peers. The visualization depicted in Figure 4 reveals that such employees exchange advice and information about digital technologies through networked relationships. (21. Bonanomi 2019 - The impact of digital transformation on formal and informal organizational structures of large architecture and engineering firms)

After having identified the informal go-to people for advice and information about digital technologies and their informal relationships' pattern (see Figure 4), we also investigated the formal relationships that the reporting structure builds between these professionals (see Figure 5). This analysis finds that only 35 percent of them can formally connect with one another thanks to the direct reporting relationships that the formal structure builds between them. (21. Bonanomi 2019 - The impact of digital transformation on formal and informal organizational structures of large architecture and engineering firms)
although actors may appropriate innovation, the stability and performance of the network also depend on knowledge mobility via formal and informal communication channels. (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
At the same time, the highly collaborative attitudes of other managers led to a higher number of integrative practices within the team, including social gatherings outside work hours. (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
Behaviors that characterize interdependence include formal and informal time spent together, oral and written communication among professional colleagues, and a valuing of and respect for colleagues' professional opinions and input as necessary to do one's job (Abramson Rom:naval, J995; Billups, 1987; Kagan, Goffin., Golub, & Pritchard., 1995; Kane, 1980; Lansdale, Webb, & Briggs, 1980; Mattessich and Monsey, 1992; Soler & haulier, 1993; Webb & Hobdell., 1980). 2 (85. Bronstein 2002 - Index of interdisciplinary collaboration)
Case B contractor ensured with formal and informal approaches that BIM communications run smoothly. Case B contractor's site engineer argued that "we make appointments in advance. We have a BIM kick-off meeting, where we go with all our partners to agree how we are going to provide, what sessions we're going to get to keep our noses in the same direction for BIM." The architects also often contributed in good communications. (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
Community building: the 'Clock Plaza' is a place in Infojobs' Barcelona offices where all kinds of communiqués are made. Whenever there is an occasion to celebrate, some food is brought in (generally pizza), and they meet in this plaza to have a pleasant time. (35. Moreno Romero 2020 - The Path towards Evolutionary—Teal Organizations)
Data gathered through the two rounds of surveys allowed us to identify the informal structure for advice and information exchange about digital technologies operating within Stantec (see Figure 4). (21. Bonanomi 2019 - The impact of digital transformation on formal and informal organizational structures of large architecture and engineering firms)
Information exchange and communication
"As organizers, we are always aware of everything that may affect the producers' attendance to the market. They communicate it to us directly. And if they want help from us, we see a way to help them, for example, when they Centralized communication have a money problem. Where we have a blind spot is in the production process. For instance, we are not following their Visibility production schedules, we only visit their production units or farms from time to time to check that the required agroecological practices are met." ((26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)
"I feel that our collaboration is based on trust and constant communication among members. For instance, if there is something, a problem that is preventing us or making it difficult for us to Collaboration continue operating, we sit down, talk and try to solve things in the most efficient way and as quickly as possible." (INT3) (26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)
"if BIM database is built early in SD phase before it is passed to us, we should not be using too much effort in DD". (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)
"Information flows quite efficiently because there is no purchasing department that manages all the suppliers. Instead, each of us is responsible for a few suppliers. We are the direct link with those suppliers, so they communicate with us if an issue regarding production or supply emerges. This way, we can solve problems immediately in most cases." (26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)

"it is better to have the client as part of the team because it is better to have the tensions with them at the beginning of the project, rather than at the end. [...] This will force them to be more responsible in what they want. They cannot change it later on ifthey are committed earlier on" (Quotation-21-B). (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
"One time, it was the middle of the week when we noticed that traffic was getting really bad close to our collection point because of the The use of digital technologies construction of a bridge nearby. So, we decided to change our collection point. This was communicated to our consumers on a Thursday, which gave them a three-day notice. Luckily, they all supported the change and were able to collect their products from a different location." (26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)
"our customers and clients have not yet confidence in the construction industry, because of the mistrust. ... So, if we are open about what we want to make, then we get another discussion" (Case B architect, lead architect). (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
"To establish the district, business leaders carried a major leadership role. The approach included extensive collaboration, networking, and communication. Leaders met with other property owners and with elected and appeinted public officials, circulated petitions, published notices in newspapers, and held informal meetings. Although bound- aries were controversial, the property owners approved the district... (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)
"We do lot at in the model at DD to define design decisions to get building permit [...] then once the sub-contractor comes in then changes start to surface because more subcontractors are getting involved. There may also be need for budget cut and there is inefficiency due to cost of changing models" (Interviewee G). By involving subcontractors at DD could bring greater efficiency. (30.Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)
"Well, before the pandemic, we had already set up the chats and implemented the 'order and collect' system to minimize food waste. So, when the pandemic started, we were able to implement home deliveries quickly. I think having the chats helped us a lot." (26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)

Investment in relationships
• Information about project progress, risks, and deliverables is provided to all team members (charts in meeting rooms, weekly memo updates, etc.) – different managers are responsible for different parts of update (O, I).   • Counterparts share 'reasonably confidential information' e.g., related to relevant experiences from other projects with different counterparts, regarding traditionally sensitive subjects such as price or proprietary drawings (O).   • Communicating face-to-face: team members walk to each other, instead of using email or phone (O, I).   • Communicating frequently with counterparts to align on all steps (O).   • Team members in the meetings provide feedback constructively and respectfully if something goes wrong (O).   • People have time for counterparts and team members, are available for discussions and help (O).   • An 'open-door approach' by the project directors and functional managers – anybody can walk in for questions, concerns or a chat (O, I).   • The team together discusses collaboration in a very honest and open manner; how successful it was and what were the challenges and outcomes (O). (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)

• Treating everyone equally. Every person and job are important for the project. No hierarchy. Project directors and functional managers have an open-door policy, walk on the project floor to talk casually to any team members O, I). • Everybody has the right to voice their own ideas, thoughts, and concerns; one person talks at a time, everybody listens (O, I). • "Thank you" is regularly said for good work. Contributions are recognised and celebrated in weekly meetings, newsletters, etc. (O, I) • Managers try to understand and accommodate different cultures (e.g., Asia, Europe) (I). • People arrive at meetings on time and keep to the time schedule. Volunteer timekeeper gives notice of how much time is left, and meetings end on time (O). (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
A plethora of studies supports the collaboration benefits of BIM (Barlish and Sullivan, 2012; Demian and Walters, 2014) that are debatable for others (Dainty et al., 2017). This study departs from this dichotomy and claims that BIM artefacts supported more the structure than the agency of BIM collaboration (Knowledge contribution A). (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
According to Taylor and Levitt (2007), construction systems with strong relational stability and permeable boundaries perform better with misaligned innovation—and probably with BIM innovation. (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
According to the 'management as organization' approach, information systems could support communication and collaboration within and among groups (Johnston and Brennan, 1996). However, the study revealed that collaboration is partially supported by BIM artefacts. The study also highlighted a transition in digital areas from a tool-oriented approach towards behaviorally driven considerations, similar to the transition of PM literature (Söderlund, 2004). (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
As parties are interdependent, they together can reach a goal that they cannot reach individually (Thomson & Perry, 2006; Thomson et al., 2009) Interest of every party is best served when the overall objective is reached (Meng, 2012) Neither party wins if others lose; recognition of mutual benefits (Yeung et al., 2012) (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
Commitment Parties need to commit to changing part of their identity to reach mutual goals and put them above individual objectives (Thomson & Perry, 2006; Thomson et al., 2009) Agreement to pursuing shared objectives (Yeung et al., 2012) Top-management support of collaboration (Suprapto et al., 2015) (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
Commitment We honor our commitment/word and recognize its value for the team. We demonstrate learning through action inside a 24-hour performance cycle. Being responsible matters. We are delivering something difficult; the faster we recognize failures and recover, the sooner we succeed. (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
Governance is related to the decisions that parties jointly make about collaboration: what collaborative bodies will govern their relationship, which behaviors are expected, or how risks and rewards will be shared. Administration covers the roles, responsibilities, and control procedures within the established collaborative structures. Autonomy is about reconciling individual and collaborative interests: although each party maintains its identity within the collaboration, it needs to adjust its behaviors and actions to achieve collective interests. Mutuality grows from interdependence as parties realize that by working together, they can achieve goals that they would not achieve individually. Finally, Norms relate to social capital norms - reciprocity and trust. (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
In Case A, they approached BIM more as a digital technology and tangible (Quotation-6-A), but in Case B, they were using it more from a relational approach (Quotation-12-B). (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
Joint problem-solving, negotiation, and compromise solutions

'most learning happens by doing and sharing and learning from others. So, in that sense, we are promoting it from a learning-culture angle, I think that the collaboration platforms that I mentioned earlier are helping in that way.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
"BIM gives better projects, because then you know each other and what to ask from your partners to think different and it helps to build trust in the long run" (Quotation-22-B). (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
"I believe the pandemic forced us to form alliances among us. We came together to send a message to the community to say 'yes, we are open, and we are going to continue providing this service, in these spaces, or in this new way'. So, I think that gave us an opportunity to start differentiating ourselves as alternative food networks." (26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)
"The first orders were delivered on a Saturday, and by Monday, a meeting was being called via zoom to talk about emergent issues. For example, we needed to urgently buy a cooler for the delivery of dairy products and meat. In other words, we were talking about all our needs. So, implementing home deliveries was easy, but there was a learning curve." (26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)
"We tried to predict the obvious issues and create a number of workflows to help solve those problems before they arose" [70]. (16. Koseoglu 2019 - Challenges and enablers in BIM-Enabled Digital Transformation)
A 1983 study describes how intergovernmental collaborative groups (with members from elected bodies, the voluntary sector and the public sector): moved forward, stowty: and deliberately in an 'effort: to solve Probl (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)
A collaborative working environment [12,24,55–59], advanced project monitoring and control system [34,35,57,59,60], BIM tools [12,18,23,61], BIM Policy [26,32,55,61–63], and organizational structure [64–66], are found to be key enablers for the INA BIM implementation case. (16. Koseoglu 2019 - Challenges and enablers in BIM-Enabled Digital Transformation)
a high intensity of KMS activities occurs at this stage, mainly to allow the supplier to understand the product definitions correctly. The knowledge sharing was supported by IT such as e-mail and videoconferences using specific software employed by AGRO, and CAD designs shared by File Transfer Protocol (FTP). These designs were storage by AGRO in their PLM system. Since the supplier used a different CAD software package, some issues arose with sharing 3D designs, such as there being no possibility of exploding components of the object in view. Some problems arose because the supplier could not understand some of the definitions produced by AGRO in Stage 1, so CWS activities were required and achieved through videoconferencing. Several PRMS activities were carried out to define and validate the plan for the tractor engine. During all the stages AGRO regularly monitored the progress of product definitions by using workflow software and project management software; however, since none of the software for PRMS was shared with the supplier, the information to be declared in the internal software was obtained mainly by e-mail. (36. Ayala 2020 - The contribution of IT-leveraging capability for collaborative)
A shift from contract negotiations to collaboration: The shift from contract negotiations to collaboration focused especially on the relationship with the IT department and the municipal business units. (74. Ylinen - 2021 - Incorporating agile practices in public sector)
a structurational view (enabled by communication, conflict management, negotiation, and teamwork) as opposed to a structural view of collaboration (e.g. BIM as software) can fully support the implementation of digital innovations. (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
Knowledge sharing and learning
'most learning happens by doing and sharing and learning from others. So, in that sense, we are promoting it from a learning-culture angle, I think that the collaboration platforms that I mentioned earlier are helping in that way.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

Academics typically work as part of collaborative R&D teams to help improve capacity and skillsets, and this engagement introduces social dilemmas and invisible costs or what some call the 'dark side of collaboration'. This can act as a disincentive to collaboration for some academics that can undermine willingness to exchange ideas and knowledge fully. (95. Fernandes 2021 - Managing Collaborative R&D Projects)
although the Case C contractor made a rather large investment in a BIM center, they did not further disseminate BIM knowledge across their partners, and innovation was not appropriated by partners, by creating a silo of knowledge. The ambitious BIM center could be described as an effort to induce a tight coupling in the system of Case C (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
Among the four indicators of lean construction, emphasis on customer value receives 79.9% of positive responses (including the responses to both Very Positive and Positive); encouragement of learning and innovation receives 68.6% of positive responses; effort for waste minimization receives 77.7% of positive responses and commitment to continuous improvement receives 77.7% of positive responses. (12. Meng 2019 - Lean management in the context of construction supply chains)
An analysis of effort distribution and the project outcomes can allow companies to learn over time in regard to their BIM implementation process. (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)
AR supports tacit knowledge exchange. A remote expert can transfer their tacit knowledge through AR via demonstration. (20. Nassereddine 2022 - Design, Development, and Validation of an Augmented Reality-Enabled Production Strategy Process)
As digital services no longer required the onboard physical presence of service engineers, customers were initially "worried that the onboard skill level would decrease because everything was done remotely." Despite these concerns, customers ultimately learned how to use and maintain the firm's equipment, with remote support from the firm. This form of collaborative learning improved crew members' technical knowledge and skills. (04. Tronvoll 2020 - Transformational shifts through digital servitization)
based on the effort curve (Figures 5, 6 and 9) early contractors and subcontractors' involvement at the SD phase, and early involvement of the site manager at DD are seen by experts and project actors as a remedy for achieving greater efficiency. (30. Aibinu 2019 - Conceptualizing and operationalizing team task interdependences)
Best-practice organizations drive knowledge management further into the flow of work by incorporating knowledge-sharing behaviors in employee performance goals and discussions. (72. Robu 2021 - Digital Transformation Designed to Succeed)
BIM artefacts were boundary objects with limited function-alities in Case A, as there was a sequential knowledge sharing process with a lot of reworks (Quotation-4-A), similar to linear and over-the-wall models of collaboration (Papadonikolaki et al., 2016). (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
Leadership and digital experts support
convener who is asked by stakeholders to intervene, and does so responsively, holds a different sociological position than does the convener who proactively and intentionally works to implement a collaborative alliance. (84. Wood and Gray 1991 - Toward a comprehensive theory of collaboration)
. Jaume agrees with Laloux that one of the indispensable requisites for an evolutionary organization is that the top manager has an evolutionary leadership style. Jaume is a telecommunications engineer, but he has also studied enneagram, neurolinguistic programming (NLP), gestalt, and coaching. He offers these resources to the staff, which helps to spread a common language. (35. Moreno Romero 2020 - The Path towards Evolutionary—Teal Organizations)
'to accelerate this digital transformation, our organization has recruited a highly qualified digital leadership team and established a new digital organization with more than 400 existing employees.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'we have delegated digital transformation to the function heads. They are responsible for managing required resources to execute digital transformation strategy.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

