The effect of digital transformation on information systems development.

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Abstract: The growing of digital content and tools are rapidly changing the way the organization can create, use and exchange information. Whether or not an organization has launched a formal digital transformation initiative, so the use of digital technologies may lead to change a business model and provide new revenue and value-producing opportunities; it is the process of moving to a digital business. Digital transformation has become a vital for enterprises to improve organizational spirit. There is no doubt that most business operations are inseparable from the information technology (IT) infrastructure on which they run. As a result, technological advances, if properly managed, can translate directly into business advances. However, many companies struggle to bridge the gap between their existing IT infrastructures and practices and the value that new digital technologies could create. Information systems (IS) can strengthen such transformation, and they are very promising in digitalization. The sociotechnical perspective recommends that information systems development projects implicate both organizational and technical aspects. This study employed a quantitative design to examine the relationship between the main constructs for information system development (ISD) such as external digital databases, training, knowledge management systems, team member selection and communication with the effect of digital transformation. The digital economy has now a widespread impact on the whole economy and leads companies to transform and adopt new competition rules. The study shows that digital database resources have a significant impact on modifying ISD culture in the current situation. The use of digital databases makes it possible to understand, planning and identification of user information needs, and evaluating the effectiveness of user database resource utilization

Keywords: Information System Development, Information Digital Transformation, Digital External Databases Accessibility, Training, Knowledge Management system, Team Member Selection,

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1. Introduction

The rapid development of digital technologies, such as artificial intelligence, big data, cloud computing, blockchain, and the industrial internet, is transforming the traditional economy into the digital economy and intelligent economy, and digital transformation has become an integral mechanism for enterprises to achieve breakthrough innovation and sustainable development [1]. With the rise of new digital technologies, firms in virtually all industry domains are conducting multiple initiatives to explore and exploit their benefits [2] [3].

This frequently involves transformations of key business operations and affects products and processes as well as organizational structures, as companies need to establish management practices to govern these complex transformations [4]. Thus, the society as a whole is facing a rapid and radical change due to the maturation of digital technologies and their ubiquitous penetration of all markets [4]. One important contributor to tackle these challenges and support the transformation

is given by information systems (IS) research [5] [6]. Therefore, IS can support such transformation, and it is assumed that it has great potential for digitalization. IS are crucial to organizations, and companies invest heavily in them with the expectation of improving their operational and strategic positions. Different systems will have differing levels of impact on the organization within which they are developed and implemented [7] [8]. Organizational change is often a response to changes to the environment. Enterprise architecture (EA) provides an integrated representation of an organization's current and desirable future business capabilities, processes, systems, data and IT infrastructure. EA can interact with and enhance other organizational capabilities, including business transformation capabilities [9].

Information systems development (ISD) projects are critical and improving them has been the focus of considerable research, and successful projects remain elusive. Sustainable development has addressed the evolvement of innovations such as IT and the need to act more responsibly [10]. ISD projects continue to show a propensity to fail, with less than half being successful [11]. The reasons for failures are related to technical complexity, dynamic power structures, and uncertain and changing requirements [12] . This is consistent with the need to share knowledge among IT and business project stakeholders (managers and staff) to address this issue of failures. Socio-cognitive factors are the primary causes of ISD challenges [13] [14]; for instance, different stakeholders' conceptions of reality [15] [16] and evolution [17]. Thus, mutual understanding (MU) among key stakeholders (business and IT managers, users, and developers), or the extent to which they have a shared conception of the ISD project, is important to the success of the project. However, MU itself may change, developing, or deteriorating over time (Davidson, 2002) [18]. Rapid digitalization across various fields is of great relevance and poses tremendous opportunities for both, companies and society, for example, by offering novel business models or enabling new forms of collaboration [19] [20]. As a result, every industry is spending billions of dollars per year on digital technology, even in sectors that are typically considered non-IT-intensive [21]. Therefore, digital transformation has become increasingly focal to business research and practice. Transforming businesses poses various opportunities (e.g., creating novel business models) but, in contrast, constitutes numerous challenges (e.g., changing processes and organizational structures). Elements of digital transformation, drivers and barriers, and value creation through digital content have frequently been discussed in the academic environment during the last 20–25 years [4] [22].

The current trend of digital transformation is taking this development to the next level. Digitally enabled innovations entail new combinations of digital and physical components to create novel and disruptive products, services, and processes based on new business or value-creation models [23]. Hence, digital transformation activities are not to be confused with technology-driven optimizations, changes, or refactoring tasks [24].

According to a survey of the priorities sought by more than 2,000 chief information officers (CIOs) conducted by an information technology research and advisory company [25], organizations develop IS to meet important business objectives, such as improving competitiveness, increasing productivity and efficiency, accelerating growth, supporting innovation and reducing costs. The surveyed CIOs see technology strategies as closely related to business strategies. Because IS can support such transformation, and the expectation for it is to have great potential for digitalization. Thus, there is an increasing amount of

digital transformation literature in IS. However, because of the popularity and diverse areas of application and types of research, a combined overview of digital transformation is necessary. As business and technology environments change at an exceptional rate, software development agility to respond to changing user requirements has become increasingly critical for information systems development performance [26]. One important contributor to tackle these challenges and support the transformation is provided by IS research [5] [27] [23]. Hence, digital transformation has received more attention in IS research in the past several years.

