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## Artificial Intelligence in Automated Bookkeeping: A Value-added Function for Small and Medium Enterprises

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**Abstract**— Bookkeeping plays a vital role in dealing with records of day-to-day financial transactions from invoices until payment. It is also a method of documenting all company transactions in order to create a collection of accounting documents. Studies show that an evolution of bookkeeping management from manual record keeping to electronic record keeping had simplified most burden of bookkeepers as well as more reliable and accurate. Bookkeeping includes, in particular, classifying items correctly and entering financial details into an accounting system. However, with the rise of artificial intelligence, automated bookkeeping system is common to large businesses tasks at real time with hassle free. The system will function more than just journal management but also a decision-making tool to any businesses. Despite the benefits of the system, many small and medium enterprises especially in Malaysia still hesitate to implement the system. Artificial intelligence will further improve automated bookkeeping making it simpler and efficient for all levels of businesses. This paper presents an Artificial Intelligence perspective and methods used in automated bookkeeping focuses on invoices processes such as Optical Character Recognition (OCR), for document recognition, machine learning and auto journal record entries. Besides that, its challenges to be implemented in small and medium enterprise. The result of these studies highlighted benefits in the automated bookkeeping process to suit Malaysian small and medium enterprises. Future work will look at the suggested intelligence features to be implemented for a more efficient automated bookkeeping for small and medium enterprise.

**Keywords**— Automated bookkeeping; automated invoices recognition; artificial intelligence; optical character recognition.

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### I. INTRODUCTION

Manual bookkeeping as well as electronic bookkeeping are two common methods widely used in business organizations to maintain and observe their records. Bookkeeping is the systematic measurement technique of any business process and exercise that plays an important aspect in developing the growth of an organization. It is crucial specially to maintain business revenue and expenses. The manual record keeping system consists of paper-based journals or entries and they are separated into sections for receipts and settlements [1],[2]. In electronic bookkeeping, software is used to maintain journals automatically. Transaction processes are entered conveniently and simply by the bookkeeper and matches the significant account [3],[4]. Implementing an artificial intelligence (AI) indicator such as pattern recognition, and expert business rules in

promoting automated functionalities to a few stages of record keeping will give value added into record-keeping technologies.

Electronic bookkeeping methods have been widely used by business organizations as well as the small and medium enterprises (SME) because it is time effective and proper journals management. Many business owners especially in the SMEs hardly understand financial information provided by the accounting department; hence technology came with easier automated accounting for business organizations [5], [6] has come out with the advantages of automated bookkeeping and accounting which declare that most business owners are not capable of challenging accounting; thus, they need a more simple, reliable, able to collaborate and cost-effective software to accommodate their accounting tasks. According to [7], many SMEs in Malaysia, lack proper record keeping and have poor information and communication technology (ICT) adoption in managing their

business accounting. This situation indicates that SMEs are not responsive to the significance and security of accounting records. Most of the SME business owners do not use automated bookkeeping. Without a clear understanding of why automated bookkeeping will benefit most SME owners, business will have difficulty in terms of real time transaction, especially in this digital era. The main goal of this study was to highlight AI implementation in a few stages of the automated bookkeeping processes, primarily in invoicing and journal record entries based on previous studies as well as to analyse the SME benefits and challenges in implementing automated bookkeeping, based on a case study to provide key elements concerning bookkeeping management.

The sections below describe certain important understanding dealing in the areas of bookkeeping management, its relationship to AI adaption and the implementation challenges for SMEs.

#### *A. Bookkeeping*

Bookkeeping is the systematic technique of any business processes and exercise, which plays an important role in developing the growth of an organization [1],[8],[1] further indicated that organizational sustainability assessments play a critical role in monitoring and evaluating success for goals and achieving sustainable growth and corporate sustainability. Invoicing refers to the coupons provided and obtained by each unit and person in the purchasing and selling of goods during the business processes [9]. This is an integral part of bookkeeping. Meanwhile, the expansion of technology in businesses, using electronic commerce, is seen as a valuable cost reduction alternative to the digitalization of billing [10]. The Journal Record Entry commonly provides a regular review of cash receipts or bills and a weekly report of receipts and invoices as well as expenditures [11]. The journal is the primary and essential book for reporting the events of everyday transactions. Recording a correct entry into the report would display the business' proper financial position not only to people individually but also to external customers.