"(1) Being knowledgeable about state systems; (2) having previous experience with an interagency approach; (3) using participatory policy development style; (4) being informed about funding sourves and sys- tems; (5) having political shills that encourage actors such as legislators — and the governor to support Part H; and (6) being able to take risks. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)
"convening power, that is, the ability to induce stakeholders to participate" (p. 71) (84. Wood and Gray 1991 - Toward a comprehensive theory of collaboration)
"convincing" the board of directors to approve digital projects, and the adoption of a digital mindset throughout the company. (41. Rocha 2021 - Collaborations for Digital Transformation Case Studies of Industry 4.0 in Brazil)
"unlearning" existing practices was a common theme noted as an important skill for effectively interacting and collaborating with a wide range of new partners in digital ecosystems; this requires transformational leadership. (01. Warner 2019 - Building dynamic capabilities for digital transformation)
A 1992 study looks at a collaborative groupinthe garmentindustry who was applying for community development funds to start a job training program. The group found their poor reputation in the community posed a major barrier. (87. Mattessick e Monsey 1992 - Collaboration What Makes It Work)
a convener may possess informal authority such as that based on position and influence in an informal network, expertise and knowledge with respect to the problem domain, or credibility among the stakeholders of the domain. (84. Wood and Gray 1991 - Toward a comprehensive theory of collaboration)
Professionals must be technically competent / digital competencies
A large and complex number of tools and interactions opens up the scenario of the needs and skills required to effectively and efficiently support and implement the new technological background. (Piccarozzi, (2024). Roadmap to Industry 5.0)
interviewees emphasized the importance of bearing in mind that soft skills – including collaborative skills, system thinking, and communication – are as fundamental as hard skills. (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)
'a big challenge for leadership today is to stay technically updated about all new developments happening in the industry. It is also an opportunity to be on the frontline and shaping the future, together with the customers.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
"full stack data scientist generalists" (Colson, 2019) must be attracted to avoid overspecialization and the creation of excessive interfaces. Second, institutions must develop digital talent. (60. Piccione 2021 - Realistic interplays between data science and chemical engineering in the first quarter of the 21st century, part 2)
"This has resulted in uncontrolled growth of the number of consultants. Every time some new development project is started, a new consultancy agency is brought in. [The IT department] is on this endless tendering treadmill." (74. Ylinen - 2021 - Incorporating agile practices in public sector)
"We have to hire people who have skills in data collection and analysis to cope with the increasing volume of data (…). We have never had that before, and it requires completely different skills than in our industry. Their task is to work with the data to see what we can use it for, or to help a customer who wants to solve a problem. Our computer scientists then try to figure it out on the basis of the available data. If they can solve the customer's problem, we may want to offer the solution as a new service or insert some algorithms so that things happen automatically. It is increasingly common for the customer to come to us, wanting to know something; then we do the analysis and provide them with a result." (04. Tronvoll 2020 - Transformational shifts through digital servitization)
"You need to scale your organization with people who are able to further develop IT systems and maintain them—because in the service contract you promise the customer maintenance throughout the lifecycle and at the pace of development in the IT world, not in the electrical world, where you change the drive every 10 years. (04. Tronvoll 2020 - Transformational shifts through digital servitization)

A similar situation is displayed by Theta and Sigma in terms of their trajectory toward digitalization, as these organizations have been trying to improve transparency so that all employees, regardless of their hierarchical level, receive training and attend events promoted by the company. Such events are aimed at raising awareness not only about the technical aspects and applicability of digital solutions but also about managerial and social aspects (41. Rocha 2021 - Collaborations for Digital Transformation Case Studies of Industry 4.0 in Brazil)

A skill that project managers also require is being digitally competent. To be digitally competent, a project manager requires digital intelligence (DQ). The DQ Institute has formulated the competencies associated with digital intelligence and these digital intelligence competencies were used in this research to determine the digital intelligence of project managers within the South African context. (44. Marnewick 2021 - Digital intelligence A must-have for project managers)

A successful digital strategy must consider employees' need for process and software training and the management support required to fulfil their requirements. (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)

Smart and customized processes, products a/or services

— customer expectations are shifting — products are being enhanced by data, which improves asset productivity~ — new partnerships are being formed as companies learn the importance of new forms of collaboration, and — operating models are being transformed into new digital models. (80. Schwab 2017 - The Fourth Industrial Revolution)

~ew technologies are transforming how organizations perceive and manage their assets, as products and services are enhanced with digital capabilities that increase their value. (80. Schwab 2017 - The Fourth Industrial Revolution)

"We have to hire people who have skills in data collection and analysis to cope with the increasing volume of data (…). We have never had that before, and it requires completely different skills than in our industry. Their task is to work with the data to see what we can use it for, or to help a customer who wants to solve a problem. Our computer scientists then try to figure it out on the basis of the available data. If they can solve the customer's problem, we may want to offer the solution as a new service or insert some algorithms so that things happen automatically. It is increasingly common for the customer to come to us, wanting to know something; then we do the analysis and provide them with a result."
(04. Tronvoll 2020 - Transformational shifts through digital servitization)

"When we embarked on integrated operations, we said that all services would become integrated operations and that we are in the business of integrated operations. Of course, we manufacture things, and we install them, and we help, and we analyze; but the whole thing can actually be described as integrated operations. (04. Tronvoll 2020 - Transformational shifts through digital servitization)

a partner's expertise in cloud computing provided "the ability to offer complete digital services for any vessel type" beyond vessels carrying the firm's equipment. This innovation (which was radical for the industry) enabled comprehensive monitoring of a ship's operations, giving the firm a significant competitive advantage. To commercialize this invention, the firm had to work closely with external shipyards, ship designers, and fleet owners to facilitate the coupling of the underlying software. (04. Tronvoll 2020 - Transformational shifts through digital servitization)

As well as upgrading existing digital services, new offerings were introduced; for example, a digital energy efficiency service monitored fuel and energy consumption for optimization of vessel energy flows, and an operations monitoring service used motion forecasts to support decision-making under changing navigational conditions (e.g., weather). (04. Tronvoll 2020 - Transformational shifts through digital servitization)

Availability of content: the digital environment is able to adapt access to the information to the needs of the user, such as special needs, cognitive and motor disabilities, and linguistic limitations. (34. DeMartini 2020 - Education and Digital Transformation)

Cobots can be condensed as key pillars of I5.0 as they encapsulate and enable the true essence and orientation of the new revolution (Maddikunta et al., 2022). Indeed, Cobots combine the strengths of human and robot, fostering a collaborative and symbiotic relationship in the workplace (Mukherjee et al., 2023). (Piccarozzi, (2024). Roadmap to Industry 5.0)

Companies that eectively manage digital technology can expect to gain in one or more of three areas: better customer experience and engagement, streamlined operations and new lines of business or business models. Though innovative new business models are what every CEO dreams of, companies more often see digital technologies help transform their customer experience or operations. (Fitzgerald 2013)
Digitalization by projects drives digital change of permanent organisations by projects, programmes and portfolios as enablers of socio-technical transformation (Papachristos et al., 2024; Papado-nikolaki et al., 2023) – this view is related to digital transformation. (Papadonikolaki, (2025). Call for papers)
Stakeholder identification, early involvement and engagement
If we analyze the whole life cycle, it turns out that only approximately a third of total projects are developed without management problems, easily carrying out their tasks, and achieving the initial objectives. (42. Sagarna Garcia 2019 - Agro-food projects)
'secondary' (those actors who will use the technology day-to-day, but who do not necessarily input into its functionality); and 'supporting' (those actors who may contribute to data uploaded to the ledger or who have an interest in how they function but do not contribute to the running of the ledger nor use it for commercial purposes). (02.Li, Greenwood e Kassem 2019 - Blockchain in the built environment and construction industry)
"a central characteristic of loosely coupled networks is an inhouse capability for systems integration" (Brusoni and Prencipe 2001, p. 1033). Accordingly, the actors of the two foregoing described pairs could qualify as orchestrators of innovation, depending on the procurement routes and, essentially, their involvement. For example, a DB contract may provide the opportunity that the contractor to play a systems integrator role, following clients' prescriptions (Case C). (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
"How is the project doing?" has to be answered from the perspective of each of the stakeholder groups. By getting the input of individuals who represent different stakeholders, a balanced view of the efficacy with which the project is being carried out can be obtained. (Cleland 1985)
"We have gained good feedback on the way [we operate] and . . . we have succeeded in providing what they were expecting." (Account manager A) (74. Ylinen - 2021 - Incorporating agile practices in public sector)
23.0 percent of them failed, either canceled before completion or never implemented. The current rate of failures on projects is consistent with other sources and quite significant. Carroll (2006), in his research on critical success factors in e-business projects, concluded that only 33 percent were successful. (42. Sagarna Garcia 2019 - Agro-food projects)
32.1 percent of the projects were successful. This implies, according to CHAOS Report definitions, that they were completed on time, on budget, with all the elements and functions required and with a satisfactory result. (42. Sagarna Garcia 2019 - Agro-food projects)
According to the empirical data, in cases in which the architect and the structural engineer followed compatible BIM adoption drivers, communications and project outcomes were better (Case B) (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
Actors have been allocated one of three levels of contribution: 'primary' (those actors Bandwidth & Connectivity / Interoperability / Poor APIs Redundancy / Throughput & Latency / Scalability / Software updates / Malicious Attacks / Nascence / Consumption Security / Privacy Energy Skills Legal / Exchange rate / volatility Fig. 4. Challenges mapped across the DLT Four-Dimensional Model. Regulations / Integration of services / Resilience / Better predictive capabilities / Immutability Provenance / Supply Chain / Miners / Educational Institutions / Communities of Practice who have a direct role in development of the technology, policies, standards, and regulations and who have a say in how technologies develop over time even after adoption); (02.Li, Greenwood e Kassem 2019 - Blockchain in the built environment and construction industry)

After analyzing three cases of project networks in Dutch construction, the empirical data displayed an interdependence between BIM adoption drivers— external or internal—and sophistication or maturity of BIM implementation, namely the utilization of varying functionalities (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))

Strategic guidelines, continuous improvement, and process evolution

"Create a sound digitalization strategy and stick to it," advised Mr. Elwart. (70. Elwart 2020 - Ergon refining A digital transformation story)

"is a blueprint that supports companies in governing the transformations that arise owing to the integration of digital technologies, as well as in their operations after a transformation." (p. 340). They view DTS as separate from "IT strategies and all other organizational and functional strategies" (p. 340) while structural changes, defined as "variations in a firm's organizational setup" (p. 341), must be carefully planned to leverage digital technologies for the benefit of the organization without forgoing financial constraints. (78. Vial 2019 - Understanding digital transformation)

a clear definition of the nature of digital strategy and the role of architecture and design principles at its core begs the question of what kind of strategist will be best suited to initiate a digital trans-formation and see it through to completion. (Piccoli, (2024). Digital transformation requires)

A good example of this continuing commitment to innovation is Vodafone Idea (VI), an Indian telecom operator associated with global technology communications company. Despite the pandemic, Vodafone Idea deployed their Open Universal Hybrid Cloud, a hybrid cloud platform based on open technology and open standards. VI now better serves nearly 300 million subscribers by enabling networks and IT capacity to be deployed faster with increased automation and lower costs. (75. Cooney 2021 - How "Dynamic CEOs" outperformed by adopting a transformation mindset)

Although the generic concept of strategy is often invoked to explain these responses (e.g., Yoo et al., 2010b), the literature refers to two novel concepts in the context of DT: digital business strategy and digital transformation strategy (78. Vial 2019 - Understanding digital transformation)

As for Sigma, the organization headquarters structured in 2016 the digital strategy to be followed by its subsidiary plants. The Smart Factory document, created initially by the headquarters, represents the planning and development of Industry 4.0 practices. Sigma's regional factories are free to adapt and customize this strategy so that it is applicable to the context and needs of each plant. The corporation aims to create a transparent relationship with its subsidiaries according to the guidelines of this document. The corporation aims to create a transparent relationship between its subsidiaries and headquarters according to the guidelines of this document. There is a digital Committee at the Sigma subsidiary, which monitors the status of digital journey. More specifically, the members of this committee and their leader discuss, monthly, the status of projects aimed at the Smart Factory and discuss what are the next steps toward digitalization. (41. Rocha 2021 - Collaborations for Digital Transformation Case Studies of Industry 4.0 in Brazil)

As the project is delivered, continuous assessment through an integrated project control and performance control are also conducted. (16. Koseoglu 2019 - Challenges and enablers in BIM-Enabled Digital Transformation)

At Omega, the journey toward factory digitalization is strategically and deliberately represented by goals, activities, and schedules of the company's digital project. The project design was completed in 2018 with the development of Guidelines for Industry 4.0 to be operationalized within the next five years. (41. Rocha 2021 - Collaborations for Digital Transformation Case Studies of Industry 4.0 in Brazil)

Automate (78. Vial 2019 - Understanding digital transformation)

Based on the integration of lean and BIM, these projects achieved significant success in terms of early completion and cost reduction to different extents. The quality of these projects exceeded the expectation of their customers. (12. Meng 2019 - Lean management in the context of construction supply chains)

