Towards the Measurement of Digital Trust in the Workplace: A Proposed Framework

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Abstract—*The ever-changing technological innovations disrupt lives. It affects how we deal with people or things. It Influences our feelings and emotions. It changes the way we believe in the ability, reliability, and power of something or someone. A global research on digital trust in the workplace is conducted in collaboration and partnership with schools in Asia, Latin America, Europe, and the USA. It is lodged in a university in Germany. The research is primarily aimed at measuring digital trust in the workplace with an emphasis on people, technology, and process. This paper is aimed at describing the underlying principles and theoretical underpinnings of the research "Digital Trust in the Workplace." Specifically, it presents the framework employed in the study. Likewise, it describes each theory and principles and their relationship to each other. An Input-Process-Output model was used in the formulation of the conceptual framework of the study, which was anchored on the principles of information systems. Theories and principles included in this study are Forrester Social Technologic Ladder, Decision-making models, Technology Adoption Theory, Management Theory, Software Quality Model, General Data Protection Regulation Principles, Digital Citizenship Principles, and Caldicott Principles.*

Keywords— *Digital trust; e-trust, globalization, innovation, information and communication technology, transformation, workplace.*

I. INTRODUCTION

The rapidly changing technological innovations disrupt lives. It influences a person's feelings and emotions. It changes the way people believe in the ability, reliability, and power of something or someone. It affects how humans trust people or things. Legitimacy, effectiveness and transparency, and technological drivers for transformation can build a long-lasting trust [1]. Generally, studies have shown that trust affects responsibility norms and organizational outcomes [2], workplace safety climate [3] as well as to organizational performance [4]. Likewise, trust plays a significant role in employee's decision-making [3].

Digital trust "underpins every digital interaction by measuring and quantifying the expectation that an entity is who or what it claims to be and that it will behave in an expected manner" [5]. From the consumer's point of view, "it is an outcome that you can influence but not control, where confidence in your digital services drives consumer loyalty, unlocking a new kind of relationship and huge untapped potential [6]." It refers to the "level of confidence in people, processes, and technology to build a secure digital world" [7].

Norbert pointed out that businesses must address digital trust issues related to "ethics and control of data access and use, interaction through the Internet, digital risk resilience and value creation in the digital age." Attempts have been made to measure volatility in trust in the institutions of government, media, business, and NGOs [8]. Specific drivers to digital trust are safety, security, reliability, privacy, and data ethics. Likewise, the survey of [6] includes reliability, credibility, transparency, integrity, and security. In a survey conducted by [9], the six pillars of trust include security, legitimacy, community, user experience, shareability, and relevance. Likewise, environment, experience, attitudes, and behavior are the identified drivers of digital trust, according to the 2017 Digital Evolution Index [10]. Interestingly, many of these drivers are highly emphasized from the perspective of consumers.

A global research on digital trust in the workplace was conceptualized in collaboration and partnership with schools in Europe, the USA, Latin America, and Asia. In this study, digital trust is adopted from [7], which refers to the "level of confidence in people, processes, and technology to build a secure digital world." In the same manner, the research adopts the definition of a workplace by [11] that is "a central concept for several entities." The ultimate goal of the study was to assess digital trust among employees and his perspective about his/her own experience as a worker, his or her attitude towards the employing organization, as well as his or her behavior in the society as a whole. Specifically, the research is primarily aimed at measuring digital trust in the workplace with an emphasis on people, technology, and process. The study excluded digital trust as perceived by a specific cohort of consumers.

The purpose of this article is to understand better the underlying principles and theoretical underpinnings of the research "Digital Trust in the Workplace." Specifically, this article presents the framework employed in the study. Likewise, it describes each theory and principles and their relationship to each other.

