The Development of a Design Theory for Web Based Information Systems

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Abstract – There is a common assumption among individuals that the complexity involved in developing novel systems utilizing Web technologies implies that Information Systems (IS) that are Web-based must possess fundamental and significant distinctions from conventional IS. This study raises skepticism regarding the veracity of this claim. The literature pertaining to academic research, manuals, and sales material frequently espouses optimistic claims regarding the capabilities of e-commerce and e-business technologies and applications, often grounded in the assumption of novelty associated with the Internet. The objective of the research is to establish a systematic classification system for information systems theory based on its efficacy in addressing four fundamental objectives: analysis, explanation, prescription, and prediction. This study utilized both experimental and descriptive qualitative methodologies. Subsequent to the analysis phase in the system development cycle of information technology, the design phase ensues. The results indicate that the evolution of an information technology system can be delineated by its phases of requirement specification, design planning, and execution. The manifestation of this phenomenon is observed through the development of a strategic blueprint, the production of a visual representation or draft, or the organization of multiple components into a functional entirety. In conclusion, it is imperative for information systems to give priority to both the user and the integration of the system.

Keywords – Information Systems Design Theory, Management Information Systems, Theory of Reasoned Action, Web-Based Environment.

I. INTRODUCTION

An information system is a comprehensive database that ensures the attainment of a business objective. The information technology industry cannot be disaggregated into distinct information systems. The effective adoption of data and business processes necessitates integration. Hence, it would be more suitable to utilize a triangular metaphor to represent the information system. The triangle comprises the fundamental components of process, people, and technology. The proper functioning of an information system is contingent upon the criticality of each constituent part. To optimize the distribution of information, an information system utilizes a diverse range of tools. This equipment typically encompasses hardware, software, and other virtual tools that comprise operating systems and applications. The information system can be perceived as a software application that facilitates the arrangement and evaluation of data in various manners. Usually, the process of converting raw data into comprehensible insights is facilitated.

The versatility of information systems enables them to cater to a diverse range of applications. A type of information system that is intended to serve multiple functions is referred to as a "general-purpose information system." A database management system is classified as an information system. This program can facilitate the organization and analysis of any type of data. Through the utilization of a mathematical equation, analysts could infer additional sets of data, which may include the identification of seasonal trends in consumer expenditures. In contrast, a bespoke information system is specifically designed to fulfill a singular purpose within an organization. Hence, its capabilities are restricted to specific tasks. Expert systems exemplify this type of system due to their emphasis on addressing problems through specialized knowledge and reasoning. The implementation of expert systems in the field of medicine presents a distinctive array of challenges. The objective is to provide a service that is characterized by enhanced efficiency and accuracy compared to an individual's independent efforts.

The impact of Information Systems on Information Technology within the context of both commercial enterprises and broader societal structures has been a subject of scholarly investigation by Muryantoro and Efrilianda [1]. This

phenomenon can be attributed to the indispensable requirement of IT infrastructure support for the optimal functioning of WBE. Developing and executing an information system that is appropriate for the Web-based environment (WBE) is a demanding and laborious task, for which there is now theoretical support. The authors of this study have developed a theoretical framework known as the Information Systems Design Theory (ISDT) to tackle this problem. **Table 1** presents a compilation of Shea, Usman, Arivalagan, and Parayitam [2] that have integrated theoretical perspectives on strategy with empirical investigations of Management Information Systems (MIS).

Table 1. Theoretical perspectives on strategy with empirical investigations of Management Information Systems

Theory Perspective	Core Theories	Profit Approaches
Flexibility	Real options, Dynamic capabilities	Schumpeterial flexibility rent (Improve or preserve position and value using superior adaptations)
Competence	Knowledge-based views, Resource-based views	Ricardian operational-effectiveness rent (Resource exploitation to capture and create value)
Governance	Agency theory, Transaction costs economics	Cosseian transactional-effectiveness rent (Effective assignment of resources to capture and establish value)
Coordination/Collusion	I/O economics, Structure-conduct-performance	Banian market-power rent (tacit collusions to restrict entry and restrain rivalry)

Numerous investigations have been carried out in the field of information systems pertaining to the Web-Based Environment (WBE), encompassing the stages of strategizing, executing, utilizing, and assessing information technology in diverse contexts. Subsequently, the development of information systems is carried out in a phased manner, wherein each subsequent stage produces increasingly detailed outcomes.

The process of system development frequently commences with an evaluation of user requirements in the framework of a macrosystem approach, succeeded by an assessment of the medium- and long-range aspirations and objectives of the organization. The phases of information system development are reflective of the iterative nature of system development. The genesis of a novel system is often rooted in a state of perplexity. It is imperative to select an appropriate development model from the various options at hand, which would facilitate the creation of a productive and integrated end product. The facilitation of information distribution is among the various functions that are streamlined through the utilization of Information Systems (IS). The employment of the internet as a means of dissemination is indicative of the advancement of information and communication technologies. One of the most notable attributes of the website is its user-friendly setup process, which facilitates prompt and efficient utilization.

Websites, akin to information systems, can serve as a rapid and precise means of disseminating information. The roles of information systems encompass the procurement, administration, aggregation, evaluation, and distribution of data to fulfill predetermined objectives. Information systems have facilitated the enhancement of global information sharing and circulation. The deployment of information systems enhances operational efficiency and productivity in an enterprise.