Structure, incentives, rules, and collocation

as construction firms seek to adopt BIM, they need to establish new ways of communicating that facilitate greater collaboration and the sharing of data and information, internally within teams and

externally with their supplier network. (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)
(SMEs) will have the advantages of speed and the agility~ needed to deal with disruption and innovation. (80. Schwab 2017 - The Fourth Industrial Revolution)
, it is necessary to align relational norms with formal processes and procedures of collaboration. For instance, if one of the relational norms relates to openness and sharing information, channels through which information is shared need to be made available for the team (e.g., project information in the 'mission control room', regular joint meetings to support openness and the ability to share information). (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
'even though we are focusing on digitalization within the company, the benefits will be reaped by the customers. Co-creation and co-innovation will be a standard process, and the new ways of working will show in everything we do, from sales to manufacturing.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'I have a team of 35 people; I have instructed all of them to report to one person, and that one person reports to me.' Similarly, GM added, we are working on becoming less and less hierarchical all the time, especially for digital transformation. But it goes hand-in-hand with company culture as well.' (46.Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'personally, I like freedom with responsibility…you take care of this part, and I'll take care of that part. How you do it is up to you.' So, our data shows that leaders who are dealing with digital and related topics are more open toward less formalization and promoting a more goal-oriented approach. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'to accelerate this digital transformation, our organization has recruited a highly qualified digital leadership team and established a new digital organization with more than 400 existing employees.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'we should adopt an agile working environment where we can utilize cross-functional resources. Currently, people are allocated to certain positions by function or organization, and cross-utilization of competencies is not very high.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
"all partners sit around the table to highly structure on a daily basis what needs to be done to make everything run (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
"Collaboration is a process in which autonomous or semiautonomous actors interact through formal and informal negotiation, jointly creating rules and structures governing their relationships and ways to act or decide on the issues that brought them together; it is a process involving shared norms and mutually beneficial interactions." (Thomson et al., 2009, p. 25). (83. Nikulina 2022 - The interplay of formal integrative mechanisms and relational norms in project collaboration)
Trust and long-term relationships
trust-based relationships with their clients; (68. Shojaei 2022 - ENABLERS FOR THE ADOPTION AND USE OF BIM IN MAIN CONTRACTOR COMPANIES IN THE UK ECAM 12.01.22)
(2) a structure for I4.0 standardization to develop and sustain trust among partners; (50. Han 2022 - Towards a data science platform for improving SME collaboration through Industry 4.0 technologies)
for business leaders and policymakers, emotional intelligence is the vital foundation for skills critical to succeed in the era of the fourth industrial revolution, namely~ self-awareness, self-regulation, motivation, empath~ and social skills. ~2 (80. Schwab 2017 - The Fourth Industrial Revolution)
'Developing trust between partners in collaborative R&D projects', Bürger and Roijakkers discuss the development of trust between partners in a collaborative R&D project. Communication and user involvement (which were identified as key CSFs in the second chapter) will not take place unless there is sufficient trust amongst the partners. (95. Fernandes 2021 - Managing Collaborative R&D Projects)
"[In terms of] customer collaboration – there we have gained trust; they know now how they can get things forward." (Consultant C) (74. Ylinen - 2021 - Incorporating agile practices in public sector)

"BIM gives better projects, because then you know each other and what to ask from your partners to think different and it helps to build trust in the long run" (Quotation-22-B). (07. Papadonikolaki, van Oel and Kagioli 2019 - Organising and Managing boundaries (BIM))
"I feel that our collaboration is based on trust and constant communication among members. For instance, if there is something, a problem that is preventing us or making it difficult for us to Collaboration continue operating, we sit down, talk and try to solve things in the most efficient way and as quickly as possible." (INT3) (26. Michel-Villarreal 2021 - Resilience and Digitalization in Short Food Supply Chains)
"our customers and clients have not yet confidence in the construction industry, because of the mistrust. … So, if we are open about what we want to make, then we get another discussion" (Case B architect, lead architect). (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
"the collaboration and how one must work with BIM and the expectations of each other should be well-pronounced, in order to trust each other." (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
"Trust between partners in interorganizational arrangements is based on mutual understanding and confidence that all partners are working toward collective action" (Morris, J. C., & Miller-Stevens, K. (2016). The State of Knowledge in Collaboration)
Value creation and cocreation
'even though we are focusing on digitalization within the company, the benefits will be reaped by the customers. Co-creation and co-innovation will be a standard process, and the new ways of working will show in everything we do, from sales to manufacturing.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'leaders have to involve customers in piloting. It requires leaders to balance the speed of execution with the level of quality needed.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
'we need to open up our landscape toward customers… it means that we will co-create with customers much more.' GM further added that 'if somebody wants to test a new type of doing business or provide new services with the customers, we allocate a separate team for this purpose… it's like an initial internal start-up setup.' (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
• Focus on value. Delivering value rather than inflexible contract deliverables is the goal. The decision-making focus is on what provides most value to society, i.e. Social Value. (63. Whitmore 2021 - Are Megaprojects Ready for the 4IR)
According to Dhanaraj and Parkhe (2006), all knowledge mobility (via formal and informal communications), appropriability of innovation, and network stability are interdependent. (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
an equal proportion (i.e. 66%) of participants thought that as a business enabler, digital transformation is a big opportunity for industrial organizations, in terms of value generation capacity, value addition, creating new business, enhancing current offerings into digital, better chances of success, and providing more services than products. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)
As appropriability entails the capturing of benefits from innovation via trust and mutuality, it relates to innovation investment and ownership. Across cases, firms used knowledge externalities to improve and develop their own BIM implementation process (see quotation of Case B contractor, site engineer). (06. Papadonikolaki 2018 - Loosely Coupled Systems of Innovation (BIM))
As the forum's Collaborative Innovation: Transforming Business, Driving report outlines, when firms share resources through collaborative innovation, significant value can be created for both parties as well as for the economies in which such collaborations take place. (80. Schwab 2017 - The Fourth Industrial Revolution)

case organizations are focusing on the development of new values in their systems. These values include bringing agility to actions, openness toward digital transformation, an experimentation culture, failing fast, co-creation and validation with customers, sharing culture, feedback culture, coaching culture, taking ownership, empowerment, collaborative mindset, support for everyone, promoting innovation, and ecosystem system thinking. (46. Imran 2021 - Digital Transformation of Industrial Organizations Toward an Integrated Framework)

Digital technologies alone provide little value to an organization (Kane, 2014). It is their use within a specific context that enables a firm to uncover new ways to create value, consistent with the enduring idea that organizational change is an emergent phenomenon (Markus and Robey, 1988). (78. Vial 2019 - Understanding digital transformation)

APPENDIX 2 – STUDY 2 - PROTOCOL - INTERVIEW WITH SPECIALISTS

PROJECT STAKEHOLDER COLLABORATION AND THE DIGITAL TRANSFORMATION CONTEXT

This interview constitutes the face validity step. comprised within scale development procedures. when the collaboration and digital transformation questionnaires are evaluated by experts aiming to gather suggestions for improvement. It is organized into five sections:

- Profiles of the specialists.
- Dimensions of collaboration
- Collaboration items
- The digital transformation context
- Digital transformation items

Before starting the interview, this study ensured the specialist authorizes the recording of the interview for later transcription and analysis.

1. Profile of the specialist
2. Name:
3. Academic background:
4. Current organization:
5. Current position:
6. Years of professional experience in project management:

Dimensions of collaboration

Table 18 summarizes the five dimensions of collaboration, adapted from Bronstein (2002) to measure project stakeholder collaborations. It also shows other authors that discuss concepts related to those dimensions. In this section, this interview analyzes these definitions aiming to gather feedback to refine them.

Table 18: Dimensions of Collaboration

Definition of Dimension	Authors
Interdependence: Project stakeholders depend on each other to perform tasks and reach goals. They are identified and managed through formal and informal communication channels.	(Aibinu & Papadonikolaki, 2020; Ayala et al., 2020; Bonanomi et al., 2019; Bronstein, 2003; Fitzgerald et al., 2013; Gray, 1985; Imran et al., 2021; Meng, 2019; Michel-Villarreal et al., 2021; Moreno Romero et al., 2020; Morris & Miller-Stevens, 2016; Papadonikolaki, 2018; Sagarna Garcia & Pereira Jerez, 2019; Tronvoll et al., 2020)
Flexibility: Project stakeholders adapt their roles to suit the environment and the demands of the project. As they establish interpersonal relationships and trust, they constructively discuss and negotiate compromises favoring project outcomes.	(Agarwal et al., 2022; Ayala et al., 2020; Brodeur et al., 2022; Bronstein, 2002; Camarinha-Matos et al., 2019; Çıdık & Boyd, 2022; Gray, 1985; Han & Trimi, 2022; Meng, 2019; Morris & Miller-Stevens, 2016; Nikulina et al., 2022; Papadonikolaki et al., 2019; Schwab, 2017; Sjödin, 2019; Ylinen, 2021)
Reflection on the Process: Project stakeholders evaluate how they work together to gather feedback that can enhance the collaborative process. They share knowledge. recognize their peers' skills and value their opinions.	(Aibinu & Papadonikolaki, 2020; Bronstein, 2002; Gray, 1985; Imran et al., 2021; Kayabay et al., 2022; Kokkonen & Vaagaasar, 2018; Papadonikolaki et al., 2019; Robu & Lazar, 2021; Shojaei et al., 2022; J. Zhang et al., 2022)
Collaborative Outcomes (Newly Created Professional Activities): Stakeholders deliver unique results that exceed what would be achieved if each of them worked independently. Such outcomes generate value for clients and/or end users. as well as for the project stakeholders themselves.	(Aibinu & Papadonikolaki, 2020; Bronstein, 2002; Demartini et al., 2020; Fukuzawa et al., 2022; Gray, 1985; Johansson et al., 2021; Meng, 2019; Morris & Miller-Stevens, 2016; Papadonikolaki, 2018; Piccione, 2021; Rocha et al., 2021; Tronvoll et al., 2020; Warner & Wäger, 2019)
Collective Ownership of Goals: Stakeholders share the gains and risks associated with the project. Additionally, they coordinate their activities and resolve conflicts in favor of the project's success.	(Ayala et al., 2020; Bonanomi et al., 2019; Bronstein, 2002; Gray, 1985; Koseoglu et al., 2019; Kruachottikul et al., 2021; Linnander et al., 2017; Marnewick & Marnewick, 2021; Morris & Miller-Stevens, 2016; Nassereddine et al., 2022; Nikulina et al., 2022; Papadonikolaki et al., 2019; Tronvoll et al., 2020; Warner & Wäger, 2019)

APPENDIX 3 – STUDY 2 - ONLINE QUESTIONNAIRE

SECTION ON PROJECT STAKEHOLDER COLLABORATION

Items	Preliminary Dimension
*C01: I worked collaboratively with my project colleagues.	Interdependence (adapted from the original scale)
C02: The clients and/or end-users participated in the project discussions related to them.	Interdependence (adapted from the original scale)
*C03: My colleagues and I communicated frequently, for example with quick communication via chat or telephone.	Interdependence (adapted from the original scale)
*C04: My colleagues and I established informal communication (like chats and coffee intervals).	Interdependence (adapted from the original scale)
*C05: Our project organized regular meetings.	Interdependence (included)
C06: Our project identified its main stakeholders from the beginning.	Interdependence (included)
C07: Our project recorded relevant verbal information for sharing.	Interdependence (included)
C08: When my colleagues brought relevant information, I asked questions to check my understanding.	Interdependence (included)
C09: Our project engaged its key stakeholders in the project discussions.	Interdependence (included)
C10: My colleagues considered my opinions.	Interdependence (adapted from the original scale)
*C11: Our project included professionals with specific knowledge, skills and/or abilities.	Interdependence (adapted from the original scale)
C12: My project colleagues tried to create a positive environment for our project.	Flexibility (adapted from the original scale)
*C13: I kept cohesion with my project teammates despite our project's uncertainties.	Flexibility (adapted from the original scale)
*C14: Project decisions were taken by listening to various perspectives from the professionals in the team.	Flexibility (adapted from the original scale)
C15: I was optimistic about my colleagues' ability to work with me to solve problems.	Flexibility (adapted from the original scale)
C16: My project colleagues were committed to working together.	Flexibility (adapted from the original scale)
*C17: My project colleagues took part in implementing the project solutions.	Flexibility (adapted from the original scale)
C18: I was open to taking on tasks outside of my job description when it seemed important.	Flexibility (adapted from the original scale)
*C19: My project colleagues were open to taking on tasks outside their role description when this seemed important.	Flexibility (adapted from the original scale)
C20: My project colleagues communicated in good situations.	Flexibility (included)
*C21: My project colleagues communicated in bad situations.	Flexibility (included)

C22: My project colleagues did the best they could for us to reach the project results.	Flexibility (included)
C23: I consistently gave feedback to other professionals in the context of the project.	Reflection on the Process (adapted from the original scale)
*C24: My project colleagues and I discussed how to improve our working relationship.	Reflection on the Process (adapted from the original scale)
*C25: My project colleagues and I talked about our skills and roles.	Reflection on the Process (adapted from the original scale)
*C26: My project colleagues and I evaluated how we work together.	Reflection on the Process (adapted from the original scale)
*C27: Mark "Neither agree nor disagree" to check the attention to the answers.	Attention verification
*C28: My project colleagues and I did not evaluate how we worked together.	Reverse item
*C29: My colleagues did not consider my opinions.	Reverse item
*C30: My project colleagues and I discuss who should be involved in resolving specific situations.	Reflection on the Process (adapted from the original scale)
C31: Creative solutions emerged from our teamwork.	Reflection on the Process (adapted from the original scale)
*C32: My interactions with my project colleagues occurred where there was freedom to be different and disagree.	Reflection on the Process (adapted from the original scale)
*C33: My project colleagues and I discussed ways to involve other professionals in our work.	Reflection on the Process (adapted from the original scale)
C34: My project colleagues and I shared knowledge to design improved solutions for the project.	Collaborative Outcomes (Newly Created Professional Activities) (included)
C35: The collaborative work with my project colleagues led to results we could not achieve alone.	Collaborative Outcomes (Newly Created Professional Activities) (adapted from the original scale)
C36: New solutions emerged from the collective work of project colleagues from different areas of knowledge.	Collaborative Outcomes (Newly Created Professional Activities) (adapted from the original scale)
*C37: My project colleagues believed that they could do their work better with the help of their peers.	Collaborative Outcomes (Newly Created Professional Activities) (adapted from the original scale)
C38: Our project aimed to produce results for the organizations involved.	Collaborative Outcomes (Newly Created Professional Activities) (included)
*C39: Our project developed the professionals engaged.	Collaborative Outcomes (Newly Created Professional Activities) (included)
C40: Our project aimed to produce results that satisfied customers and/or end users.	Collaborative Outcomes (Newly Created Professional Activities) (included)
C41: I was willing to sacrifice a certain degree of autonomy in favor of delivering shared results.	Collective Ownership of Goals (adapted from the original scale)
C42: There was coordination between my colleagues from different areas of knowledge.	Collective Ownership of Goals (adapted from the original scale)
C43: My project colleagues and I shared a vision about our project.	Collective Ownership of Goals (included)

*C44: My project colleagues and I mutually benefit from our project.	Collective Ownership of Goals (included)
*C45: Our project brought benefits to those who got involved with it.	Collective Ownership of Goals (included)
*C46: Teamwork with other project professionals was fundamental to my ability to deliver results.	Collective Ownership of Goals (adapted from the original scale)
C47: My project colleagues understood well the distinction between my role and theirs.	Collective Ownership of Goals (adapted from the original scale)
C48: My project colleagues made proposals that improved our capability to meet customer needs.	Collective Ownership of Goals (adapted from the original scale)
C49: My project colleagues discussed conflicting situations with the aim of resolving them.	Collective Ownership of Goals (adapted from the original scale)
*C50: I helped my project colleagues solve conflicts with other professionals.	Collective Ownership of Goals (adapted from the original scale)
*C51: My colleagues and I shared the problems and rewards of our project.	Collective Ownership of Goals (included)
*C52: Our project did not bring benefits to those who were involved with it.	Reverse item
*C53: Technology has improved the team's ability to communicate.	Inclusion suggested by one of the specialists
*C54: The digital skills of my project colleagues were essential for collaboration.	Inclusion suggested by one of the specialists

* item eliminated during Exploratory Factor Analysis

Source: proposed by the author, based on Bronstein's (2003) collaboration scale

SECTION ON THE DIGITAL TRANSFORMATION CONTEXT

Items
TD01: Our project changed the business processes of the organization undergoing digital transformation.
TD02: Our project amplified the use of data to generate information in the organization in digital transformation.
TD03: We implemented smart products / services / processes as a result of the digital transformation project.
TD04: Our project had professionals with digital competencies.
TD05: Our organization established digital strategic guidelines.
TD06: Our project was aligned with our organization's strategic guidelines.
TD07: My project colleagues and I were dedicated to continually improving the business processes of the organization that was undergoing digital transformation.
*TD08: Our project influenced the sustainability pillars of the organization that was undergoing digital transformation in the following dimensions: environmental
Social
Governance
*TD09: Our project took place in an environment of technological change.
*TD10: Our project took place in an environment of market uncertainties.
*TD11: Our project utilized new technologies, including those listed below: Cloud Computing
IoT
Artificial Intelligence
Big Data
Cyber Physical Systems
Virtual Reality
Augmented Reality
Collaborative Robots
Drones
3D Printing
Other (specify)
TD12: Our project used digital technologies that connect the real and digital worlds.

