Journal of Theoretical and Applied Information Technology
31st December 2023. Vol.101. No 24

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

ANALYTIC HIERARCHY PROCESS-BASED EVALUATION APPROACH FOR DIGITAL TECHNOLOGY SERVICE MANAGEMENT

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ABSTRACT

Rapid digital technology advancement, automating of production procedures, and effective decision-making in company operations are all results of the industry 4.0 revolution. There is a lack of empirical study examining the desire to embrace industrial technology for managing services, considering the potential advantages of industrial technologies in operations administration that have been described in the existing literature. By discussing how disruptive innovations that includes the Cloud Computing (CC), Internet of Things (IoT), and Artificial Intelligence (AI) support service transformation in industrial firms. In a time of lightning-fast technological development, the contributions of research in information technology are important because they are essential in spurring innovation, improving system performance, and tackling difficult problems all of which help to shape the course of the digital revolution. Component-level issues like data are transformed into information and knowledge by the technologies using the Analytical Hierarchy Process (AHP) model, which enables the evolution of services. Even though it is primarily required for becoming an availability provider, the study identify that IoT is the cornerstone of any service change. Advancing to an effective provider profile requires AI. CC is specifically utilized to apply an industrializer approach, resulting in established, predictable, and component products, in addition to offering adaptability across every profile. The study examines the potential for operations managers to efficiently and effectively recognize technologies intended to increase productivity in operations according to the findings.

Keywords: *Industry 4.0; Digital Technology; Digital Transformation; Service Management; Analytical Hierarchy Process;*

1. INTRODUCTION

The economy of the country has been increasingly becoming digital in the last few years, and legislation and regulations have now been passed with the intention of laying the groundwork for the shift to revolutionary, digital technology. When it became essential to organize, simplify, and digitize certain business operations that were performed by firms as well as activities conducted at the national, regional, and municipality levels, the emergence of digital technologies started at the very end of 2016 [1]. At both corporate and business levels, programmes and initiatives pertaining to the transition to revolutionary and technologically advanced digital technologies are being embraced in order to attain the objective. It is anticipated that the move to digital innovations will not merely secure the general expansion of the economy of the country but also improve the effectiveness of specific company procedures at various economic firms, reduce expenditures, and boost production. All regarding this will help make the country's economy increasingly competitive overall, improve the standard of products and services, and encourage the development of novel approaches to business and network frameworks [2]. Digital technologies are simultaneously intended for applications in company operations, communities, education, healthcare, and the administration of government. IT research makes a positive impact by stimulating creativity, propelling the creation of innovative technologies, and expanding the frontiers of technological feasibility. It is essential for maximising the usability and efficacy of IT systems by reducing procedures, increasing system efficiency, and enhancing overall performance. IT research offers answers to difficult problems, tackling problems like managing information, cybersecurity risks, and scaling challenges while strengthening the stability of digital ecosystems. Helps stakeholders make well-informed decisions about technology adoption, budget allocation, and safeguarding IT infrastructure by providing strategic advice and vision. Acts as the cornerstone for programs aimed at digital transformation, allowing businesses and sectors to change with the times and remain successful in the digital era.

Significant developments are taking place in global manufacturing, and businesses must respond to the increased pressure of competition brought on by customization and differentiation. Automated and technologies for digitalization built on the use of sophisticated information technologies and systems enable the flexibility needed to withstand these modifications [3]. The raises awareness of the possibilities for industry-wide adoption of digitalization and technological advances to gain an advantage in competition. While adopting new technologies can improve a business' manufacturing and process skills, it could prove to be inadequate enough to provide a sustained competitive edge over other companies. Obtaining an edge over the competition depends, as is widely acknowledged, in large part on the capacity to launch new items to customer demand [4]. Nevertheless, only about 30% of the companies have developed an innovative or considerably enhanced goods or procedures over a duration of three years, therefore the good development rates achieved by the companies are not very encouraging. Therefore, an important query is whether implementing technologies as a type of innovative processes may aid businesses in their attempts to increase product development and provide innovative goods and services. Particularly with regard to businesses in the process businesses, where there is a strong correlation between manufacturing technology and innovation, the connection between technology and innovative product and service has hardly been investigated [5]. These sectors may be less likely to employ technology as a tool for new innovation in products and services due to their concentrate on the handling and transforming basic supplies. Producers of plastic and rubber materials, chemicals and Pharmaceuticals Company, manufacturers of metallic substances, and makers of food and beverages are a few instances of businesses in the process industries.

The implementation of digital technology is a crucial building block for manufacturing businesses to launch novel services, according to research from other sectors of the economy. Manufacturing companies can improve their entire business competitiveness by providing independent services or services to promote the implementation or utilization of merged tangible products, but it is unresolved to what extent the widespread utilization of technological innovations has a connection to the development of innovative goods and novel offerings that will eventually contribute to competitiveness in the marketplace Single instances from the procedure industries demonstrate the possibility of technological innovations for the advancement of novel products and services [6]. For example, in the mining sector, sensors and digital representation technological advances allow businesses to create a digital replicas of the underground and frequently remote the mining process mechanisms, allowing for real-time remote monitoring and boosting productivity as well as security. Digital technologies allow innovative research and development methodologies in both the pharmaceutical and chemical sectors by enabling quicker simulations when utilizing novel compounds or a more environmentally conscious manufacture of chemicals based on big information or artificial intelligence [7]. The advancements of digital technologies also enable businesses to do specialized investigation to test the supplies that are in the applications (for example, friction qualities of lubricant in breakers), resulting to the invention of services in addition to the retailing of the unprocessed components.