The objective of the research is to establish a systematic classification system for information systems theory based on its effectiveness in addressing four fundamental objectives, such as analysis, explanation, prescription and prediction. This study utilized both experimental and descriptive qualitative methodologies. Subsequent to the analysis phase in the system development cycle of information technology, the design phase ensues. This study utilized both descriptive qualitative and experimental methodologies. This paper is organized according to the following framework: Section II presents a review of literature concerning the development of a design theory for web-based information systems. Section III presents a methodology employed for this article. Section IV focuses on a discussion of the results, where concepts such as definition of the theory, theory of web-based system, technology acceptance model, and information infrastructure definition, are discussed. Lastly, Section V presents final remarks regarding the article.

II. LITERATURE REVIEW

Alsharari and Ikem [4] posit that organizations utilize information technology and systems to enhance their competitiveness in the international market by leveraging their core competencies, streamlining their operations, and reorganizing entire industries. Studies conducted by Yoo, Hur, and Goo [5] have demonstrated the efficacy of information systems in contributing to the sustained success of businesses. When utilized efficiently, information systems possess the capacity to transform the business landscape significantly. Furthermore, research conducted in Western countries has demonstrated that the favorable impacts of information systems on organizational outcomes are influenced by numerous critical success factors. The information system of a company encompasses various components such as its workforce, technological infrastructure, software applications, network connectivity, data repositories, operational procedures, and regulations that govern the handling and dissemination of the organization's information.

According to Naceur, Cimon, and Pellerin [6], the field of management information systems is intricate and multifaceted, requiring meticulous attention from those in positions of authority. This underscores the significance of corporations dedicating ample time to meticulously select individuals entrusted with the task of managing their systems. The implementation of Management Information Systems (MIS) could potentially provide advantageous decision support tools for a company's management team. Employing a data processing system that leverages contemporary and prospective technology represents a viable approach to obtaining valuable outcomes from data processing. Information

systems are created through the collaboration of information technology and individuals who utilize it to facilitate management and operations. The utilization of electronic information has become a ubiquitous phenomenon in contemporary society. It is imperative to undertake this task in order to meet the escalating demands for superior computer service standards, optimized resource allocation, streamlined resource utilization, enhanced time management, and regulated information heterogeneity.