* item eliminated during Exploratory Factor Analysis

Source: proposed by the authors, based on previous studies on the Digital Transformation Context

APPENDIX 4 – STUDY 3 - INTERVIEW GUIDE

Practices and Behaviors that Influence Project Stakeholder Collaboration in the Digital Transformation Success

This study is conducted by Danielle Paiva, a doctoral student in the Project Management Program at Universidade Nove de Julho (Brazil), as part of her doctoral thesis. Professor Roque Rabechini Junior, from Universidade Nove de Julho, and Professor Gabriela Fernandes, from the University of Coimbra, supervise this research. The study is funded by CAPES Brazil (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior), a government agency supporting graduate studies.

The main objective of this thesis is to characterize and empirically describe the relationship between Project Stakeholder Collaboration and the Digital Transformation Context.

Through a literature review, it was found that Project Stakeholder Collaboration is highly relevant in Digital Transformation Success. However, there is a lack of studies that systematically describe either Project Stakeholder Collaboration or the Digital Transformation Success. Therefore, by analyzing the relationship between the level of Project Stakeholder Collaboration and the level of Digital Transformation Success, this research aims to contribute to the knowledge of project management in today's digital environment.

In addition to the literature review, this study also comprises two complementary phases. In the second phase, a questionnaire was developed, and quantitative data were collected, which demonstrated that the level of Project Stakeholder Collaboration correlates with the level of the Digital Transformation Success in which the project is embedded.

Now, in the third phase, the aim is to deepen the understanding of Project Stakeholder Collaboration within Digital Transformation Success. The specific objective is to describe the practices and behaviors that foster Project Stakeholder Collaboration within the organizational Digital Transformation Success, through semi-structured interviews with experts. The interview is expected to last approximately one hour.

Key Concepts of this Research

Project stakeholders collaborate when two or more parties pool resources to solve a problem that cannot be addressed independently.

"Practices" are the tools and techniques used to carry out a project management process, such as the Project Charter or Progress Monitoring Reports. In turn, "behaviors" are actions that can be objectively observed, influencing and simultaneously reflecting the social environment in which the stakeholders operate.

In this study, Project Stakeholder Collaboration is focused on Digital Transformation Success. This phenomenon involves the use of new technologies - such as the Internet of Things, Artificial Intelligence, Cloud Computing, and Blockchain - to enhance business processes, improve customer experience, or implement new business models.

Main Questions

1. Please summarize your experience in project management.
2. Describe a project you have participated in or are currently involved with that relates to the organization's digital transformation.
3. What skills differentiate project management professionals working in the Digital Transformation Success?
4. How does technology influence collaboration among stakeholders?
5. What practices are used in the project, for example, to solve problems that foster collaboration?
6. What behaviors do stakeholders adopt in the project, for example, to promote dialogue, that encourages collaboration?
7. How do stakeholders consider different perspectives when addressing project issues and problems?
8. How is stakeholder engagement fostered in the project?
9. What behaviors adopted by stakeholders demonstrate an intention to collaborate?

Anonymity and Confidentiality

In advance, no risks associated with participation in the interview have been identified. All responses will be treated as confidential and will be reported only in an anonymous and summarized form, both in the doctoral thesis and in any subsequent scientific articles. You may end the interview at any time, and in that case, the data collected will not be included in the study.

If you have any questions, please do not hesitate to contact me, Danielle Paiva (paiva.danielle@uni9.edu.br), or the supervisors, Prof. Roque Rabechini Jr. (roquejr@uni9.pro.br) and Prof. Gabriela Fernandes (gabriela.fernandes@dem.uc.pt).

SECTION ON THE PROFILE OF RESPONDENTS

Items
Which economic sector do you work in?
What project management approach was adopted in the project in question?
What function did you play in the project in question?
What application was implemented by the project in question?
How many primary stakeholders participated in the project in question? (considering team + suppliers + end-users/clients)
How many years have you been working with projects?

APPENDIX 5 – EXAMPLE OF TRANSCRIPTS (INTERVIEW 6)

D:

Estão algumas perguntas que vamos fazer.

Eu queria te contar que estou estudando a colaboração dentro do contexto da transformação digital.

Essa curiosidade surgiu porque uma série de artigos afirma que a transformação digital facilita a colaboração e a integração, mas existem poucos dados empíricos que nos permitam corroborar essa afirmação.

Portanto, a intenção é obter essas informações.

M: Ok.

D:

Bom, primeiro eu queria te pedir para resumir sua experiência com gestão de projetos, por favor.

M:

Gestão do projeto. Ok, eu tive a vida toda ligada à tecnologia, mais como tecnólogo. Durante muitos anos, ou seja, a fazer, não estava a gerir projetos, mas a trabalhar na área da eletrônica primeiro e depois no software. Sempre na área da energia, que é onde está a E, a empresa onde trabalho atualmente.

Depois, a certa altura, comecei a gerir alguns projetos e, em seguida, a gerir produtos e até a gestão de produto, pois tinha equipas nas áreas em que estava a trabalhar.

Depois, fiquei com algumas funções um pouco distintas. Era responsável por acompanhar, embora não fosse eu propriamente a gerir projetos, tinha a organização debaixo de mim. Sou Diretor de Tecnologia e é onde estou hoje, também como diretor de tecnologia. É uma função mais transversal.

Portanto, a minha experiência direta já vem de alguns anos. Fiz uma transição significativa entre Waterfall e Agile, especialmente na área do software. Começámos a implementar isso há alguns anos.

A empresa não usava Agile e nós começámos a utilizar na área onde eu estava. Portanto, fiz uma grande transição para metodologias como Scrum e reuniões diárias, além de práticas de software como Continuous Integration e Continuous Delivery,

e algumas metodologias um pouco mais radicais que proporcionam resultados diretos e imediatos, com base na experiência e nos resultados.

E sempre a fazer. Por fora, as coisas estavam prontas e íamos exercitando, digamos que o próprio cliente estava no loop do que íamos fazendo.

Portanto, a minha experiência é um bocadinho extensa, mas como gestor propriamente dito, já há alguns anos que não o faço. Estou no projeto, é claro.

D:

Olha que interessante. Você está em uma manufatura? Você me contou que estão usando Agile para fazer grande parte dos desenvolvimentos na manufatura?

M:

M: Isto não é bem. Nós fabricamos o que fazemos.

A minha área, o meu pelouro (setor), digamos assim, é a tecnologia e a tecnologia envolve a criação de produtos novos.

Ou seja, em rigor, o meu escopo de atuação é um escopo não de manufatura, mas de inovação e de produtos. Ok.

Portanto, sim, estamos (numa manufatura). Mas o que está a ser utilizado é para fazer produtos novos, para inovação e desenvolvimento. Ok.

D:

Ok. Imagino que seja. Deixa ver se eu entendi. Você foi claro.

Imagino que sejam softwares embarcados nos equipamentos. É mais ou menos isso? E é aí que vocês trabalham? nesse desenvolvimento de software.

M:

Nós fazemos software, fazemos hardware e fazemos produtos de um espectro alargado.

Transformadores, coisas que são hardware a sério, físicos, transformadores pesados, aparelhagem de média tensão, carregadores para veículos elétricos ou então software, mesmo software que gere redes elétricas e por aí afora.

Mas neste escopo, tenho imensas equipas de tecnologia que fazem estes produtos nessas áreas.

No desenho de novos produtos, no teste de novos produtos e na entrega, digamos assim, de novos produtos, é que aplicamos Agile.

Já quem fabrica estes produtos e quem os coloca depois no mercado são áreas de produção e operações, digamos assim, onde são mais tradicionais na forma de atuar.

De qualquer maneira, não é o meu escopo de atuação, mas não creio que usem Agile na fabricação, percebe?

D:

Perfeito, era esse o ponto que eu fiquei curiosa. Se vocês estão usando Agile para a fabricação de equipamentos. Não, né?

M:

Acho que não.

D:

Perfeito.

M:

Mas não é a minha área. Portanto, não intervenho muito aí. Está certo.

D:

Você poderia caracterizar um projeto interessante em que tenha estado envolvido recentemente ou atualmente? Pode ser como patrocinador também.

M:

Temos muitos projetos. Quer dizer caracterizar de que forma? Explicá-lo? O que é que?

D:

Falar um pouco sobre o escopo, talvez de uma forma que eu consiga caracterizar e escrever sobre ele, sabe? Descrever o produto.

M:

Temos várias áreas, uma mais de produto de prateleira, vamos chamar assim. Sabes o que é, ou não? Não se usa?

D:

Usamos, usamos.

M:

Tipo, o caso dos carregadores de veículos elétricos, que é um exemplo. São ciclos muito rápidos e é preciso colocar rapidamente um produto novo no mercado.

Portanto,

há ciclos de inovação, com desenho, prototipagem e certificação, em que colocamos no mercado muito rapidamente. Há muita concorrência, muita competição e, portanto, a velocidade é tudo.

Recentemente, foi lançado um novo carregador na área do portfólio de veículos elétricos da E, chamado X, que foi desenvolvido numa fase de recuperação da empresa, já com um enfoque em processos mais rápidos. Estamos a trabalhar em mais dois. Portanto, é uma área interessante porque o ciclo de desenho, experimentação, protótipo e certificação por lá fora é particularmente rápido, com equipas de engenharia e de software misturadas a tentar ser rápidas na sua execução.

Mas temos áreas completamente distintas em que demoramos anos, literalmente anos, a desenvolver.

Portanto, estamos a renovar a gama do nosso produto que gera redes elétricas, por exemplo. É um produto gigante, uma plataforma, uma suíte de produtos que tem milhões de linhas de código.

A renovação radical que está a ser feita é evidente que ocorre por incrementos, mas vai demorar anos a concluir.

Há muita variedade de produtos para todos os gostos e projetos acompanhados, mas sempre focados no produto e não propriamente no projeto. Não sei se entende. O projeto é visto como uma etapa do plano do produto.

D:

Perfeito. Ficou claro, M.

M:

Mas se quiseres fazer perguntas mais específicas, talvez eu possa ajudar. Eu sei que é um bocado vago, mas...

D:

Ficou claro. São dois tipos de projetos diferentes, mas em ambos percebi que você mencionou prototipagem, experimentação e lançamento.

Esses são pontos que aparecem bastante quando estamos lendo sobre o assunto. Isso é importante porque, ao tratar de tecnologia nova, talvez se você não testar, não conseguirá garantir que funciona.

M:

Temos um grande problema para resolver, sobretudo nestas áreas que são mais conservadoras. Quando estamos numa área que não deixa de ser a de energia, das utilities, os clientes compram um transformador que vai operar no terreno durante 40 anos. Isso também se aplica a quem compra um software para gerir o centro de comando da rede elétrica, que terá pelo menos dez anos de uso. Ou seja, não é como uma app para o telemóvel, que estamos sempre a mudar. Há algum conservadorismo por parte do nosso cliente. Mas mesmo neste contexto mais conservador, temos que envolver o cliente muito no loop, na experimentação e na validação o mais cedo possível.

Às vezes, apenas com protótipos ou com um PowerPoint que explica o que o produto vai fazer, porque senão o risco de fazermos a coisa errada é muito grande, e o investimento também é elevado. Portanto, sim, a experimentação existe.

M:

M:

Mas isto para dizer que sim, é fundamental e, digamos, ganha-se tempo à frente. Nós, há 20 anos, fazíamos de forma diferente. Era muito mais waterfall e, digamos, estávamos dois ou três anos sem feedback de ninguém e, ao chegarmos ao fim, muitas vezes tudo estava errado. Portanto, sim, mudou. Mudou bastante a forma de fazer estas coisas agora.

D:

Ótimo. Muito bom. Na sua percepção, M, quais competências distinguem os profissionais de gestão de projetos ou de gestão de produtos que atuam nesse contexto de transformação digital?

M:

As competências. A primeira competência é a flexibilidade, ou seja, a capacidade de adaptação, mudança e transformação, porque o mundo é particularmente difícil de prever e as prioridades mudam muito. Apesar de se tentar seguir um caminho, a probabilidade de termos que mudar passado três meses é alta.

Portanto, diria que a flexibilidade, a capacidade ou a aceitação da mudança, ou até mais do que a aceitação, ser promotor da mudança, é a primeira competência e uma das mais importantes, pelo menos para mim, nas pessoas com quem trabalho.

Depois, têm de ser de facto competentes no sentido digital do termo. Ou seja, o mundo mudou e o gestor tradicional já não encaixa neste contexto. É preciso pessoas que compreendam as novas dinâmicas e não apenas aquelas situações grandes, antigas e muito fixas no tempo.

Portanto, tem de ser pessoas que tenham uma cultura tecnológica digital na gestão do seu trabalho, porque as evidências de quem fez o quê são essenciais.

