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Implementing the Robotic Process Automation Framework in Financial Accounting

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Abstract:
Purpose: The primary aim of this research is to examine the factors influencing the adoption of Robotic Process Automation (RPA) in Financial Accounting using the theoretical lens of Technological-Organization-Environmental Theory (TOE), Diffusion of Innovation (DOI) and Eight Lean Waste Management Theory (ELW) and provide a up-to date analysis and current framework.

Design/Methodology/Approach:The research followed the DesignScience Research Method (DSRM) to gather a literature review of 400 articles including search engines such as Science Direct, EBSCO, PROQUEST and Google scholar. The framework has been designed based on future research gaps.

Findings:The results propose the Integration of RPA and Artificial Intelligence (AI) for successful application of RPA in Accounting with scalability for Generative Artificial Intelligence (GAI) enabled RPA.

Originality/ Value:The research findings add originality to the body of Literature with valid framework for Application in Financial Accounting.The framework encompasses all parameters for human talent which provides technical insight to the current and future accountants to a great extent.

Key words: Robotic Process Automation, Financial Accounting, Generative Artificial Intelligence, Design Science Research Method, TOE Theory

Introduction

Robotic Process Automation (RPA) is defined as a software robot that automates structured, repetitive tasks [13][20]. The RPA mimics human behavior in processing a task [37][93].RPA is evolving into intelligent automation or hyper automation which is a combination of RPA and Artificial Intelligence ([17][75]. The emerging technologies in accounting are RPA, AI, GAI and Block Chain [84]. RPA is a non-engineering solution for the automation of repetitive structured tasks [75].RPA is a growing market with aCompound Annual Growth Rate with visible Return on Investment (ROI) of less than 12 months. RPA is an excellent service solution for automation in accounting, however as per prior research studies more than half of the projects implemented are not successful [93], hence intensive research on RPA Adoption and the statistical validation is necessary. AI projects are already in existence at infancy level in finance [24]. The benefits of RPA include benefits on ROI, Full time-equivalent savings (FTE) and stake holder satisfaction other than the time and cost savings [10].

Research Method:

The Design Science Research Method (DSRM):was followed throughout this research to form a robust framework. DSRM has applied in IS research and has recently extended its roots to Accounting Research. The unconventional creation of a framework with the most current and never before researched constructs calls for DSRM [29]. The Data as output must be meaningful to the stakeholders. An artifact subject to dynamic changes must be created from the real-world problems and to arrive at semantic constructs [45]. The DSRM has also been adopted for the new model development. The DSRM consists of six stages [20]:

1. Problem Identification and Motivation
2. Research Objective
3. Design and Development
4. Demonstration
5. Evaluation
6. Communication

DSRM activities	Activity description	Knowledge base
Problem identification and motivation	*What is the problem?* Define the research problem and justify the value of a solution.	Understand the problem's relevance and its current solutions and their weaknesses.
Define the objectives of a solution	*How should the problem be solved?* In addition to general objectives such as feasibility and performance, what are the specific criteria that a solution for the problen defined in step one should meet?	Kowledge of what is possible and what is feasible. Knowledge of methods, technologies, and theories that can help with defining the objectives.
Design and development	*Create an artifact that solves the problem.* Create constructs, models, methods, or instantiations in which a research contribution is embedded.	Application of methods, technologies, and theories to create an artifact that solves the problem.
Demonstration	*Demonstrate the use of the artifact.* Prove that the artifact works by solving one or more instances of the problem.	Knowledge of how to use the artifact to solve the problem.
Evaluation	*How well does the artifact work?* Observe and measure how well the artifact supports a solution to the problem by comparing the objectives with observed results.	Knowledge of relevant metrics and evaluation techniques.
Communication	Communicate the problem, its solution, and the utility, novelty,and effectiveness of the solution to researchers and other relevant audiences.	Knowledge of the disciplinary culture.