Digital technology changes how procedures and methods get carried through. Organizations and businesses must adapt or risk getting left below. As a consequence of digitalization, organizational processes have evolved, which is also creating new opportunities for producing value across sectors globally. Businesses all through the globe are focusing closely on digitalization because it has great benefits for many different industries. Digitization has greatly benefitted industry, particularly in manufacturing and production, however there remains a great deal of untapped potential [8]. Performance throughout every aspect of the value chain has been greatly improved because to automation, artificial intelligence, big data statistical analysis, and Internet of Things developments. To digitize their corporate operations, several companies are investing heavily.

A fundamentally important characteristic that is driving the tremendous change in organizations and the environment of competition is the characteristics of digital technologies. The impact of these technological innovations is now manifesting with "full force" and enabling "unprecedented things" in order approach a turning point. Various technologies, including mobile devices, geographically based, virtual environments, digital duplicates, the block chains, the use of artificial intelligence, connected devices, chatbots, the field of neuroscience, and the automation of business processes, are currently convergent [9]. The Internet of Things also enables machine-to-machine interactions. The breakthroughs combine several technologies from the tangible, digital, and social environments, building on and amplifying one another. Additionally, due to their constant communication and accessibility, technological advancements facilitate greater authority, regardless of their location. These characteristics are apparent in contemporary services and goods and allow for instantaneous communication as well as access to a wealth of information as well as computational capacity [10]. More businesses are developing digital technology that are very reactive and are capable of moving commodities from the production facility to the consumers as soon as requirements are received as technological advancement replaces outdated working methods. The era of factories producing items while sales representatives awaited to market them is gone from existence [11].

Adoption of digital technologies has been proved to boost an economy's capacity for innovation. Most academics concur that digital technologies provide doors for creative thinking and entrepreneurial activity by altering the structures of value generation and value capturing, which in turn helps to increase the competitive advantage of innovations. Thus, it appears unarguable that being adopted of digital technology has a favorable impact on innovation [12]. However, the widespread implementation of digital technology may strengthen the competitive environment in the business ecosystem while burdening businesses with environmental costs; in addition, it is unclear how the adoption of digital technologies influences businesses' effectiveness in environmentally friendly development. While the fundamental processes by which technological advances adoption influences enterprises' effectiveness in environmentally friendly development remain unambiguous, investigations on the relationship between adoption of digital innovation and technological advancement effectiveness in businesses have a tendency to concentrate on the immediate impact of adoption on innovation efficiency [13]..

An approach for generating decisions that may be utilized to assess and rank digital technology managing services alternatives is the analytical hierarchy process. In order to offer consumers dependable and effective service, digital technology service management comprises managing technological innovations such hardware, software, and networking. An organized method called the Analytic Hierarchy Process helps decision-makers to assess complicated issues by dissecting them into a simpler manner, smaller portions. The decision requirements and options are arranged into a decision tree utilizing a hierarchical structure [14]. To identify the requirements relative relevance in reaching the intended result, the requirements are then assessed and compared to one another. By establishing the decision hierarchy, allocating weights to the requirements, and comparing the possibilities to the requirements, the Analytic Hierarchy Process may be used to evaluate digital technology service management [15]. Cost, dependability, accessibility, reliability, safety, and satisfaction among consumers are just a few examples of the criteria that might be used. Numerous Digital technology service management options, such as cloud-based service management, premise-based solutions or hybridization strategies, might be the alternatives. According to the decision maker's choices, the Analytic Hierarch Process compares the requirements and options in pairs. The weightings for the requirements and alternative are then determined using the comparison findings, and a final score is then determined for each option. The suggested course of action is then determined by which choice received the greatest score [16].

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

2. RELATED WORK

Bryukhovetskaya et al. suggested managing the growth of digital technology in the country's economy [17]. The management of the advancement of digital technology in the economy of the country is the focus of the essay. The study's analysis revealed that the Federation of Russia is ranked 23rd out of 32 countries in terms of the advancement of the digital economy. Despite that, Russian businesses and the economy have no plans to halt their efforts, and numerous manufacturing enterprises are prepared to invest several hundreds of billions of ruble in the use of technology in the decades ahead. The absence of the required infrastructures expertise, state assistance, monetary resources, cyber security threats, and other variables, along with other considerations, were highlighted as transitional risks and impediments. Because of the above, the research put out established a framework of the variables influencing the growth of the digital economy, whose management will guarantee a both quantitative and qualitative shift to cutting-edge and technologically advanced digital technologies. However, depending on the situation, there may be a number of variables that aren't constantly predictable during the period of change to digital technologies; these variables could be associated to a shortage of essential technologies, a deficient digital infrastructure, circumstances and characteristics of the functioning of digital devices, an absence of an equipped base of businesses, among other things.

The Digital transformation employing digital technology for the subsequent generation of services has been proposed by Mohamed Zaki [18]. The goal of the article is to analyze the digital evolution and its four trajectories, including the client experience, based on information models of business, technological advancements, and digital planning, which might influence the development of the future generation of services. It also involves an investigation of the prospects that will allow businesses to develop and capture value through new business models, as well as whether the market and organizations are fully prepared for the digital shift. Offering services is a tried-and-true method for maintaining competitive advantage, generating steady long-term income, and creating new market prospects. It is also evident that certain firms are finding it difficult to undergo a digital transformation. As a result, the analysis offers a small glimpse into how businesses investigate the potential of technological change and travel through these unfamiliar waters. Modern digital technologies have an impact on a company both inside and outside, allowing for the development of novel business strategies and redefining the customer experience. The current owners are well aware of the fact that they must strategically restructure and create novel value chains and networks.