Os planos têm de ser fáceis de manobrar usando as ferramentas disponíveis, seja o Jira, os DevOps ou outras ferramentas atuais e modernas, que não são necessariamente aquelas que eram tradicionalmente usadas. Porque, mais uma vez, é impossível lidar com esta dinâmica, com esta velocidade em que as coisas mudam, numa lógica muito estática da gestão de projetos tradicional.

Portanto, diria que sim: flexibilidade, capacidade de mudar e promover a mudança, além de ser competente no uso de ferramentas atuais. O mundo mudou.

D:

Muito bem.

M:

Mas há outras, tantas outras. Olha, uma delas, já agora, é que quanto mais anos temos de carreira, mais claro fica a necessidade de nos adaptarmos às pessoas.

As pessoas são todas distintas, efetivamente. Portanto, não há uma receita que resulte para todos, não é? E quem achar que o gestor de projeto vai funcionar tal como está escrito nos livros para toda a gente não terá sucesso.

Portanto, há aqui o tema de ser capaz de perceber, ler a sala, adaptar-se e fazer aquelas milhas extras para que o projeto resulte bem. Porque, no fim, as pessoas são pessoas e há muita subjetividade.

D:

Perfeito. Está ótimo. Vou para a próxima. M, como a tecnologia influencia a colaboração entre os stakeholders nesse contexto?

M:

A tecnologia é fundamental e pode ser uma fonte de muita frustração, porque não há comunicação. Não porque seja difícil partilhar o que estou a fazer ou ter trabalho colaborativo, mas sim porque usamos ferramentas pouco adequadas ou pouco modernas.

Ou, pelo contrário, pode ser uma fonte que quase normaliza essa interação. A comunicação é a partilha e a partilha de trabalho, no sentido de co-trabalho, digamos assim. Faz toda a diferença usar as ferramentas certas, ou pelo menos as que servem. Faz mesmo muita diferença. Sim, portanto, diria que é fundamental.

D:

Ótimo. Muito bem. Você falou um pouco sobre incerteza. Como a incerteza influencia os projetos? Acho que foi a primeira resposta.

M:

Não é? Sim, já referi isso um pouco.

E mesmo em áreas conservadoras, como a área onde trabalho, já não existe nada que seja verdade durante muito tempo. Mesmo os projetos que parecem sólidos, se demorarmos demais, as condições mudam, o cliente muda de ideias e chegamos ao fim. E, no limite, já não é o que estávamos a fazer. Portanto, a incerteza neste momento é a única estabilidade.

As equipas têm de estar montadas precisamente para funcionarem bem; ser competentes significa ser capazes, mas não necessariamente para fazer sempre a mesma coisa, porque o mundo e os desafios vão mudando.

Portanto, é preciso ter uma boa equipa, ágil, mas não necessariamente especialista em nada, porque, na verdade, as coisas estão a mudar.

D:

D: Perfeito, tem que estar pronto para aprender outras (habilidades).

M:

Aprender. E agarrar sem medo outras áreas.

D:

Perfeito. Muito bem. Agora, M, queria perguntar sobre as práticas que vocês utilizam ou que você utiliza para fomentar a colaboração nos projetos.

M:

As práticas? As práticas?

O Agile funciona muito bem e, portanto, aquelas cerimônias mais tradicionais do Agile, como os daily meetings e as sprint reviews, são importantes para abrir para outros stakeholders.

Nesta lógica, estou a usar bastante a linguagem do Scrum, que é fundamental. Nós tentamos e usamos algumas cerimônias de envolvimento dos próprios clientes finais. Portanto, há um trabalho interno que funciona muito nesta base, com daily meetings dentro da equipa, o que cria uma lógica de interação permanente diária.

A sprint review abre, portanto, a outros stakeholders, como o gestor do produto ou o responsável comercial que quer saber como está o andamento. Assim, outras áreas que precisam de feedback podem saber o que se passa, se está atrasado ou não.

Ou cerimónias mais tradicionais. Em termos do Project Review, tipicamente fazemos mensalmente e, nesse caso, com a gestão de topo que queira acompanhar o projeto. Os projetos mais críticos são assim, para quem quiser acompanhar.

E depois há umas cerimónias que temos conseguido montar em alguns projetos para gerir risco, em que o cliente final está sempre envolvido, pelo menos de dois em dois meses, no pior cenário. Em projetos longos, há uma espécie de workshops sobre o que já foi feito, o que está a ser feito, as dificuldades, etc, para trazer o cliente, pelo menos a cada dois meses. Portanto, diria que estas cerimónias, que são conhecidas. Não estamos a inventar nada. São as que funcionam bem para promover a colaboração entre as pessoas.

Depois há outros mecanismos de divulgação em canais comuns entre equipas, que no Spotify se chamam guilds. Sem guilds, mas organizados por áreas funcionais. Acho que é a isso que me refiro. São esses mecanismos.

D:

Vocês também têm as guilds ou algo similar?

M:

Não formalmente, mas temos coisas parecidas, embora não com o mesmo formalismo, porque não temos dimensão. É preciso bastante gente para que a coisa funcione bem. Mas temos interação e sessões técnicas sobre determinados temas, em que vêm as pessoas que entendem do assunto. Vamos fazendo um pouco isso.

D:

Que legal! Vocês estão avançados, hein? Essa configuração é bem rara de se encontrar.

M:

Não sei. Mas sim, tentamos. Tentamos estar mais ou menos em cima.

D:

Legal. Interessante. Muito bem. Falamos sobre práticas. Agora vamos tentar olhar para os comportamentos adotados pelos stakeholders que fomentam a colaboração.

M:

Comportamentos? Ora bem, há vários. Estivemos a falar de lideranças, e isso tem a ver com o estilo de liderança. É, portanto, há comportamentos que devem ser evitados, um pouco pela negativa. A crítica aberta, digamos, em relação a ideias ou em fóruns de discussão, por exemplo.

A crítica aberta, sobretudo das chefias, deve ser moderada ou evitada, especialmente se for agressiva e se as equipas forem pouco maduras. Quer dizer, porque senão mata (a inovação).

Todos os comportamentos que permitam o erro são importantes.

A colaboração surge e a inovação acontece quando ninguém tem medo de arriscar, quando não há risco nenhum envolvido.

Portanto, isto tem muito a ver com a ausência de culpabilização. Deve haver espaço para experimentar, correr mal e tentar novamente, evoluindo.

Isso é uma lógica muito das equipas onde não há medo. Portanto, tudo o que tenha a ver com medo deve ser evitado. Tudo tem a ver com confiança. Permitir errar deve ser mantido e estimulado. Os comportamentos estão relacionados com a forma como as pessoas se posicionam, sejam líderes ou não.

Às vezes é preciso o contrário, pois há alguns indivíduos que tendem a tornar o ambiente mais tóxico ou a serem mais críticos em relação aos colegas. Aí sim, acho que o líder é importante para ajudar a moderar ou até chamar a atenção. Por quê? Porque, às vezes, é dentro da equipa que essa toxicidade pode surgir. É preciso estar atento e tentar evitar isso.

D:

Perfeito. Muito bom. M, quando temos um projeto, invariavelmente surgem situações em que existem várias perspectivas para tratar uma questão ou um problema. Como a equipe trabalha para lidar com essas várias perspectivas e soluções para resolver um problema?

M:

Olha, aqui é quase uma visão pessoal, mas nas áreas onde eu tento trabalhar, isso acontece a todos os níveis. Em rigor, não é propriamente só num projeto; estamos sempre a lidar com isso, não é? Eu sou muito fã de decidir rapidamente, de não estar muito tempo a engonhar. Não estar muito tempo a dar voltas, sempre à procura da solução ideal, e depois demorar é contraproducente. Portanto, sou fã de decidir sem precipitação, que é diferente, mas não deixando de agir. Decidir e, se correr mal, mudar de ideias e tentar outra coisa.

Porque a sensação que tenho, com base na experiência do passado, é que, às vezes, o processo de avaliação dos méritos, como uma análise SWOT das opções melhores e piores, é tão profundo que passam semanas ou meses e, de repente, já poderíamos ter experimentado e ter tido mais sucesso. Mas, mesmo assim, sou muito fã de abrir a discussão, fazer workshops e brainstormings e depois tomar a decisão. Não gosto de ficar com a decisão por tomar.

Se não houver informação suficiente, de alguma forma, como dizem os ingleses, uso o meu gut feeling. Decido na mesma e depois corrijo se for preciso. Mas é um pouco assim.

Portanto, fazer workshops para decidir, obter informação, ser rápido e seguir em frente. Acho que é isso.

D:

Ficou claro. O próximo ponto é como o engajamento dos stakeholders é fomentado no projeto.

M:

(engajamento dos stakeholders) E isso é difícil. Vamos lá ver, são muitas coisas, não é? Não é uma pergunta que possa ser respondida em duas ou três frases. Mas, tentando simplificar, é constante. Ou seja, nunca se pode deixar de ir buscar e de estar permanentemente presente.

Não é porque o CCO ou o CTO disse que sim, que estava a acompanhar o projeto ou que patrocinava o projeto há três meses, que ele ainda se lembra dele e sabe do que se trata. Portanto, o engajamento tem de ser frequente e constante.

Ou seja, é necessário publicar, publicitar, realizar workshops, fazer um ponto de situação aberto, trazer as pessoas para dentro e realizar revisões de projeto com regularidade, sempre de forma aberta, convidando os stakeholders que possam estar interessados.

Se eles não vieram, é importante publicar o PowerPoint ou o que for, com o ponto de situação.

E depois, dentro da equipa, a mesma coisa. Ou seja, é fundamental não deixar de realizar as cerimônias só porque estamos com pouco tempo.

É mesmo necessário realizar cerimónias de forma disciplinada. O Agile ajuda nisso, e é importante não deixar de promover o engajamento constantemente.

Há muita política na questão dos stakeholders. É preciso estar sempre a colocar na ordem do dia os temas e os projetos que nos interessam, para que eles acompanhem, patrocinem, e organizem o apoio. Sim, acho que é isto. Não é muito mais do que isto.

D:

Sim, é isso. E as relações, M, como elas entram nessa questão? Você entende que é necessário cultivar essas relações com os stakeholders importantes?

M:

Sim, (cultivar as relações) é fundamental. É um tema que se aprende mais quando se está em funções de gestão de topo.

Não se pode passar muito tempo sem alimentar ou acarinhar as relações pessoais. O Teams não ajuda muito nesse aspecto. Relações com proximidade, sim, como um almoço aqui, um café ali, uma reunião.

Um engajamento relativamente frequente para manter, digamos, a nossa agenda na cabeça de todos também é muito importante. Sim, é fundamental.

D:

Perfeito. Muito bem. E, na sua percepção, quais comportamentos dos seus parceiros demonstram a intenção de colaborar?

M:

Pois, perdão, devia ter lido as perguntas antes. Para mim, é preciso pensar um pouco.

Quais comportamentos dos stakeholders?

Eu gosto muito do contacto físico pessoal, ou seja, de ler e interagir na sala. É tipicamente aí que tudo se torna mais claro e evidente, não é? É muitíssimo mais fácil.

Ah, isto é chato, não é? Nesta época do ano, em que tudo é feito por Teams, o que estou a dizer é muito pouco digital, mas é mesmo assim. Ou seja, é muitíssimo mais fácil perceber se há interesse e, de alguma forma, até tentar mudar a percepção e a ideia se for numa conversa ou numa reunião presencial,

Normalmente, as pessoas da gestão de topo são muito diretas, não é? E uma das coisas que se aprende é que não há muitos rodeios. As pessoas não sobrevivem muito tempo se forem pouco claras sobre o que lhes interessa e o que não interessa. Não estou a dizer que não há pessoas assim, mas normalmente percebe-se que as pessoas são claras e transparentes quando dizem não.

Até mesmo do que estamos a falar. Mas na gestão de topo, isso acontece.

Portanto, não tenho tido grande dificuldade em perceber quem está interessado em apoiar as minhas causas. Mas nesta lógica de porque as pessoas o dizem e por que se pergunta, é porque privilegio muito esta interação mais pessoal.

Portanto, apesar de eu adorar ferramentas tecnológicas, nesse aspeto prefiro ver cara a cara, olhos nos olhos.

D:

Faz diferença, né? Eu concordo com você. Muito bem, chegamos ao final, M. Nem doeu muito né.

M:

Sim. Não. Ótimo. Muito bem. D, ajuda para alguma coisa?

D:

Ajuda muito. Você trouxe vários insights superinteressantes e alinhados com as pesquisas também.

M:

Muito bom! Que bom!

D:

Eu agradeço sua disponibilidade e tudo mais. Prazer te conhecer.

M:

Boa sorte! Vais fazer uma tese aí?

D:

Sim. Eu tenho mais um ano para terminar. Volto ao Brasil e termino por lá. Mas é isso.

M:

Muito bem. Então que corra bem.

D:

Agradeço, M. Muito obrigada.

DP
Fica à vontade, YC. Fica à vontade. Bom... Ai, ai. Deixa eu contar para você rapidinho a minha pesquisa. Eu estou estudando a colaboração entre os stakeholders de projetos, num contexto de transformação digital. Então, se o banco já era digital há 20 anos atrás, imagino que agora ele ainda é mais. É... Aí, o que eu percebi, né? Ao ler os artigos, assim, para começar a fazer o meu trabalho, eu comecei a perceber que muita gente falava que a colaboração habilita a transformação digital, mas muito poucos dados, sabe? Muitas falas são muito subjetivas. Aí, essa ideia de trazer dados empíricos para poder corroborar essa afirmativa. Aí, a primeira coisa que eu preciso é que você resuma a sua experiência em gestão de projetos. Finge que eu não sei.

YC
Nossa. Minha experiência em gestão de projetos. Eu acho que... É uma palavra tão antiga agora que eu já não consigo nem mais definir ela, na verdade. Porque tudo é tão ágil e gestão de projetos leva a uma coisa tão... antiga no sentido de waterfall, né? De coisa sequencial e demorada. Eu tô entendendo, né? É mais o conceito...

DP
É isso mesmo, é isso mesmo. Acho que se você tem essa vivência grande de sair do waterfall e ir para o ágil, se você conseguir me contar isso como foi, vai ser bem legal.

YC
Tá Eu acho que a principal mudança, quando eu vejo, é principalmente da perfeição. O Waterfall, quando a gente fazia gestão de projetos antigamente, a gente pensava sempre em acertar o máximo possível, garantir que tudo estava perfeito antes da sequência do próximo passo, que seria a implantação. Então, errar era um problema no passado.

