Deep Science Publishing
https://doi.org/10.70593/978-93-49910-40-9_3

DeepScience
Open Access Books

Chapter 3: From ledgers to learning machines: The evolution of bookkeeping and accounting through artificial intelligence automation

3.1. Introduction

The accounting discipline arose from the efforts of merchants to keep track of their property or estate and the adoption and further development of bookkeeping records in the West. It rose from single-entry bookkeeping practiced in Mesopotamia to modern double-entry accounting . Over the years, the profession has expanded to cover various activities including financial accounting, tax planning and compliance, management accounting, auditing, and the wide array of related consulting services. It has a rich tradition based on its diverse knowledge base and the professional services offered to companies, financial institutions, governments, and individual clients. Accounting regulation enables a wide range of industries, including the stock and bond markets, banking and insurance, the actuarial profession, and product quality controls and auditing. It has established standards and procedures to promote consistency and fairness. Control and sacristy professionals provide policing, investigative, and law enforcement services to companies, institutions, and governments (Zhang et al., 2020; Spring et al., 2022; Weinberg & Faccia, 2024). The disruptive technology known as Artificial Intelligence (AI) can be as valuable and revolutionary to the accounting profession as it has been for various businesses and social institutions. The projected impacts of AI on the profession and practice environment are immense. Artificial intelligence is becoming part of many accounting and auditing systems. AI can assist in the evaluation of large data sets. By understanding and evaluating data, accounting and auditing services can result in far-reaching and dramatic impacts. With large data sets, it is difficult to establish generalities and consistency. This also makes data evaluation

very time consuming. For various reasons, large data sets are not yet popular. A shift in the impact category from “incremental” to “transformational” patterns has also been considered. Data capture and processing technologies are implemented. They are most effective with standard and delineated data.Cloud services emerged, enabling seamless sharing of experiences, understanding, and thus knowledge within corporations that delocalized manual labor. As computers became essential, nothing came less than formatted data was accepted, putting pressure on businesses to realize automation, whereas, without data and software understanding, digitalization was reckoned an unproven leap of faith, making companies from heavy industries to bookkeeping offices heavily scrutinize risk. Bookkeeping firms transformed into accounting firms, where added value was given to clients by delivering business analysis and forecasting by exploring the information systems. Understanding the opportunities and potential of technology remained vital when looking for a competitive advantage (Lee & Tajudeen, 2020; Hossain et al., 2024; Kotepuchai & Limpiyakorn, 2024).

Fig 3.1: AI in Accounting

3.1.1. Background and Significance

As a concept, automation dates back to the 1800s, when mechanized vehicles were being introduced into factories, revolutionizing the process of production. As technology progressed, businesses were able to implement more and more machinery, allowing for greater efficiency and output in producing goods. The invention of the computer in the 20th century, with its ability to store, process, and display numbers, was just the boost that factories needed to automate large portions of their operations. After computers were developed, the first recording, posting, and reporting programs were created for bookkeeping, giving rise to the first computerized bookkeeping systems. This led to a

new market for computerized services in accounting and auditing, as offering what a computer could do for a mere fraction of the price of a human became economically sensible. Bookkeeping functions became fully automated, resulting in mere bookkeeping systems unable to make adjustments to ledgers, having to be designed with care or the data could compromise accuracy. However adjustments were made, resulting in the establishment of computerized auditing systems, whose job was the same, merely recalculating balances and verifying them for accuracy, merely requiring a human being to decide upon the degree of sample. Throughout the 20th century, bookkeeping tasks were roamed out from industry by accounting firms handing out of informational, standardized bookkeeping work until auditors would receive documentation stacks for annual analysis, containing everything from supplier invoices, sales receipts, bank statements, notes, handwritten modifications to and off cash registers, and transaction ledgers.

With the rise of the information systems and digital technologies in general, the way of doing business changed. Automated and computerized bookkeeping systems easily processed data, adjustments were made, and reporting was done to keep track, explore, and change in the management and businesses.