An Input-Process-Output model in the principles of information systems was used in the formulation of the conceptual framework of the study. Likewise, the determination of the level of confidence in digital technology is anchored on the principles of information systems. Theories and principles included in the study are Forrester Social Technologic Ladder, Technology Adoption Theory, Management Theory, Information Systems Theory, Software Quality model, General Data Protection Regulation Principles, Digital Citizenship Principles, and Caldicott Principles. The study does not include the measurement of digital trust among consumers and users of digital products and services.
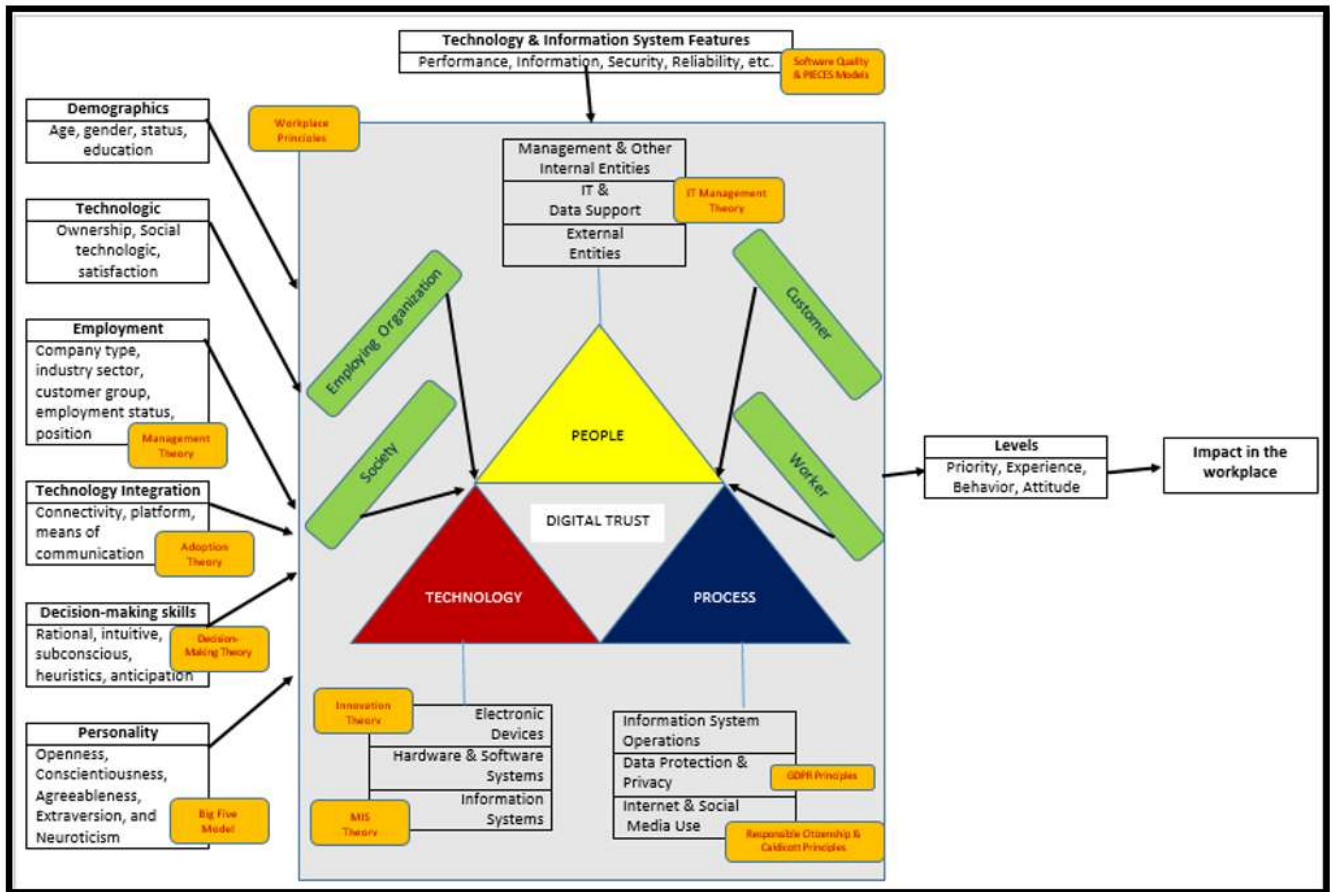
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Fig. 1. Theoretical Framework of the Study "Digital Trust in the Workplace"