Agora, eu acho que essa é a principal mudança em relação à gestão de projetos. Nada precisa estar perfeito, acabado, para você implantar, para você seguir o próximo passo, porque o que você quer é validar rapidamente se aquilo ali tem valor, se aquilo faz sentido, se é factível. porque senão você nem gasta tempo e esforço fazendo aquilo.

Então, como ciclos são muito curtos, muito diferentes, antigamente quando a gente trabalhava com gestão de projetos, um projeto demorava muito comumente um, dois, três anos no banco. Então, era muito sequencial e longo, porque entrava-se muito no detalhe das coisas, você tinha que documentar tudo muito bem. E agora essas coisas não têm tanto valor, porque o que você quer é uma resposta rápida.

Então, os seus ciclos de entrega passaram a...

Para você ter uma ideia, a gente está aqui num Kaizen que acabou de ser concluído, que está repensando a jornada de criação de produtos digitais no banco. E o problema é o lead time dessa

jornada ser de nove meses. É um tempo exageradamente grande para o que a gente tem hoje no mundo digital, na era digital. O que antes, nove meses no Waterfall, era um projeto super rápido. Né?

E nove meses que eu tô falando é desde a concepção, da ideia, da descoberta, do desenho, da implantação, do pós, da operação. Então, nove meses hoje passou a ser um tempo muito grande para você provar valor. Então, acho que hoje tem muito mais essa cultura de experimentação. Enfim, não sei se eu te respondi, D, ou se eu fui para outro lado.

DP
Não, respondeu sim. Só para me ajudar, fazer uns dados demográficos, me ajuda a pensar, quando que você começou a trabalhar com gestão de projetos?

YC
Tá, eu comecei em 2000... 2004.

DP
2004, tá, legal. Sempre no banco, né, YC?

YC
Não, 2004 eu trabalhei na Brasil Telecom, em Brasília, em telecomunicações, eu acho que o primeiro grande projeto que eu atuei foi o lançamento da operação móvel da empresa de telecomunicações, que era uma empresa de telefonia fixa e banda larga. Então, eu fui para estruturar a operação móvel, e foi um projeto que durou praticamente dois anos da data que eu cheguei, mas já estava sendo trabalhado antes.

Eu acho que é uma boa perspectiva sobre o erro. Antes a gente não podia correr o risco de errar, então acho que os projetos eram muito longos. Agora eu acho que errar pequeno tá tudo bem.

DP
É,   né?   Muito   bom.

YC
Porque você corrige rápido também esse erro, se ele é pequeno.

DP
Sim. Sim, essa é uma mudança interessante, assim, real, né? Muito bom. Bom, você me falou, você já me falou sobre um projeto que você está atualmente trabalhando, né? Pode ser esse do Kaizen, você quer falar um pouquinho mais sobre ele ou quer falar de um outro? Eu preciso

que você me fale de um projeto que tenha transformação digital aí na veia, que você tenha trabalhado ou que você esteja trabalhando e que envolva várias pessoas, várias áreas, sabe? para dar essa ideia de como existe essa relação entre as áreas.

YC
Vou escolher outro, D, que é o que estou tocando aqui, que é reuso.

DP
Reuso. De quê?

YC
Então, assim, Reuso de tudo, de aplicações, de produtos, trechos de código, porque eu não estou mais com experiência, não estou mais em design, estou em produtos agora. E aí, qual que é a minha missão aqui? Gerar eficiência, velocidade e garantir que o banco esteja, garantir é forte, que eu jamais vou conseguir garantir isso num banco desse tamanho, mas assim, garantir que o banco esteja construindo valor novo e não valor repetido, de peças iguais.

Então, por exemplo, Biometria digital. Biometria digital é um produto, em várias jornadas do banco, contratação de vários produtos, você pede a biometria em múltiplos canais. Como que eu garanto que todos os negócios do banco estejam usando a mesma solução de biometria digital? Então, é o reuso dessas peças em múltiplos canais, porque faz com que diminua o custo de infraestrutura, enfim, porque pensa que eu possa ter várias soluções de biometria espalhadas pelo banco. Tem um time que está mantendo cada uma delas, então tem custo de pessoas, tem custo de infra.

Então, como que eu, primeiro, mapeio onde estão essas distorções aqui, essa ineficiência de estoque, de ativos tecnológicos, e como que você fomenta que as comunidades redesenhem a solução, porque muitas vezes a solução é concebida no lugar onde aquela pessoa está alocada. Então, sei lá, biometria digital, o dono desse produto está alocado em canais, PF, ele está vivendo a realidade daquele lugar onde ele está lotado funcionalmente. Só que tem uma série de negócios do banco, maquininha de cartão, canais PJ, que talvez tenham a mesma necessidade e que ele nem saiba que ele pode impactar esses outros lugares. Então, de forma muito resumida, como que você muda a mentalidade de construção de coisas dentro do banco e como que você começa a fomentar que pessoas pensem de uma forma mais eficiente, né, cara, Se eu for construir alguma coisa, deixa eu olhar se já não tem alguma coisa pronta, eu vou reusar e vou construir algo a partir dela. Ou se ela não me atende, eu vou construir só o que falta nela pra ela me atender, que é um requisito, uma feature, alguma coisa, sei lá, é um toque por botão e não por, sei lá, alguma outra coisa, link, sabe? Então eu tô neste momento, nesse projeto aqui, D.

DP
Entendi. Muito legal YC. é muito interessante, né? Realmente percebi várias coisas, na sua falo, percebi um direcionamento pelo objetivo, né? Você começou falando dessa missão, o que você quer conseguir, então as atividades Veja se eu interpretei correto, né? As atividades são

decorrentes desses objetivos. Atividades, projetos, tudo que precisa ser feito é decorrência desse objetivo.

YC

Isso. (Atividades, projetos, tudo que precisa ser feito é decorrência desse objetivo.)

DP

Então esse é o seu drive, né? Muito, muito legal. E é cross, né, YC? é extremamente cross, né? Requer que você trate com uma série de áreas funcionais, com diversos mentalidades e necessidades. É isso mesmo? Foi isso que eu pensei. Algumas coisas que eu...

YC
É isso mesmo. A gente foi aprendendo com o tempo.

Então, por exemplo, isso nasceu... Eu estava em Canais ainda, pasme, na mesma comunidade. Só que é uma comunidade que vive um contexto de canais ali e que não tem esse alcance no banco inteiro. E agora esse tema está numa comunidade enabler aqui, que são essas comunidades que produzem coisas para o banco inteiro reusar. Então, coisas de infraestrutura, que não tem escolha, tudo nasce daqui. Então, coisas que são escaladas para o banco inteiro estão nessas comunidades.

DP
Me explica a comunidade, YC, não sei se eu sei totalmente certinho.

YC
Essa é uma grande transformação que aconteceu no banco, D. Assim, antes as estruturas funcionais do banco eram organizadas por linhas de negócio, por produtos de negócio, crédito, renegociação, Agora o banco inteiro foi reorganizado por necessidade do cliente. O cliente tem uma necessidade de construção de patrimônio. Então eu vou organizar múltiplos times disciplinares.

Vou trazer alguns exemplos.

Squad é um time que está organizado junto ali de mais ou menos 9 a 12 pessoas. com especialidades múltiplas, são células, que ficam juntas resolvendo um problema. Então, cuidam de um produto digital. Então, tem a pessoa de tecnologia, tem a pessoa de negócios, o designer, a pessoa de riscos, de qualidade, enfim, é um time multidisciplinar resolvendo algo único. E aí a soma de squads compõe uma RT. Aí a soma dessas RTs compõe uma comunidade. Então

você tem comunidades seguras. A comunidade onde eu estou é integração digital. Então, cada comunidade no banco tem um nome aqui que está ligado a algum driver.

Foi esse que eu te falei.

E aí você tem diretores ali em cima. Então, essa é a estrutura matricial que fala. Então, as pessoas estão espalhadas nesses times, focadas em resolver alguma coisa. E aí você tem as estruturas funcionais. Então, por exemplo, a gente que era de Ux. Estou alocada lá numa squad que é da Comunidade Seguros. Mas o meu gerente que faz a minha avaliação de performance e tal, está nessa estrutura funcional de UX, de design.

DP
Nossa, que louco.

YC
A habilidade para disciplina.

Esses times são formados por multidisciplinas. É um pouco de como o banco se reorganizou, acho que justamente para trazer essa velocidade, porque senão eu faço a minha parte, entrego para o outro, que vai fazer a parte dele, que entrega para o outro. Não, está todo mundo trabalhando junto na mesma coisa.

DP
Juntou, é como se eu tivesse... Antes, os projetos, por exemplo, tinham uma estrutura matricial, mas ela era bastante filada. Era matricial, mas não era muito.

YC
Antes tinha uma dependência muito grande (da área funcional).

DP
Uma dependência da área funcional. Talvez seja uma forma de realmente trazer maior proximidade para uma necessidade específica. É bem interessante.

YC
O que eu comentei com você,

Mesmo eu estando em uma comunidade, eu tenho um time que faz algumas coisas aqui, eu ainda dependo de outras especialidades para fazer esse movimento acontecer no banco. Tem o time de arquitetura, de negócios. Então, a arquitetura está espalhada no banco inteiro, que são os arquitetos de solução e negócios.

O reuso não acontece se não tiver a minha força comercial espalhada. Então, é esse cara que vai direcionar o time. Cara, não. Não vai construir algo novo, porque já tem uma peça existente

no banco para você reusar. Ou vai construir, pensa nos múltiplos consumidores que essa peça vai ter no futuro. PF, PJ, cartonista e tudo mais. Então, essa é uma das parcerias. Aí tem parcerias com várias outras estruturas para fazer o negócio acontecer.

DP
Muito interessante, hein? Muito legal, adorei. Muito parecido com a estrutura do Spotify, né? Da agilidade do Spotify, mas eu acho que eu nunca tinha visto na prática assim.

YC
Se baseou no Spotify, D. O RG fez toda essa transformação acontecer no banco. Ele já tá quase se aposentando, sabia? O RG.

DP
Que bonitinho! É que é 70, né? Que aposenta. Nossa, mas será que já tem tudo isso, YC?

YC
Não, não sei assim, mas eu já tô percebendo a movimentação que a gente tá fazendo já, sabe? Já colocando umas pessoas ali, mas eu acho que esses caras nunca se aposentam, eles viram conselheiros, né?

DP
Mais ou menos, eu lembro que a gente, quando a gente tava no banco, aposentou, acho que você nem tava, o RC, você tava?

YC
Eu tava nesse dia!

DP
Ficamos anos falando sobre a aposentadoria desse ser.

YC
Não, eu acho que quando o RG se aposentar vai ser assim, nossa, um choque aqui, sabe? Porque ele é muito forte.

DP
Ele é muito bom.

YC

E a estruturação foi baseada na estrutura do Spotify.

DP

Cara, mas é muito difícil de fazer. Assim, tô pasma, porque é muito difícil, porque requer, assim, uma dança, né? Todo mundo tem que dançar pra um lado, junto, né? E se não tá junto, tem que um cutucar. Muito legal, muito interessante.

YC

Mas eu acho que esse processo todo que eu te narrei aqui, eu acho que demorou uns 15 anos pra acontecer. Ele foi gradual, foi aos poucos.

DP

Muito   legal.

YC

Você percebe que o RG cuidou de cada detalhe para o negócio acontecer, foi influenciando, convencendo, um cara muito bom.

DP

E é legal porque assim é o cerne dele, a gente lembra dele lá na SG, Você lembra dos princípios, valores,   né?   Os   princípios   estão   espelhados   aí.

YC

Querendo ou não, ele foi muito percursor na própria visão de experiência do cliente, de UX

DP

E essa coisa de interagir, de não ser silado, né? Enfim, bem legal. Muito bom, YC. Vou voltar aqui, a gente não acaba. Na sua opinião, quais são as competências que distinguem, que diferenciam os profissionais nesse contexto digital?

YC

Eu acho que abertura ao novo, total. Eu acho que a sede de se reinventar e reaprender. Parece meio piegas as coisas que eu vou falar, mas eu acho que se não tiver essas características, não sobrevive, se frustra num ambiente como esse.

Eu acho que a questão de estudar continuamente, porque a velocidade que aparecem as novas tecnologias, novos métodos de trabalho, se você não está aberto ao novo, você para no tempo. Eu acho que agora a gente vai viver a maior transformação que está sendo um desafio, que é a inteligência artificial.

Trabalhar com dados, saber usar dados para criar as soluções, e ter familiaridade com tecnologia para acelerar a produtividade. Isso tem tudo a ver com essa questão de agilidade. Acho que não está sendo esperado que os profissionais dominem isso, mas que eles estejam estudando sobre, brincando, interagindo. Já tem soluções de inteligência artificial aqui dentro e acho que a cobrança está vindo muito forte nesse sentido.

Então, eu acho que as duas principais características são estar aberto ao novo, facilidade de adaptação e estudo.

DP
Muito bom. E como que você vê a tecnologia influenciando a integração entre as pessoas, a colaboração entre as pessoas.

YC
Eu acho que a gente nem consegue mais viver sem tecnologia. Eu acho que desde as ferramentas de comunicação e de trabalho básicas, por exemplo, hoje a gente não faz nada sem o Teams aqui. Para se conectar com o outro, fazer reuniões, Acho que sempre houve isso na nossa época, e é até hoje, a dificuldade de agendar salas. E as ineficiências, sabe? Tipo, cara, vou de uma torre para outra, lembra? Deslocando de 1 polo para o outro. Cara, isso é uma realidade que mudou muito, assim.

Então, acho que a tecnologia vai desde as ferramentas mais básicas de trabalho, até as ferramentas que são usadas para criar coisas. O exemplo que eu dei aqui de inteligência artificial. Para você ter uma ideia, D, eu acho que a gente não está nem 1% do potencial que a gente pode fazer com ela. A gente está se redescobrindo aqui. Assim, por exemplo, tudo que ela consegue criar, fazer para acelerar a produtividade do time.

Então, por exemplo, vou dar um exemplo aqui. Uma das principais dificuldades do reuso é uma comunidade conseguir contribuir com código do produto da outra comunidade. Então, por exemplo, a pessoa que está ali tocando biometria digital tem que contribuir com um código de sistemas de autenticação e autorização de clientes, segurança. A primeira barreira é, cara, eu não manjo nada dessa realidade de segurança. O meu foco aqui é crédito. As ferramentas que eu uso para desenvolver são outras. Eu não entendo a documentação, enfim. Uma das coisas que a gente está explorando é criar um agente de inteligência artificial para interpretar o código lá de segurança e transformar na linguagem que o cara de crédito consegue entender. Como que ele abstrai a complexidade de interpretação.