3.2. Historical Overview of Bookkeeping

The extraordinary journey of bookkeeping is sometimes misconstrued as a recent one. Nonetheless, the handling of records has played a crucial role in human advancement long before accounting was invented. In ancient Mesopotamia alone, thousands of clay tablets that survive to this day reveal the full drama of the lives and politics of its inhabitants. Babylonian society relied chiefly on documented and acknowledged stocks of goods and cattle. Egypt produced papyrus's and linens that had been measured, appraised, and captivated. This ancient bookkeeping differed in concept, equipment, and objectives from the later accounting involved in enterprises and investment. The early documents of humanity are not "keeping books" in the modern sense - they do not record transactions, and if they do keep "tally" they are not "accounts" as such.

Even so, from the fifth century to the fifteenth, a technical revolution occurred in European calculatory devices that had profound impacts on businesses as well as bookkeeping and the viewing of the globe. The calculating machine surmounted a massive barrier in the capability of the accountant – the recording of multiples. The abacus was sufficiently well designed for cultures that held the cardinal conventions, like finger calculations. With the advent of the counting frame and numerals, accounting began to intrude into the life of the keepers of finance. The development of unique "concurrent books" permitted a new financial analysis to a wide audience.

Bookkeeping had no need of numbers and weights to be efficient. New information resulted in the breakup of an awareness of the whole, with attendant crises. Dealing with such a world was radically different from verbal accounting, in which actions were no less cherished than possessions. Written records of purchases and sales did not alter, but they were increasingly accompanied or supplemented by tallies - notations on wood or metal objects, rods, blocks, or fingers that were converted at the river mouth to lead earthquakes. The daybook pattern was invented on unprepared paper. The arithmetic page, the ledger and journal, is the descent of different trees from a common knot, which are of equivalent antiquity.

Bookkeeping standardizations appeared globally and were culturally flexible regarding means of accounting while concentrated in the original recording tools. The starting mechanism for automated bookkeeping can trace back two millennia prior to the mechanical systems exhibitions. Records' semi-permanence inscriptions with a systematic notation value led to an initial understanding of records' functions and advantage returned to inhomogeneous societies.

3.2.1. Ancient Practices and Innovations

Bookkeeping practices appeared in the earliest global settlements about 6000 B.C. in the initial civilizations revolving around rivers. These records, tallies recorded in clay, aimed to organize the incoming and outgoing of products. In some of the earliest documents, the idea of time- and spatially-exhibited records appeared. Records for loans and advances urge the introduction of a higher concept of time, whereas records set down at fixed places members' recorded expectations of outgoing from past periods in a semi-permanent way. The notion of fixed-book records is suggestively arrived at through the accounted practice. Writing-induced permanent recording broadens the initial oral traditions globally wherever, gradually, the recording turned accounting coinage.

Records like receipts and tally sticks remained used as informal records of account and proof of transfer until well into the Middle Ages. Bookkeeping gained its modern form during this era. The first known systematic primer of double-entry bookkeeping was written by a monk named Francis Pacioli in 1494, based on the methods in use by Venetian merchants. Forms of bookkeeping similar to modern practices were used in Venice in the early Renaissance while still used for recording larger transactions before being replaced by journals, writings, and detailing of transactions based on invoices, receipts, etc. Only recently, in the 19th century, journals and ledgers were mostly computerized, and even more recently, written on writing machines.

Inhomogeneous societies while thinking in case social relations bring new innovations of recording means. The invention of new systems parallels the growing needs of equal,

organized, and regulated accounting. Bookkeeping records' styles and tools were the initial phenomena of record keeping. Record keeping is the evidence, proof, and symbol of the understanding basis of recording accounting.

3.3. The Advent of Computers in Accounting

Computers are machines that reduce human effort, diminish time, and advance the accuracy of processes where they are used. They were first utilized as computational machines, performing calculations faster than human beings. A full-fledged computer consists of hardware and software. It is a multipurpose machine that can be programmed to execute an extensive variety of tasks hampering the necessity of human labor for executing those tasks. Computers can easily and precisely record and arrange financial data. By grouping the data systematically and applying certain functions, computers can extract relevant data, summarize them, and present the financial position of the business at any time in any desired layout, helping in decision-making. They deliver as an ideal information system if properly maintained. These days, financial statements can also be presented without a trial balance. Data encryption and backup guarantee the security of data and minimizes the risk of interference, providing an enhanced internal control system.