#### *B. AI implementation in Invoice Recognition and Automated Journal Entries*

Artificial intelligence (AI) is the analysis and integration of techniques that enable behaviour requiring human intelligence to be carried out on computer devices. A number of viewpoints, in the study of intelligence can be perceived from the perspectives of philosophy, psychology, cognitive science, arithmetic and medicine, where all of these domains do have an impact on the discipline and must be considered in modelling a human intelligent behaviour on a computer [12]. [12], in his study, stated that machine learning (ML), is a field of artificial intelligence that offers a great potential [13], for the creation of genuinely robust systems that can be responsive to environmental changes, contextual problems or circumstances. The capacity to establish a system that can learn and react from examples will make it possible for artificial intelligence to solve the problem of extracting information especially from the expertise, evaluating the knowledge, and then executing it. Artificial intelligence (AI) is a vital technology which supports the day-to-day social

life as well as the economic activity, and the usability of AI contributes significantly to the sustained development of Japan's economies and solves numerous social problems [14]. AI has attracted scrutiny as a key to development in developed countries such as Europe and the United States, and emerging countries like China and India. The emphasis is mainly on the development of new AI technologies for information communication technology (ICT) and robotic technology (RT). The advancement of artificial intelligence technology has increasingly entered the accounting sector, which plays a significant role in enhancing business performance, deducing errors, minimizing, and managing corporate risks, enhancing business efficiency, and enhancing human resource efficiency. The implementation accounting software has largely replaced manual accounting such as filling in receipts and financial statements, which has made it possible for many accountants to reduce complex accounting operations [15].

Today, the enterprises go towards the digital and automated approach and have started digitalizing bills [10]. This will cause less difficulties to the generation of data transaction and push the requirements to revolutionize the data to generate a meaningful piece of information and insight to the business. The insight into the business data would be beneficial to decision- makers in making more informed decisions [16]. A rule based expert system has made a lot of benefits in billing decision- making. This reduces erroneous claims and claim rejections, increases customer satisfaction, and improves company's revenue as real time performances are also taking place [17]. [18] in their studies found that automation via automated journal entry will reduce repetitive tasks [19] human errors, time consuming and stress, and that journal entry automation could support accountants effectively in all aspects especially data entry and bookkeeping. [20] mentioned that when manual entries and tasks are automated, more focus would be given to analytical services by experts in the field.

Optical Character Recognition (OCR) is a machine readable and editable system that infers images captured by a scanner [21]. The OCR process consists of pre-processing, segmentation of images and recognition. The segmentation process is the main role and the most significant and complex process of the overall OCR processes [21]. With OCR empowered by AI, invoice recognition and data extraction could be done without the same set of rules or templates [22]. The dominant portion of recognition is done through the pre-process input image. These images are digitized through a scanner, digital camera or software [23],[24]. Poor results of OCR classification will result in a higher error rate and error in information extracted for the next step such as journal entry.

#### *C. Small and Medium Enterprise in Malaysia*

The process of innovation in small and medium enterprises (SME) is challenging and the strong correlations between promotion factors and innovation still have not been adequately clarified compared to large businesses [25]. According to the SME Corporation Malaysia, SMEs in Malaysia are described as a pyramid of entrepreneurs. SMEs are categorized into the manufacturing sector and other sectors. In the manufacturing sector, the ratio of employees

in small enterprises is from 5 to or equal to 75 with sales turnover ranging from RM300, 000 to RM15mil while in the other sectors, the ratio of employees is between 5 to 30 with sales turnover of RM300,000 to RM3million annually. Meanwhile at the top part of the pyramid the number of employees is between 75 to 200 with sales turnover of RM15million to RM50million while in the other sectors the ratio of employees is between 30 to 75 with sales turnover of RM3million to or below RM20million [7].

