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Enhancing ERP Research through the Integration of Complementary Frameworks Brings New Insights and a Holistic Approach to Understanding Enterprise Resource Planning

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Abstract. *Since the early 1990s, the complexity of ERP systems has posed a challenge for practitioners, but the amount of empirical research exploring new ERP projects has increased over the past ten years. The progress of information technology (IT) has been disrupted by the emergence of new trending and rapidly evolving topics, causing the focus of information systems (IS) research to continuously shift to new issues before the theory or normative knowledge for existing topics is fully developed. The situation occurring in ERP research reflects a problem hindering the progress of the IS discipline: widespread dissatisfaction with the delay between the practical issues faced by practitioners and the normative knowledge generated by academic research. Using ERP as an example, this paper presents two main arguments: (a) IT-based innovations can be addressed by recognizing the important patterns behind each emerging IT phenomenon; and (b) once these important patterns are recognized, a complementary logic between variance- and process-oriented lessons can be proposed, which benefits the advancement of the ERP research model and provides relevant and timely practical lessons.*

Keywords: *ERP Implementation, ERP Research, Complementarity, Variance-Based Studies, Process-Based Studies*

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INTRODUCTION

The current literature on ERP systems has uncovered numerous challenges in their implementation, along with notable organizational and individual impacts, as recognized by both academics and professionals (Mahmood et al., 2020). ERP systems were initially regarded as a revolutionary concept designed to replace outdated, fragmented, and incompatible information systems with a unified, fully integrated solution across the organization. Although marketed as a universal solution incorporating "best practices," ERP systems have evolved over approximately 30 years, primarily aiming for complete control over material flow in manufacturing (Koch, 2004). Just a few years ago, ERP was one of the most critical topics in technology management. Between 1997 and 2000, conferences and special journal editions placed heavy emphasis on ERP, highlighting its complexity and far-reaching impact, and calling for greater involvement from IS researchers. However, the focus of IS researchers has since shifted to newer, emerging IT innovations, often following the latest trends.

There is a growing concern that ERP could become a leading topic of discussion before enough comprehensive studies have been conducted to fully understand the intricacies of its

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management and implementation (Rerup et al., 2010). This raises the broader question of whether this is a recurring trend in the field of IS. Are IS researchers spending adequate time and effort on each IT subject before shifting their focus to the next? What sort of practical and normative knowledge is being developed? As new topics emerge frequently, much of the research tends to be exploratory in nature. However, exploratory studies are just the starting point for generating normative, practical insights. In light of this, Klein's suggestion to identify key recurring issues within these emerging topics is especially relevant (Klein & Myers, 1999). Although the impacts of technology are always changing and depend on context, this doesn't mean every instance of technology use is entirely distinct. On the contrary, recurring patterns in problems and solutions linked to the same technology can often be found (Orlikowski, 2000), even if they don't manifest predictably. Similarly, various IT innovations can lead to comparable societal changes, needs, and demands, which indicates that overarching patterns can indeed be identified.

ERP systems are classified as configurational software. After the selection phase is completed, ERP projects enter the configuration phase, which is often associated with high complexity, significant costs, and considerable risks (Matende & Ogao, 2013). I refer to ERP implementations as complex operational contexts. By analyzing ERP systems, it becomes clear that key patterns can be identified in relation to emerging IT applications that influence organizational change. The question, "What sets ERP implementation apart from other information system implementations?" highlights the complexity and challenges stemming from two main trends: organizational needs and technological solutions. These trends, which I define as "global-local translation" and "cross-functional integration," distinguish ERP from traditional or internally developed information systems (ISD). However, these trends are also visible in other areas of IT research. For example, "global-local translation" mirrors the trend toward packaged software. Acknowledging this foundational pattern global-local translation within ERP projects can enhance research by linking existing ISD methodology literature and ERP studies with those on packaged software. Similarly, "cross-functional integration" is another crucial factor.