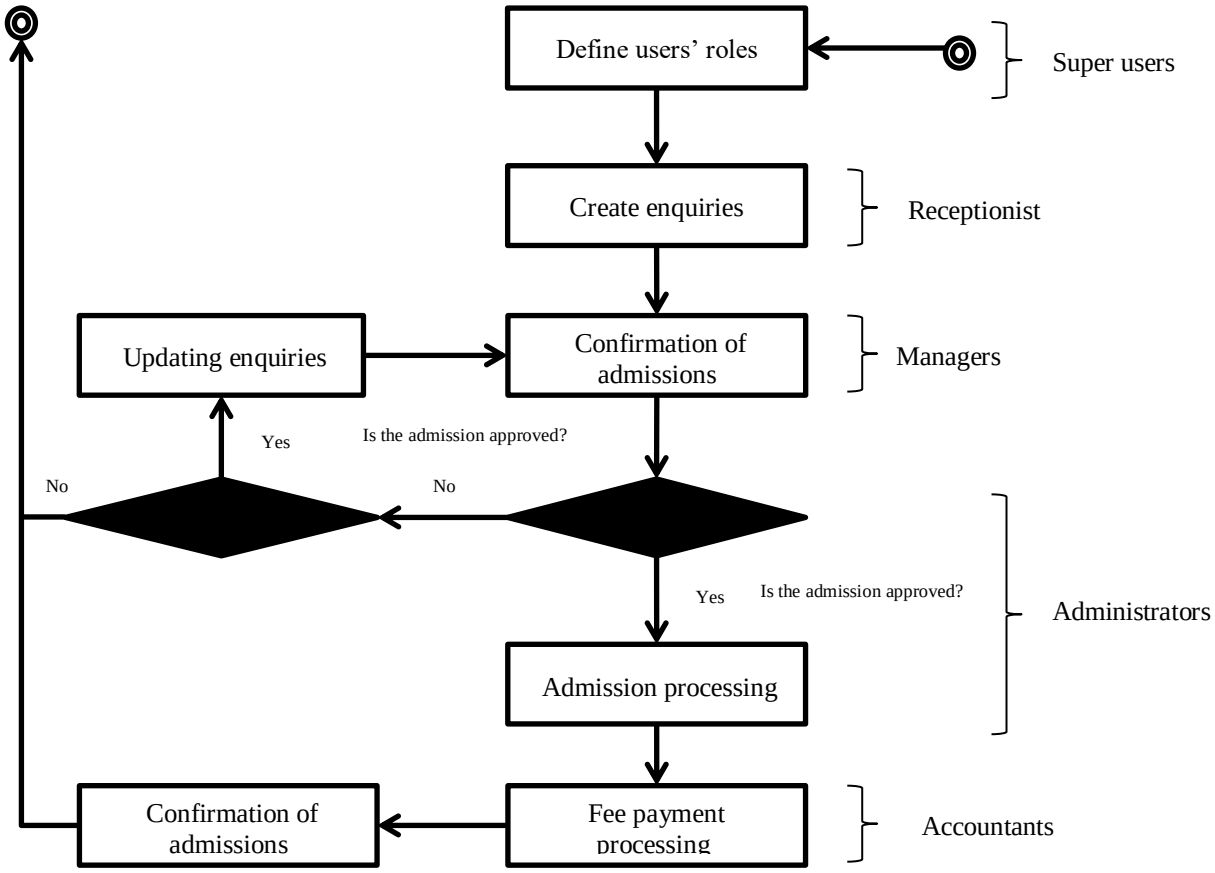

Fig 1. An illustration of activities of MIS

Nezafati, Razaghi, Moradi, Shokouhyar, and Jafari [7] put forward a Management Information System (MIS) that features a user-friendly interface designed to facilitate the management of college personnel, finances, and enrollment records. Please refer to **Fig 1** for a visual representation. The creation and management of accurate and current information pertaining to a student is of paramount importance during the college application process. The system in question effectively oversees data pertaining to various personnel categories, encompassing technical and instructional staff, students, as well as financial and accounting records. It comprehensively monitors all aspects of the admissions process from inception to completion, including work progress, reporting, and comprehensive student data. Furthermore, the college's comprehensive array of courses, detailed departmental categorizations, exhaustive roster of personnel, and academic updates disseminated to the faculty and staff will all be encompassed. A variety of reports and inquiries can be generated based on a wide range of options pertaining to personnel, cohorts, academic departments, financial management, and the institution as a whole. These tools can provide valuable insights to the administration regarding the full spectrum of administrative activities taking place within the college.

Digital technology and computer networks are utilized to gather, systematize, and disseminate scientific literature and data in a digital format, thereby enabling universal access to this information for individuals with internet connectivity. The present inquiry employs Information and Communication Technology (ICT) in the guise of a Short Message Service (SMS) Gateway. The proliferation of information technology (IT) is influenced by various factors, namely: (a) the availability of IT products, (b) the accessibility of IT products, (c) the capability of IT, (d) the demand for user-friendly public services, (e) the optimization and simplification of work processes, and (f) the expansion of national, regional, and global infrastructure. Information technology can serve two primary functions, namely, as an information system and as a means to gather, systematize, and disseminate scientific data and knowledge in digital format.

A system is comprised of interdependent components that collaborate in order to achieve a shared objective. These elements are interdependent and cannot be separated from each other. The objectives of the system are achieved through the interdependence and interconnectedness of numerous subsystems that constitute the entirety. The defining

characteristics of any given system include its components, system boundaries, external environment, connections, inputs, outputs, processors, and objectives. In contrast, an information system refers to a collection of interconnected resources that work in unison to achieve a shared objective. Information refers to organized data that has been tailored to fulfill the needs of a specific individual, team, administration, or other interested party. Data is comprised of facts that express the value of things and individuals. The phrase "information system" pertains to the structural framework, technical tenets, and organizational guidelines that are primarily intended to facilitate business operations.

The trend of shifting management information systems that heavily depend on databases and/or transactions to online platforms, where users can access them through web browsers or mobile devices, is on the rise. Within a web-based information system, individuals have the ability to retrieve data through web interfaces. These interfaces typically consist of semi-structured documents that feature a navigation structure spanning across various documents and pages that are organized in a network or hierarchy. Web-based information systems are widely utilized due to their accessibility via contemporary web browsers, among other factors. The provision of data extraction and manipulation services should be included in the system or underlying database. The integration of management information systems can potentially yield substantial benefits for an organization's endeavors towards achieving sustainability. Furthermore, the environmental data that has been obtained, analyzed, and interpreted by the scientific team is contingent upon the assessment frameworks for management decisions in the monitoring of safeguarded regions.

The utilization of a management information system can aid an environmental organization in accomplishing its objectives by gathering, retaining, and analyzing multifaceted environmental data to facilitate the implementation of efficient environmental management policies and planning strategies. The comprehension of intricate transitions and change management requires the utilization of fundamental concepts such as "life history," "system life cycle," and "entity or class life history." To distinguish between two behavioral characteristics of a web-based management information system, it is necessary to apply the following principles. The term "life cycle" pertains to the distinct set of general phases and stages that a system may experience throughout its entire life history. On the other hand, "life history" pertains to the factual sequence of steps that a system has undergone or will undergo throughout its lifespan.

The management information system that operates through the internet is characterized by two perspectives. The first perspective is static and portrays the system's architecture at a specific point in time. The second perspective is dynamic and captures the system's architecture as it progresses through its application usage. Soelistijanto and Siringoringo [8] have observed that the issue of alignment between information systems (IS) and business strategy, and its implications for the effectiveness of IS and business success, is infrequently discussed in China. A structural mathematical model was employed to test the efficacy of the theoretical framework. According to Jie and Puspitasari [9], the degree of strategic alignment between business strategy and information system strategy is a more precise indicator of organizational success compared to the individual impact of either information system strategy or business strategy.