#### D. Challenges for implementation Bookkeeping in SME.

SMEs have less priority in implementing accounting functions within the company due to lack of knowledge in accounting [26]. The management of accounting systems and methods should explore and discover a new cost-effective way, through accessible resources and properties for potent decision-making [27]. An inappropriate and inaccurate documents and records processes will result in unsuccessful business to any organization [28] Poor record-keeping is a major factor in contributing to failure in business progress. According to [29], lack of knowledge and skills in financial and management are the main causes for the closure of SMEs. [30] describe the problems as the introduction of management accounting standards including the lack of access to finance for SMEs to implement modern accounting practices, insufficient understanding of creativity due to a lack of skills and experience, restricted use of new technologies and shortage of human capital. [31] concurs with the other authors on the need for SMEs in empowering accounting knowledge to sustain their existence in the business world. [8] further state that the majority of the SME owners have minimum basic knowledge of accounting and maintain their own record- keeping due to the steep cost implicated in preparing financial statements.

Next, the structure of the paper are as follows: section II briefly discussed methodology which consists of method selection and approach in the subject area. Section III will discuss the findings, analysis and discussion. Finally, section IV is the conclusion of the research.

## II. MATERIAL AND METHOD

This study consists of content analysis of past reviews to acquire the necessary information. The research goal was to analyse the AI approach in the bookkeeping processes focusing on invoice recognition and automated journal entry. The reviews were sorted based on their keywords, methods, description, and results. The reviews were gathered from various sources mainly indexed by Scopus and WOS. Other than that, the challenges and benefits faced in implementing this system in SMEs were measured. The study adopted a few case studies supported by secondary data through a systematic literature review approach which identified, evaluated, and deduced all available research relevant to the theme of the study. According to [32], case studies are deemed suitable for contemporary phenomenon research. The selections for this study were based on the criteria. This was done to narrow down the search based on the scope area as shown in Table 1.

TABLE I  
CRITERIA OF CASE STUDY SELECTION

Criteria	Selection
Study region	Region selected based on developed country such as (SMEs) in United Kingdom & United States that practised automation process
Field	Field focusing in first layer of accounting (Bookkeeping Management)
Scope	Automation in internal accounting management
Sub-scope	Internal auditing and external auditing
Functions	To identify results of implementing automation in accounting sectors.

#### A. Case Study

This section describes three case studies. Their findings would be used further in the analysis and discussion in the next few sections. The case studies are represented by Case Study A, Case Study B and Case Study C.

##### 1) Case Study A (CS-A):

Case study A (CS-A) has hundreds of various activities scheduled and arranged across Europe and Finland. They are an expert in the fields of visual design, decoration, stage prepping and setting up, interior design and the creation of powerful events that integrate all their different abilities. They realise and fully understand that each occurrence reflects the brand of the client; thus, they prioritise consistency in all their tasks. They use Finago's Procountor, an automated financial reporting device, as do several other Finnish and Nordic firms. Accountor Finago is one of the elements of the Accountor Group's SMEs Software business., Procountor, is a user-friendly platform with hundreds of thousands of users, but sales invoices are submitted manually from the company administration or the ERP applications to Procountor. Once the number of invoices hikes up, it becomes tedious to submit them manually. Hence, they reach-out to Scoro by Youredi, to accelerate and automate the process of invoices. Not only that, Scoro is an all-in-one enterprise management software that helps teams effectively collaborate, execute tasks more effectively and track revenues. Implementing Procountor saves them a great deal of time and is not error-prone, free of manual data entry and tasks. Now they can be assured that almost all invoices will be sent to Procountor in real time without any vital detail being lost. As all invoices from (CS-A) are now moved directly from the Scoro enterprise management system to the financial management platform through the cloud-based Procountor, they will easily continue to grow their core business rather than just perform administrative tasks. Now they can concentrate on what they do best to provide excellent event opportunities to their clients.