The Management of ICCT Fundamental Technologies utilized for Digital Service Innovation was proposed by Aithal [19]. Information, communication, and computation technology, often known as digital technology, is regarded as a general-purpose, universal technologies since it can address a wide range of issues in human civilization relating to fundamental requirements, cutting-edge demands, and aspirational goals. Numerous quality aspects of digital services as well as some well-known written works related to digital service innovation have been firstly recognized in the chapter. For potential innovations in these industries, the key fundamental technologies of ICCT that are now being recognized as 21st-century technologies are taken into consideration. These include AI and robotics, big data management and analytics for business, cloud-based computing and archiving, internet marketing, 3-D printing, the IoT, online common education, quantum computation, data storage technology, and augmented and virtual realities. The management of ICCT fundamental technology utilization techniques for digital service development in tertiary sector businesses are investigated, and the uses of ICCT fundamental technologies in several of the well-known service industry areas are discovered.

Mark et al. [20]examines the influence of ITIL on transforming the management of IT services. The success of enterprises depends on the provision of successful information technology services. The Information Technology Infrastructure Library, also known as ITIL, was deployed by five Australian organizations, the findings of which are presented in the report. As a result, all of these organizations have revolutionized their management of IT services to offer their organizations a number of significant advantages, including more stringent testing and system change management, foreseeable infrastructure, enhanced IT group consultation, a decrease in server errors, effortless end-to-end assistance, recorded and standardized IT service management procedures throughout the organization, and consistent incident logging. Implementing ITIL successfully depends on getting the impacted individuals on board, getting top management's backing, and communicating the outcomes.

Tao et al. [21] predicted that blockchain technology and digital twins will improve the administration and collaboration of smart manufacturing services. The Industrial Internet platform-based manufacturing service collaboration has recently emerged as the primary approach for manufacturing cooperation, where several interest-independent stakeholders are involved. It is due to the growth of technological innovations and individualized demands. However, the platform's progress is hampered by the mistrust amongst stakeholders (mistrust among collaborators and concerns about data accuracy). Manufacturing services that are primarily based on static information struggle to adapt to shifting physical conditions, which dissatisfies stakeholders who depend on the quality of the data. In addition, people stay away from the site due to distrust among unknowing stakeholders. Blockchain (BC) and digital twin (DT) technologies have received a lot of attention because they can offer a reliable mechanism for the procedure of integrating cyber and physical systems. The study suggests a DT-BC improved manufacturing service collaboration mechanisms towards the Industrial Internet platform as a result of the inadequate interaction of physical as well as cyber spaces and distrust difficulties encountered in the implementation of the present Industrial Internet platform dependent manufacturing service collaboration.

The Performance Implications of Digital Technology Adoption on Product & Service Innovation: A Process-Industry Perspective was researched by Blichfeldt and Faullant [22]. European manufacturers are under growing pressure to embrace the digitalization technologies covered by the new Industry 4.0 framework. On the other side, capacity for innovation are crucial for offering new goods and services and are crucial for gaining a competitive edge. Although there is a common link between technology adoption and business innovativeness, the connection is not commonly recognized. In particular, it is unknown how technological adoption, innovation in products and services, and competitive advantages connect to process industries. In order to incorporate acceptance of digital technology, the article builds and implements a theoretical framework for new innovation in goods and services. Researchers examine data from process sectors through a qualitative investigation utilizing quantitative information from the European Manufacturers Survey. The key findings demonstrate that businesses that use digital technology more extensively are capable of introducing radical new services and goods improvements. Companies that innovate both radically and in terms of services considerably increase the potential of their applied technology. Contrary to the expectations, radical technological advancement in the processing sector does not result in increased returns on sales. Digital technologies are employed to create new products and services in the low-tech industries, which results in improved performance. The research has several restrictions. Initially researchers employed information from the European Manufacturers Surveys which includes well-recognized indicators of technological innovation and uptake. The innovation measure merely records whether enterprises supplied new items to the market, rather than how numerous, despite being built on the CIS-type assessment for innovation in products and services. Furthermore, the assessment for radical innovation seeks to represent the level of innovativeness by determining if any of these new goods were novel on the market. There is considerable flexibility for interpretation when determining whether a good or service that is unique to the market is actually radically revolutionary because it depends on the features of that market.

Cagliano et al. examined the factors influencing supply chain adoption of digital technologies. With the help of the Industry 4.0 framework, which is transforming supply chain organizations, the article aims to highlight the key trends in the deployment of new digital supply chain technologies. In order to do that, a collection of DSC efforts have been examined using a Measure of Variance in order to comprehend the impact of various social and economic aspects on the adoption of DSC solutions. Findings indicate that key factors influencing the adoption of DSC technologies include time, GDP per capita, the quantity of overseas investment, and R&D spending. Even while both of these innovations, together with virtual reality and AI often describe most current applications, Big Data are connected with a larger financial effort than blockchain. The current results may encourage research into the contextual elements influencing DSC dissemination and help practitioners and policymakers develop effective DSC initiatives. The study encounters certain limitations. Initially the magnitude of the investments in each of the assessed DSC initiatives has not been considered into account. Similarly, the repercussions produced by project execution have not been here explored. Finally, because the work's major focus is on how the business environment affects the implementation of DSC methods, it neglects to take into account issues pertaining to the SC operations or the SC echelons that the companies who are working on the projects [23].

Jantti et al. [24] investigated how digital culture and transformation were present in service organizations. The rise of digital technology affects how people and businesses work and engage with their surroundings. Service organisations face both possibilities and threats from emerging digital platforms. Having a good impact on consumers' perceptions of service is one of the worthwhile chances. Addressing and surpassing shifting client's requirements through internet channels, platforms as well as interactions is what is meant by "digital experience". In the essay, researchers concentrate on investigating how digital change and cultures relate to service management. The study's central research question is: How do organizations that offer services for consumers perceive the change in technology and digital culture. The primary contribution of the study is its conclusion on digitalization issues, developments in digitalization within routine service management tasks, and activities service personnel take to foster and advance the digital culture. Data collecting involved using a variety of business collaborators for the TUPLA project as well as perspectives about digitalization.