The objective of the article is to recommend a taxonomy, which categorizes IS theory based on its approach towards explanation, analysis, prescription and prediction. The theory is characterized by five distinct functions, namely analysis, explanation, prediction, explanation and prediction, and design and action. The constructed theory must be pertinent to the issue at hand and the inquiries posed. The evaluation of the questions needs to be conducted considering the present status of knowledge within a respective field. The core functions of theory are commonly regarded as description and analysis. The theory defines the aspect under investigation, the exploration of the interconnections between said constructs, the extent to which these constructs and associations can be applied to other contexts, and the limitations that govern the validity of these relationships and observations. The theory employs diverse causation perspectives and reasoning techniques to elucidate the occurrence and timing of events. The primary objective of furnishing such an elucidation is to facilitate individuals in acquiring novel viewpoints regarding the phenomenon under consideration. Moreover, the theory of prediction elucidates the future events that would take place provided a certain set of assumptions are satisfied. The accuracy of IS predictions is expected to be limited to a probabilistic extent.

III. METHODOLOGY

The study utilized both descriptive qualitative and experimental methodologies. The statement highlights the distinct attributes that practitioners, in their capacity as both subjects and researchers, bring to the realm of participatory action research (PAR). The primary objective of the PAR is to enhance its knowledge and development by exerting an impact on the surrounding milieu. Researchers and participants engage in collective, self-reflective inquiry to gain a deeper understanding of their activities and the circumstances in which they are involved, with the aim of improving them. The reflective process is informed and entrenched by an understanding of history, culture, and local context, which subsequently influences and shapes one's actions. Individuals ought to experience a greater sense of agency and self-efficacy through engagement in the Participatory Action Research (PAR) methodology. In contrast to traditional action research, participatory action research is characterized by a more cooperative and mutually beneficial reconfiguration of the responsibilities of investigators and participants.

IV. RESULTS AND DISCUSSION

Definition of Theory

Theories serve the purpose of fulfilling the human desire to comprehend the world by enabling the accumulation of a corpus of knowledge that can be utilized to elucidate, predict, and manage observed phenomena. To restate the ideas of Smangs [10]: Theories within the realm of sciences are indicative of overarching generalizations. Similar to other forms of language representation, sign systems are utilized.

Theories are conceptual frameworks that are employed to apprehend, regulate, and legitimize the phenomena that we refer to as "the world". Our current objective is to achieve the highest possible level of mesh refinement. The perspective that posits theories as mere approximations of reality, thereby rendering them susceptible to fallibility and uncertainty, is commonly referred to as fallibilism. Thus, the empirical foundation of objective science lacks absoluteness. The epistemological underpinnings of science are not entirely infallible. The audacious framework of the theories is derived from a challenging situation, so to speak. The configuration bears resemblance to a structure that is supported by piles. The cessation of the pushing of the piles will not be attributed to the attainment of a solid foundation, but rather to the impracticability of continuing due to the excessive moisture content of the swamp. According to Inazumi, Kuwahara, Jotisankasa, and Chaiprakaikeow [11], construction work on the piles is discontinued once their strength is confirmed to be sufficient for supporting the building.

The present ontological perspective acknowledges the existence of theoretical constructs as independent entities, distinct from the subjective understanding of any individual. According to Grundmann [12], a theory is characterized by agreement among individuals who possess the necessary expertise and credibility to comprehend the intricacies of the subject matter, even in cases where the material is not widely known.

This perspective aligns with the ideologies of Doeser and Frantzen [13] acknowledges the existence of three distinct spheres. The tripartite framework comprises the objective realm of actual and possible occurrences, the subjective realm of personal perceptions and convictions, and the social realm of communal relationships regulated by conventions. Andrews [14] categorize them as Worlds 1, 2, and 3. World 1, also known as objective reality, is the realm in which physical entities are present. The realm of mental states, also known as World 2, is confined to the cognitive faculties of the observer. Conversely, the abstract domains of language, mathematics, knowledge, science, art, ethics, and institutions, collectively referred to as World 3, possess both objective and figurative existence. This situates the theoretical domain within the third dimension. While a computer program can be considered a physical electronic entity (World 1), its underlying algorithm or design principles (World 3) are abstract concepts that are better comprehended outside the realm of World 1. Theoretical knowledge and theory are products of human creation rather than discoveries. In order to comprehend our experiences, we formulate novel concepts, frameworks, and patterns, which we subsequently assess and refine in light of new information.

Theoretical concepts are human constructs that utilize abstraction as a useful mechanism for arranging and expressing the relationships between observable phenomena. Ideas and abstractions are constructed; however, they consistently correspond to a certain facet of the actual world. These theories endeavor to achieve comprehensiveness by integrating diverse theoretical frameworks. Nonetheless, it is important to acknowledge that not all phenomena can be accounted for solely through theoretical frameworks. As evident from the previously mentioned definitions, theories are primarily characterized by their incorporation of abstraction and generalization pertaining to phenomena, interactions, and causality. The notion of theory does not encompass the mere acquaintance with a collection of factual data or a singular event. According to Raynal [15], data should not be considered as theory.

However, if they are analyzed and interpreted appropriately, they can be utilized as theoretical constructs. Conveying the construction process of a particular instance lacks a theoretical approach. Diverse perspectives exist regarding the requisite degree of universality or generalization in theoretical frameworks. Kromolicka [16] provide a comprehensive analysis of the concept of universality and the associated challenges. The author concedes that attaining complete certainty in natural laws, which encompass a wide range of laws, is unattainable. Nevertheless, the author contends that the natural sciences should endeavor to pursue such assertions and concepts.