The ERP experience, in my opinion, is a fantastic example of how to identify trends in the ERP domain. I'm continuously working on identifying and incorporating common trends in my ongoing research on ERP deployment. I recommend this as a subject for further research, even though I am unable to offer conclusive findings at this time. Identifying shared patterns across different applications indicates that significant benefits could arise from encouraging collaboration between established and emerging IT sub-fields. Additionally, this paper makes a second related contribution by applying the concept of complementarity to variance and process models found in ERP research. (AlMuhayfith & Shaiti, 2020), although the ERP literature is not extensive, section 2 of this paper reviews key studies on ERP implementation, classifying the theoretical models and empirical evidence into two categories: variance-oriented and process-oriented. (Southworth, 2022), how complementary are these two types of lessons? Although there are proponents of keeping variance and process models separate, I believe in their inherent complementarity, as evidenced by practical examples. In Section 3, I explore how the complexity of ERP projects can be effectively managed in both research and practice by employing a complementary framework.

LITERATURE REVIEW

Around 90 papers were examined, with 24 chosen based on their focus on ERP implementation, their quality, and the relevance of their contributions. I categorized the findings into two main approaches: variance-oriented and process-oriented perspectives, which represent two foundational methods for examining ERP phenomena. Variance-oriented research, sometimes referred to as "factors research models" (Newman & Robey, n.d.), seeks to explain ERP implementation by exploring relationships between dependent and independent

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variables. From this set of studies, I identified several factors, constructs, and variables that can be used in future research for modeling and testing.

METHODS

This study employed a qualitative literature review approach, designed to synthesize and critically analyze existing scholarship on enterprise resource planning (ERP) implementation. The review followed a structured process to ensure rigor and transparency. First, a comprehensive search was conducted across major academic databases, including Scopus, Web of Science, and Google Scholar, to identify relevant publications on ERP implementation, success factors, and theoretical frameworks. The search was restricted to peer-reviewed journal articles, conference proceedings, and book chapters published primarily between 1990 and 2023 to capture both foundational and contemporary contributions to the field. In total, approximately 90 publications were initially collected. These studies were screened for relevance based on their explicit discussion of ERP implementation processes, outcomes, or conceptual models. After this filtering stage, 24 studies were retained for in-depth analysis. The inclusion criteria emphasized studies that either adopted a variance-oriented approach (focusing on independent and dependent variables, predictors of success, and measurable outcomes) or a process-oriented approach (focusing on sequences of events, socio-political dynamics, knowledge transfer, and organizational learning mechanisms). To analyze the selected studies, a two-step procedure was followed. First, key constructs, variables, and patterns were extracted and classified according to whether they represented variance-oriented or process-oriented perspectives. This categorization allowed for the construction of Tables 1 and 2, which summarize the major factors and mechanisms reported in the literature. Second, a thematic synthesis was conducted to identify recurring patterns, complementarities, and gaps across both streams of research. This comparative analysis formed the basis for developing the argument on the logic of complementarity, which seeks to bridge variance- and process-based lessons. Additionally, bibliometric tools, including VOSviewer, were used to visualize citation networks and thematic clusters within the ERP literature. This analysis provided supplementary evidence regarding the evolution of ERP research and the relative influence of different methodological approaches. By combining systematic literature review techniques with bibliometric mapping, this study offers both a conceptual and empirical overview of ERP research, highlighting opportunities for integrating complementary frameworks.

RESULTS AND DICUSSION

The identification of potential predictors for an ERP (Enterprise Resource Planning) implementation's success is covered in the offered text. Many of the studies presented are exploratory because the field is still developing. Few studies have examined the connections between predictors and intended results empirically. Implementation success (Markus et al., 2000), ERP efficacy, and value are examples of commonly measured outcomes (dependent variables). Furthermore, a number of research have looked into risk factors, competitive advantage, and performance (Mata-Alvarez et al., 2000). (see Table 1).

Table 1. Variance-Oriented Lessons and ERP Factors

Dimension	Factors	Authors
Technology	Software complexity Number of Configuration Options Technical Flexibility Funcionality Quality Software Dosumentation and Training Materials	Adam & O'Doherty (2000).; Lütkenhöner et al., (2005); Markus et al., (2000).

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People	Implementation Team Member: Knowledge and skills Top Manager: Top Management Expectation and perception Top Management Commitment and Support Champion and transformational leadership	Adam & O'Doherty (2000); Baskerville & Myers (2023).; Park & Nagy (2018).
Implementation	Management process Team building (multi-functional and/or balanced) Implementation time and cost Configuration process Degree of Fit or miss fit (the gap between ERP functionalities) Degree of fit to cross-functional integration Degree of customization Mediation process Software implementation Nature of pocess of knowledge transfer	Markus et al., (2000); Lütkenhöner et al., (2005); Lerman et al., (2022). Adam & O'Doherty (2000); Sabherwal & Robey (1993).