Figure 1 DSRM Research Method

Problem Identification and Motivation:
Organizations have emerging concerns about how to adopt RPA for their business processes. Which tool to be used, which technology to be utilized, which process to be automated and how to implement the same. RPA successful implementation fails in over 30% of the projects*[25]*. Hence there is a need to understand key constructs for RPA Adoption[10]. Accountants concerns regarding their future job and job skills as emerging technologies such as RPA and AI are adopted in accounting [91] The Motivation for this research is the concerns of both organizations, the accountants, and the emerging market for RPA.

Research Objective: The objective of this study is to develop a theoretical framework to address the construct that influences the Application of RPA in Accounting. The Research objective are as follows:

1. To study the positive impact of Innovation on Application of RPA in Accounting
2. To study the positive impact of Technology on Application of RPA in Accounting
3. To study the positive impact of Organization on Applicationof RPA in Accounting
4. To study the positive impact of Environment on Application of RPA in Accounting
5. To study the positive impact of Human Talent on Application of RPA in Accounting

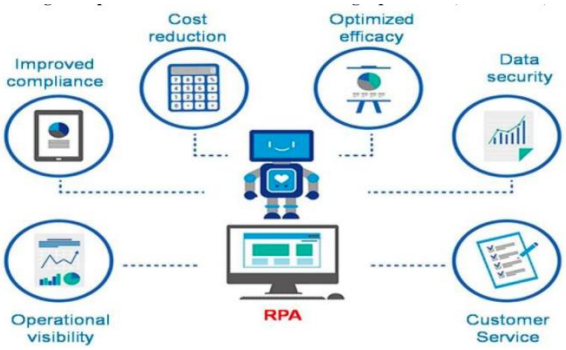
Design and Development:
The design and development phase involves an extant and intensive literature review process progressing to the development of Theoretical and Research Framework. The definition of the respondent population and sample size are covered in the Design and Development stage.

Literature Review:

Digitalization:
Emerging technologies such as RPA, AI and Block Chain are focused on transforming the accounting profession [38]. Automation and Digitalization encompasses the majority of our lives with lasting metamorphosis change that cannot be reinstated [43][11] and [70]. A myriad of available data has brought the focus on the need for automation [11]. The outsourcing of jobs and the data security limitations have justified organizations in automation of their repetitive tasks [53]. Digitalization using RPA assists the accounting in thedata analysis of high-volume nature and produce meaningful output to its stakeholders. Digitalization of Accounting is a novel topic. Routine tasks are automated and non-routine tasks involves moreaccountants completing the tasks[62]. AI is increasingly being used to digitalize the non-routine tasks of the accounting function [43].

RPA in Accounting: RPA will be more autonomous with AI integration [26]. RPA has a considerable impact on the accounting processes and its accountants [93]. Some of the applications of RPA in Accounting are Reconciliations, Reporting, Payables and Receivables, Inventory Accounting and Cash Entries [53]. The benefits of RPA in Accounting include the automation of repetitive tasks in accounting. Automation of payroll, payment advice and bank reconciliations are some of the tasks automated in accounting [14].

The benefits of RPA for an organization are summarized as:



Source: [53]
Figure 2 Benefits of RPA

TOE Theory:
The TOE Theory was coined by [85]. The TOE Theory is broader in scope compared to other theories with the inclusion of Technological, Organizational and Environmental factors for the adoption of technology and provides a more comprehensive model explaining the technological adoption decisions [60]. Based on this research context the TOE has been justified for application because the factors leading to decision making with regardingthe Adoption of RPA and the implications for both organizations and accountants are to be analyzed. TOE is considered as the best model for technological adoption [9].