Nevertheless, it is commonly overlooked within the realm of social sciences that social phenomena are governed by immutable natural laws. Gramling [17] argues that while earthquakes are triggered by preexisting conditions in plate tectonics, wars do not emerge from preexisting political conflicts. Johnson and Cureton [18] presented a compelling argument that our comprehension of human affairs is less reliable than our comprehension of universal laws or laws of nature. This is due to the existence of other factors that have been discovered to be more inconsistent and unpredictable. Additionally, the effects of certain medicines such as rhubarb and opium have not always been consistent in producing the expected results of purging and inducing sleep, respectively, for all individuals who have consumed them. It is commonly acknowledged that social science and information technology theories ought to possess a certain degree of generality.

Theory for web-based systems

The Technology Acceptance Model (TAM) is founded on the Theory of Reasoned Action (TRA) that postulates that an entity's attitude and behavior towards a particular issue are shaped by their initial reaction to that issue.

Theory of Reasoned Action

The direct cause of actions may be attributed to the intentions to act or refrain from doing. The two primary factors that significantly influence an individual's behavioral intention are attitude, which refers to the evaluation of one's conduct, and subjective norm, which pertains to the evaluation of what significant others believe one should do. The beta weights in multiple regression analyses serve as indicators of the true association between attitude, behavioral intentions, and perceived norm. Whenever an attitude beta weight is more than the subjective norm beta weight, the conduct is perceived to be more affected by attitudinal controls compared to normative controls. Conversely, if the beta weights are reversed, the opposite holds true.

Scholars who aim to impact human behavior could gain advantage from comprehending the elements that mold attitudes and subjective norms. Behavioral beliefs and evaluations of outcome desirability are influential in shaping an individual's attitude towards the likelihood of specific outcomes. The subjective norm of an individual is determined by the opinions of significant others and the extent to which the individual is motivated to comply with those opinions. According to the assertion, summative procedures have an impact on both an individual's attitude and their subjective norm. It is commonly believed that individuals engage in the process of combining their behavioral belief-assessment products to form an attitude. Similarly, it is believed that individuals combine their normative belief-motivations to effectively comply products meant to effectively structure subjective norms.

The Difference between Subjective Norm and Attitude

The reasoned action theory has faced criticism from various perspectives. The difference between subjective norms and attitude has been a topic of discussion among many individuals. While empirical arguments have been presented, which will not be expounded upon in this context, the fundamental concern pertains to the conceptual framework. It is important to note that subjective norms are molded by normative beliefs and a desire to conform, while objective norms are established based on considerations of potential outcomes and evaluations of those outcomes. This understanding is essential for comprehending the conceptual complexity of the topic. In the event that normative perspectives and behavioral convictions pertain to identical concepts but are labeled differently, what implications might this have?

Assuming that consuming a chocolate bar is the action that elicits anxiety, and that the underlying belief is that "my paternal figure will express dissent if I indulge in chocolate consumption." An instance of a normative perspective is illustrated by the statement "According to my father's belief, it is not advisable for me to consume a chocolate bar." The notion that there exists a significant disparity between these two perspectives is contradicted by the observation that they seem to be distinct approaches to articulating an identical concept. If this differentiation is deemed to be flawed, then the delineation between objective and subjective norms is also subject to scrutiny. It could be contended that this constitutes an instance of falsification. There exists a possibility that Ajzen [19] may respond with circumstances wherein the differentiation appears to diminish, in which it may furnish instances wherein the demarcation seems considerably more pronounced. Scholars may concur on the presence of occurrences, however, they may hold divergent views regarding whether such illustrations corroborate or contradict the differentiation being established. Hence, it appears that the reasoned action theory presents a conceptual limitation that impedes its falsifiability. Fujikawa, Son, Hayashi, Kondo, and Eto’s [20] findings corroborated an additional postulate that was employed by Masello, Castignani, Sheehan, Guillen, and Murphy [21] regarding the utilization of seat belts in both secure and hazardous driving contexts.

Morris, Florida Atlantic University, Lieberman, and Florida Atlantic University [22] employed a multiple regression model to determine that attitudes were the primary determinant of an intention to wear seat belts in scenarios of safe driving, while norms were the primary determinant of behavior in hazardous driving situations. In order to examine this phenomenon, Fishman, Yang, and Mandell [23] carried out a series of three studies with the aim of altering the attitudes of participants regarding the significance of utilizing a seat belt while operating a vehicle. In the event that the differentiation between subjective norm and attitude is deemed fallacious, the impact of attitude manipulation on behavioral intentions should remain consistent regardless of whether the examination is conducted in a safe or hazardous driving setting. If an assertion that attitudes govern the usage of seat belts in safe driving state while norms govern seat belt usage in risky driving conditions holds true, then the modification of attitudes would solely impact behavior intentions in safe driving setting, and not within vulnerable driving setting. The aforementioned prediction was validated through three distinct evaluations.

Furthermore, a series of comparable studies were carried out by Ham, Jeger, and Frajman Ivković [24] to illustrate that the alterations in subjective norms had an impact on the participants' intentions to partake in actions that are regulated by norms, but not on their attitudes. Makowski, Pham, Lau, Raine, and Chen [25] conducted an examination of the distinction at the belief level, where the allegation of non-falsifiability seems most relevant. An ancillary assumption was utilized to investigate the cognitive process by which individuals establish connections between their beliefs. The objective was to ascertain whether individuals differentiate between behavioral and normative convictions. It was hypothesized that individuals utilize behavioral beliefs in the formation of their attitudes, necessitating a comparison of these beliefs with others, ultimately yielding connections among behavior beliefs. The aforementioned perspective posits that it is imperative to establish linkages among normative concepts as well.