Process-Oriented Lessons

In contrast, research that focus on processes analyze patterns or sequences of events that result in particular results in an effort to better understand the implementation of ERP. By exposing the fundamental factors that determine success or failure in ERP adoption, these studies aim to explain how interactions between persons and organizations affect the process. They also draw attention to similarities and variations among different implementation methods, offering more in-depth understanding of the dynamics at play. (Table 2).

Several research have investigated the dynamics of ERP deployment, seeking to explain how and why specific development results are attained. A positivist methodology is used in some of these-research to explain the relationship between predictors and ERP implementation outcomes through the use of process models. Some take an interpretive stance, concentrating on how process participants view and understand the ERP installation journey. Three repeating themes emerge from a survey of process-focused research, which show that various viewpoints have been taken into account when studying ERP deployment.

Table 2. Process-Oriented Lessons and ERP Implementation Menchanisms

Pattern 1: ERP implementation as a social and political process	**Pattern 2: ERP implementation as a cognitive, knowledge transfer or learning process**	**Pattern 3: ERP implementation as a successful of unsuccesfull "IS" experince**
Social Technical Mata-Alvarez et al., (2000) **Social Shaping** Koch (2004); Oldham et al., (2000). **Political Approach**	**Knowledge Management** Baskerville & Myers (2023), Hislop (2002) **Cognitif Change Process** Sastrodiharjo & Khasanah (2023). **Organizational Learning** Sabherwal & Robey (1993),	FCS or 'metrics' approaches Trauth & Jessup (2000). **Risk Factors** Wickramasinghe & Naranpanawa (2022)

Adam & O'Doherty (2000).	**Theory of Culture Perspective** Naeem et al., (2023); Park & Nagy (2018).	

Pattern 1, the Social and Political Aspects of ERP Implementation ERP implementation is shown as a social and political process in the first set of studies. In this study, I have distinguished three separate subgroups. In order to understand why businesses occasionally engage in intricate, dangerous, and unclear procedures yet nevertheless manage to make sense of them, some academics first concentrate on the fundamental mechanisms of technology adoption and implementation. I have found two of these mechanisms to be misunderstandings. (Adam & O'Doherty, 2000) and mythmaking (Mata-Alvarez et al., 2000). Second, there are scholars who explore technology adoption as a social and political phenomenon in greater detail and who share the social shaping approach. They seek to comprehend the long-term interactions between businesses and ERP installation rather than only elucidating the "why." I draw attention to the work on spotting negotiating possibilities by (Koch, 2004), the examination of internal political processes by (Koch, 2004), and the discussion of rhetorical methods by (Oldham et al., 2000).

Lastly, two studies adopt a highly critical stance on the political processes behind ERP implementation, discussing the concept of emancipatory management of technology (Koch, 2004) and the political nature of innovation appropriation processes. In summary, when ERP implementation is viewed as a socio-political process, the negotiation of meanings surrounding decisions about configurational tools is deeply intertwined with two key factors. First, the political nature of these negotiations, where differing conceptions, expectations, and interests either conflict or find consensus to preserve or alter structural properties. Second, the interventionist nature of mediation in its various forms such as direct interaction with consultants, marketing, demonstrations, training, and prevailing public opinion which significantly shapes users' understanding and perceptions of the technology's features and functions.

Pattern 2, Using ERP as a Cognitive Process The discussion of meanings and interpretations is a common theme among the papers in this group and the one before it. The majority of research concentrate on ERP implementation from a knowledge transfer perspective when it is examined as a cognitive, knowledge transfer, or learning process rather than as a political one. According to this method, information is seen as an instrumental component that is essential to make well-informed decisions, which are frequently classified as "right" or "wrong," or appropriate or inappropriate. These investigations reveal two recurring themes. The first topic is that changes in knowledge requirements are brought about by the deployment of ERP. provides a framework for managing the "essential knowledge" required for ERP deployment, for instance. The mismatch or misfit process that usually precedes ERP installation is the second theme, which flows from the first. This frequently refers to the discrepancy between what the adopting organization truly requires and the capability offered by the ERP solution.