Literature Review of Independent Variables:
Innovation: Digital Innovation is a solution for businesses to mitigate the potential disruptions by emerging technologies for businesses [44]. The predominant innovation projects of an organization entail technology adoption [72]. RPA is not always an innovative solution for increasing benefits to the organization unless the process parameters are analyzed and automated accordingly [79]. The Automation in Accounting is an innovation that eases the work tasks of the accountants for added benefits [42]. RPA has been adopted globally and is certified as consistent and secure software for automation. The evolution of financial reporting with current accurate data is said to be aided by the technological innovations such as automation in accounting [53]. AI is considered as an innovation enabler for all work tasks including automation [4]. The five indicators identified under Innovation are as follows:

Triple Entry Accounting:
Data security risk is a major concern for accountants and organizations with automation and emerging technologies and has raised the necessity for encrypted data [39]. The Triple Entry is an advancement to the double entry of the accounting system. The third entry requires a digital signature from the authorized user thus transforming sensitive data to crypto codes for those without formal access [77]. Triple Entry automates the accounting function significantly and provides a more secure transactional algorithm [34]. The application of AI is said to enhance the triple entry accounting to quadrupole accounting with due importance to the source of funds and the transactor information [3].

Hyper Automation:
The RPA is limited to structured tasks in the world of higher unstructured tasks. To prevent the Bots Obsoletion and to increase the sustainability the integration of RPA with AI is considered [93]. The non-integration of RPA and AI with is hyper-automation is a significant limitation to achieving the maximum benefit via automation [71]. The combination of RPA and AI represents the future of automation ([23]. RPA is already an advanced automation tool and AI aids significantly in making RPA a smarter bot [58]. The future is predicted to be intelligent automation with the harmonization of RPA and AI [8]. RPA is a standalone software with limited benefits and combining it with Natural language Processing (NPL) will increase the scalability of RPA [17]. RPA will be dissolved into AI and Generative Artificial Intelligence (GAI) in the future [70].The cost of automation is expected to decrease with hyper automation by way of increase in scalability [*90*].

Diffusion of Innovation:
DOI is an important theory for understanding the characteristics of innovation itself and how it influences the adoption of technology process. Rogers segmented the adopter of innovation into a scale comprising from innovators, early adopters, early majority, late adopters and laggers [2][1]. The early adopters of RPA were able to achieve benefits such as improvements in accuracy, speed and other tangible improvisations that are directly proportional to an increase in profits. The benefits achieved by early adopters have been more than the operational benefits such as improvement of the process. Accuracy, cost savings and time savings are non-operational benefits [82].

Innovative Disruption
The emerging technologies contribute to the disruption of the businesses [44][64]. The technological ease that comes with automation will create a differentiation for one organization over those businesses not into technological adoption thus disruption arises [46]. RPA growth with the current magnitude will eventually make the software a disruptive tool [54]. There is still need for a framework that addresses the disruptive technologies especially in financial accounting. RPA is confirmed to be disruptive as per study findings and hence the methods to use RPA to extract the maximum benefit must be identified by the companies innovatively [36].

Digital Transformation
The digital transformation enhances the work progress [91]. The importance of Automation was in focus especially in Accounting after the Covid pandemic [66]. RPA is considered as Digital Transformation technology for organizations [92]. RPA automatesthe human method of automating repetitive tasks [32]. RPA helps to automate repetitive tasks by reducing errors and saving costs as the output of the digital transformation [5].The lack of technical help, high implementation costs and the security of data are certain limitation to digital transformation in an organization [36].AI will bring about important evolution such as automation, value creation and decision making as a single package in digital transformation of businesses [35].

Technology
RPA is a less code software that is relatively easy to implement and the best automation tool. RPA is used to automate the entry posting of invoices, payment transactions and credit controls[28]. AI is another important technology for future automation. It is not a single technology but a combination of multiple technologies and hence lacks a standard definition for AI [89].The five indicators identified in Technology as Independent Variable (IV) are:

Technological compatibility:
RPA automated structured tasks. However, the world is currently functioning with a large volume of unstructured data. Hence NPL based Optical Character Recognition is used to read the unstructured invoices for processing [17]. OCR converts documents in format of PDF, files, and images into editable data. Open-Source OCR has been suggested in research for future document compatibility of RPA with Unstructured documents[52].OCR is still in its infancy and its integration with NLP is foreseen in the near future[7]. Some of the compatibility key factors in RPA are structured tasks, if-then algorithm, digital, mature, and routine tasks. Since automation eliminates high volume tasks , the return on investment (ROI) is higher [20].