DP
Legal.

YC
Então vai desde a escrita de um código.

Então o cara que está chegando agora. Pessoas que estão entrando no mercado de trabalho. Então, eu acho assim, são tecnologias que vão tirar o emprego de quem não quer saber lidar com elas, porque emprego para criar agentes, para saber como ela pode ser usada, isso sempre vai ter. Agora, o problema é quem quer fazer exatamente da forma como estava fazendo, sempre fez antes, entendeu? O jeito raiz de ser.

DP
Muito bom. Quais são as práticas que vocês usam hoje YC que você entende que fomentam a colaboração?

YC
As práticas? Acho que a questão de todo mundo estar conectado num mesmo objetivo. Então, todo mundo tem que estar comprado com o mesmo objetivo. A meta precisa ser igual. Tá todo mundo com o mesmo driver. Acho que esse é o principal. Começa por ele.

DP
Eu tive um revival que a meta tem que ser igual. Nossa! E hoje consegue fazer a meta ficar igual? Caraca! Difícil.

YC
É difícil ainda, D, (negociar para ter meta igual) mas eu acho que tá mais fácil do que antes porque os times já estão sentados ali juntos, né? Então, já está todo mundo com o mesmo objetivo. Acho que isso facilita a colaboração.

Acho que está a questão de estar sentado junto, o dia a dia que faz acontecer. Também acho que faz total sentido a diferença na colaboração.

Deixa eu pensar o que mais aqui.

Eu acho que o principal é todo mundo estar comprado que estamos indo para o mesmo caminho, sabe? Aí aquelas questões que aparecem no meio, né? Tipo, administrar ego, pessoa querendo aparecer que foi ela que fez. Isso sempre existiu e vai continuar existindo sempre. Mas eu acho que é isso. Acho que é quando a gente está com o mesmo driver.

DP
Legal, muito bom. E quais comportamentos desses profissionais YC que fomentam a colaboração?

YC

Comportamentos desses profissionais que fomentam a colaboração. Tenho que pensar até aqui na minha realidade aqui. Eu acho que é pensar menos no que eu faço, no meu contexto aqui e o que impacta o banco inteiro. Acho que é olhar menos para si e mais para o todo. Acho que essa é uma postura de um colaborador que fomenta a colaboração.

YC

É... O que mais? Faz de novo a pergunta? Talvez eu pense em outra coisa.

DP

Quais os comportamentos dos profissionais digitais que fomentam a colaboração? Você já falou um pouco, né? Você falou de abertura à aprendizagem, né? Falou um pouco, tá bom.

YC

Acho que o comportamento é isso, é quando eu olho menos para o que eu cuido aqui, olho para o que o banco precisa. E acho que é isso, D, as outras coisas que eu também já tinha falado.

DP

Boa, muito bom. Você falou um pouco no começo YC sobre a forma como os projetos são implantados, com muita rapidez e tal, não buscando... a perfeição. Você acha que isso... Por que você acha que essa nova forma de operar, ela faz mais sentido? Você... Na verdade, assim, eu tenho uma pergunta aqui que fala assim, como que a incerteza digital influencia os projetos? A incerteza, a incerteza, a incerteza. Tudo diferente, né? O cliente cada hora quer uma coisa, a tecnologia muda toda hora, o mercado muda, entra player, sai player. Em geral, as pessoas respondem... Tô fazendo uma loucura dessa entrevista, mas... Ai, meu Deus. Mas, assim... Você percebe esse contexto de incerteza? Primeira coisa, pra gente voltar pro prumo..

YC

Eu acho que a incerteza tem a ver com a velocidade do mundo como um todo. Eu acho que o mundo é incerto, e as coisas estão mudando muito rapidamente. Então, acho que não é só no contexto do trabalho que você lida com incerteza, você tá lidando na sua vida, em todas as relações pessoais, em tudo.

No trabalho você toma conhecimento de uma forma mais rápida. Principalmente a gente aqui que está num banco que respira isso, que o RG é esse cara visionário, então parece que tudo chega muito antes aqui e você já tem que começar lidando conhecendo esses temas, esses temas entram muito mais rápido, mas não que isso não seja difícil…

É difícil lidar com isso. Por exemplo, quando a gente começou a falar de IA aqui, todo mundo estava achando que ia perder emprego, além da própria mudança para a comunidade. Ninguém entendendo: meu gestor não vai me acompanhar, como que fica a progressão da minha carreira se ele está super distante de mim.

Então, eu acho que as incertezas são relacionadas a tudo que é novo na nossa vida. A gente passa pelo processo de Primeiro, ter mais informação. Então, a primeira reação é pânico. Eu acho que os bons profissionais é que reagem com menos pânico quando essas coisas acontecem. Eu falo para as gerações novas. Cara, vai mudar, não fica preocupado. Eu já passei por 50 mil fusões, aquisições, reestruturas. Você leva a vida de uma forma diferente. Acho que a maturidade traz isso também de vida. Né, D?

DP
Sim, sim. Legal. Você acha que essa mudança de configuração, deixamos de entregar os projetos waterfall, agora a gente entrega de uma forma mais rápida, você acha que isso também é reflexo da incerteza que a gente vive?

YC
Da incerteza, eu acho que não. Tem a ver com...

Acho que o tempo de resposta das coisas. Acho que é muito mais a velocidade que as coisas acontecem no mundo do que por incerteza. Se você demora um pouco para tudo, um tempo de leitura de uma tela, acho que qualquer... Perda de tempo gera evasão, né? Gera desinteresse.

Então, eu acho que não é pela incerteza, não.

DP
Entendi, entendi. Entendi, legal. Você já me contou de como vocês fazem gestão de projetos. Ainda tem lista única? Deve ter, né? Como que faz para fazer priorização?

YC
Não tem mais. Então,

Cada unidade faz as suas priorizações. Na verdade, é assim. O MM, que é o presidente, ele escreveu uma carta compromisso, que é, ele escreve esses grandes drivers, centralidade no cliente é prioridade, são 21 prioridades, que o banco deveria olhar. Se você tem dúvida do que você está fazendo, se elas não estão conectadas com essas 21 prioridades, pare de fazer e rume para elas. E aí isso vai concatenando até chegar no menor nível lá, que é a squad.

Então, por exemplo, a diretoria do RG contratou drivers de eficiência, velocidade, qualidade, que estão diretamente conectados com esses do MM, os compromissos do MM. E aí isso vai descendo para os times. Então, fala-se menos sobre projetos, o que eu vou entregar, e mais sobre resultado que eu quero atingir. O meio que você vai atingir esse resultado é problema seu, as comunidades pensam como elas vão fazer. Entendeu? O que a gente acompanha no banco hoje são esses resultados que vêm desses objetivos. Então, aumentou a satisfação do cliente?

DP
São os OKRs, né?

YC
Os OKRs. Eu não tô falando essas palavras porque eu não sei o quanto que você tá habituada, tô evitando usar sigla.

DP
É, eu entendo ela, eu não vivo ela, mas eu entendo ela. É legal, é legal. Assim, as entrevistas que eu fiz que me pareceram mais modernas, vai, todos falaram em OKRs, é bem interessante mesmo.

Eu só fico me perguntando YC se não dá crepe lá na cozinha, sabe? Porque eu lembro lá, antes de a gente ter a lista única, lembra que as equipes de sistema se batiam porque tinham vários donos, cada um mandava uma coisa e o cara não sabia o que ele atendia. Eu tenho um pouco de dificuldade para entender como é que se resolve essa... essas prioridades, não sei se você já...

YC
Bom, às vezes pode rolar dependência, então para eu entregar alguma coisa eu dependo que alguém construa algo, aí agora aqui tem um método que são os envolvimentos, Então, como que funciona? A sequência aqui é trimestral, então o banco trabalha por release. A cada release você tem que entregar um KR. Por exemplo, agora a gente já começa a negociar o que a gente vai fazer no trimestre seguinte, no segundo trimestre. Então, se eu tenho alguma dependência, eu já vou começar a negociar com esse time, eu vou abrir envolvimento, e vou passar horas para ele desenvolver isso. Então, ele aceita ou recusa esse envolvimento.

Só que o que a gente quer com o reuso, que já é um avanço dessa transformação digital, é que não exista abertura de envolvimento. Você vai lá, contribui com o código do cara, se é prioridade para você e ele não quer te atender, Vai lá, você faz no código do outro. Então, é quase que as prioridades das comunidades estão saindo, porque cada um está construindo o seu que lhe cabe. Então, o banco quer diminuir a quantidade de envolvimentos e fazer com que as pessoas consigam ter liberdade para contribuir no código do vizinho, do amigo.

DP
É uma mudança total de paradigma, né? Bem interessante.

YC
Muito grande. E isso traz agilidade, né? Porque eu não dependo da prioridade do cara, velocidade, tudo se conecta com o tempo, né? Waterfall, ágil, você vê. É muito respostas rápidas. Tempo e resultado.

DP

Muito bom, que legal. Quando vocês têm, assim, uma situação em que existem vários caminhos para resolvê-la, existem várias possibilidades, como que vocês tratam essa situação? Como é que vocês desenrolam essa conversa e essa decisão?

YC

Eu acho que, de novo, eu vou conectar com o KR. Então, acho que se tem múltiplas frentes aqui, iniciativas. Qual traz mais resultado? Acho que é uma matriz de esforço e resultado. Aquilo que você consegue entregar rápido e a expectativa de resultado é grande. Então, essa é a que você prioriza, geralmente. E aquelas com um alto esforço e baixa expectativa de resultado, expectativa é hipótese, porque pode ser que a hipótese não se concretize. E por isso que gasta-se muito tempo levantando dados, fazendo o discovery, para ser o mais assertivo possível em escolher essas hipóteses, falar com o cliente e tudo isso.

Então, eu acho que Eu responderia assim, D, a essa.

DP

Nesse descobrimento, nesse levantamento, envolvem-se várias equipes, né? Eu estou imaginando. Que não trabalham muito. Já era. Já essa própria equipe.

YC

A equipe é multidisciplinar. Já tem um designer ali que está descobrindo o problema com o cliente. Aí já tem um analista de dados que está manipulando bases de dados para entender se, de fato, aquele é um problema que a gente tem que resolver. Então, já é esse grupo multidisciplinar que está super imerso nessa realidade.

Então, como é cíclico, você também já está testando, ah, funcionou ou não funcionou? Não, então é uma outra abordagem. Vamos despriorizar todo esse tipo de abordagem aqui e vamos focar em outro. Assim, D, no discurso, é isso que tem que rolar sempre.

Não estou falando que todos os times têm. as disciplinas, né? Tem gente que, por exemplo, eu rodo com um time aqui de quatro, cinco pessoas. Eu não tenho um cara de dados dedicado para aquela squad, né? Mas tem estruturas que rodam nesse modelo ideal que eu tô te contando.

DP

Legal, legal. Muito bom. E como que vocês fomentam o engajamento dos stakeholders ou dos envolvidos? Não sei se é assim como é que fala.

YC

Sim, acho que é stakeholders que a gente fala mesmo.

DP

Como fomenta o engajamento desses caras?

YC

Acho que a gente está vivendo um momento agora, que é, vou te responder com um exemplo.

O RG declarou em um evento de tecnologia que até 2028 100% do banco vai estar com todas as aplicações modernizadas na AWS. Então, não tem mais nada on-premises em máquinas físicas e estaremos 100% na nuvem. Legal. Como que a gente sensibiliza stakeholders? Porque tecnologia está muito comprada, mas a prioridade vem de negócios, vem de produto. Então, se produto determina que você não vai modernizar, que você tem um problema de um cliente para resolver, prevalece a decisão de negócios. Mas como que a gente influencia negócios para dizer que manter uma tecnologia legada vai impactar cliente em algum momento dessa etapa?

Porque não tem mais ninguém para administrar esse sistema, vai começar a dar incidente, as pessoas que conhecem desse sistema estão saindo do banco, Então, começa-se, de novo, começa por KR. Definimos três KRs mandates que subirão no comitê lá do MM, para que sejam um direcionamento daqueles compromissos que ele estabelece: Então, MM, precisamos que esses três KRs aqui sejam mandates no banco. E aí não basta só o MM falar que é prioridade, porque tem muita gente que acaba não contratando. Aí cada diretor tem que conhecer a comunidade de negócios e falar a língua que vai tocar o diretor de negócios.

Então, eu sei que o problema do cara é risco, então eu preciso tratar o tema de modernização conectado com riscos com ele, que é a única forma de sensibilizá-lo. Então, tudo passa por drivers, por OKRS. Porque como o banco fala muito em resultado, você tem que ficar convencendo os stakeholders e mostrando: olha, se eu fizer isso, vai impactar os seus outcomes, que é o termo que a gente fala aqui.

DP

Nossa, que legal, né? Muito interessante YC. Parece que tá amadurecido, né? Olhando de fora aqui, de lado, 20 anos longe, 20 anos longe, não, 10 anos. Parece bem amadurecido, né? Bem amadurecido.

YC

Tá menos burocrático, menos hierarquizado. Tem comunidades que são mais hierárquicas, mas tem outras que o poder de decisão tá na mão do cara lá do PM que tá numa squad, sabe? Do líder de produto que tá ali.

DP

Muito bom. E as decisões pautadas pelos objetivos, né? Eu tenho que ir lá... Uma coisa que você falou, que eu tenho que entender a língua do cara pra tentar convencê-lo de que aquele projeto vai beneficiá-lo, né? Mas a diferença no KR dele, né?

YC
Cara, 30% do tempo aqui não dá pra gente priorizar com isso. 70% a gente foca no que você precisa, mas de alguma forma a gente precisa começar a resolver esse outro problema, que hoje é quase uma gestão de riscos. Hoje ele pode não estar impactando, mas a longo prazo vai, e talvez o cara de negócio não tá conseguindo enxergar o impacto disso.

DP
Muito bom, bom Temos aqui que você já tocou todas, dados e clientes. E as relações, YC? Como que elas aparecem? Qual é a relevância das relações humanas nesse contexto?

YC
Acho que total. Acho que aí entra a questão do debate remoto presencial, que acho que também a gente viveu agora o ano passado, foi a volta para o presencial. E no começo também foi um chororô, né? E ainda assim tem muita gente que concorda e não concorda, mas o banco ainda teve uma postura de manter as pessoas oito dias no presencial. Então você pode escolher, você quer ir a semana inteira e depois as outras três semanas você fica em casa. Você escolhe, os times decidem como eles querem pagar esses oito dias. E aí eu acho que é no presencial que se prioriza o contato humano mesmo, a relação.