According to cultural theory, a misalignment between the ERP package's embedded values which represent the culture of its suppliers and designers and the adopting organization's corporate culture's core values may result in implementation difficulties (Lütkenhöner et al., 2005) According to (Baskerville & Myers, 2023), when considering ERP installation as a cognitive process, people's interpretations of the technology vary because of their differences in knowledge, proficiency, and experience with configurational tools. The cognitive viewpoint sees "best practices" as accumulated knowledge in the form of corporate reference models, in contrast to the political approach, which sees them as rhetorical devices for persuasion. Knowledge transmission is facilitated when these methods are implemented within an organization. This viewpoint therefore highlights the significance of gaining the required knowledge and abilities, a process that is facilitated by consultants and suppliers. Mediation is viewed as an organizational learning process that involves all stakeholders in the implementation or as a way to transfer knowledge from suppliers to users.

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Pattern 3, The "IS" Experience of ERP Implementation: Success or Failure ERP deployment is framed as either a successful or unsuccessful information system (IS) experience in a number of studies that concentrate on Critical Success Factors (CSFs), risk analysis, and success metrics. Some of these studies also look at how intended outcomes are attained or not, even though their main focus is on factors that either favorably or negatively affect those outcomes. Research on the enterprise system experience by (Markus et al., 2000) is a noteworthy example. They portray success as a multifaceted, dynamic, and relative concept that changes over time, defining it as a dependent variable. Even within one ERP installation phase, their analysis found varying success rates. In order to take into consideration the unforeseen outcomes and outside influences that are characteristic of dynamic and emergent processes, they developed the idea of "optimal success." Essentially, the variables involved lose their fixed nature and their interactions become context-dependent when ERP deployment is examined as an emergent process. These studies, like the "cognitive" group, focus on conventional technical difficulties, but they run the risk of oversimplifying the process by failing to adequately account for political and social variables. "Best practices" are seen as a strong argument for implementing an ERP system, and any flaws are ascribed to how businesses manage its setup problems that might be fixed as the technology advances. In order to maximize the results of the intricate social activities involved in ERP implementation, training, communication, and mediation are frequently emphasized as critical elements that must be controlled.

Discuss how to include variance into process-oriented lessons. Variance theories concentrate on predicting outcome levels from levels of contemporaneous predictor variables, whereas process theories seek to explain how outcomes change over time (Markus et al., 2000a). According to Niederman & March (2018), this discrepancy can be explained in terms of the suggested relationships between logical antecedents and consequences. In short, the variance theories state that the antecedents are both required and sufficient circumstances for a predicted occurrence. The conclusion is truly unforeseeable, and process theories do not assume that the antecedents are sufficient to produce it (Niederman & March, 2018) Therefore, it is impossible to integrate variance and process theories into a single theoretical framework without creating some confusion because they fundamentally disagree in their presumptions on the relationship between antecedents and outcomes (Lerman et al., 2022). Many could benefit from gathering both quantitative time series and qualitative narratives in the same research endeavor, according to a recent argument by (Lerman et al., 2022), in contrast to those who maintain that variance and process approaches must be kept distinct. She actually thinks that there may be a way to view variance and process theories as complementary. "It might be crucial to comprehend how events impact an entity's state (a variable) or to determine how a contextual variable influences the course of events." Langley's main contention is that variables and events are extremely difficult to separate, and that the insistence on excluding variables from process research excessively restricts the range of ideas that can be developed.

(Trauth & Jessup, 2000) offer a recent example of attempts to integrate positivist and interpretive techniques. They employed parallel research designs, in which methodologies were carried out simultaneously and the outcomes informed one another. Their results demonstrate the value of merging positivist and interpretive techniques in a way that is mutually beneficial, even if each approach makes unique contributions. In order to respect and represent the many traditions of each methodology, (Kaplan & Duchon, 1988) they carried out a longitudinal, multidisciplinary study that integrated quantitative and qualitative methodologies. Their research shows that although these kinds of partnerships are fruitful, they are frequently difficult since researchers have to convince one another of the merits and standards of their own viewpoints. According to (Sabherwal & Robey, 1993) it is feasible to reconcile variance and process approaches since they might have a similar epistemological basis despite having differing ontological presuppositions. They follow the epistemological tenet that the social world is objective and observable in order to avoid more difficult concerns regarding whether social reality is subjective or objective. This makes it possible to reconcile various approaches. They

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suggest a hybrid approach, contending that both process and variance methodologies can be applied to the gathering of qualitative or quantitative data. They seek to show that these tactics are compatible when common epistemological assumptions are embraced by highlighting the fact that the main distinctions between them are ontological and methodological.