The dynamic nature of the new marketplace today has created a competitive incentive among many companies to consolidate and reconcile their knowledge assets as a means of creating value that is sustainable over time. To compete effectively, companies must leverage their existing knowledge and create new knowledge that favorably positions them in their chosen markets. Companies must develop the ability to use prior knowledge to recognize the value of new information, assimilate it, and apply it to create new knowledge and capabilities [28].

ISD management has received considerable attention from both academics and practitioners [29]. ISD project complexity influences project choice, time, cost, and quality objectives [30]. Moreover, the management of project resources, such as personnel, project process capabilities, user involvement, and top management support, is challenging due to the impact of project complexity. Managing ISD project complexity has become a strategic issue for contemporary organizations to ensure project success.

As illustrated in Figure 1, the rules and norms of the participants also originate from different areas, and the means of ISD.

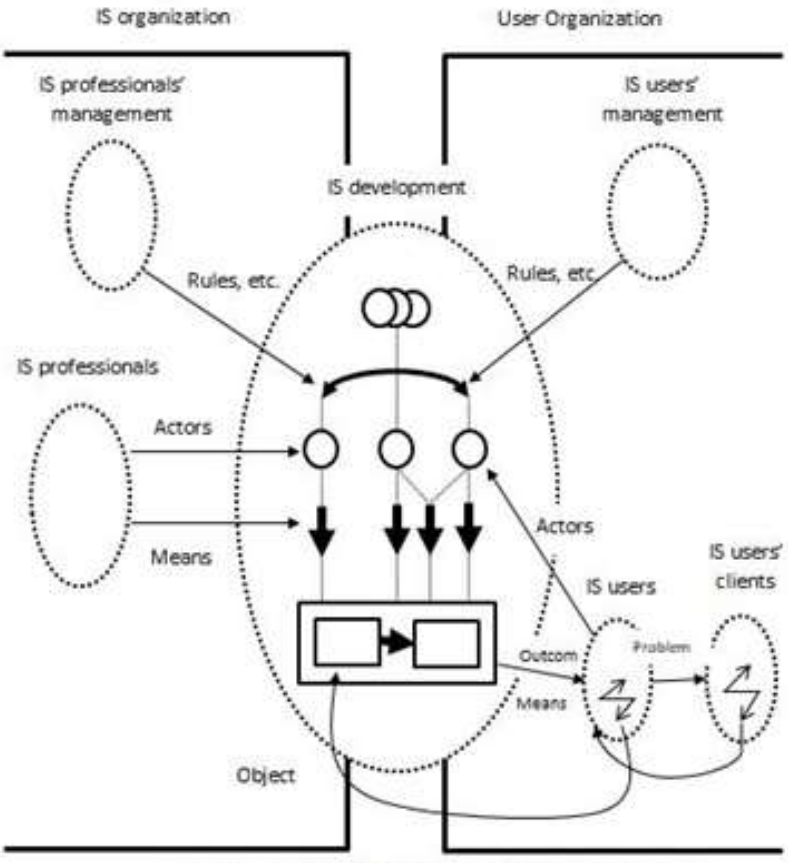

Fig 1. Rules and Norms of the Participants in Information Systems Development

To improve return on investment in IT, organizations must first make progress in their capability to produce effective ISD projects. ISD responsiveness indicates why and how organizations identify and react rapidly as they develop and maintain information systems applications. Therefore, risk is an integral component of ISD projects.

The main aim of the study is to explain through a developed a research model the role of team member selection and communication, digital external database accessibility, knowledge management systems, and training in ISD. This study will contribute to determining the factors affecting ISD company practice .This study reviews the relevant literature related to ISD and digital transformation. Then, the models are described, hypotheses presented, and methods defined. Finally, the results are discussed and conclusion and implications for further research are presented.

2. Theoretical foundation

2.1 Digital transformation definitions

Although digital transformation lacks a well-accepted definition, only limited studies have been conducted to structure and state the concept of digital transformation. Currently, it is one of the dominant terms around the World Wide Web [31]. Literature review focused on selected aspects of digital transformation;

however, it did not include a holistic view of the field.

The following definitions are used in the literature. Digital transformation is the use of new digital technologies, such as social media, mobile, analytics, or set-in devices, in order to enable major business enhancements: improving customer experience, modernizing operations, and creating new business models [2]. As such, it goes beyond merely digitizing resources and results in value and revenues being created from digital assets [32]. Digital transformation is a process in which the "digital world" merges with the "physical world" [33], forcing companies to cope with radical change and shocks of uncertainty. According to the dynamic capability theory, digital transformation is a trigger for the creation of dynamic capability [34] and represents an innovation process of enterprise integration, reconstructing internal and external resources, processes, and structures. Organizational ambidextrous capability includes exploitative innovation and exploratory innovation.

It is also defined as the change of, or new investment in, technology and business models to more effectively engage digital customers at every point in the customer experience lifecycle. [35].

While digitization commonly describes the mere conversion of analog information into digital, the terms digital transformation and digitalization are used interchangeably and refer to a broad concept affecting politics, business, and social issues [36] [37] [38]. Digital transformation is now commonly interpreted as the use of information and communication technology, when nontrivial automation is performed and fundamentally new capabilities are created in business, public government, society, and the lives of people [39]. Digital transformation is defined as the use of technology to radically improve the performance or reach of enterprises [40], and it is the change that digital technology causes or influences in all aspects of human life [41]. An enterprise's digital transformation involves integrating internal and external resources through information, computing, communication, and connectivity technologies in order to reshape its corporate vision, strategy, organizational structure, processes, capabilities, and culture to adapt to the changing digital world [1]

The different definitions for digital transformation may be categorized into three distinct elements:

(1) Technological – is based on the use of new digital technologies such as social media, mobile, analytics, or embedded devices;

(2) Organizational – requires a change of organizational processes or the creation of new business models;

(3) Social – is a phenomenon that influences all aspects of human life, for example, by enhancing customer experience.