Technological complexity: The technological complexity in RPA is relatively low because it is almost code free software with a non-intrusive IT structure. The cloud infrastructure for RPA adoption is an advancement to lessen the complexity[75]. RPA is considered as a business solution that provides easy implementation [31]. The RPA can be bifurcated into attended and unattended RPA. Attended RPA requires minimal human intervention and is also easy to integrate in an organization. This makes it ideal for SMEs. The unattended RPA is for organization wide automation with xero human intervention making it a perfect solution for larger organizations [86].This study calls for future research on the technological complexity of RPA in businesses [53].

Trust on Bots: RPA automates high volume and repetitive tasks of the organization thus increasing the stakeholder satisfaction [14]. However, if the programmed or the input data have errors then it will run the data with errors to give an erroneous output. Hence periodic monitoring of RPA is mandatory to mitigate the malfunction [74]. The malfunctions and errors created by RPA made the accountants to distrust the software. Regular monitoring of RPA helped the accountants to reduce the errors in RPA and increase the trust by modelling different routine tasks to be automated [51].

*Data Security:*The top concern in RPA is the data security accounting, which is a data abundant function. The manual processing of all documentation before and after RPA still poses a substantial security risk. Hence data security is a current issue in RPA adoption [47]. Another study suggested future research in Data Security for automation in RPA [26]. Cloud computing has been found to provide benefits to accounting with easy accessibility and current data [66]. A recent study validated the importance of a Cloud Data Management System (CDMS) to provide adequate data security and access to data from any location [14]. Cloud computing also reduces the cost of automation [5].. Another limitation of RPA is its storage. Only limited and temporary data files are stored by RPA and calls for external storage of all documents. Hence research finding calls for external cloud data storage for RPA [74].

Open-Source Cloud Platform: As per research findings, the important component of RPA Adoption checklist is the deployment and functionality of open sources in RPA Adoption and access from external sources such as open interface [10].RPA has the range and ability ofan open interface to achieve scalability across organizations [93]. RPA is already an Application Programming Interface (API), that connects different software in its system [69][74].

Organization: A major innovation in an organization is the technology adoption. The framework for the application and guidance of RPA in an Organization is still required as per a recent study[20]. Organization is an important factor influencing technological adoption [60]. The five Indicators representing Organization are as follows:

Business Process Redesign: The strategic sound implementation contributes to the successful adoption of RPA in an Organization. Each work task must be analyzed to evaluate the suitability of RPA for increased Return on Investment (ROI). This study contributes to the failure of RPA in organizational decisions and strategies thus emphasizing the importance of Organizational factors in RPA implementation [30]. Multi-Criteria Decision-Making algorithm (MCDM), Analytical hierarchy process (AHP) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) have been suggested for meticulous evaluation of processes for automation [21]. Another study suggested the Task to Fit theory lens to analyze the tasks for automation analysis for successful implementation thus increasing the ROI faster and for added benefits [59].The redesign phase of the business process management has a significant impact on the emerging technologies. A combination of RPA and AI is said to automate most of the tasks thus decreasing the business process management tasks [50]. AI is expected to dominate the business process redesign advocating the dynamic functioning of

the businesses [81].

Employee Robot Communication: The adoption of technologies as per research has contributed to human robot interaction [33].Prior research raises the primary future research need to study the human and robot interactions as emerging technologies are adopted. An understanding of the accuracy of the technology may contribute to enhanced communication between robots and employees[50]. Decision making is considered as the niche factor of human robot collaboration, especially with AI and RPA [68].

Efficiency: RPA automates repetitive high-volume tasks thus freeing the staff from mundane work. This increases the efficiency of the working process [56]. Automation and AI together contribute to the analysis of accurate data and decision-making thus enhancing the efficiency of the organization [57]. Based on this research, RPA has been proven to increase the efficiency of ERP systems. Employee awareness about RPA focuses on enhancing efficiency[65]. Programmable and structured tasks are automated in organizations using RPA thus increasing the efficiency [53].