##### 2) Case Study B (CS-B):

Case Study B (CS-B) is a family-owned business that distributes beer and non-alcoholic beverages. They distribute the products across Alabama and North Carolina. The company realized that they needed automatic software to manage sudden spikes in invoices. They started processing an average of 2000 invoices per month, excluding the product's invoices manually. Delays in processing approvals and controlling invoices became an issue since they were having a multi-tiered Case Study B (CS-B) is a family-

owned business that distributes beer and non-alcoholic beverages. They distribute the products across Alabama and North Carolina. The company realized that they needed automatic software to manage sudden spikes in invoices. They started processing an average of 2000 invoices per month, excluding the product's invoices manually. Delays in processing approvals and controlling invoices became an issue since they were having a multi-tiered approval, but they were not centralized and visible; hence follow-ups and data tracking took longer as they had to chase for invoice paper and signatures. The problems prevented their work from running smoothly. After they implemented the automatic software (Beanworks) to manage their piles of invoices, they were able to make remote management. Communication between the branches speeded up and managers were able to access invoices and make amendments in cloud, resulting in easily slated for payment. During the covid-19 pandemic, managers could approve invoices easily through mobile apps and the team members were able to process them at any place. The team was saving more time on data entry and manual tasks. Invoices were automatically captured, coded, and routed to the approver. approval, but they were not centralized and visible; hence follow-ups and data tracking took longer as they had to chase for invoice paper and signatures. The problems prevented their work from running smoothly. After they implemented the automatic software (Beanworks) to manage their piles of invoices, they were able to make remote management. Communication between the branches speeded up and managers were able to access invoices and make amendments in cloud, resulting in easily slated for payment. During the covid-19 pandemic, managers could approve invoices easily through mobile apps and the team members were able to process them at any place. The team was saving more time on data entry and manual tasks. Invoices were automatically captured, coded, and routed to the approver.

### 3) Case Study C (CS-C):

Case Study C (CS-C) is an accountancy practice firm offering a range of services including accounting and tax advice, bookkeeping and business development. The founder leverages digital innovation in order to automate outdated and inefficient administrative processes. When they decided to eliminate manual data entry, they chose AutoEntry, driving significant returns of investment (ROI), for the firm consequently. (CS-C) wanted to adopt a data entry solution that was quick to process, simple to use and highly accurate. It also wanted one that could capture data from a range of documents, including purchase and sales invoices as well as bank statements, to effectively serve its range of clients. As part of its due diligence, it decided to try a free trial of AutoEntry in early 2017. It loved how intelligent AutoEntry was, whilst being so easy to operate. The firm now uploads over 300 documents a month onto AutoEntry either via the web or the mobile app, and it can monitor the progress of these items through its personalised dashboard, helping to streamline service delivery. At the same time, it had the capacity to take on more bookkeeping clients, helping to increase its turnover by over 50% by automating its bookkeeping data entry.

## III. RESULT AND DISCUSSION

The breakdown of challenges in implementing bookkeeping is shown in the Table 2 based on previous literature. From the Table we can conclude that knowledge constraints mostly the challenges faced by the business owners to implement bookkeeping followed by poor business management, cost, and record errors due to human errors. Hence, an automated function of bookkeeping was introduced to simplify record-keeping tasks with less supervision. The function of automated bookkeeping is extended to 'no-data-key-in' where AI, which functions in the electronic software, will extract all the data information from the OCR-scanned image. Hence human errors will be reduced especially when data and information are manually keyed-in by staffs in the normal electronic system.

TABLE II  
CRITERIA OF CASE STUDY SELECTION

References (Year)	Knowledge constraints	Cost	Record errors	Poor management
[26]	√			
[27]		√		
[28]			√	√
[29]	√			√
[30]	√		√	√
[31]	√			
[8]	√	√		

\*Note: (√) indicates challenge highlighted in respective reference(s).

### B. Artificial Intelligence Approach

In many areas of AI application, machine learning (ML) algorithms were applied, and researchers put a lot of work into improving the accuracy of the ML algorithm. ML is used as an injection of the AI approach in OCR recognition as well as other processes in automation such as detecting invoices based on templates [22]. The evolution on the AI approach is as shown in Table 3. The results of this study were collected through research articles using the inductive approach based on the criteria set out and discussed earlier. The automated system is able to intelligently recognize and identify invoices based on a few templates stored in the database and learn from the system for a new invoice for which templates are not available in the database by doing a template-matching technique from previous learning. By maintaining basic OCR processes, the additional processes would be template matching and information exporting. Based on Table 3, the AI solutions on the invoice recognition processes were continuously done by the researcher to produce an automated process. [33] proposed an automatically input from the invoice into a computer by scanning the document, while [34] proposed an automatic invoice document classification to classify the types of invoices. By and by, researchers proposed more automation techniques such as character recognition, automated data extraction from invoices and intelligent invoice recognition based on templates. All of these projects showed that automated invoice recognition was getting attention towards AI functionalities.