2.2 Information system development

We believe that an IS project intended to meet the information and processing needs of an organization can be considered an information technology project. IS projects require the strong collaboration of IS staff, end users, and management. Therefore, IS projects are organized and performed in teams, and thus are related to all concepts of group dynamics, interactions, coordination, and communication. The different qualifications of team members are an extremely important issue for the success of the team because of the communication and coordination activities of the group [42] [43].

IS projects, as sociotechnical systems, have become important to the endurance and well-being of companies because they require investment of considerable capital and human resources. Certainly, the data evoke that IS projects are mainly abandoned because they are considered necessary to the approach of doing business in the information age [44] [45].

Organizations should learn lessons from past decisions to abandon projects.
The cancellation of projects can be classified as due to the following factors:

• *Project objectives:* deficiency of projects goals and unacceptably formulated objectives.

• *Project team* constitution: A fragile or challenging project team.

• *Project management and control*: Deficiency of the measurement system that regulates the progress and identifies potential risks in time to moderate them and the leadership responsible for taking critical decisions at different phases of the project.

• *Technical expertise*: Insufficient level of expertise and involvement of the team working on the project.

• *Technology base or infrastructure*: The non-assessment of the current information technology infrastructure within the organization preceding the project.

• *Senior management involvement*: Experts monitor the project development and make decisions at critical stages when is needed.

• *Increasing project cost and time of accomplishment:* Requesting senior management consideration before arriving at the crisis stage.

The next section reviews literature that is relevant to ISD, ISD company practices, and our research questions.

1.1.IS process and product performance

Several studies have been conducted to assist IS developers in improving the awareness of both drivers and the consequences of ISD risk [46]. ISD risk is an important IS performance indicator [47]. IS process performance is a measure that can be defined by acquiring knowledge during development, management control degree, and excellent communication quality between the IS team and users.
The efficiency of the project is often measured by the extent the project adheres to costs and time estimates [46] [48]. It also refers to the success of the development process itself [49]. Information system performance can be described by technical performance, consistency between the information system and user needs, and the degree of flexibility of the information system developed and of transforming user requests [46] (Na et al. 2004). It also refers to the quality of the developed system [50] [51]. Information system development performance is divided into two categories:

a. ***Subjective performance*** is an assessment method that considers the opinions of people involved in the ISD (Wohlin et al., 2000). Whereas this technique has the advantage of easy data collection, it has difficulties with standardization since the project evaluation is restricted to the judgment of the manager (Gray et al., 1999) [52]. Two commonly used subjective performance constructs are process performance and product performance. The software development literature extensively studied these two subjective performance measures [46] (Wallace et al., 2004) [53] [48].
b. ***Objective performance*** consists of measurable factors, for instance, cost, effort, and schedule overrun (Gray et al., 1999). Since information systems development performance measures have different implications for different organizations, the existing literature often recommends using both subjective and objective performance measures [54] [55].

Most existing research related to the performance of ISD focuses on organizational development instead of the acquisition of information systems by the organization. Therefore, the majority of studies have attempted to determine the

factors that affect subjective performance measures. A number of methods have identified where norms can facilitate the performance risk reduction of software development [56]. The use of norms or methods permits IS staff to study and understand their mutual effort without difficulty and thus to accept system and testing more efficiently to reduce the risk of' errors [57] [58].

Coordination of activities among large groups of developers may reduce the possibility of project delays and exceeding cost estimates. It inspires a good form of communication between the participants in a project that leads to an interrelated organizational culture, where organizational members speak the same technical language share common practices and procedures, and refer to organizational goals as their own. Generally, clear software processes stipulate control and reliability over software development, increasing the chances of achieving appropriate results [59] [60].

The research model of this study presents four variables that affect ISD success during digital transformation: team member communication training, knowledge management, and digital external database accessibility. The research model is presented in Figure 2.

a. Team member communication

By choosing suitable members, teams could face challenges immediately because appropriately chosen team members increase effectiveness of the team. [61]. ISD is extremely reliant on teamwork for high quality development of information systems [49]. Teams invariably outperform individuals if they are working effectively. When groups come together to solve a problem, they come up with more creative and flexible solutions than could individuals. [62].The elements of the team are key factors in an ISD project success.

Cooperation among team members is required, but it does not guarantee harmony among team members in all cases [63]. Most information systems projects in the industry are implemented by teams of professionals rather than by individuals because of the size of these projects but also because teams are predisposed to operate better more comprehensively than individuals [64]. It is significant that organization objectives guide the development process of the project and they are likely to assist the team in gathering details to guide the rest of the development [65].