RPA Training for Employees: Lack of basic technical skills among employees slows the successful adoption of RPA [53]. A recent study highly recommended that organizations to provide technological training to their employees on emerging technologies. This training should not be reduced due to cost or turnover rate [40]Automation can lead to reduced errors in data abundant accounting functions. Accountants must be provided with training to maintain the accounting records [6].

Infrastructure as Service (IaaS)
Cloud Accounting provides exceptional benefits for accounting ranging from accessibility to data from even remote locations to the storage and security of data. Pay as a service taken provides excellent cost savings for organizations. Investment in IT hardware or software has also been significantly reduced by way of cloud accounting [66]. Iaas is a model thatprovides hardware, software, and network online (HSN). RPA requires an adequate landscape of all the HSN combinations for implementation. A recent study highlighted the need for future investigation of IaaS for RPA adoption [20]. Organizations with not optimal IT structure can struggle with RPA adoption [53]. The key concern for RPA with respect to Information Technology (IT) is for the servers to be maintained. RPA is said to be non-dependent on IT otherwise [74].

Environment : Recent research has emphasized the importance of future investigations of sustainable RPA (Patrício et al., 2023). The environmental factor of TOE Theory analyzes the limitations and opportunities for the Adoption of RPA in this research. As per Institutional Theory the businesses are run not only for profits but are also bound to the cultural and ethical boundaries(Oliveira & Martins, 2011).

GAI enabled RPA : Generative Artificial Intelligence (GAI) enabled RPA is a relatively new tool since 2022. This research elucidates the importance of GAI with RPA and highlights the ethical focus in implementing this software. Transparency is required in the data input of the AI so that the output will be more trustworthy for the organizations and its stakeholders. GAI RPA is easily integrated with any API and RPA already has the API facility already for such integration [13]. AI is predominantly required in accounting for analytics and decision making. The author suggests integrating both humans expertise and AI for benefits [80].

IFRS
Digital Accounting Audits reinforce the need for quality and reliable financial accounting [88]. IFRS is an accounting body that monitors the accounting and quality of the reports. This author calls for future research on Integrated Financial Reporting [93]. The integration of AI with RPA has highlighted concerns regarding the support of accounting bodies in the digital transformation of accounting [78]. The unification of accounting standards has been called for the integrated reporting in the accounting future [67].

Governance: Emerging technologies need clarity on the rules, regulations, and ethics to be able to compound their roots without barriers [50]. Recent research advocates the necessity for future studies on governance related to Intelligent Automation which is a combination of RPA and AI [15]. RPA is used to comply with regulations [93][39].Governance is

required for effective digital transformation [73].A robust governance structure provides for technological integration with an ethical conformation [46] [48].The regulations vary between countries hence must stringent rules are required for in RPA implementation [87].

Job Enrichment: Many studies through their findings validate that there is job displacement by way of emerging technologies including RPA and AI and those work with high automation showed increased productivity by employees [76]. The future of accountants with AI and Technology adoption does not encompass job displacement. Rather, it will be job enrichment, since the organizations will look forward to utilizing the expertise of accountants for adherence to regulations, compliance and for external communication [91]. This study also has validated the finding of job enrichment for future accountants with additional value-added tasks [53]. These new job tasks will detach from traditional data entry and evolve into management tasks for accountants [78].

Cultural Shift: A good cultural environment and communication in an organization are required for the successful implementation of emerging technologies [36]. The adoption of RPA will bring about cultural shifts in the organizations including the work lifestyles and robot integration [20][12].

Human Talent: The most important resource of the organizational ecosystem is employees [55]. Employees significantly affect each stage of RPA implementation. Employees should be made aware of RPA [61]. In the converging evolution of emerging technologies, one study claims that employee awareness of these technologies needs future investigation [16].

Digital Workforce: The diffusion of robots into the workplace has catapulted to the extent of a current research suggesting that robots should be given friendly metaphors for integration at work with human employees [83]. The Digital workforce encompasses of employees who are digitally empowered. Hence the RPA automation of mundane tasks frees up the employees for more creative tasks thus increasing the productivity and efficiency. The future of RPA is expected to have a significant positive impact on the digital workforce[56]. The human- robot collaboration of Cobots help to automate repetitive tasks yet in a cost-effective manner[18].