3. PROPOSED ANALYTICAL HIERARCHY PROCESS

The research that is being reported in this investigation is exploratory because the subject field is still developing. Creating an investigation strategy before starting theory-building work is advised. Then, based on research from a sample of three businesses, these concerns are addressed utilizing a qualitative multiple case study technique. When developing a theory in its early phases of exploration and when the phenomena being studied are not fully understood, case research has shown to be very helpful.

3.1. Data collection and analysis

Secondary sources, including corporate documents, websites, and company presentations in open workshops, have been used to supplement and triangulate the information acquired. The participants' responses have been examined in regard to the structure for every service offered by the researched case as well as for the entire offering, the influence of each digital technology examined, including its relationship to the trajectories.

The sample that was gathered has been determined to be sufficient. Any missing values and non-engaged replies that were not included in the data were validated in the database. Exploratory factor analysis (EFA) was used during the analytical phase. To guarantee that only pertinent items are incorporated, EFA enables the recognition of the primary structures or dimensions present in the data. Data assessment, qualitative analysis, factor analysis, findings interpretation, including a test for reliability are all included. The common variance was examined using the single-factor Harman test. To identify a sufficient number of components to account for variation, the EFA is performed, and the unrotated solution is examined. Maximum Likelihood was employed as the extraction technique for the statistical evaluation.

3.2. Analytical Hierarchy Process

The AHP approach [25] is a useful tool for analyzing the factors influencing the issue in situations where instinctive decision-making is prevalent. The contrast matrices adjust the criteria proportionately to one another using multi-level hierarchical frameworks. The problem-solving criteria and sub-criteria are modeled using a hierarchical framework. It features a straightforward and straightforward solution procedure for assessing these requirements collectively and individually. The AHP method's solving approach essentially consists of four phases of implementation.

Step 1. Developing a hierarchical framework and describing the decision-making problem.

The problem's framework is specified, and the standards that will affect it are chosen. For the issue, a hierarchical structure with multiple levels is created. A hierarchical framework with a purpose, criterion, potential sub-criterion stages, and possibilities is developed for every difficulty.

Step 2. Generating matrix for evaluating the requirements.

By using binary assessments, AHP derives the important values of the parameters. when the

Journal of Theoretical and Applied Information Technology
31st December 2023. Vol.101. No 24

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

binary evaluation has been completed. Table 1 displays the scale parameters.

Step 3. Assessment of the criteria's significance.

The generation of normalized matrices is the following step in the AHP process. Every column value is multiplied by its corresponding column total to create the normalized matrix. The median for every sequential value is calculated after leaving the normalized matrix. The significance weights for every criterion are represented by these determined values.

Table 1: Scaling parameters

Level of importance	Description
1	Uniformly important
2	Medium level important
3	Partially important
4	Medium level important
5	Strongly important
6	Medium level important
7	Very important
8	Medium level important
9	Extremely important

Step 4. Examining the comparison matrices' reliability proportions.

The homogeneity of the matrix of comparison must be taken into account after determining the weights. The weights produced are unable to be used if the comparison matrix is inconsistent. First, one must acquire the vector (max) that guarantees the equality (M*w = λmax*w). "w" stands for the obtained weight matrix where "M" is the comparison matrix. The consistency index (C_I) is derived using the equation.

$C_I \frac{\lambda max-}{n-1}$By multiplying the weight vector by the corresponding values that are relative, the value max is produced. The Random Index (R_I) must also be determined once the C_I value has been computed. It is given for various matrix sizes. Table 2 displays the $R_I$values for various matrix sizes.

Table 2: Variable of Random Index

Random index	0	0.64	0.59	0.10	1.11	1.23	1.35	1.42
Size of matrix	1	2	3	4	5	6	7	8
Random index	1.48	1.50	1.55	1.60	1.64	1.69	1.72	
Size of matrix	9	10	11	12	13	14	15	

Finally, using the ratio of C_I to R_I, a "Consistency Ratio (C_R)" is discovered. The usage is consistent if the CR is less than 0.1. This number should not be surpassed, and a new assessment of the judgements is necessary.

$C_R = C_I/R_I$ The unpredictability index in this case is called R_I. The number of elements of the contrast matrix, or the n value, affects R_I.

An additional approach that may be used for the numerous issues that arise every day is the AHP technique. Decision-makers have the ability to evaluate options, criteria, and sub-criteria in both tangible and abstract ways. The AHP method, which can be applied in any situation requiring decision-making, was chosen as an application tool.

3.3. Research framework with Case study

A network of business and academia that addresses service innovation in manufacturing organizations that was founded more than ten years ago, ASAP Service Management, was used to purposefully select two prominent companies for the study. The following factors are taken into consideration when choosing a case, including having the capacity to exchange information and take part in the research, as well as an acceptable depiction of cutting-edge technology-driven service improvements dependent on Internet of Things, CC, and AI. The primary descriptive information regarding the cases is a count of the interviews and responses for every instance featured. The strategic significance that the corporation places on the offer; the arrangements, structures, and tools utilized to create unique products; and the methods employed for gathering information, management, and protection. Existing interviews and data from various firms, including executives in the fields of product or service-service creativity, service and product organizing, and support and assistance management, were collected to increase the study's credibility. The conversations were written down. The researchers independently coded and double-checked the consistency of the material and fidelity to reality, then held an internal meeting to reach an agreement. The informants were then sent the minutes and the primary messages for evaluation and clarification.