The coordination of IS staff, end-users, and senior management is necessary for the development of large IS projects. People who participate affect the success of project work. Good communication is an essential tool in achieving productivity and maintaining strong working relationships at all levels of an organization. It is necessary to resolve misunderstandings about requirements or design decisions among project members and to stress team building to transform individual ability into project achievement [65]. Therefore, communication is another critical success factor of IS development [66] [67]. Because information systems are cross-functional systems, coordination and communication among users in all departments is essential [68]. Through communication, information about the benefits of IS are easily accessible and efficiently flow to all members in the organization, leading to the dissemination of the benefits of the IS [69].

One significant concern of ISD is building successful teams by converting the team constituent with distinctive interests, qualifications, and skills into a combined and valuable functional element, even though this process differs depending on the complexity, nature, and size of a project. Good management and organizational structure involve a preliminary spirit of project team members to support them in performing project activities (Verma, 1996, 1997). However, this approach may not produce an

acceptable result if the members are not suitable or their roles are not defined clearly [70].

The high rate of unsuccessful of IS projects indicates that the accomplishments of IS team members are conditional on other members of the team and not on technical skills alone [71]. Acquiring modern ways of designing IS project development teams to improve teamwork could result in more effective teams and thus better overall performance [72].

A team may be created just for managerial purposes, to accomplish individual goals, or for community membership [73]. On the other hand, it can be formed to work interdependently, committed to mutual goals, and producing high-quality outcomes. A team is considered to be a small number of people with complementary skills who are dedicated to a shared commitment, performance goals, and approach for which they are mutually accountable [74]. Effective teams are those looking for excellence and success despite educational differences [75]. A team can work well together through good communication. If communication between team members is poor, there is likely to unnecessary tension and anxiety. This is one of the most important reasons why businesses should encourage their employees to clearly communicate with one another when working together [76]. Group communication is important because it is through messages that groups make decisions, manage conflict, and build the rapport that is necessary to keep the group going in difficult circumstances.

b. Training

Training is one of the most cited factors for successful IS implementation [77] [78]. Training is a crucial activity for complex systems. Effective training programs for IS should be complete and provide users with general awareness of the system's functionality and various business process changes after implementation. It is important that the training provides users with a complete picture of the system and knowledge of how it fits into the whole organization. Otherwise, the training program would not help IS adoption [79]. Many IS projects fail due to insufficient training [56] [80].

Continuous learning and internal training can serve to empower a workforce, leading to collaborations between departments and teams that might otherwise never occur [81]. Today, training is considered an important and effective tool, which helps employees raise the quality of the workforce [43] [82]. Organizations can develop and enhance the quality of current employees by providing comprehensive training and development. Immersive training helps employees to participate in the company's digital progression while gaining the skills, understanding, and knowledge to perform their roles at an optimum level of competency. In terms of digital transformation, and indeed change management in general, there are multiple players, and they all need to be lined up successfully in order to meet the goals. One of the most overlooked elements in digital transformation is the role of providing ongoing professional training [83].

Digital transformation is changing and expecting new skill sets. To obtain the benefits of these trends, training systems need an improved response to these changing realities.

Indeed, research indicates that investments in training employees in problem solving, teamwork, and interpersonal relations result in beneficial firm-level outcomes [84] [85].Training provides a unique service to the employees

Most studies stated that training may promote general knowledge, skills, abilities (KSAs), experience, understanding, and standards of employees by improving skills, prospects, and expertise of the employees in a certain area [86] [87]. It is also a process that improves

the learning of people by modifying knowledge, skills, or attitudes through learning experience to achieve effective performance [88]. Training develops skills, specifies measurable objectives, and results in observable changes in behavior [89].

Studies have stated that training is an essential element for sustainable competitive advantage and survival in the 21st century as it is the process of providing employees with specific skills or helping them to correct deficiencies in their performance. The objective of training often involves the acquisition of knowledge needed for staff to perform their functions. The roles and responsibilities of the individual should be reviewed as needed throughout the development process. A successful systems training program ensures that personnel who plan, implement, and assess achieve the mission and objectives of the organization. Encouraging key individuals of a team to contribute together to the organization simplifies development and implementation. This decisive phase assists in supporting the project throughout the organization. The training program should be developed with accurate information, stakeholder participation, and attention to the unique needs and constraints of the organization.

Most offered training programs meet the employee's expectancy needs because they are applied to real-world work environment Therefore, the employees are competent to apply the techniques acquired from the training programs. [90]. Moreover, the employees are able to acquire input by learning and sharing experiences of other participants in most training programs [87] [91].

Investment in human capital can occur through formal training in a structured environment or informal training. Organizations may hesitate to undertake training because it can be costly to develop and put into action [92]. Managers prefer to spend on training for conflict resolution skills, which develops goal-setting skills and planning skills [93]. By introducing customized, active learning that is integrated in their regular workflow, employees will have more skills and enthusiasm to support plans for ISD success.

c. Knowledge management systems

The pace of change related to the digital world is rapid and not expected to decrease anytime soon. To remain relevant and current in this incredibly competitive landscape, employees across departments need access to resources and platforms that will empower them to constantly improve their skills and learn new proficiencies. To remain competitive in a digital environment, organizations must foster a culture of knowledge, sharing, and continuous learning. A very important consequence of digital transformation with strong impact on business practices are big data [94]. Big data are an important asset for an organization, but they also involve numerous challenges. Big data encompass a large quantity of knowledge but mining them is a complex process.