Individuals may juxtapose their behavioral beliefs with normative concepts; however, this does not necessarily demonstrate any discernible associations between the two. Assuming that one desires to ascertain the viewpoints of

individuals regarding a particular course of action, it is expected that the process of following an association link from the initial recalled behavioral belief to a subsequent behavioral belief would be uncomplicated. In a comparable vein, the process of reaching an additional normative belief ought to be relatively straightforward if the initial belief that has been restored is also normative in nature. Consequently, it is a justifiable expectation that there will be a certain level of clustering observed among the retrieved beliefs, in which behavior beliefs are more likely to be retained in close proximity to one another, and the normative beliefs are more likely to be recollected in close proximity to one another. This assumption was supported by three trials that took into account factors such as the possible priming implications and the semantic proximity of beliefs.

As demonstrated in [26], it is possible for individuals to be subject to either under-attitudinal or normative control. According to Conner and Norman [27], the enhancement of the attitude-intention relationship is achieved by considering the private self, while the subjective norm-intention associations are enhanced by considering the collective self. By incorporating appropriate auxiliary assumptions, the reasoned action theory was effectively utilized to test predictions that may have otherwise been unsuccessful in distinguishing between subjective norm and attitude. In the event that these predictions did not materialize, it is my inclination to consider the reasoned action theory as flawed rather than ascribe the shortcomings to erroneous auxiliary assumptions. This implies the existence of certain evidential support for a hypothesis that is intended to be flawless.

Cognitive and Affective Attitude Elements

As per the reasoned action theory, an attitude categorized as a cognitive construct that encompasses the evaluation of the feasibility and desirability of anticipated consequences. Nevertheless, Rischer, Savallampi, Akwaththage, Salinas Thunell, Lindersson, and MacGregor [28] contend that attitudes are comprised of both affective and cognitive components. Several scholars have employed factor analytic research paradigms to examine these hypotheses. Participants were requested to confirm items, which constitute attitude measures, and factor analysis was employed to control whether an item loads onto either one or two factor. It has been observed that researchers frequently encounter two distinct factors, in contrast to the singular factor anticipated by the reasoned action theory. These factors are characterized by the loading of emotional elements onto one factor and cognitive elements onto the other.

Tonyali et al. [29] provided a rebuttal to the factor analytic research by presenting a sophisticated argument that was grounded on three key points. Initially, it is imperative to assign nomenclature to the constituents derived from factor analyses. While there may exist unanimity regarding the cognitive factor, the nature of the second factor, whether it gauges emotion or pertains to an alternative construct (such as health), and remains uncertain. Secondly, there is no justification for favoring an "affective/cognitive" clarification over an "attitude/something else" interpretation. In fact, the opposite could hold true if it were demonstrated that one of these factors exhibits a strong correlation with bieiand intention, while the other factor does not, or exhibits a weaker correlation. Finally, Gomes, Gonçalves, Maddux, and Carneiro [30] presented an empirical illustration of this phenomenon. The authors identified a health component that exhibited a weak association with behavioral intention, but demonstrated a positive correlation with health-related factors,

The notion of reasoned action may be harmed rather than helped by Hinsz and Nickell's [31] brilliant argument. No apparent means exists to disprove Kang and Lee's [32] attitude conception if the information from factor analyses may be used to either validate or refute the theory, depending on the researcher's level of persuasion. However, if scholars are unable to branch out from factor analytic paradigms, then this problem infalsification will remain insoluble. Megee [33] used factor analysis alongside an additional assumption called the association hypothesis. This theory proposes that strongly held ideas, whether cognitive or emotional, tend to form close ties with one another. Participants' retrieval processes involve the use of associative pathways connecting different types of beliefs, both cognitive and affective. Mirea, Rimbu, and Iordoc [34] found evidence supporting this idea by employing several different types of experimental designs. When adjusting for the possible confounding metrics such as belief valence, language similarity, and others, participants tended to retrieve the cognitive beliefs and affective beliefs closer to each other. Therefore, the reasoned action theory's claims that an attitude does not contain different emotional and cognitive components is reasonably (but not absolutely) falsified by these results. In addition, the theory has evolved as a result of this falsification, with the distinction now being included in more current versions of the theory.

Technology Acceptance Model

The Technology Acceptance Model (TAM) is a theoretical model rooted in psychology that seeks to elucidate the behavior of computer users. It does so by exploring the interplay between trust, attitudes, intensity, and their interactions. The model endeavors to offer a comprehensive account of the fundamental aspects of IT user behavior that culminate in IT user acceptance by delineating IT acceptance across specific dimensions that are relatively easy for the user to control. The extent to which consumers adopt new information technologies is influenced by various factors such as external influences, user perceptions of convenience and usability, user attitudes, behavioral inclinations, and actual usage. The objective is to assess whether specific variables can predict an individual's level of proficiency in utilizing a computer. The frequency of a computer's utilization is primarily contingent upon the user's assessment of its efficacy and ease of operation.