TABLE 1. Common technology adoption theories, grouped by purpose

Diffusion Theories	User Acceptance Theories	Decision Making Th. (incl. Problem Solving Theories)	Personality Theories	Organisation Structure Theories
Innovation Diffusion Theory IDT also called Diffusion of Innovation Theory DOI (Rogers 1962) Technology Lifecycle Theory (Rogers 1962; Moore1995) **Focus on technology, on the environment and on the using organisation**	Theory of Reasoned Action TRA (Ajzen and Fishbein 1973, 1975) Theory of Planned Behaviour TPB (Ajzen 1991) Technology Acceptance Model TAM 1; TAM 2 (Davis 1989) Motivational Model (Vallerand 1997) User Acceptance of Information Technology UTAUT (Vankatesh et al. 2003) **Focus on the rational employee interest**	Rational Choice Theory/ Game Theory Decision Making under Uncertainty Risk Management Change Management Media Richness Theory (Daft and Lengel 1984) **Focus on the rational organisational/man agement interest**	Technology Lifecycle Theory (Rogers 1962; Moore 1995) Non-technology related approaches are : Social Cognitive Theories SCT (Compeau and Higgins 1995) **Focus on the individual cognitive interest**	Disruptive Technology Theory (Bower and Christensen 1995) Creative Destruction Theory (Schumpeter 1912, 1942) **Focus on the strategic organisational interest**

II. THE PROPOSED FRAMEWORK

Figure 1 is the conceptual framework of the study titled "Digital Trust in the Workplace." As seen in the framework, six interrelated variables were hypothesized as factors that may affect the digital trust level. These are demographic profiles, technologic profiles, employment background, technology integration, decision-making skills, and personality type of respondents. On the other hand, the level of digital trust will be measured in terms of the three components of the information systems workplace. These are people, technology, and process, and each of these categories has specific variables. For technology, the level of digital trust will be measured in terms of the electronic devices, hardware and software systems, and information systems used in the workplace. For process, the level of digital trust will be determined in terms of the information systems operations, data privacy and protection practices, and the use of the internet and social media. The level of digital trust in terms of people component will be measured in terms of the management and other internal entities of the organization, IT and data support, and external entities that has direct bearing to the operation of the organization. Further, the study hopes to determine the levels of trust in particular with the priorities, experience, and attitude among the respondents. In the long term, the study will look at the impacts of digital trust in the workplace.

A. Inputs that may Affect Trust

1) Demographic profiles

The Technology Diffusion Theory [12] explains that there four main elements that influence innovation. These are the innovation itself, communication channels, time, and a social system. All of these depend intensely on the social and personality attributes, knowledge, habits, including the creativity of the technology adopters [13].

On the other hand, studies show that generalized trust is affected by age, which is moderated by contextual factors like income inequality, developing status, and individualism [14] and trust varies in term of age cohorts [15], [16]. Likewise, gender affects trust, the possibility of being trusted, and the degree of trustworthiness [17] in differing levels [18], [19], [20]. Trust also differs in terms of race and ethnicity [21] and other social classes [22].

What about digital trust? Are these variables affect digital trust? With the results in mind, it is worth studying to determine if age, gender, race, civil status, and educational attainment affects digital trust. The study will uncover also differences of digital trust level among the different generations (gen x, y, z), gender (male, female, LGBT-Q+), civil status (single, married, divorced, widowed), nationality (European, Latin American, American, Asian) as well as with highest educational attainment.

2) Technologic profiles

E-commerce studies showed that digital trust is influenced by perceived usefulness and perceived ease-of-use of the technology [23], [24]. Both are the main components in the Technology Acceptance Model, an adaptation of the theory of reasoned action of Fishbien and Ajzen. In the model, perceived usefulness refers to "the degree to which a person believes that using a particular system would enhance his or her job performance." On the other hand, perceived ease-of-use, as defined by Davis, refers to "the degree to which a person believes that using a particular system would be free from effort." In an interview among workers in energy distribution control rooms, [25] found out that quality of instruction is perceived to be the most critical factor in digital trust, followed by reliability, performance, understanding, communication, expectancy, confidence, proactively, ability, respect, and honesty. In this study, technologic profiles refer to the ownership of electronic devices that are usually use at the workplace, such as smartphones, tablets, laptops, desktop, smartwatch, and other wearable devices.