The dynamic nature of the new marketplace today has created a competitive incentive among many companies to consolidate and reconcile their knowledge assets as a means of creating value that is sustainable over time. Knowledge management systems (KMS) are seen as enabling technologies for an effective and efficient knowledge management (KM).The practice of developing (KMS) in organizations is primarily based on IT and uses ideas from IS development methodologies [95] [96] [97]. IS researchers concentrating on knowledge management (KM) follow one of two methods. First, researchers are observing individuals, project teams, or entire organizations in order to understand which factors influence KM (Swan et al., 2010) [98] [99].

There is a general agreement in business practices and academia that small

and medium enterprises (SMEs) have not benefitted from KM; they are still behind large companies [100]. In fact, limited empirical studies have been conducted to identify the factors influencing KM adoption in SMEs [101]. In addition, there is a growing need for a qualitative analysis of the effects of knowledge management practices of networked SMEs [102]. KMS apply to a category of information systems utilized to manage organizational knowledge. IT-based systems developed to reinforce and enhance the organizational processes of knowledge creation, storage/retrieval, transfer, and application. KMS are considered as successful tool that can support users to acquire informative knowledge simply and rapidly (Gold et al., 2001) [103]; and also a suitable background facility for employees to store their knowledge [104].

Databases are primarily used for storing, modifying, extracting, and searching for information and appropriate means for teams to gain knowledge [105]; they are helpful repositories for team members to access the knowledge of the environment. They are a driving force of knowledge [87], [106] [107] [108]. Knowledge management can be understood by the innovation process of an organization to search for creative problem-solving methods. The essence of KM is to adjust organizational performance by dealing with processes such as acquisition, conversion, and usage of knowledge as well as its protection by intentional and systematic methods.

KMS not only share the tasks of databases but also discover, locate, document, and study past data, generate knowledge, and share it with other users [95]. KMS influence knowledge innovation required for ISD team solving problems [106]. KMS refer to all types of IT systems that store, retrieve, capture, and use knowledge; improve collaboration; locate sources; extract repositories for hidden knowledge; or enhance the KM process in some other way.

The above definitions of these systems are vague because there is no consensus as to what constitutes KMS. In practice, many different (and quite distinct) technologies could come under the umbrella of KMS including web content management systems, electronic document and records management systems, collaboration tools, search engines, classification tools, and portals. Each of these systems delivers specific functionality that could support KM objectives and projects.

In this regard, not only knowledge but also adequate skills, are necessary, to develop organizations. They will be able to transfer knowledge; productivity is increasingly the application of knowledge, while training requires a logistical systematic approach as it is the backbone of the effectiveness of the organization [109].

d. Digital external database accessibility

In the knowledge-based economies of the 21st century, the acquisition of external resources is a strategic element for modern firms. Fortunately, there is a clear way to optimize digital transformation efforts: focus on the data. Indeed, a case can be made that digital transformation is likely to fall short unless it is based on a solid foundation of "data transformation." [24] In this context, data transformation does not only encompass the traditional "extract, transform, and load" processes of collecting, cleaning, reformatting, and storing data but also includes the subsequent analysis and use of collected (or real-time) data to inform decision-making of a company, its operations, and its high-level digital transformation strategies. This change primarily deals with the increasing use of information technologies and data available, which constitutes crucial challenges in different aspects of an organization. Because digital transformation focuses on the key of business operations, it incorporates

changes in products, processes, organizational structures, and management concepts [4].

Several scholars have supported firms looking for knowledge globally [110]. The common element of these theories is that external knowledge sources provide an important balance to in-house learning and innovation efforts, and thus contribute to improved innovative performance.

In recent years, however, even as data volumes and sources have increased, new generations of tools have simplified and automated many of the most time-consuming data management tasks. Solutions such as using machine learning and other artificial intelligence technologies can help analyze massive amounts of data. Offering employees access to platforms, technologies, and curriculums will allow them to continually upskill according to emerging trends and technological developments by the competition.

Absorbing existing external knowledge in the firm can improve the state of a team's knowledge [111]. It will convey a relationship between knowledge developed within a group and acquired from outside [112]. The abundance of knowledge and innovation raises significant strategic challenges for competing firms [113].

External resources qualify firms that are more efficient and effective to participate in the product market [114]. Activities related to sharing between organizations measure inter-organizational knowledge sharing [112].

Scholars focus on understanding how knowledge-bases are transferred and used among partners [115] in addition to inter-organizational forms of acquiring or gaining access to external resources [116] [117]. Furthermore, additional research studied the existence of complementarity between internal and external resources (focusing on technology) [118] [119]. Although the resource-based theory highlights the significance of internal resources in a firm, external resources are also worthy from the perspective of small businesses.

Technology diffusion theory emphasizes the role of external entities, such as consultants and IT vendors, as knowledge providers in lowering the knowledge barrier or knowledge deficiency on the parts of potential IS adopters [120].

Today's companies may find themselves buffeted in a sea of digital transformation currents, but they can use this new-generation of data management tools to build a solid, data-based ground on which to move forward. Shared knowledge can improve performance [121] [122].

3. Development of hypotheses

A review of frameworks, models, and theories to demonstrate the effects of ISD company practices and their composites on information system process and product performance was conducted above. To extend the theoretical background, we hypothesize that there is a clear relationship between ISD company practices, information system process and product performance. In other words, an increase in process performance will be associated with an increase in ISD company practices. To address the research question, we calculated a composite score for all selected elements of ISD company practices listed above with respect to the impact on the information system process and product performance, as presented in Models 1 and 2. The extent each individual ISD company practice composite impacts the information system process and product performance is represented in Models 3 and 4, respectively.