The phrase "information systems design theory" has been applied within a particular context. Designers draw upon a corpus of knowledge comprising of principles, assumptions, hypotheses, and overarching scientific principles from the domains of natural and social sciences to effectively translate design predicaments into resolutions for distinct categories of information systems issues. The theory of design comprises a collection of theoretical principles, standards, and ideas that are embraced by the scholarly community regarding the interconnection between these fundamental elements of design. The utilization of theory is evident in each design as they all make a reference to it. Assuming the validity of the concept, the implementation of design principles is expected to yield favorable results. The secondary objective is to provide beneficial normative constructs in the guise of practical guidelines by instituting all-encompassing standards. The initial theory utilized in this inquiry was the Kernel Theory. This is a compilation of scientifically formulated fundamental concepts, assertions, or methodologies. The process of codification was employed to elucidate the fundamental theories, using the principles of hermeneutics. The Kernel Theory can be employed during the information system design phase to produce forecasts regarding the performance of the proposed solutions, as presented in **Table 2**.

Table 2. Elements of the IS Design Theory

Goals/Requirements	Description of the Goals' Class for the Theory
Design principles	Procedural codification whereby when employed enhances the probability of attaining the required system features. The procedures are obtained logically from the kernel theory.
Kernel theory	The theory from social and natural sciences providing governance to design processes and requirements arriving at them.
Systems features	A collection of IT artifacts that are hypothesized to accomplish certain requirements.

The extant theories pertaining to the construction of information systems design theory represent instances of distinct sub-theories within the broader domain of design theory. These sub-theories can be synthesized to yield practical recommendations for the development of particular types of information systems.

Information Infrastructure Definition

The term "IT infrastructure" pertains to the interconnected system of electronic devices, including computers that facilitate the fundamental back-end operations of an enterprise. The term "IT infrastructure" pertains to a corporation's significant expenditures in services, software, and hardware, which may encompass education, training, and consulting. The IT infrastructure encompasses the assemblage of software and hardware components that are necessary for the functioning of an enterprise. Apart from the tangible constituents, an entity's information technology framework encompasses the personnel and assets essential for the smooth functioning of routine activities. The utilization of a company's IT infrastructure as a means of providing service to customers, suppliers, and employees is a viable option for businesses. The optimal condition for this infrastructure is to provide complete support to all organizational information systems and commercial undertakings.

Table 3. Elements of the IS design theory for information infrastructure

Goals/Requirements	Develop the integration base as to gain momentum, control flexibility, and provide evolutional openness
Design principles	A codification of about 5 principles that when employed will enhance the probability of attained the required collection of systems features (openness, managed complexity, and development in installed base): Making it simpler, designing initially for usefulness, drawing on the prevailing installed base, expanding installed base by a persuasive approach, modularizing by constructing separately the functions of every infrastructure, gateways and use layering.
Kernel theory	Evolutionary economics, complexity theory: Utilize modularity to provide organic evolution and growth; establish lock-ins via positive networking externalities; identify path dependency; gain momentum; and enhance organic growth and novel combinations
Systems features	Shared, evolving, heterogeneous collection of installed base IT capabilities among the users' community

The strategic plans for commercial and corporate information systems are significantly impacted by emerging information technologies. The emergence of novel IT has a significant implication on IS and business strategy, as well as the range of services that may be issued to potential customers. It provides the capacity to effectively adapt to novel situations that may arise over the lifespan of a given model. The system exhibits a robust structure that enables modifications to be executed internally. Organizations that undergo changes and reorganizations require information systems that are adaptable. Such adaptability extends to the construction of data, which forms the foundation of the database. This framework is crucial in maintaining the operational structure of the information system, as depicted in **Table 3**.

The notion that Intelligent Information (II) is dynamic phenomena that undergoes growth and evolution over time is substantiated by a comprehensive analysis of literature by Yang, Xu, Kuang, Wang, Gao, and Wang [35]. This approach

enables the portrayal of these dynamics and provides a compelling argument in support of the theoretical framework supporting this investigation. Pena-Caballero, Kim, Gonzalez, Castellanos, Cantu, and Ho [36] posit that the implementation of information infrastructures is a means for companies to enhance their competitiveness and progress their business strategies. Enterprises operating in fiercely competitive industries encounter external pressures, and the implementation of Intelligent Information Systems (IIs) can be regarded as a tactical remedy to these predicaments. Simultaneously, these modifications establish and modify the competitive environment within which enterprises function. In order to enhance its competitive edge in the international market and withstand increasing competition within the industry, IBM undertook a comprehensive overhaul of its infrastructure centered on a Customer Relationship Management (CRM) system during the latter part of the 1990s. The objective of IBM's implementation of a customer relationship management system was to expedite the various stages of the business process, including the identification of business opportunities, the formulation of offers, the drafting of contracts, the delivery of solutions, and the monitoring of customer satisfaction. The aforementioned deployment, however, brought about a modification in IBM's competitive environment.

Dos Santos [37] posit that corporate performance can be indirectly influenced by strategic investments in information and communication technologies. Contemporary corporations not only establish information infrastructures to satisfy market requirements, but also to adapt to the modifications resulting from technological advancements in the information technology domain. It is imperative for organizational infrastructure to undergo adaptation in order to align with emerging industry standards and achieve compatibility with widely accepted ones. Each infrastructure's set of standards involves a compromise between consistency and flexibility, necessitating ongoing development and adjustment. The aforementioned conflict serves as the primary impetus for the restructuring of the information infrastructure. The implementation of standards, in fact, reinforces the de facto standards, thereby influencing the technical domain within which commercial enterprises function. The argument in [38] provides evidence of the importance of standards in the creation of Norsk Hydro's II. The implementation of the Bridge standard is expected to have significant implications for the organization's proposed infrastructure expansion.