Porque a preocupação do banco é com quem entra agora no banco. Como que ficam os atributos de cultura? Se você está isolado na sua casa, como que você começa a vivenciar o que é a cultura do banco? E aí, acho que quando você tem os encontros presenciais, é onde você fomenta essa relação humana, porque, no fundo, se você gosta da pessoa, você vai entregar mais. Se você se sente à vontade para colocar suas opiniões, também você vai entregar mais. E com quem você não gosta, você vai evitar o contato, o relacionamento. Não muda isso. Com digital, nada muda. na relação humana. Ela sempre ainda é muito importante.

DP
Última. Na sua percepção, quando você está lidando com seus parceiros, que tipo de comportamento deles te sinaliza que eles estão abertos para colaborar? É...

YC
Eu acho que conecta com a mesma resposta de antes, D.

Eu acho que só vai rolar uma sinalização de ajudar se você vender o porquê você está fazendo aquilo. Porquê que é importante e como ele pode te ajudar. Então, por mais que não tenha nada a ver com o que ele faz, se ele entende o propósito do que você está propondo e que é importante para o banco, ele sabe o que é importante para o banco, porque ele conhece as diretrizes.

E eu acho que o grande mote da cultura do banco tem alguns pilares ali da cultura, mas um dos principais mais citados é o vamos de turma, que é exatamente o fomento à colaboração. A gente não sabe de tudo, errar é humano, vamos de turma, Então, naturalmente, essas coisas saem até nas negociações. Ah, conta comigo, vamos de turma. As pessoas falam isso no dia a dia aqui. Porque, de fato, essa questão da cultura vai descendo, vai sendo internalizada.

DP
Internalizada?

YC
a cultura é internalizada, os líderes vão passando. Olha, a gente não faz nada sozinho, a gente está aqui pelo cliente. Eu acho que é água mole em pedra dura tanto bate até que fura, sabe? Tipo, o excesso ali de bater esses pontos da cultura, assim. Eu acho que você sensibiliza seus parceiros dessa maneira.

DP
Muito bom, muito bom. Terminamos, YC. Olha, nem doeu.

YC
Olha, eu achei que eu viajei aqui em algumas respostas, mas...

DP
Não, não, não!

APPENDIX 7 – TECHNOLOGICAL PRODUCT - WEBSITE PROPOSAL IN PORTUGUESE

A.   Website: DigitalCollabInsights

A transformação digital e a colaboração entre stakeholders são mutuamente dependentes: uma não funciona bem sem a outra.

Pense da seguinte forma: a transformação digital fornece o cenário — os sistemas digitais e a abundância de dados que exigem uma mudança estratégica. Contudo, é a colaboração eficaz que atua como o motor, garantindo que essa tecnologia complexa seja realmente usada para resolver problemas reais dos clientes e não apenas para automatizar tarefas antigas. Quando as equipes compartilham sentimentos de confiança e um propósito unificado, elas garantem que a estratégia digital entregue valor mensurável, como resultados rastreáveis via a ferramenta metodológica de Objetivos e Resultados-Chave (OKRs), em vez de apenas completar tarefas.

De forma simples: quanto mais digital uma organização se torna, mais colaboração ela necessita para manter o foco e acelerar o sucesso.

a.   COLABORAÇÃO ENTRE STAKEHOLDERS DE PROJETO

A Colaboração entre Stakeholders do Projeto é um processo social e estratégico no qual duas ou mais partes — organizações, grupos ou indivíduos — unem seus recursos e conhecimentos para enfrentar problemas complexos que não poderiam resolver individualmente.

Os stakeholders escolhem colaborar, pois esse relacionamento os aproxima de alcançar resultados de qualidade superior e benefícios mútuos.

Na colaboração, os profissionais trabalham de forma interativa, compartilhando responsabilidades e, quando necessário, ajustando seus processos individuais para atingir o objetivo coletivo. A Figura 11 mostra o layout do site, especificamente a seção sobre Colaboração entre Stakeholders do Projeto.

Figura 11: Colaboração entre Stakeholders do Projeto no website DigitalCollabInsights

Fonte: desenvolvido pelo autor

i. Por que a colaboração entre stakeholders é importante em projetos?

Basicamente, a colaboração muda o foco da equipe. Em vez de as pessoas focarem apenas em "entregar suas tarefas individuais", elas começam a trabalhar juntas para "entregar valor real" ao cliente e à empresa.

ii. Pilares da Colaboração entre Stakeholders de Projeto

Para que isso funcione, a colaboração entre stakeholders apoia-se em três pilares interconectados:

- **Cultura Colaborativa (O Lado Humano):** Esta é a base relacional. Trata-se de criar um ambiente de confiança, entendimento mútuo, transparência e ter um objetivo comum (visão compartilhada). Os stakeholders sentem-se valorizados e motivados a alcançar objetivos compartilhados, por isso esforçam-se para trabalhar juntos.

- **Práticas de Engajamento (O Lado Prático):** Um bom ambiente não é suficiente se não houver organização. Este pilar define como o trabalho é feito. Ele destaca a importância de identificar e interagir com os stakeholders-chave desde o início e durante

todo o ciclo de vida do projeto. Também inclui ter regras claras e usar uma coordenação eficiente para entregar os resultados.

- **Criação de Valor (O Objetivo Final):** Este é o resultado da combinação dos dois pilares anteriores. É o que se ganha com a colaboração. Quando as pessoas (cultura) e os processos (práticas) estão alinhados, o projeto entrega o que realmente importa: clientes satisfeitos, equipe motivada e resultados concretos para a empresa, como economia de custos ou aumento de vendas. Os stakeholders reconhecem que o trabalho em equipe pode produzir resultados superiores, mesmo que isso signifique renunciar a um certo grau de autonomia.

iii. Raio-X Simplificado da Colaboração entre Stakeholders do Projeto

Responda a 12 perguntas para entender o nível de colaboração entre stakeholders no seu projeto:

- Estive aberto a assumir tarefas fora da minha especialidade quando pareciam importantes. (criação de valor)
- Estive disposto a sacrificar um certo grau de autonomia em favor de resultados compartilhados. (criação de valor)
- Houve coordenação entre meus colegas de diferentes áreas de conhecimento. (práticas de engajamento)
- Meus colegas e eu compartilhamos uma visão sobre o nosso projeto. (cultura colaborativa)
- Meus colegas estavam comprometidos em trabalhar juntos. (cultura colaborativa)
- Meus colegas tentaram criar um ambiente positivo para o projeto. (cultura colaborativa)
- Nosso projeto envolveu stakeholders-chave nas discussões. (práticas de engajamento)
- Nosso projeto identificou stakeholders-chave desde o início. (práticas de engajamento)
- Nosso projeto visou produzir resultados para as organizações envolvidas. (criação de valor)
- Nosso projeto visou produzir resultados para clientes e usuários finais. (criação de valor)
- O trabalho colaborativo com meus colegas levou a resultados que não poderíamos alcançar sozinhos. (criação de valor)

- Clientes e usuários finais participaram das discussões do projeto relacionadas a eles. (práticas de engajamento)

Após os profissionais responderem ao questionário rápido, será exibido um gráfico como um raio-x simplificado do seu nível de Colaboração entre Stakeholders do Projeto, conforme apresentado na Figura 12.
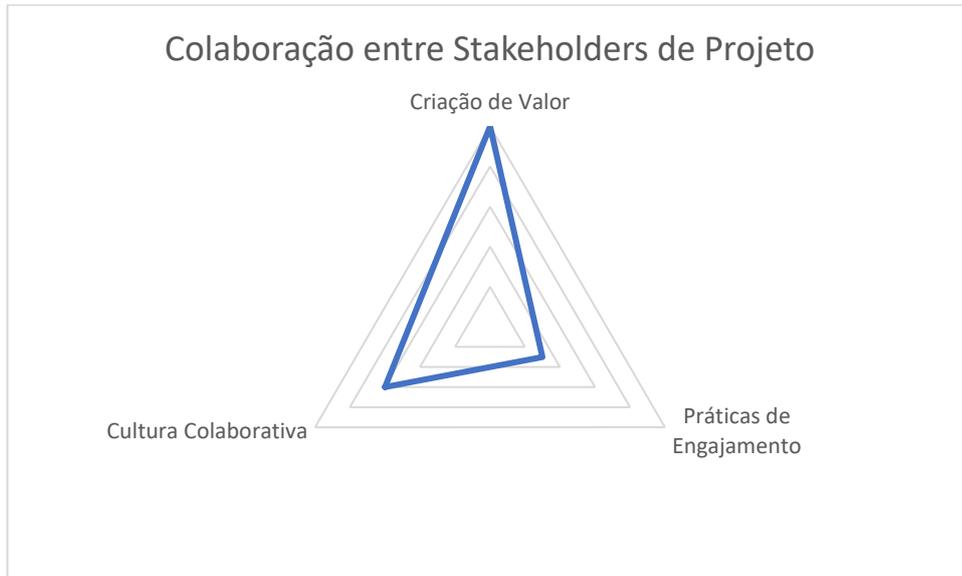

Figura 12: Raio-X Gráfico para Colaboração entre Stakeholders do Projeto

Fonte: desenvolvido pelo autor

b. SUCESSO DA TRANSFORMAÇÃO DIGITAL

O sucesso da transformação digital é alcançado por um ecossistema integrado que moderniza a organização, baseando-se em uma estratégia deliberada e personalizada, profissionais com competências digitais e a desmaterialização de produtos e processos. A Figura 13 mostra o layout do site, especificamente a seção sobre Sucesso da Transformação

Digital.

Figura 13: Sucesso da Transformação Digital no website DigitalCollabInsights

Fonte: desenvolvido pelo autor

i.   Por que a transformação digital é importante para as organizações?

A transformação digital não é apenas sobre comprar novas tecnologias; é uma "revolução de costumes" que ajuda sua organização a acompanhar uma sociedade que, muitas vezes, já é digital.

É uma forma estratégica de fazer melhorias profundas nos negócios, adotando novas tecnologias para criar produtos e processos mais inteligentes. Quando bem planejada, essa transformação ajuda a maximizar os resultados do seu negócio, melhorar a eficiência da sua operação e criar experiências muito melhores para seus clientes.

ii.   Pilares do Sucesso da Transformação Digital

Uma estratégia digital colaborativa usa tecnologia e dados para resolver os maiores desafios de uma organização. Essa mudança só é possível com profissionais qualificados que entendam tanto a tecnologia quanto os objetivos de negócio.

- **Desmaterialização:** É a mudança de processos físicos e analógicos para formatos digitais, utilizando novas tecnologias e empregando dados para gerar inteligência.

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- **Uma Estratégia Digital Colaborativa:** É o "mapa" que alinha projetos e a estrutura da empresa com a estratégia e os objetivos digitais, personalizada para as necessidades e o nível de maturidade da organização.

- **Competências Digitais:** É ter pessoas com o talento e as habilidades (tanto técnicas quanto de negócios) necessárias para executar a transformação.

iii.   **Raio-X Simplificado do Sucesso da Transformação Digital**

Responda a 4 perguntas para entender o nível de transformação digital do seu projeto:

- Nosso projeto contou com profissionais com competências digitais. (competências digitais)

- Nosso projeto estava alinhado com as diretrizes estratégicas da nossa organização. (estratégia digital colaborativa)

- Nosso projeto utilizou tecnologias digitais que conectam os mundos real e digital. (desmaterialização)

- Nosso projeto ampliou o uso de dados para gerar informações na organização em transformação digital. (desmaterialização)

Após os profissionais responderem ao questionário rápido, será exibido um gráfico de raio-x simplificado do seu nível de Sucesso da Transformação Digital, conforme apresentado na Figura 14.
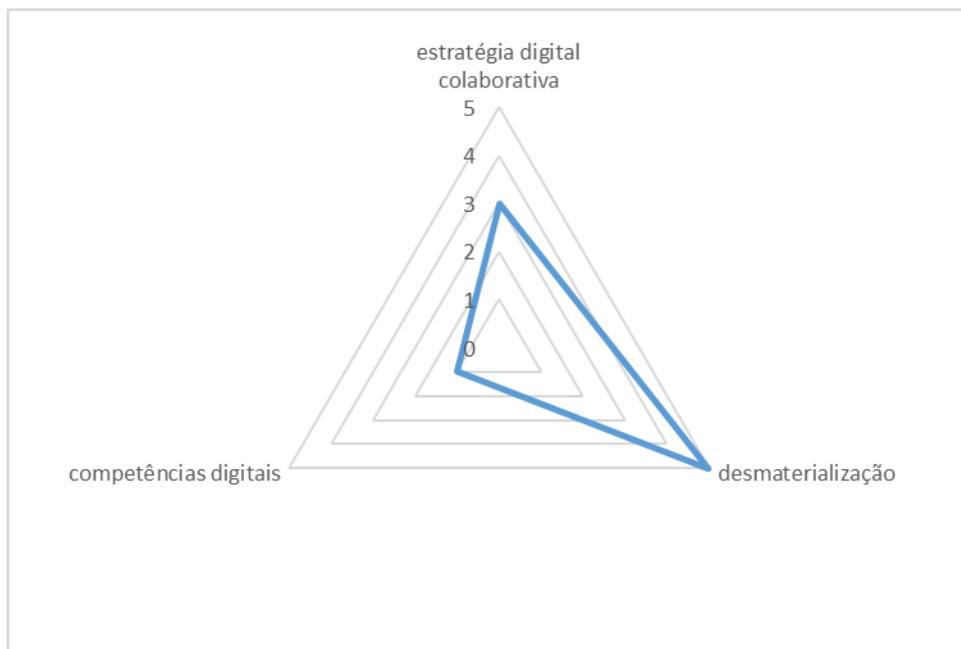
Figura 14: Gráfico Raio-X para Sucesso da Transformação Digital

Fonte: desenvolvido pelo autor

c.   **DIAGNÓSTICO DETALHADO DA COLABORAÇÃO DIGITAL**

Se você deseja obter um diagnóstico detalhado da Colaboração entre Stakeholders do Projeto e do Sucesso da Transformação Digital, por favor responda ao questionário no link abaixo:

https://docs.google.com/forms/d/1sv7bCtJLuYix32PivGfdHohFfARc6rjcEqywgJgb94M/edit

Ao terminar de responder, um diagnóstico completo do nível tanto de Colaboração entre Stakeholders do Projeto quanto de Sucesso da Transformação Digital será enviado para o seu e-mail, mostrando seus pontos fortes e fracos, e destacando áreas com sugestões de melhoria.