Emerging Jobs: The most novel question for future investigation is whether RPA implementation entails the internal employees with technical skills or specialists in RPA [93]. Another study strongly recommends future research on the new job tasks of the accountants. The migration appears to be more analytical, and more management oriented for accountants [91]. The accountants will be handed over the task of financial reporting to the stake holders [53]. Another study also validates that accountants will be integrated and offered more new job roles [27].The job tasks which can be automated is expected to be automated by AI. The remaining jobs are likely to be of an analytical position especially in finance [35].

Emerging Technical Skills: RPA specialists are said to be in demand after RPA implementation as per research findings. The author further suggested external consultants [10]. Another author suggested basic technical skills for accountants in cloud computing and AI [91]. Digital skills for accountants are emphasized in this study. The digital skills are categorized ranging from basic to advance. Skills related to AI are most sought out by the accountants[40]. RPA skills are of high priority for accountants and the low code approach of RPA helps the accountants to easily adapt to RPA [75].Another study validates the technical skills required for accountants to adapt to the emerging technologies [27].

Non-Utilized Talent: The RPA is said to automate all repetitive tasks helping the employees to focus more on value added tasks [22]. Employees who are free of mundane high volume repetitive tasks can then focus on analytical or creative tasks. Automation helps to eliminate the non-utilized talent [27]. RPA is directly proportional to the decrease in non-utilized talent as per previous research findings [54].

Digital Divide: AI and GAI will contribute to the digital divide between those countries depending on the rate of adoption [13]. As per research, accountants are seen as a solution to close this digital divide as per research. Low Data Literacy is a primary limitation in the adoption of RPA in Accounting [46]. Another author validates through his findings the importance of Digital Literacy for the future adoption of automation [75].

Outcome and Measures:
Customer Satisfaction: RPA adoption as an innovation factor in the organization contributes to customer satisfaction [56]. The process time and response time are decreased by way of automation and increases the customer satisfaction [31]. Adoption of AI also increases the customer satisfaction [11]. The higher job satisfaction leads to the customer satisfaction, the customers being the users of RPA [49].

Good Quality of Accounting: This research finding confirms that the automation leads to better accounting quality by reducing errors and enhancing process time. The author also recommends future investigations of the quality of accounting with automation [93].

Competitive Advantage : The AI and Automation in Accounting contributes significantly to cost savings and acts as a competitive advantage for the firms [56]. RPA has been confirmedto be a competitive advantage tool [14].

Compliance with Regulations: RPA adoption helps adhere to regulations based on research findings[55][56].

Increased Productivity: RPA assists significantly in the automation of repetitive tasks and non-value-added tasks. This enhances the productivity [32].

Research Framework:

The Stage 3 of the DSRM entails the Design and Development. Hence, the following framework was developed based on a literature review.