To emphasize the importance of combining several approaches with various underlying presumptions, Mingers emphasizes the concept of varying paradigms, in contrast to (Sabherwal & Robey, 1993). He lists the three primary ways that methodological pluralism is conceptualized. The first is "loose pluralism," which is rooted in the conventional wisdom that paradigms are predicated on assumptions that are incompatible and mutually exclusive. The second is the "complementarist" viewpoint, which maintains that each paradigm has its own unique rationality and that the discipline should respect them. Last but not least, Mingers supports a "pluralist" position that encourages integrating several approaches, particularly those from other paradigms. He notes that there are four layers of difficulty in connecting research methods that are usually linked with various paradigms: philosophical, cultural, psychological, and practical. The philosophical level is one of the four levels that Mingers distinguished as being especially pertinent to our conversation. According to Mingers, it is totally feasible to separate a particular approach from its typical framework and use it, critically and knowingly, in a different setting. For instance, an objectivist epistemology is not always required when using quantitative data. It is possible to comprehend quantitative data by seeing it through the prism of social meaning, which acknowledges that it is a product of social constructs. Although this claim seems plausible to me, I wonder how well it may be expanded to defend the use of qualitative-qualitative data in the context of variance-process methodologies.

(de Guinea & Webster, 2017) in other words, it appears reasonable to concur that variance and process approaches can be effectively combined within a positivist framework. I still have trouble, though, seeing academics who are working from an interpretive perspective completely adopting variance techniques. Therefore, I tend to tilt toward the second position the complementarist stance when comparing my work to one of Mingers' three perspectives. Making a firm assertion regarding the viability or suitability of combining disparate philosophical presuppositions is not my goal. Rather, I adopt a more cautious stance, suggesting that researchers can mix different approaches to arrive at a more thorough understanding of their research issues as long as they keep their assumptions consistent. There may be benefits to investigating and using a variety of methods in order to improve knowledge, since the lines between paradigms are not always obvious and may even be deceptive.

Applying a Logic of Complementarity

Assuming that it is possible to talk about complementarity between process and variance theories respecting different ways to interpret the world, I tried to apply this to ERP research. In the previous section, I presented the major findings from variance and process-oriented studies separately, looking for contributions from both. However, I suggest that the lessons produced by variance and process-oriented studies are potentially complementary. How can a logic of complementarity be applied in order to improve ERP implementation in research and practice? (Sastrodiharjo & Khasanah, 2023) have given excellent examples of this logic of complementarity, explaining how real-time observations (to understand how these changes occurred) can be used to supplement the various dimensions measured by surveys and interviews (which determine whether and what changes occurred). Similarly, by creating research questionnaires that collect measures of variables and also collect supplemental measures of a chronology of important actions that took place during the process, (Sabherwal & Robey, 1993) demonstrate how studies using large samples can also benefit from a logic of complementarity. Similarly, retrospectively examining the events that have occurred after the last data collection might be beneficial for longitudinal research, which measures variables at several periods in time. The “collateral” effect of a logic of complementarity is not incoherence but complexity, the research design becomes

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much more complex. In any case, the price of understanding complex and ongoing phenomena is not rooted in simplicity or facility.

Table 3. Using Process and Variance Approaches Complementarily

Process-Oriented Variance-Oriented	Social and Political Mechanism	Cognitive and Learning Mechanism
Technology Factors		*Example* 2
Human Factors	*Example* 1 ⟶	

Through the examination of current research, relevant instances can be derived in accordance with the concepts of variance and process complementarity (Lerman et al., 2022) The strategy entails looking at variables found in variance-oriented research from the perspective of process-oriented approaches and vice versa. Two mechanisms (from Table 2) and two factors (from Table 1) taken from variance-oriented and process-oriented research, respectively, are used in Table 3 to demonstrate this. This results in four quadrants that can be combined freely, allowing for up to fifteen different combinations. To demonstrate the practical implications of this complementarity logic, I will present two examples.