Canon

Over the years, Canon has created pay-per-page agreements as a kind of documentation management services. The corporation strives to maximize equipment uptime because Canon charges clients based on the number of printed pages. The replacement of consumables, some scheduled servicing, and labor for repairs are all included in service contracts for this purpose. Canon regularly collects information on machine state and the number of copies printed in order to produce invoices, schedule maintenance chores, and purchase toner supplies. The information was first sent to Canon headquarters by clients and field technicians, who routinely visit customers' sites. It became increasingly likely that there was going to be more linked technology that regularly communicated its readings to the company's ERP as internet-based technologies proliferated. Connecting printers to the internet raised privacy issues, worries about how difficult it would be, and costs due to modifications to both the hardware and software as a result of the early ad hoc efforts made by Canon affiliates to streamline data collection and payment [26]. Canon created the cloud-based platform eMaintenance® in order to address these problems and profit from a significant initiative. Ink levels, activity logs, defect registries, and data relating to meters and machine status can all be sent to the platform by Canon equipment that is now installed all over the world. Printers are preset with an allocated IP address prior to installation. As soon when customers are linked to the client's system, they create a secure socket layer internet connection, register for the platform, and access their master data that has already been uploaded. eMaintenance solutions have also been provided by Canon to its network of standalone retailers. In this case, Canon employed webservice technologies to provide secure access to sensitive information about the customers and service contracts of other merchants for its partners.

Alpha

Alpha has historically provided performance-based services, starting out as a normal manufacturing business that made the majority of its earnings by selling industrial goods and maintenance services to the Oil & Gas industry [27]. Alpha recently started a major software venture dubbed Alpha Software in order to speed the development of DTs and services. By utilizing innovations that more efficiently utilize its comprehensive network of technological skills and years of expertise, Alpha has built a cloud platform for developing IoT applications for industrial gear. Furthermore, Alpha provides its clients and subsidiaries with field devices that can connect to the corporate controlling modules and send data over the World Wide Web or 3G/4G connectivity. IoT developers of applications may use the cloud platform to build up archives for keeping data collected from sensors in the field. Then, via a PaaS, they have access to a variety of tools that can be installed and customized. Workspaces may be used with simulation frameworks made in Matlab®, Simulink®, or other software to produce mobile-friendly dashboards, data analysis, time-series evaluation, and statistical analysis, for example. Alpha is merging situation monitoring and health monitoring apps that had been developed by software developers in exclusive tools onto the platform it controls in accordance with a mid-term strategy. Any producer of industrial machinery is expected to be able to subscribe to the platform and create their own industrial applications, according to Alpha. As more products and apps are made available as the basis of the PaaS method, the amount of coding required would reduce. In the end, Alpha seeks to support the development of an ecosystem of different players that shares information regarding predictive techniques, including suppliers, technology providers, research institutes, and systems integrators. It is obvious that adopting a comprehensive cloud approach is required to achieve this.

KONE

The last ten years have seen KONE, one of the biggest lift manufacturers in the world, refocus on its core values as a business "dedicated to people flow." In order to address this idea, KONE committed resources to creating people flow solutions that are easier to use, safer, more individualized, and connected. Additionally, KONE provides complete susceptible contractual support on the installed foundation, taking on the duty of achieving a lift availability level that has been set forth in the contract. However, KONE has encountered several challenges in determining whether the claimed efficiency is actually realized because to the heterogeneity, complexities, and size of the deployed bases. Additionally, an additional layer of complexity is added by the fact that about sixty percent of lift components are purchased from outside vendors. In order to get out of this predicament, the business has signed a deal with IBM to utilize Watson technologies to create smart building solutions. Initially a project that is still in progress uses Watson's machine learning skills to create condition tracking and preventative maintenance procedures that reduce downtime and hasten equipment rehabilitation. The business anticipates being able to remotely handle the majority of the technological problems in addition to spotting impending breakdowns and automated repair calls. Additionally, all equipment and plants installed in the structure, such as sliding doors, escalators, and elevators, will be linked together in accordance with a "system of systems" perspective [28] to provide coordinated solutions that adjust to the contingency of individuals flow and maximize their efficiency. KONE and IBM are developing insights to determine the entire cost of moving people inside a structure in addition to the reductions in energy consumption that correspond to different control logics in reaction to this problem. They also expect IoT technology to support automated and management of security in a manner that will ultimately make it easier for systems of monitoring to enforce access limits on specific areas for security reasons. Finally, "smarter" elevators that are able to adjust to a person's wants and limits are being developed.

4. RESULT AND DISCUSSION

4.1. Exploratory Factor Analysis (EFA)

The principal component analysis has been employed to identify the factors for an exploratory factor analysis (EFA) in SPSS Statistics. The results of Table 3's Bartlett's test and KMO measurement for the three models demonstrate that there is no multicollinearity and that the KMO values are within the range of a suitable sample size. The commonly used bias analysis on the three methods showed that the total variation explained by one component for AI, IoT, and CC. All values fell below the 50% cutoff, indicating that common procedure bias did not impact the data utilized for research.

Table 3: Barlet and KMO testing of three models

Testing		Coefficient of CC	Coefficient of AI	Coefficient of IoT
Barlett's testing	Differentiation	274	300	324
	Sigmoidal	0	0	0
	Chi-Square	1457.82	1542.70	1720.55
KMO measure		.810	.835	.842

To further establish the validity of the employed measurements, correlation matrices, average variance extracted (AVE), and composite reliability (C_R) matrices were acquired. Tables 4, 5 and 6 in the appendix provide the results for every model, with AVE and CR values in every case exceeding 0.5 and 0.6, respectively, which have been regarded as suitable for evaluation. The correlation matrix findings support the models' validity as both discriminant and convergent.