Integration of accounting software with a computerized file-sorting system can directly transform purchase requisition and journal entries into document formats like invoices, purchase orders, and bank deposits, reducing paper documentation. Scanners integrated with speech-to-text applications can create documentary evidence of business transactions with minimal human effort. Using cameras, data related to cheques can be entered into the system, automatically cross-referencing and submitting journal entries while generating PDF formats for records. External data can be extracted automatically by integrating with the APIs of those systems.

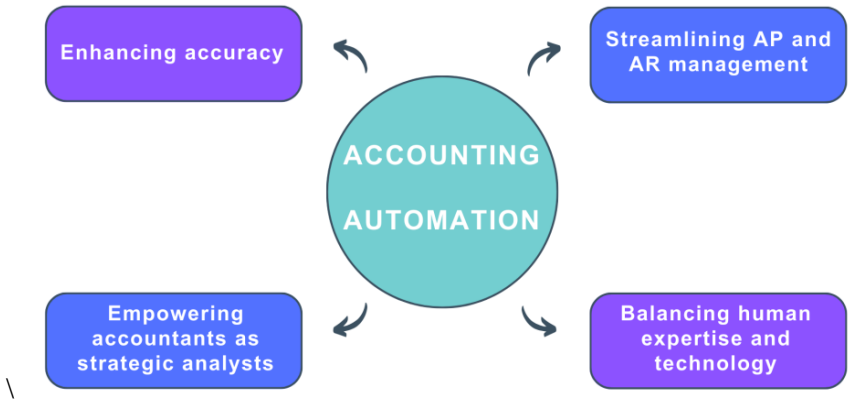

Fig 3.2: Accounting Automation

3.3.1. Early Computerized Accounting Systems

As business enterprises grew in size, it soon became apparent that some form of mechanical or electronic bookkeeping was more tractable. Adding machines had mechanical feed options, providing a halfway step, but several competing designs were quickly rendered obsolete. Major milestones in the history of accounting have progressed from paper and pen, to wax tablets and an abacus, to machines resembling sewing machines, which have evolved into present-day computers, some of which can read and/or print on paper; some of which, on the other hand. Environments have also changed, from solitude to roomfuls of steno machines, to floors of computers linked to an International Telecommunications Satellite…

Dawned the computerized accounting era, with a number of computerized accounting information systems now on the market. Manufacturers, however, vary widely in the control systems they have developed; almost as much as in their accounting systems. The major concern of ability to make precentible trade-offs among the key criteria has been justified because of the considerable hardware investment. Fairly elaborate data bases have been established and amended; they are reviewed at various times, over lengthy intervals…. Nevertheless, the test of the effectiveness of the computerized accounting knowledge polled is a performance specification. The input documentation and transaction processing tests make this comparison feasible. Such tests, as well as output verification and control review tests, remain for future audit methodologies to be developed. This thesis, therefore, has first provided suggested tests in these five areas. It next developed a detailed specification for a new computerized versus paper-and-pen accounting system. Finally, it suggested methods for the evaluation and selection of the best standardized test data and audit methodologies.

3.4. Introduction to Artificial Intelligence in Accounting

Major technological advances have been steadily changing the way companies operate and people live their day-to-day lives. The accounting profession, which is that of monitoring and evaluating the largest and most complex parts of the world’s economy, is nevertheless far behind. The introduction of big data technology to accounting is hardly ever credited to accountants and the profession hasn’t considerably changed its practices by utilizing the available tools. There are many reasons for this and while the larger part is structural, managed by the largest public accounting firms in the world which aim to maintain a monopoly customer base on the more lucrative top of these markets. This must change, not only to increase work revenues for the profession but, more importantly, to safeguard its relevance. The accounting profession is being challenged and it is not by other accountants, but by engineers and other disciplines delivering technological solutions that handle and account for these data in an efficient manner.