TABLE III  
LITERATURE REVIEW OF AI METHOD ON OCR TECHNIQUES FOR INVOICE RECOGNITION

References	AI Project	Method	Results	Additional information
[33]	Proposed a solution to increase operational efficiency of financial staff in which Arabic numerals and Chinese characters were automatically input from the invoice into a computer	Using the linear whole block moving method in each vertical segment, a new fast algorithm is put forth to detect and rectify the slant image.	Highest accuracy rate for Chinese character is 97.2% and accuracy rate for Arabic is 95.2%	The adhesion of form line and characters makes character segmentation difficult, becoming a major factor in increasing the recognition rate.
[34]	Proposed an automatic invoice document classification system to classify invoices based on the analysis of the graphical information present in the document.	Using k-Nearest Neighbor (k-NN) classifier since no training phase is required.	The closed world classification achieves 99% of correct classification in case of 1-NN while the open world classifier performance reaches 79% accuracy.	OCR techniques and label indexing will improve the obtained results and could provide a less compelling alternative to bar code identification systems.
[35]	Explore the utility of Artificial Neural Networks-based approach to the recognition of characters.	A unique multilayer perception of neural network is built for classification using backpropagation learning algorithm. Technique used on 6 different geometrical features to extract 48 parameters are fed into ANN.	Recognition rate of 84.8% for 10 class problem in which out of 75 samples, 65 samples are correctly recognized.	Other kinds of pre-processing and neural network models may be tested for a better recognition rate in the future.
[36]	A classification system to recognize the first page of invoices from scanned documents.	Natural Language Processing (NLP)	Logistic regression scores the best with average 95.02% accuracy.	Errors are partly because of OCR errors. This work mainly uses words, the smallest unit in document layout, to extract features.
[37]	OCRMiner system designed to extract the indexing metadata of structured documents obtained from an image scanning process and OCR.	Text Blocks method classified by rule based and machine learning (ML) classifier.	OCRMiner system, enables the integration of text analysis techniques, with positional layout features of the recognized documents blocks achieving an average of 80.1% precision.	Various kinds of OCR errors detected during the experiment.
[38]	Receipt extraction and OCR verification to improve text detection.	Connectionist Text Proposal Network (CTPN) explores rich context information of an input image, making it powerful to detect horizontal text.	The system scores 71.9% of F1 score for both detection and recognition task.	Improving OCR verification on handwriting.
[22]	Intelligently identify invoice information based on template matching.	The optical character recognizing OCR is used to transform the image information into text so that the information derived can be used directly.	High precision of 95 % and an average runtime of 14 milliseconds	Information including money, goods, and purchaser were identified accurately.
[39]	Automatic approach to classify invoices into three types: handwritten, machine-printed and receipts.	Deep Convolutional Neural Network (CNN) AlexNet. Features are classified using Random Forests (RF), K-nearest neighbors (KNN), and Naive Bayes (NB).	KNN classifier achieved 97.92% accuracy.	Recommend this approach to as a preprocess step for OCR systems.

Other than that, there are other areas that benefited with the implementation and advances of machine such as computer vision and object recognition, prediction, semantic analysis, natural language processing and information retrieval [22]. The techniques available for these solutions are Decision Trees, Random Forests, Artificial Neural Networks (ANN), Support Vector Machines (SVM) and Bayesian Network. To measure accuracy of their system, refer to Table 3. Based on the findings, OCR is a preferable method used to recognize invoice documents and featured extraction to automate journal entry. Various methods and ML classifiers are involved in assuring that OCR produced an accurate output. This is vital in the automation of invoice documents so it could extract information data for automated journal entries and the classification of journals. Hence a lot of research has been done to increase the accuracy of OCR

functionalities (Table 3). Based on the research objective focusing on the AI approach in automating bookkeeping processes especially in invoice processing and journal entry, both processes mutually rely on the OCR process.