Based on prior literature, the authors proposed **Models 1** and **2** shown in Figure 2. The models reveal the effects of the ISD company practice composite, which includes team selection (TMS), training (TR), KMS, and digital external database accessibility (EXD), on the information systems process and product performance.

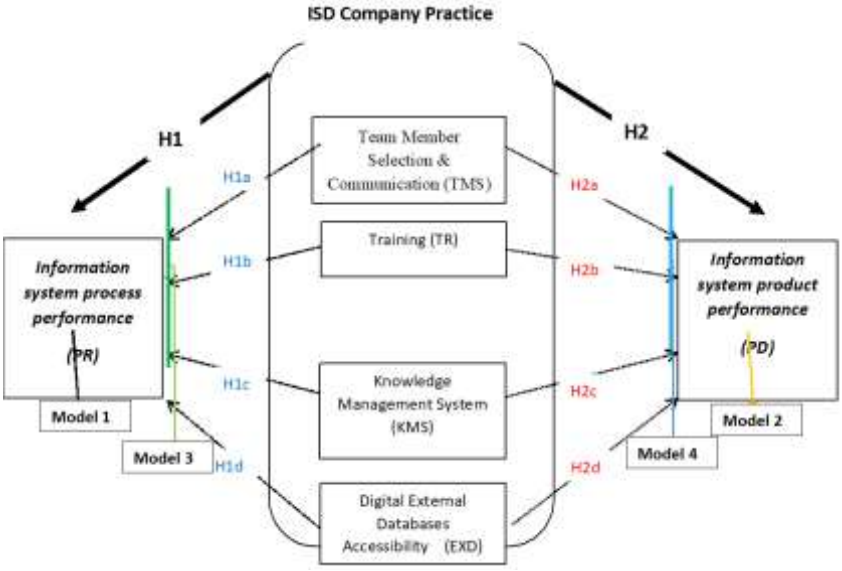

Fig 2: Research models

H1 ISD company practice is positively related to IS process performance
H2 ISD company practice is positively related to IS product performance

In **Models 3 and 4, we determine** the impact of each element of the composite ISD company practice effect used in Models 1 and 2 on the information systems process and product performance.

The sub-hypotheses, which guided this line of inquiry, are as follows:

Model 3

H1a Member selection & communication is positively related to IS process performance
H1b Training is positively related to IS process performance
H1c KMS is positively related to IS process performance
H1d Digital external database accessibility is positively related to IS process performance

Model 4

H2a Member selection & communication is positively related to IS product performance
H2b Training is positively related to IS product performance
H3c KMS is positively related to IS product performance
H4d External database accessibility is positively related to IS product performance

4. Research Methodology

The data collection tool used for this study was a survey approach. The approach was developed based on a literature review and the outcome of a preliminary fact-finding, obtained through unstructured interviews of some user representatives and developers chosen randomly from organizations that were involved in ISD projects to provide a deeper and more complete conception and to validate the proposed theoretical models [123] [124]. Views from developers

limited, views from users are necessary to capture their connections with the IS project team which is precisely to the purpose of our study.

A pilot test was conducted to validate the survey items derived from the literature. Then, a preliminary test was conducted with knowledge experts from academia and industry. Finally, the survey was modified to reflect the information that has been collected. The final questionnaire was composed of two parts. The first part consisted of questions collecting the demographic and organizational information of the respondents, such as gender, age, position, working experience, and other organizational information, such as industry type, size of the team project, and duration of the project. The second part included the measures of the theoretical constructs of the research model. The survey was e-mailed to IS managers and system analysts from mature Saudi companies like manufacturing industry Telecommunication & information Technology Health care industry, Banking & finance, Agriculture & food industry, and Transportation & tourism. It was requested from IS managers to deliver the survey questionnaires to system analysts in the same department/unit. The respondents were invited to respond to all questions by considering the most recently accomplished IS project. This process produced 272 usable responses.

The researcher used a multiple regression analysis because it enabled us to predict values of predictive variables [115]. This methodology allowed for a statistical analysis of the data. It was also an efficient means of gathering data without introducing threats to reliability that can occur with other data collection means [116]. An explanatory study must answer the following questions: (a) were the researchers trying to develop or test a theory about a phenomenon to explain "how" and "why" it operates? This study attempts to explain how the phenomenon operates by identifying the causal factors that produce a change in it [117]. Specifically, the backward method of multiple regression calculates the contribution of each predictive variable by looking at the significance value of the t-test for each predictor. If a predictor meets the removal criterion (i.e., if it is not making a statistically significant contribution to how well the model predicts the outcome variable), it is removed from the model [115].

After this is completed, all remaining variables are assessed to determine their contribution to the outcome of the dependent variable of this quantitative study of ISD, process performance, and product performance. The panel data were analyzed using multiple linear regression analysis in the SPSS 24 statistical package. In each case, the data were tested with the significance level of 5%. The first regression was conducted with IS process performance as the dependent variable, and the calculated composite score for all selected independent variables (TMS, TR, KMS, and EXDs). This analysis permitted testing the association between ISD company practice and ISD process performance.