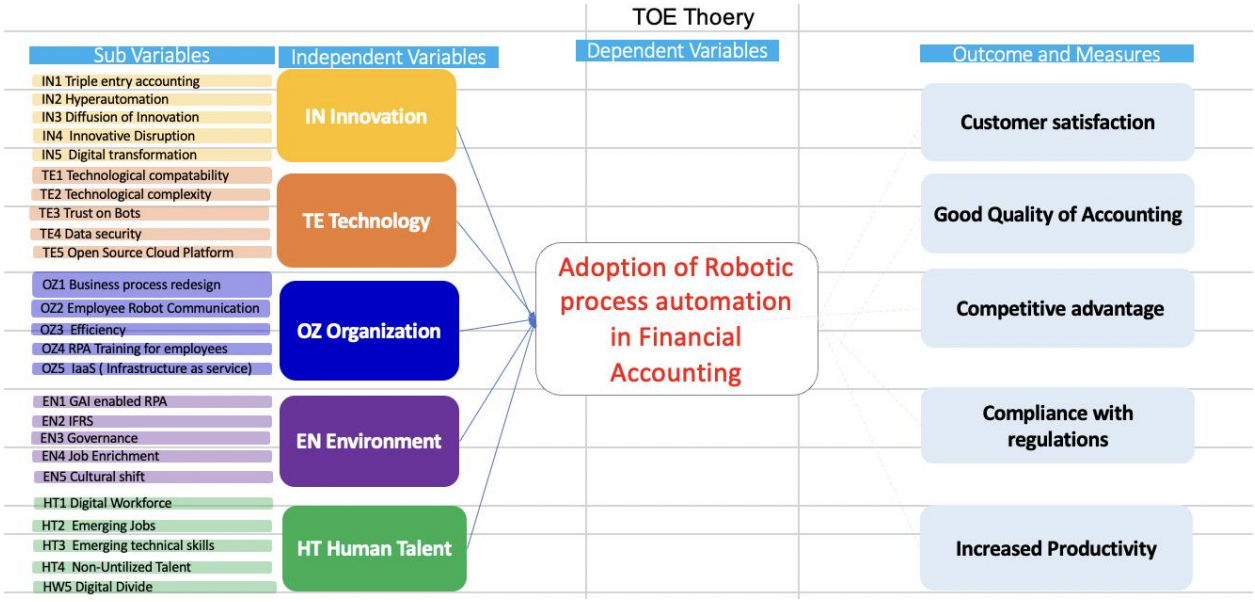


Figure 3 Research Framework

Conclusion:
Based on the Literature Review gathered, the following framework was formulated. The five constructs of Innovation, Technology, Organization, Environment and Human Talent are said to have a significant impact on the Adoption of RPA in Accounting. The indicators with influence on the constructs are defined in the framework.

Future Scope: The framework was designed based on the extant literature. The next step will be to fulfill the Stage 4,5 and 6 of the DSRM with quantitative and statistical evidence to validate this framework. The future step is to undertake a

quantitative study with a population consisting of those already working with RPA in Accounting at all levels. The organizational size based on literature will be analyzed if it has any impact on the adoption rate of RPA in Financial Accounting.

Contribution to Literature: This framework provides the key constructs to consider before the adoption of RPA in Financial Accounting and has been developed based on an extensive study of literature pertaining to benefits, challenges, practical adoption, and technology in adoption of RPA in accounting. This framework contributes to the accounting with the holistic inclusion of AI, RPA, and GAI in one framework. The framework has been created from comprehensive analysis of 400 articles with intensive filtration of keywords leading to 300 articles with 140 out of 300 from ABDC Journals. The framework represents the current and future real world application factors in Adoption of RPA in Accounting. The key contributions as follows:

1. The Technological integration of RPA with accounting system and future evolution of this software into hyper automation and GAI has been analyzed to increase the quality of accounting.
2. The transformation of accounting itself from double entry to triple entry system and the benefits and impact of triple entry system has been introduced in this framework.
3. The regulatory implications have been analyzed for compliance to regulations including the in-depth analysis of accounting regulatory Board for adoption of automation in accounting.
4. The organizational factors and the employer key considerations to create a competitive advantage with RPA has been analyzed in this framework which is a contribution to literature.
5. A valuable insight has been provided with Human Talent which focuses on the primary requirements from the accountants both current and future to be able to adapt to evolving technologies and increase productivity.
6. The innovation factors have been intensively analyzed and the proposed indicators in the framework are contribution for increased customer satisfaction.

Contribution to Practice: The framework provides a comprehensive view and gives a first insight into GAI enabled RPA for organizations. The key potential challenges are already analyzed in the literature review so the organizations can use this already analyzed data for application, hence reducing the R&D costs to company. A view of the guidelines for application of RPA with respect to compliance has been offered in this study. Data Security, Digital Workforce, upskilling of employees and their importance has been deduced from the literature with intensive analysis of practical application and case studies from previous literature. The complex landscape to adoption has been made easy for organizations and managers by the availability of a current and ready to use framework.

Hence this framework offers valuable insights and provides practical guidance to future researchers and organizations seeking to understand RPA Adoption in Financial Accounting. The broader scope of this framework is digital transformation in the Accounting Field.

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