Technologic profile in this study also refers to the ownership of social media and other online accounts such as Facebook, Twitter, WhatsApp, blog, Linkin, Gmail, Yahoo mail, website, YouTube, and other email providers. This study will also describe employee's social technographics by [26], which is based on Forrester Research, Inc. Although applied in digital marketing, the technographic social tool will help in understanding how the employees in the workplace "approach social technologies - not just the adoption of individual technologies" [26]. Further, the technologic profile in this study includes employee's Internet access at home and their overall satisfaction with the connectivity of their Internet.

3) Employment profiles

Employees play an essential role in any digital transformation in the workplace. Arguably, employees have differing trust in digital transformation. Security professionals, business executives, and consumers have digital trust differently according to the Global State of Digital Trust Survey and Index 2018 [27]. So, when digital trust increases among employees, productivity will also increase [28]. Moreover, digital trust is a primary economic driver of a digital transformation strategy [29].

This study focuses on digital trust as perceived by employees. Employees profile in this study includes the number of years of the current job, status, and position. On the other hand, the company's profile, such as type, form, and number of employees, are also gathered from employees to determine whether these affect digital trust. Likewise, this study will assess the profile of the respondents concerning the supply chain management of their workplace.

4) Technology integration

Technology adoption and integration is a multifaceted process that influences technology adoption decisions. According to the innovation theory, five main factors influence the adoption of an innovation. These are relative advantage, compatibility, complexity, traceability, and observability (Rogers, 1983, cited in [30]). This study will look at the digital trust of employees toward the technology that they are using in the workplace. It can be argued that trust toward technology will start from the adoption stage. Technology adoption is "a complex process where individual perceptions of technology are formed within a socio-cultural

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context" [31]. "The key to adoption is that the person must perceive the idea, behavior, or product as new or innovative" [32]. Technology adoption addresses cognitive, emotional, and contextual concerns [33], which are relevant in determining digital trust. Several theories were reviewed with an emphasis on technology, environment, employee's interest, management interest, individual interest, and organizational interest. These theories are listed by [34] found in table 1.

In this study, technology integration in the workplace refers to the availability of Internet connectivity, communication platforms like blogs, instant messenger, Facebook, and other social media platforms. It also refers to the respondent's satisfaction level towards the overall satisfaction of internet services in the workplace. Likewise, technology integration is described through an employee's communication with a supervisor, a co-worker in the same rank, as well as in the lower position.

5) Decision-making skills

Mosher [3] asserts that trust has a positive impact on workplace safety climate, which plays a role in employee decision-making. Studies show that trust is a pre-requisite in every decision-making in the workplace. In the same manner, digital technologies can support decision-making like those in a clinical setting [35]. The study of the trust-based mechanism for automatic decision-making was based on Bayesian Networks by [36] had proven "accurate decisions on adaptation which match user preferences and support user trust." In this study, decision-making is categorized into different types, which are adaptations from existing decision-making theories. These types are rational, intuitive, sub-conscious, heuristics, and anticipation. This study is also a baseline for future research on digital intuition.

6) Personality types

Empirical studies show that personality affects trust in this knowledge-sharing world [37], [38]. Likewise, there are several methods and models for determining personality types. Among the many models include The Four Temperaments/Four nHumours, Carl Jung's Psychological Types, Myers Briggs® personality types theory (MBTI® model), Keirsey's personality types theory, and among others.

In this study, the determination of the personality type will be based on the Big Five Personality Traits. The Big Five is the commonly used term for the model of personality, which describes the five fundamental factors of our personality, cited in the website of [39]. It is often used in several empirical studies to measure personality in the digitally-oriented research environment [40], [41], [42].