Example 1, Table 1 identifies the knowledge and abilities of the implementation team members as crucial components associated with a successful ERP deployment. We can investigate these. Researchers are usually expected to create a research model that describes the relationships between dependent and independent variables after selecting a collection of variables (the effects they want to study) in advance. For example, they could suggest that a deeper understanding of ERP systems results in better implementation outcomes. A process-oriented approach allows us to take a closer look at how team members' knowledge and abilities are cultivated and applied during the implementation process. This could entail looking at the particular training techniques used, the team's collaborative dynamics, and how these elements affect the ERP implementation's overall performance. In this sense, a deeper comprehension of the connection between team capabilities and implementation effectiveness can be obtained through the combination of variance and process views. In the end, this approach leads to more thorough insights in ERP research by illuminating not just the elements that go into successful ERP implementation but also the mechanisms by which these elements function.

It is possible to create more successful ERP systems by becoming more adept at configuration tasks. Nonetheless, one of the most common criticisms of variance techniques is that they are frequently static and fail to account for the ways in which various events and a changing environment impact the status of its variables over time. By adding a process-oriented approach to their fundamental variance-oriented one, researchers can enhance their empirical research and mitigate the shortcomings of static and non-contextual studies. A dynamic analysis of how factors like team knowledge and competence evolve during ERP system adoption is made possible by a process viewpoint. For example, this approach might demonstrate how team members adapt their skills in response to novel challenges, shifting organizational priorities, or technological breakthroughs. By recognizing the fluid nature of these features, researchers can better understand the challenges of ERP deployment and create strategies and outcomes that are more effective.

The research findings are ultimately strengthened by combining variance and process approaches, which also offers a more comprehensive understanding of the elements that lead to ERP deployments that are effective over time. In my first example, adopting a strong social or political perspective is one method to supplement the examination of knowledge and skills components. This viewpoint can provide light on how and why contextual factors may affect knowledge and abilities, causing them to either increase or decrease over time. In order to achieve this complementarity, researchers would need to not only carry out surveys but also fully immerse themselves in the setting under study, looking at how social and political events and variables influence the correlations they are analyzing. After identifying the factors that

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contribute to ERP implementation success, (Butarbutar et al., 2023) recommend that more research be done to hone these factors, especially through in-depth case studies that examine the relationships between these factors and more general contextual and procedural issues.

Example 2 shows a situation where researchers decide that a process-oriented approach is better suited for researching ERP phenomena. To learn how and why particular results occur, they follow a series of occurrences throughout time. The training and configuration phases are examined from the standpoint of organizational learning. Instead of carrying out the field study without elements that have already been discovered, they could use a variance-oriented method as a supplement. This would enable them to study how contextual factors impact the course of events. In this instance, they might choose elements pertaining to human and technological traits, emphasizing how people learn and collaborate to make judgments as they gain information over time. To evaluate the correlations and evolution of these chosen factors, they could measure them several times during their longitudinal study.

This complementary paradigm is powerfully illustrated here (Naeem et al., 2023). They develop a framework based on a specific emergent process theory that recognises (b) the influence of factors that affect outcomes in one stage and then serve as inputs in subsequent stages, while also highlighting (a) the often unpredictable interactions between people inside organisations and their environment. Additionally, their method considers factors that are not directly under the organization's control. From my perspective, in all the aforementioned examples, variance and process approaches are integrated from a single, recognizable positivist viewpoint, reinforcing the complementarist position: (1) no single paradigm is superior; and (2) the distinct rationalities of each paradigm should be respected.

The reasoning shown in instances 1 and 2 can be applied by practitioners. Project managers and consultants in charge of ERP initiatives can monitor variables and contextual components throughout time in Example 1. For example, they could examine the connection between the implementation team members' expertise and their ability to make decisions over time. In Example 2, they can improve the tracking of project phase sequences by incorporating embedded elements or indicators that are measured at strategic or pre-planned points during the project. This paper tentatively contributes to two important topics. First, I admit that IS researchers are finding it difficult to keep up with the quick speed of IT-based innovations. Finding the fundamental issues or trends that underlie new study subjects is therefore especially beneficial. It's crucial to remember that, considering the early phases of my research endeavor, this contribution is only partially illustrated in this work.