4.1 Data Analysis Results and Discussion

Table 1 describe the demographic characteristics, which, indicated that the majority of respondents were male (83.8%). The aim of the data collected was to expose gender distinctions, not to explain or theorize why these distinctions have arisen and continue to exist. Examples of this data includes investigations of women's vs. men's use (adoption, acceptance, etc.) of IT [125] and women's participation rate in the IT [126]. The majority of the participants were between 21 and 40 years old (69.73%); the education level reached by 38.23% respondents was undergraduate degree, and 47.79% earned postgraduate

degree. The majority of participants were system analysts (22.79%), programmers (34.55%), and IS project managers (27.57%). The respondents surveyed in this study had been working in the IS area for more than 10 years represents 41.17% , which is in agreement with the study conducted by [127].

Table 1. Demographic characteristics of the respondents

Measures	Categories	Number	Ratio (%)
Gender	Male	228	83.8
	Female	44	16.2
Age	21-30	136	50.00
	31-40	53	19.48
	41-50	18	6.62
	51- and above	65	23.90
Education level	High School	24	8.82
	Undergraduate	104	38.23
	Postgraduate	130	47.79
	Other	14	5.14
Position	Database administrator	10	3.67
	System Analyst	62	22.79
	Programmers	4	34.55
	IS Department Manager	27	9.92
	IS Project Manager	75	27.57
	Network personnel	94	1.47
Work experience	1 -5 years	70	25.73
	6-10 years	112	41.17
	10-15 years	79	29.04
	Over 15 years	11	4.04

Table 2. Demographic characteristics of respondents' organizations

Measures	Categories	Number	Ratio (%)
Industry type	Manufacturing industry	22	8.08
	Telecommunication & information Technology	84	30.88
	Health care industry	43	15.8
	Banking & finance	29	10.66
	Agriculture & food industry	22	8.08
	Transportation & tourism	72	26.47
Number of IS projects developed	1-5	68	25
	6-10	88	32.35
	11-15	60	22.05
	16-20	56	20.59
Size of team project	less than 10	164	60.3
	10-20	55	20.2
	15-20	28	10.3
	greater than 21	25	9.2
Duration of the project	less than 3 months	66	24.26
	5-10 months	71	26.10
	11-20 months	73	26.83
	21-30 months	62	22.79

The respondents' organizations varied in their fields: telecommunications & information technology, transportation & tourism, health care industry, manufacturing industry, banking & finance, and agriculture & food industry. The size of the project teams ranged from less than 10 to greater than 21, and the duration of the projects ranged from less than 1 year to over 10 years, as shown in Table 2.

In Table 2, the data represent the respondent profiles related to the industry sector of the company they work for, ISD project team size, and the duration of the project involved. A total of 30.88% of participants were from the telecommunication and information technology industry and 26.47% from the agriculture and food industry. The majority of sample respondents (60.3%) had participated in small project size (less than 10) and the duration of the projects they had been involved was less than 30 months.

ISD company practice refers to the selected composites for this study as indicated in the literature review: team member selection [49] [61] [62] and training (having educational programs for improving team members' ability) [84] [91] (Akhtar et al., 2008), knowledge management systems [103] [87] [106] [104], and external database resources [112] [111] [121]. The other constructs related to information systems project performance scale come from [46] [8], the scale is divided into product and process performances, which are related and It shows that product performance often depends on the level of process performance. [53] [8].

Product performance

Product performance refers to the outcomes and quality degree of the

information systems project development; that is, products achieve expected goals. It helps to ensure customer satisfaction, acceptance, and reduced maintenance [63] [49] [8].

The ISD company practice to IS process and product performance are first addressed, followed by the variables that are Member selection & communication is positively related to IS, training is positively related to IS process performance, KMS, and Digital external database accessibility are related to IS process and product performance .

The reliability of the responses to all instruments was assessed primarily by means of Cronbach's alpha reliability coefficient [128]. Table 3 presents a summary of the reliability results for each of the instruments used. The reliability of the overall instruments ranged from .70 to .97. All instruments met the level of .70, which is considered satisfactory for exploratory research [129].

Table 4 shows that the beta coefficient for the calculated composite score for all selected independent variables (TMS, TR, KMS, and EXDs) is .649. This means that this variable makes the strongest contribution to explaining the dependent variable IS process performance.

The second regression used IS product performance as the dependent variable, and the calculated composite score for all selected independent variables (TMS, TR, KMS, and EXDs). This regression analysis permitted testing the association and its impact on IS product performance.

Table 5 shows that the beta coefficient for the calculated composite score for all selected independent variables (TMS, TR, KMS, EXDs) is. .664. This means that this variable makes the strongest contribution to explaining the dependent variable IS product performance.

In this research, we are interested in comparing the contribution of each independent variable of the calculated composite used in Models 1 and 2. Therefore, Models 3 and 4 used the beta values.

In Table 6, the largest beta coefficient is .946, which is for digital external databases accessibility. This means that this variable makes a significant and unique contribution to the IS process performance. However, team member selection and communication beta coefficient was the lowest (.022), indicating that its contribution was low; it was also not significant.. KMS as an element of ISD company practice had a low significant negative effect on IS process performance (beta = -.067).

In Table 7, the largest beta coefficient is .939, which is for the digital external databases accessibility, as in Model 3. This means that this variable makes a significant and unique contribution to the IS process performance. However, team members' selection and communication was the lowest (.005), indicating that it made a low and not a significant contribution indicating that it made a low contribution, which was also not significant.. KMS as an element of ISD company Practice has a lower significant, negative effect on IS Process Performance (beta = -.034).