B. Determining Levels of Digital Trust in the Workplace

"An information system can be any organized combination of people, hardware, software, communications networks, data resources, and policies and procedures that stores, retrieves, transforms, and disseminates information in an organization" [43]. It is "a set of interrelated components that collect, manipulate, store, and disseminate data and information and provide a feedback mechanism to meet an objective" [44]. It provides a competitive advantage in society, business, industry, and workplaces around the globe if applied

thoughtfully and carefully [44]. There are two significant factors for the successful management of information systems [43]. These are: "a major functional area of the business equally as important to business success as the functions of accounting, finance, operations management, marketing, and human resource management; and an important contributor to operational efficiency, employee productivity, and morale, and customer service and satisfaction." In this study, the level of digital trust is measured in terms of the information technology used, people involved, and the digitalization process in the workplace.

1) On technology

"Information technology (IT) refers to hardware, software, databases, and telecommunications" [44]. Hardware innovations are fast changing to respond to the complex business process in the workplace. Artificial intelligence, the Internet of Things, and robotics are among the fourth industrial revolution innovations that disrupt workplaces. Coupled with this, users must adapt and keep abreast of technological skills. However, it is a fact that users adopt innovations at different times. Thus, users have different adoption characteristics, as stated in the Diffusion of Innovation (DOI) Theory. There are five stages of technological adoption, as stated in DOI, these are innovators, early adopters, early majority, late majority, and laggards. "The stages by which a person adopts an innovation, and whereby diffusion is accomplished, include awareness of the need for innovation, decision to adopt or reject the innovation, initial use of the innovation to test it, and continued use of the innovation" [32].

Technology components in this study refer to electronic devices that are provided by the company either for official or personal use for the employees, hardware and software systems installed, and information systems that are implemented in the workplace. The priority level of software quality components, as perceived by the employees, is also measured in this study.

Efforts have been made to improve usability, portability, integrity, and other aspects of software for it to be more users friendly and gain user trust [45]. Software quality, as defined by IEEE 610.12 standard, is "the degree to which software or process meets customer or user needs or expectations" [46]. Some of the primary software quality models include McCall Model, Boehm's Model, FURPS Model, Dromey's Model, and ISO 9126 Model [46]. On the other hand, tailored models which are originated from basic models include Bertoa Model, GEQUAMO, Alvaro Model, and Rawashdeh Model [47]. Further, open-source models that emphasize the participation of community members include CapGemini Open Source Maturity Model, OpenBRR Model, SQO-OSS Model [47].

In the same manner, this study also considered Wetherbe's PIECES framework in determining the level of trust towards the digital process. PIECES is an acronym for performance, information, economics, control, efficiency, and service. It is a framework that encompasses information systems problem, opportunity, and directive identification.

2) On people

"People can be the most important element in most computer-based information systems" [44]. They are the indispensable element for the effective operation of all information systems [43]. Undeniably, many problems in the digital world are caused by people. Thus, any individual who manages runs, programs, and maintains an information system plays a very vital role in building digital trust in the workplace.

In this study, employee's trust level to co-employees of the different ranks and levels in the pyramid of management in the workplace is determined. The level of confidence towards the people who have direct or indirect access to any digital technology in the workplace is explored. In particular, trust towards the management, IT and data support, and other external entities of the workplace are evaluated.

3) On process

Transparency in digital technology is vital for building this trust [48]. "Digital trust reflects a customer's belief that an organization is collecting, storing, and responsibly using their information and that the organization is protecting that information" [9]. Accenture revealed that 45% of consumers shifted their providers due to loss of trust, which is likely to more uncomfortable with sharing their information. It also reported that "consumers aged 55+ and those in Western Europe show the lowest confidence in the security of their personal information" [49]. The coming of the General Data Protection Regulation (GDPR) provides an opportunity for many workplaces to revisit and rethink the way they protect personal data and information. GDPR opens the door to improve digital trust [50].

In this study, digital trust to process refers to employee's practices in collecting, processing, and storing personal data. These practices are anchored on the GDPR principles. These principles are lawfulness, fairness and transparency, purpose limitation, data minimization, accuracy, storage limitation, integrity, and confidentiality, and accountability [51]. It is hoped that this study will also serve as baseline data on data privacy and protection practices in the workplace.