Table 4: AVE, CR with correlation matrix of AI technology

	CR	AVE	MSV	MaxR(H)
EAI	0.713	0.556	0.480	0.733
RES	0.834	0.627	0.242	0.847
REQ	0.871	0.629	0.181	0.872
MAR	0.750	0.501	0.473	0.759
ADO	0.834	0.626	0.242	0.839

Table 5: AVE, CR with correlation matrix of IoT technology

	CR	AVE	MSV	MaxR(H)
EIoT	0.845	0.650	0.340	0.852
RES	0.829	0.615	0.250	0.845
REQ	0.880	0.630	0.180	0.873
MAR	0.750	0.501	0.346	0.762
ADO	0842	0.624	0.251	0.840

Table 6: AVE, CR with correlation matrix of CC technology

	CR	AVE	MSV	MaxR(H)
ECC	0.691	0.526	0.450	0.690
RES	0.824	0.630	0.245	0.850
REQ	0.880	0.635	0.328	0.853
MAR	0.754	0.510	0.355	0.759
ADO	0.840	0.630	0.244	0.847

4.2. Capabilities of Digital technology

The study determined a small number of digital capabilities that have been transmitted by the technologies examined in this paper depending on the conceptual elaboration. The study arranged these capabilities in ascending order, from lower to higher levels, or from data to information to knowledge, according to their optimal placement in the structure of the analytical hierarchy.

In conclusion, the report asserts that IoT is fundamental to the majority of the listed capabilities because it enables the data collecting and transfer that businesses need to implement cutting-edge activities and services. As a result, all of the scenarios in a substantial way use one or more IoT-related features. For instance, Canon develops cost-per-use business models by identifying both the product and the customer/user. A triple function is played by CC. on the first place, it is crucial for effectively and conveniently keeping massive volumes of field data on the IaaS layer. Consequently, this enables information collecting, linked IaaS and SaaS layer the process, and data aggregation. For instance, Canon pulls data pertaining to several items used by the same consumer. Canon is able to accurately bill the client for all of its equipment by purposefully gathering data about users and users' departments, organizations, and machine IDs. Canon can additionally generate bills that include details that support the customer's financial procedure. It is made possible by connecting the company's ERP and apps with IoT data stored on the eMaintenance system.

The establishment of "data lakes" that enable the use of AI-related skills, including estimation, adaptive management and optimization, and autonomy, is also a must for CC. When a business wishes to encourage the development of new ecosystems, like in the case of Alpha, this latter function—which is connected to the usage of PaaS layers are used.

4.3. Connection among IoT, CC, AI and the service paths

IoT is widely used in the execution of any service conversion plan because of its capacity to acquire, contextualize, and transfer data. It fits with the fundamental function of data in the AHP. IoT provides effective data collection from large fleets to implement activities that progress towards establishing a provider profile. This is best shown by Canon, that, prior to CC capabilities were developed, developed internet technologies and linked remote equipment to local databases for automating measuring of meters. IoT technology are also fundamental to other pertinent cost-per-use solutions' time-stamping, geolocation, tracking, and identification features. The integration of IoT and CC in its simpler forms, nevertheless, also helps moving towards a provider profile. SaaS is very effective for having apps that analyses the cloud's basic data and produce and disseminate information throughout the organization, whereas IaaS is highly effective for collecting field data collected by connected devices. Field data is normally sought after by businesses employing performance supplier strategies because they need to know how to attain the required performance. It is discovered that in this instance, IoT, CC, and AI are used when combined to gather information from field data as well as develop meaningful assertions about defects in products and consumer behavior. Artificial Intelligence methods have been used to simulate the level of service that needs to be accomplished in association with various operational procedures and configurations of resources to determine how advantages outweigh costs, and set predicted or pre-emptive steps, including distributing preventative upkeep or transporting replacement components. KONE is a good example of this scenario since it is implementing new control logics to minimize consumption of energy without lowering service levels and to stop individuals from accidentally entering areas that are banned for safety reasons during specific circumstances. These results are summarized in the context of Figure 1 together with the digital technology that enable the associated trajectories. The changes from and to a certain strategic profile are especially made easier by IoT, CC, AI, or their combined effects.

Journal of Theoretical and Applied Information Technology
31st December 2023. Vol.101. No 24