Furthermore, the results show that the calculated composite positively affects IS process performance H1 and IS product performance H2. The relationship between digital external database accessibility and IS process and product performance was highly significant. The largest coefficients are in H1d (.964) and H2d (.939) respectively.

The details are shown in Table 8.

Table 3. Reliability coefficients for the instruments used in this research

Variable	Alpha
Process performance (PR)	**.972**
Product performance (PD)	**.847**
Team member selection & communication (TMS)	**.792**
Training (TR)	**.704**
Knowledge management systems (KMS)	**.773**
External digital database accessibility (EXD)	**.825**

Table 4. Multiple linear regression analysis of ISD company practice composite with respect to IS process performance

Variable	β	SE(β)	β	*p*
(Constant)	-.427	.851		.616
ISD Company Practice	.330	.023	.649	.000

Table 5. Multiple linear regression analysis of ISD company practice composite with respect to IS product performance

Variable	β	SE(β)	β	*p*
(Constant)	-.702	.690		.310
ISD Company Practice	.278	.019	.664	.000

Table 6. Multiple linear regression analysis for each element of ISD company practice with respect to IS process performance

Variable	β	SE(β)	β	*p*
Constant	-.015	.316		.961
TMS	.039	.033	.022	.240
TR	.104	.027	.077	.000
KMS	-.087	.027	-.067	.001
EXD	1.580	.030	.946	.000

Table 7. Multiple linear regression analysis for each element of ISD company practice with respect to IS product performance

Variable	β	SE(β)	β	*p*
Constant	2.251	.259		.333
TMS	.007	.027	.005	.804
TR	.364	.088	.081	.000
KMS	-.036	.022	-.034	.100
EXD	1.292	.025	.939	.000

Table 8. Results of study hypotheses testing

Hypothesis	**Relationship**	**Coefficient**	***SE***	***t***
H1	ISD company practice is positively related to IS process performance	.649	.023	14.029
H1a	Team member selection & communication is positively related to IS process performance	.022	.033	1.178
H1b	Training is positively related to IS process performance	.077	.027	3.868
H1c	Knowledge management system is positively related to IS process performance	-.067	.027	-3.226
H1d	Digital external database accessibility is positively related to IS process performance	.946	.030	51.908
H2	ISD company practice is positively related to IS product performance	.664	.019	14.576
H2a	Team member selection & communication is positively related to IS product performance	.005	.027	.248
H2b	Training is positively related to IS product performance	.081	.022	4.128
H2c	Knowledge management system is positively related to IS product performance	-.034	.022	-1.649
H2d	Digital external database accessibility is positively related to IS product performance	.939	.025	51.703

5. Conclusions, limitations, and future research directions

Information systems are based on objectives; some are concrete, such as hardware, and some are restricted, such as budgets, people, rules, procedures, norms, ways of thinking and practice, and software commands. All ISD projects should be identified as acquiring knowledge and test processes, and managers should accept every opportunity to fully group all the main concerns and aspects of the development process [31] [97].

Digital transformation has been viewed as a facilitator of organizational dynamic capabilities such as ambidexterity [130], [34], which need to be continuously updated to remain competitive in dynamic environments. In alignment with previous research [16], we contemplate digital transformation to be a trigger for dynamic capabilities, which can generate value both directly and indirectly [15].

The results indicated that most organizations information systems are well-concerned with ISD and having a close link with digital external databases since it is an excellent updated sources and easy accessible at any time from any place. The majority of the respondents are aware about how the ISD is very sensitive to the success of information system used in the organization. The study also indicates the process and product performance is important for ISD to have a complete information system. The respondents showed that even the training, team member selection, Knowledge management systems has an impact on the success of ISD, but the digital external database is becoming more efficient because of the cost, accessibility and other advantages like the currency of the information available in such databases.

Web-based indexes and databases have become a major staple; thus, this study tried to respond through developing a research model and explaining the influence of digital external database accessibility. The accessibility and usability of these online resources for developers of information systems using adaptive software with accessibility principles to interface promotes design that works for a range of users, with many technologies that interact with content, and in changing external circumstances [36].
Knowledge management systems make it easy for information developers to obtain answers to their everyday questions rapidly and to improve and anticipate answers without having to search for them. KM is easily deployed via the cloud without needing a specialist to manage and scale. Training corresponds with certain knowledge that will be required on ISD and improves knowledge of the information system developers [78] [131].

This study tested the association between Digital external database accessibility to IS product and process performance and its impact on IS process and product IS performance. However, team member selection and communication was not influential, contrary to the theory [49] [61] [63], the results revealed that most organizations information systems are well-concerned with ISD and having a close link with digital external databases since it is an excellent updated sources and easy accessible at any time from any place.
Digital accessibility showed a strong contribution in ISD. which, means that the development and expansion of using Internet technology have affected the use of other elements of ISD practice? External resources are fundamental strategic elements in the knowledge-based economies of the 21st century. An increasing number of scholars have indicated that firms often search for knowledge internationally [110]. What these theories have in common is the fact

that external knowledge sources provide an important complement to in-house learning and innovation efforts, and thus contribute to improved innovative performance. Absorbing existing external knowledge in the firm can improve the state of the knowledge of a team [111].

The data were collected from local organization, which naturally limits the generalizability of the Findings to other organizations from non-Saudi environments. It is recommended to replicate the same models and study and extend it to other countries (developed and less developed).

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