Respondents of this study are any employees of any company or organization. The employee must be a full-time or part-time working status, and he/she must be regular, contractual, or probationary standing in the company. The company or organization can be private or public of any size and must have few or much digital technology integration in their business operation. Several cohorts of employees are expected, such as teachers, virtual assistants, and field workers, among others. It is also likely that this study will include medical and health workers. Thus, digital trust to process also refers to the workers' practices in handling patient data. In this case, the measurement of digital trust concerning the digital process is anchored on the Caldicott principles. Caldicott principles are a set of guidelines that "organizations should follow to ensure that information that can identify a patient is protected and only used when it is appropriate to do so" [52]. This study is hoped to describe the landscape of digital trust in health care and medical workplaces, as well as how these workplaces handle patient information across the globe.

Furthermore, [53] asserts that there are two critical elements in developing a healthy digital culture in workplaces like schools. These are transparency and establishing trust. In this era of the Internet of Things, misuse, addiction, fake news on social media are ongoing issues and practices among individuals or even in the workplace. This study also measures the behaviors and practices in digital processes that are also anchored on digital citizenship. It measures explicitly digital trust concerning the appropriate norms and responsible use of technology. [54] posit that digital citizenship is the "self-enactment of people's role in society through the use of digital technologies." Digital citizenship is defined as "the norms of appropriate, responsible behavior with regard to technology use" [55]. It is hoped that this study will also describe employee's behavior and practices of their role in this digital era.

III. THE OUTPUT OF THE STUDY

A landscape of digital trust to technology, people, and process in the workplace will be developed. The level of confidence in people, technology, and process in building a secure digital world will be mapped out. Drivers that will affect digital trust among employees and his or her perspective about his or her own experience as a worker will be identified. Likewise, drivers that will affect an employee's attitude toward the employing organization will be determined. Further, drivers that will affect digital trust among employee's behavior in society as a whole will be enumerated.

Likewise, a global description, correlational, and comparative analyses are expected at the end of the study. Specifically, a descriptive report of the demographic, employment, and technologic profiles, technology integration, decision-making skills, and personality type of the employees will be presented. Likewise, a detailed discussion of the level of confidence to technology will be presented in terms of a) electronic devices provided by the company, b) hardware and software systems installed, c) information systems that are implemented in the company. It will also provide the level of confidence to people who have direct or indirect access to any digital technology such as the management, IT and data support, and external entities. Also, a detailed analysis of the level of confidence in the digital process in the workplace will be presented. The study will also exhibit employee's practices of data protection and privacy. It will also showcase the respondent's behaviors in the online world.

A correlative analysis of the factors that affect digital trust will be presented at the end of the study. Specifically, this study will provide evidence of whether nationality, age, gender, civil status, and educational attainment affects digital trust in the workplace. It will also show the technologic profile factors that can affect digital trust in the workplace. Also, an analysis will be presented in the type of company, size of the company, years working, business nature, roles, job position, and means of communication are correlated with digital trust in the workplace. This study will also provide evidence on whether digital tools used, frequency of use, and duration

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could affect digital trust. In the same manner, this study will present whether being rational, intuitive, subconscious, heuristics, and anticipation impact digital trust in the workplace. Moreover, this study will show how personality affects digital trust in the workplace.

This study will provide evidence on the differences in the level of confidence in digital technology among the employees in terms of their demographic, technologic, employment, technology use, decision-making, and personality type.

Most importantly, a business model and strategy will be designed at the end of the study that will emphasize the improvement of digital trust in the workplace. The model may include an innovative approach that will lead to digital leadership & citizenship, responsible use of social media, and digital transformation in the workplace.

IV. CONCLUSION

Measuring digital trust in the workplace is a challenging attempt. The proposed framework suggests the most practical approach to quantify digital trust in the workplace. It emphasizes the principles of information systems where people, technology, and process are vital components in building a secure digital world. A thorough descriptive and correlative approach must be employed in the measurement of the confidence level. A valid and reliable assessment tool must be developed. The instrument, Digital Trust in the Workplace Survey Questionnaire, dubbed as "Survey eTrust," must include questions that are based on the principles and theories that the study is anchored. It should undergo intensive and rigid validity and reliability testing methods to arrive at the most accurate quantification of digital trust in the global workplaces.

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