The initial data center of the organization was constructed in compliance with the Bridge protocol. As a consequence of this initial determination, all updates pertaining to II were mandated to conform to the Bridge standards. As a result, Bridge has emerged as the prevailing standard for all software deployments. Consequently, Bridge has undergone development and adaptation to facilitate the enlargement of the infrastructure. The aforementioned process has reinforced the Bridge platform, rendering it challenging to create solutions, which are not in compliance to Bridge standards. It is imperative to update and adapt the existing information infrastructure when introducing new infrastructure for similar reasons. This category encompasses both technical and organizational changes. It is imperative that the novel infrastructure is constructed in a manner that is congruous with all pre-existing systems.

Consequently, it is necessary to devise fresh benchmarks to guarantee such compatibility. The continuous standardization and gateway development will render adaptations and modifications to current systems more arduous and time-intensive, as per the findings of Higash [39]. This serves to strengthen the current infrastructure and increase its resistance to modification. Similarly, the internal arrangement of processes and routines within a corporation necessitates modification to accommodate the novel information architecture. According to Horoshilov, Krasnikova, Rybkina, Enina, Milovanova, and Kranov [40], the ease of restructuring work processes and routines can be facilitated by the redistribution and reorganization of information flow, which in turn affects the dependency of pre-existing organizational departments and functions. This is a characteristic feature of new IIs. The recently introduced II offers a contextual explication of the information streams and interconnections within organizational settings. It has been observed that the imposition of rules and standards by an individual or entity can curtail the ability of an organization to be agile and adaptable in certain circumstances. Undoubtedly, any advancement in technology or alteration in business practices will inevitably result in unforeseen outcomes.

User communities and technologies are subject to the constantly evolving information infrastructure, yet they also play an active role in its development. The outcomes of these effects could potentially be advantageous, as they may motivate these entities to increase their investments in information infrastructures. Conversely, they could also be detrimental, resulting in the creation of disgruntled individuals or groups commonly referred to as "angry orphans". Both favorable and unfavorable consequences exert influences that shape the second iteration. According to Dai, Kauffman, and March [41], although agents within an organization may strive to promote a particular technology by aligning their interests with it, the technology may have unintended consequences by serving the interests of other individuals within the organization and generating outcomes that were not initially foreseen by its original supporters.

Authors in [42] observe that the placement of Norsk Hydro II is positioned by the arrangement of interests within the architecture, while also being subject to resistance from other stakeholders. The case study of SAP implementation at Norsk Hydro exemplifies the collaborative efforts of a company's IT department and management to establish an infrastructure that proactively shapes its environment and future prospects. The technology is interconnected with other groups and is shaped by their influence. However, it is possible for relationships to undergo changes as time progresses. Initially, SAP was in alignment with the senior management of Norsk Hydro and functioned as a powerful catalyst for change. Subsequently, SAP collaborated with regional managers and end-users, providing guidance to steer the transformation towards its intended trajectory. The function of SAP underwent a transformation upon its integration into the wider information technology infrastructure of the enterprise. In summary, it emerged as a formidable obstacle for all

stakeholders due to its steadfast resistance towards any endeavors aimed at implementing organizational reforms, and instead bolstered the pre-existing infrastructure.

The efficacy of user-inclusive information system development is contingent upon various factors beyond the developmental constituents. In this particular context, the term "users" encompasses a diverse group of individuals, such as programmers, managers, builders, owners, analysts, and developers, and other stakeholders who have a vested interest in the project at any given phase. Structured problem solving is a viable approach that can be employed when attempting to address intricate problems. The identification of strengths and weaknesses of a system can be achieved through meticulous documentation of the development process. An efficient system is characterized by its optimal utilization of information technology. The evaluation of exemplary and competitive systems is frequently based on predetermined benchmarks. It is customary for analysts to establish overarching standards that delineate intricate and dynamic systems, such as database technology, software, and related domains. An effective system in both present and future contexts must possess the quality of adaptability. Thus, in order to effect modifications, it is necessary to focus solely on select areas where the work has been accomplished.

V. CONCLUSION

The significance of Information Technology (IT) in an organization's triumph lies in its ability to impact the procedures involved in the creation and acquisition of value, ultimately leading to profitability. The majority of extant literature pertaining to the role of IT in strategy is flawed in its portrayal of IT as solely a functional-level strategy. Due to the pervasiveness of this misapprehension, there is a need for a comprehensive reconsideration of the strategic function and its complex interconnections with the profit-generating operations of enterprises. The empirical evidence indicates that the involvement of users is a critical factor in achieving favorable outcomes in information systems development. It is essential to document the process of system development to enable the evaluation of its benefits and drawbacks. The central objective of information system development is to achieve seamless integration between the user and the system. The evaluation of a system's perfection and competitiveness is based on these established criteria.

Data Availability

No data was used to support this study.

Conflicts of Interests

The author(s) declare(s) that they have no conflicts of interest.

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