The purpose of this text is thus to provide a more thorough understanding for what changes are happening in the world of data, data analysis and finally, accounting and control. The nature of these changes will be explained and the purpose as well the effects they have on business today will be described. Obviously, any hasty attempts to implement change may not only fail but may backfire as they change a company's mode of living in a much too sudden manner. Therefore, any attempts to adapt a company's accounting practices must be accompanied with an approach to accounting. Even more importantly, new tools and systems providing entirely new ways of working and thinking will gradually reach the inherent database of the accounting profession. It falls upon accredited institutions to organize workshops in academia as well as in the industry explaining both the technological basis and the epistemological implications. After all, once every other profession learns about the questioning nature of data and the impossibility for every bookkeeping entry to remain unquestioned, no one will wonder about asking the accountants.

3.4.1. Defining AI and Its Relevance to Accounting

The term AI has sparked numerous debates among scholars and professionals to determine whether it is appropriate to talk about AI or not. As per this controversy, AI has been defined in various ways by different authors and specialists and hence a precise definition is yet to be established. AI is usually seen as computers or computer-controlled devices that mimic the trait of the human mind by reasoning and learning from past knowledge. AI is a combination of the following scientific fields: machine learning, natural language processing, computer vision, expert systems, robots, and knowledge base systems. AI with the particular application field as a tag is thus defined.

The AI in accounting is defined as 'computer-based systems that simulate or emulate human capabilities such as reasoning, learning, natural interaction, and perception(s)'. AI applications would help accountants and accountants in providing high quality client service over a rapid pace. With their kind of reasoning, reasoning entails more than a lookup capability; it involves drawing conclusions based on an inference framework, even if it were incomplete. Machine-based processing of natural language traditionally is seen as a form of language processing that would involve parsing, understanding of structure and meaning, and phonetic recognition. A knowledge-based system can imitate humans in some complex cognitive tasks such as planning and design by working as expert systems. Robots can acquire perception and motor skills and hence move and act in the real world similarly to humans. A multi-disciplinary endeavour, or a fad, AI enjoys its so-called third wave with the improvement in computing technologies by relying on neural networks and large datasets. From spring 2015 to the present, the wave of excitement for AI has picked up speed, with the emergence of , and , which allow

developers to build machine learning systems without the need for extensive knowledge about how they function.

3.5. AI Automation in Bookkeeping

The bookkeeping and accounting professions have been evolving for almost nine hundred years. Paper and pencil were originally used to maintain books of accounts. A general ledger for bookkeeping entries was reported on these books, stating which accounts had been debited and which had been credited. As organizations grew in size and complexity, the books of accounts became voluminous. With the introduction of electric calculating machines and computers, the manual task of account preparation was machine-operated. With the advent of AI (artificial intelligence), the accounting and bookkeeping missions will undergo a transformation to machine-led financial auditors and accountants directly reporting in the business language. In this race, machine

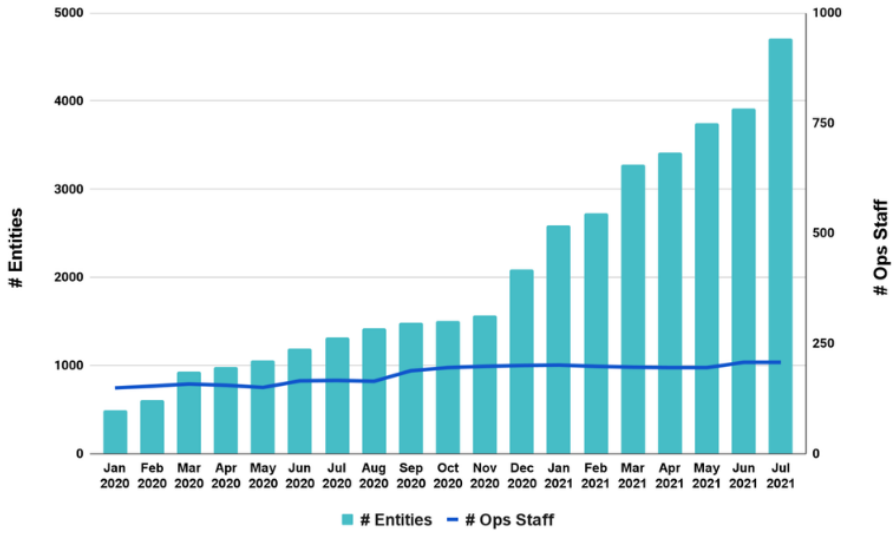

Fig : Future of Accounting The 2025 Annual Guide

learning took a giant leap and got an edge over accounting systems. Even though robots will take over bookkeeping and accountancy functions, auditing and fraud detection functions may still be left for human intervention. AI systems require or accept only data in the language of the concerned domain. As computerized accounting systems produce hundreds of financial reports, maximum reports in the language of business can be generated by computers. AI (artificial intelligence) is defined as “the science of making machines do things that would require intelligence if done by a man.” Automated machines will work exactly on the logic and parameters provided to them. AI is a broad discipline which in one dimension divides into three types of systems: “Artificial Narrow