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

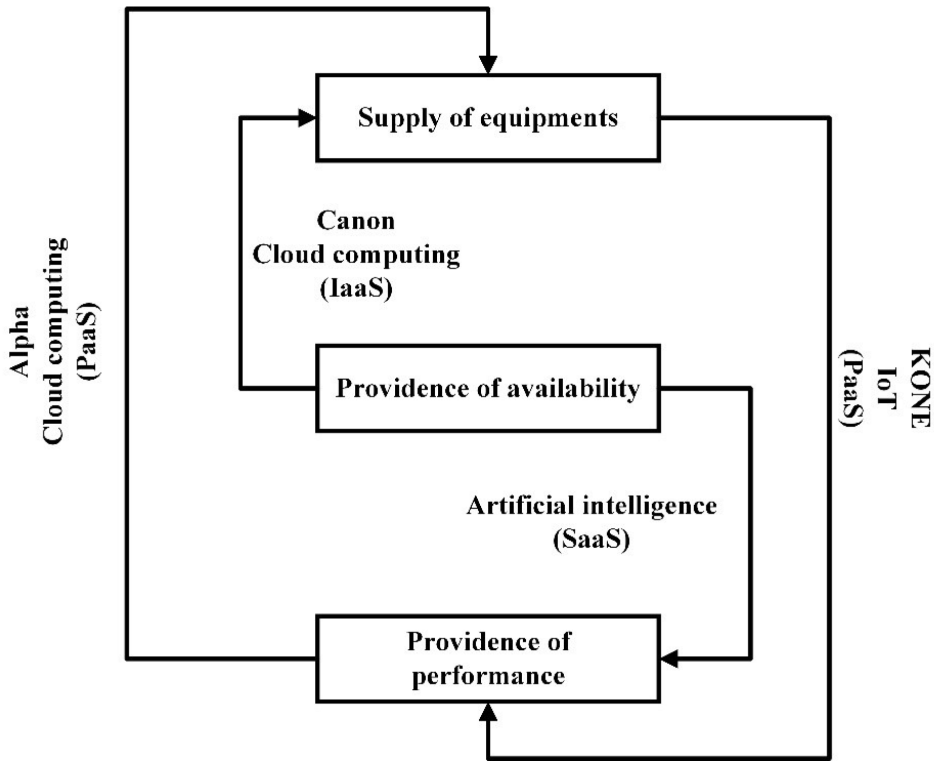

Figure 1: Connection among CC, IoT, AI with service paths

The application of IaaS and SaaS levels warrants more thought. Since data may be gathered and analyzed in more conventional ways, including by being kept in a local database where programs with embedded algorithms for forecasting operate, it contends that the use of them is not a requirement for following any of the two aforementioned routes. This group includes the monitoring and evaluation services that Alpha offered in advance of the launch of its cloud platform. However, IaaS and SaaS are useful tools for expanding technology concurrently with company development. It is seen in the industrializer path, which encourages companies to standardize and industrialize goods they have already developed, tested, and effectively promoted in other aspects like availability- or focused on performance with the goal to reach out to more consumers. The PaaS layer enables innovative technology to combine the component parts of a flexible service platform when efficiencies of scale and standardization are reached.

For instance, Canon serves as an example of how a supplier of accessibility industrializes the cost-per-page services and expands the newly developed abilities significantly outside of its organization. As Alpha uses CC to industrialize performance-based solutions, it advances. Utilizing this infrastructure, Alpha hopes to facilitate the gathering of data from manufacturing machinery and the development of internet-based industrial programs that simulate its expertise in terms of models for prediction while also having the potential to develop novel information from an entire ecosystem. The platforms for services could enhance the efficacy and efficiency of service management by preparing materials and enhancing resource density. This point of view is consistent with their assertion. In other words, because DTs promote resource mobility, the study affirm their potential for service innovation. Additionally, it is hypothesized that the integration of IoT, CC, and AI is especially important for businesses looking to "productize" their service offerings in order to go back to playing the role of a machinery supplier and market sophisticated offerings using a service-as-a-product strategy.

Table 7: GoF of three models

Measures of GoF	CC	AI	IoT
CFI	0.957	0.943	0.964
RMSEA	0.0356	0.063	0.824
TLI	0.951	0.932	0.944
GFI	0.840	0.820	0.821

Table 7 displays the goodness-of-fit (GoF) coefficients for the three techniques. To verify the model's accuracy in describing the data, various GoF metrics were computed. To evaluate the model fit, the study evaluated the comparative fit index (CFI), root mean square error of approximation (RMSEA), Tucker Lewis index (TLI) and goodness-of-fit index (GFI),. CFI, TLI and RMSEA values between 0.9 and 2.0 demonstrate good fit, while an amount of 0.8 for the GFI denotes an acceptable fit.

4.4. Discussion

I4.0 has emerged as a crucial facilitator for the digitalization of procedures and the redefinition of tasks in businesses all over the world. The significance of include risk management in industrial organizations' digital transformation has been demonstrated by the escalating environmental issues. It represents one of the processes, nevertheless, that is trailing behind in that progression. Additionally, I4.0's comprehensive implementation is still in its very early stages. The application of I4.0 technologies to reimagine important processes like risk management may be facilitated by comprehending the many aspects driving user acceptability and supporting that change. Depending on the RBV, theories of institutions, and TAM perspectives, the article has empirically examined the influence of organizational and outside variables within the implementation of AI, IoT and CC for service management. The goal is to create a deeper knowledge of how such elements affect procedures for risk management and the adoption of newly developed technologies.

Numerous chances exist for next employment. A comparable study conducted in a different country would enable the differentiation of managerial perspectives and the linkages between the components. The understanding of the usefulness and application of emerging technologies might be strengthened by an assessment of their anticipated usage and their actual utilization following an emergency. The study could compare businesses based on their various traits and technical prowess in order to examine differences between them. Future study would be interesting in exploring the linkages between the distinctive qualities of every novel technology and the different risk management processes to ascertain their effect on the behavioral intents of implementation of such technologies. Lastly, the inclusion of other emerging technologies may be useful to learn more about the featured constructions. The authors stress the necessity for close examination and identify possible risks to the reliability of their findings. The text justifies the critique criteria used, emphasizing the significance of addressing and reducing any possible prejudices or constraints that may affect the validity and applicability of our study findings. This open approach upholds the honesty of the investigation process and guarantees a detailed awareness of the research's advantages and drawbacks.

The Digital technology in the service evolution of industrial organizations is still lacking. The following contributions are made as part of the experimental attempt described in this paper to address this achievement gap.

The study initially concentrate on the three DTs that are IoT, CC, and AI, that are commonly referenced in the literature about service transformation. Researchers organize these technologies and discuss their characteristics in respect to the AHP. As far the researchers are aware, no prior research has addressed the application of the AHP architecture to categorize and explain the function and range of IoT, CC, and AI.

Secondly, based on the literature and several case studies, the study define critical digital competencies for service transformation. This compliments the larger study stream on organizational capacities for service transformation and subsidizes to the knowledge by formalizing and deepening awareness of this topic [29]**.**

Third, the study propose that, in accordance with the service transformation trajectories employed, the three technologies' contributions to the service management within manufacturing organizations must be assessed. Additionally, Researchers focus on the three modification of services routes that [30] suggested. Our analysis indicates that the IoT plays a vital role in pursuing the routes of reliability provider along with performance provider. Additionally, businesses following the efficiency provider path primarily depend on PA to analyse installed base data for knowledge and provide improved amenities. In these scenarios, the SaaS and laaS layers of CC function as significant but optional facilitators to attain cost effectiveness [31].