Second, the logic of complementarity can still be used to improve the current literature, despite the fact that it may not yet be comprehensive. ERP is a study topic that I have suggested as an example of the ongoing difficulties that IS researchers encounter. Both approaches the recognition of key patterns and the use of the logic of complementarity provide examples of how to successfully promote ERP research and practice. The interpretation of overlay visualization graphs in VOS Viewer can be done by considering several factors. The type of overlay visualization chosen can provide additional information about bibliometric elements in the network, such as subject categories associated with specific articles or journals, or the publication year of the article or journal. As seen in the results above, selecting appropriate colors can help distinguish bibliometric elements with different attributes. For example, different colors can be used to indicate different subject categories or publication year ranges. Overlay visualization can help identify patterns or trends that may be hidden in bibliometric data. For instance, by looking at an overlay visualization showing citation density, users can identify the most-cited articles or journals in the network or detect clusters of nodes with the highest citations. Overlay visualization graphs can also be used to identify the most important bibliometric elements in the network, such as nodes with the highest citation counts or nodes with the most collaborations (Wickramasinghe & Naranpanawa, 2022).

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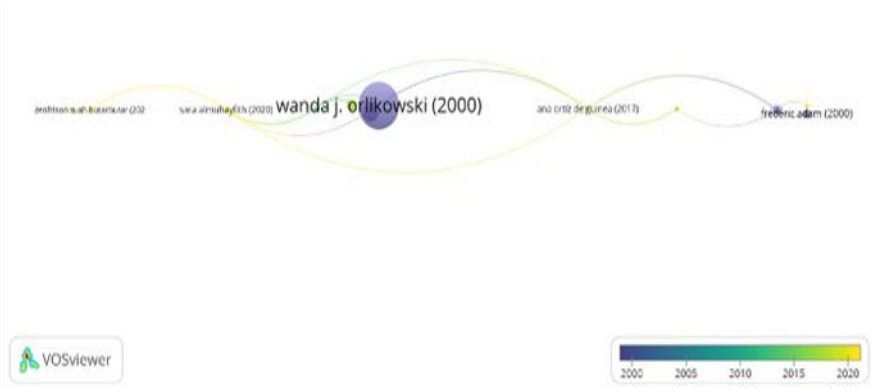

Figure 1. VOS Viewer Identify the Most Important Bibliometric Elements in the Network

The interpretation of a Density graph can be done by considering several key aspects. Peaks in the Density graph represent the nodes that are most frequently cited within the network. The higher the peak on the Density graph, the more citations that node has received. The number of nodes on the horizontal axis represents the total number of nodes in the network, while the vertical axis shows the level of citation distribution density within the network. A Density graph can help users identify groups or clusters of nodes with the highest citations in the network. In the graph, clusters with the most citations are represented by higher peaks. Additionally, the Density graph can be used to compare citation levels among different nodes within the network. Users can compare the citation distribution density between the most cited nodes and those with fewer citations (Park & Nagy, 2018).

CONCLUSION

Holistic Understanding of Organizational Change: ERP implementation is a complex and dynamic process that affects multiple layers of an organization. The process approach enables researchers to track the evolution of team skills, knowledge, and practices over time, while the variance approach allows for a clear examination of how external and internal factors influence project outcomes. The integration of these approaches provides a comprehensive view, ensuring that both the "how" and "why" of ERP success or failure are studied. Adapting to Technological Changes: ERP systems are central to organizational change in response to new technologies. Organizations need to be agile and responsive to these changes. By using both approaches, researchers can observe how adaptation happens over time and what specific factors either facilitate or hinder successful ERP adoption. This dual lens helps ensure that both the evolution of internal processes and the influence of external drivers are considered, leading to better insights into organizational adaptation. Contextual Sensitivity: Every ERP implementation occurs in a unique organizational, social, and political context. The variance approach helps uncover these contextual factors such as organizational culture, leadership dynamics, or industry-specific constraints that can significantly impact the success of the ERP system. Including process perspectives helps track how these factors play out over time, providing a nuanced understanding of their impact. Enhanced Research Depth through Case Studies: The author's suggestion to include immersive case studies supports the use of a social or political perspective. These case studies can reveal the real-world complexities and challenges of ERP implementation, such as power struggles, resistance to change, and stakeholder dynamics, which are often difficult to quantify. The combination of these approaches allows for deeper insight into the soft, human-centric factors that are crucial to understanding organizational change in the ERP context.

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