Good accuracy of the OCR processes will produce a better result in template matching and character reorganization to be used in the next process of the automatic journal entry and classification of the journal. The automation of invoice processing and journal entry with respect to AI and ML is concluded as per Table 4, according to types and usage. Based on Table 4, three types of ML are identified which are supervised learning, unsupervised learning, and reinforced learning. Used cases and subcategory are provided to differentiate each type of learning.

TABLE IV  
TYPES OF ML AND USED CASES.

Types of Machine Learning (ML)	Subcategory	Used Cases	Literature References
Supervised learning	Classification	Extract information based on template matching	[22],[37],[38]
Unsupervised learning	Clustering	Invoice separation based on category: handwritten or machine printed	[39]
Reinforced learning	Mapping	Journal/Inventory management [15]	[40]

To further strengthen the findings of the study, three case studies were reviewed, namely CS-A, CS-B and CS-C. Based on comparative study, the model produced good elements and benefits of automated bookkeeping in SMEs, (Table 5). A few factors were identified in implementing automated bookkeeping based on case studies in the United Kingdom and the United States. Most of them agreed that implementing invoice automation and journal entry automation made their daily tasks a lot easier and reduced their workloads.

TABLE V  
KEY FACTORS OF IMPLEMENTING AUTOMATED BOOKKEEPING

Benefit	Key Factors	Case Study
Managerial / staffs	Reduce workloads	CS-A, CS-B, CS-C
	Shorten reporting analysis	CS-A, CS-B
	Time consuming	CS-A, CS-B, CS-C
Company	Real time process	CS-A, CS-C
	Increase productivity	CS-A, CS-B, CS-C
	Higher growth rate	CS-A, CS-B, CS-C
	Focus business goal	CS-A, CS-B

Other than that, automated bookkeeping implementation is also time consuming and could shorten reporting analysis. A real-time process of invoicing and journal entry has made a huge difference in the company's growth. Based on the case study, the company will benefit a lot in terms of productivity increases, higher growth rate and it can focus more on its business goals as reporting analysis can be done weekly compared to before implementing the automation process. In financial auditing, auditors can achieve the desired file on archive file without having to refer to the managers.

After identifying the challenges and benefits gained by the SMEs in the previous case studies, the same approach could be adapted by the Malaysia's SMEs to have better accounting management especially in record keeping. This means the Malaysian government should play a role to overcome the cost for the SMEs in early implementation. Support such as subsidiary and tax reduction by the government could be introduced in the early phase of the implementation of the automated functions in the SMEs. This will remove the dependency of outsourcing accounting tasks, for the SMEs. Record keeping plays an important role in determining a company's direction and financial flow in

every organization's decision-making. With the injection of AI, automated bookkeeping management has made the system more reliable and less human dependent especially in handling errors. Automated bookkeeping will also benefit accountants and auditors in handling taxes. It is necessary to apply the recent accounting technology with understanding and to explore more effective ways in the implementation [41].

#### IV. CONCLUSION

Based on the preliminary study, we could summarize that the automated bookkeeping system plays a positive role in SMEs' performance as well as overcoming challenges faced by enterprises. The system helps SMEs to increase their growth rate and keep their inhouse record keeping effectively. The on-going process of the AI methods and technology to increase the accuracy of the processes, are actively done by research across the globe. Challenges discussed in this study mainly focus on knowledge constraints, yet again, cost constraints also play a major part in adapting the AI technology. We cannot deny the increasing cost of implementing technology in small enterprises, especially in Malaysia, looking at the brighter side, of automated bookkeeping simplifying the initial processes of in-house financing in every business sector. This limitation could be overcome with the support of the Malaysian government which always supports SMEs with various fund-injection programmes. Hence, more research should be conducted to investigate the role and relationship that could be played by the Malaysian government to encourage automation in Malaysian SMEs. Other than that, the readiness to implement automated functions in Malaysian organizations is something to ponder in future studies. Functions such as double entry in financing and tax management are also processes to focus on automation in future. The case studies in this paper were made to really understand the benefits of implementing automation functions in SMEs, which can be adapted to Malaysian SMEs as value-added functions.

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