Implementing a the PaaS layer of CC also contributes to the industrializer trajectory's full assortment of advantages of standardization, the use of modularization and adaptability, which enable businesses to provide solutions achieved through mass customizing the elements of intermediate concentrations or advanced offerings. To the greatest extent of the knowledge, it is one of the earliest studies attempting to make a connection between DTs and, on one aspect, the digital possibilities allowed and, on the contrary, their function in assisting particular servitization tactics. The work that is being presented is critically examined, with an emphasis on methodological rigor, constraints, and the applicability of findings. This study stands out in the constantly evolving field of research due to its comparative comparison with recent literature, which exposes both common insights and unique additions. The analysis covers the study's advantages, disadvantages, and innovative areas and provides a thorough understanding of the study's standing and significance in relation to current research projects.

Fourthly, and finally, this study is consistent with recent contributions that have questioned the literature's common assumption that service management is a move with the range and have called for a deeper examination of trial-and-error methods and deservitization moves. By discussing the stages in the technological capacities of an organization that are necessary for effectively executing every kind of service transformation path, researchers contribute to the aforementioned study stream by trying to bring illumination on particular service management trajectories such as a standardization and management trajectory.

4.4.1. Managerial implications

The conclusions discussed in the research have practical application for practitioners as well. The discussion around the manufacturing company and the emergence of I4.0 is becoming more and more heated. However, the management community currently lacks a thorough knowledge of how to carry out these transitions and how to use DTs. In actuality, servitization poses a number of difficulties, giving rise to the so-called servitization paradox, which may cause businesses to undergo the reverse process of deservitization or even go out of business. On the contrary hand, manufacturing firms, particularly SMEs, might find it challenging to prioritise expenditures and effectively complete digitization projects because they frequently are lacking sufficient understanding about novel DTs.

The study helps administrators in these circumstances have a better grasp of the function of DTs as its initial contribution. Researchers help executives in understanding the service development possibilities offered by these kinds of innovations for their particular product-service offerings by illuminating the digital features made possible by the three DTs. The complete utilization of the CC, IoT, and AI technologies now integrated into a firm's product-service infrastructure can facilitate such greater understanding of concepts.

As a result of managers' recognition of the connections between DTs and the various service transformation trajectories, they are able to strategically align their business's service expansion strategies with decisions about the digitalization of their organization at the product or procedure level. This is accomplished by developing technological advancement projects that are consistent with objectives like the development of innovative business models or service portfolios. Managers may also understand the current technological landscape and the anticipated course of service change.

Third, expenditure choices on hardware/software upgrades aimed at enhancing certain capabilities may be influenced by the recognition of a collection of digital capabilities associated with the various DTs. At the exact same time, firms may more effectively determine which fresh abilities are essential for their employees to learn and grow in the short- and long-term by connecting those abilities with anticipated service trajectories, and they can focus hiring procedures consistently Researchers suggest an approach that illustrates how IoT, CC, and AI might be utilised by industrial businesses in their move towards the service industry in an effort to generalize and make the results from the study more "actionable" for operators. The paper's main contribution to the field of study on industrial businesses' digital transformation and transition to the service industry is a model that integrates the relationships between each technology layer and the various service growth trajectory.

5. CONCLUSION

The fast development of digital technology, the computerization of manufacturing procedures, and effective decision-making in company operations have all been made possible by the industry 4.0 revolution. Nevertheless, there is a lack of empirical study evaluating the desire to embrace industrial technologies for managing products and services, despite the potential advantages of these technologies in operations administration, which have been highlighted in the current literature. By discussing how disruptive innovations like the Cloud Computing (CC), Internet of Things (IoT), and Artificial Intelligence (AI) assist service transformation in industrial organizations. The technologies based on the Analytical Hierarchy Process (AHP) principle enable the creation of services by integrating component-level issues like data into knowledge and information. IoT is an essential component of each service change, even if it is mostly required for acquiring an accessible supplier, according to the study. AI is needed to advance to a useful provider profile. In particular, CC is used to use an industrializer approach, producing products that are well-established, established, and component-based in addition to providing adaptability throughout each profile. The research adds substantially to the body of information in the field due to its creative approach, exacting methodology, and thorough analysis. A small number of samples that could limit generalization, possible data limitations, and a restricted application area that might prevent wider applicability are some of the limitations. The study explores the ability for managers of operations to quickly and accurately identify technology aimed at improving operational productivity on considering the results. The study's shortcomings include its reliance on information collected over a limited time period, which would not accurately reflect the subject's changing dynamics, and its small sample size, which could restrict how far the findings can be applied. This study presents new ideas by creatively utilizing digital technologies. This work adds substantially to the body of knowledge by offering a novel viewpoint and illuminating hitherto undiscovered facets of the subject. The investigation of this sort of technology not only strengthens the validity of the results but also creates new directions for future study and adds to the body of knowledge in the field.

Based on the knowledge gathered from this investigation, future studies should concentrate on broadening the scope of the research to include a more varied and sizable population, while also addressing any possible generalizability issues. Furthermore, investigating other approaches and taking into account longitudinal data may improve the findings' robustness. Examining new developments in the field, such as emerging technology or growing patterns, and their repercussions would offer a forward-looking viewpoint. Additionally, working together with business stakeholders could make it easier to apply research findings in practical contexts, assuring the relevance and influence of future studies. All things considered, a multimodal strategy that blends quantitative and qualitative techniques while being aware of the individual's dynamic character will support a more thorough comprehension and ongoing progress in this field.

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