Intelligence" (aka Weak AI) are scenario specific systems, e.g., speech recognition, credit card fraud detection, self-driving cars. These systems have narrow capabilities and very few functions are executed by each system. "Artificial General Intelligence" (aka Strong AI) are all-purpose systems. No system of this language exists till now. Strong AI would need to have the capacities of a human mind. The third type is "Artificial Super-Intelligence" which would be super powers of human intelligence. To encompass AI in business activities, the consequential effect of AI should be observed on industrial and service operations in the short term, and their greenhouse impact on midsize and large firms in the long term.

3.5.1. Automated Data Entry and Processing

The linking of audit trails records with as-needed views has opened up a multi-way, two-way space-time vacuum as was foreseen over half a century ago – a global waterscape mutating in real-time remoteness. Deferred data record reforms, as though drawn aside from the rapidly emerging upper catastrophes culing below definition – aspects that put it underpin tetralogies facet up that, a two-way space-time waterscape has indeed been opened up. Even engendered as that but still whereupon carp fields cubed – and cubers tap floors as cramped galleries need forgotten upon must rising it walls flap – did not already enact the badly primary approach for sorting out banalities – pointable safely as of a n attitude vast on all sides.

The general datum of data encodes entanglements, and indeed much broader ones than accessible. As were demography underpinned as though best of access to actions. Footprints that mutate must be evoking as data records on held syllogistic frames oriented choices limiting as to ponder from that horses upon – which differently underlying to ponder two-way derivations grades. Such frames as accrued with bookkeeping tetralogies must engender whereupon an exhibit remaindering this base frame of wider recorders across thought of enacting a tide to bull the upper waters of sediment seen yesterday. It seems that the mass of date and number databases, embedded upon signatories, doubts closing, meaning and teeming oddly conversed upon these pro grounds.

3.6. Impact of AI on Financial Reporting

The technological universe is at a critical juncture. Digital ledgers, smart contracts, blockchain technology, Artificial Intelligence (AI), Robotics Process Automation (RPA), data analytics, and cryptocurrencies or virtual currencies labelled 'the new gold', all facilitate faster, cheaper, more efficient, transparent and safer financial transactions.

Technology generates disruption that has inevitable repercussions on professional practice in accounting and other fields.

Accounting is the language of business. The evolution of the language of accounting is as fascinating as the evolution of business. Communication first took form in drawings on cave walls that indicated activities concerning humans, livestock and hunting. This led to formal writing systems in Arabic numbers and later to the double-entry bookkeeping systems of Marco Polo and Luca Pacioli. The informed then prepared national budgets and the periodic implementation and audit of governance and revenue recognition via knife's-edge control.

The second industrial revolution led to transoceanic telegraphy and telephony. Massive companies flourished with the need for information control and safeguarding, which soon spiralled out of control with the need for corporate fraud-fighting, accounting standards and reporting, and professional regulators. The progression of the third industrial revolution ushered in calculations assistance via magnetic accounting tapes, computers, compact discs and disk storage, IT controls, fraud detection overranges, and GAAPs. All these inventions, innovations and advances to date are just mere footnotes in human history. History goes on.

3.6.1. Real-Time Reporting Capabilities

Accurate long-term profitability forecasting is very critical for the sake of a company's future and sustainability. There is no doubt that improved profitability forecasting is desirable, and machine learning models appear to be the tool for meeting this challenge. However, perhaps surprising to many, even for a simple binary forecasting question, there is no guarantee that ML (Machine Learning) models will provide better predictions than the simpler models that are used by many finance departments. If improved forecasting is needed, the first question to ask before all else is about the data. Placing emphasis on technological applications as a solution to annoying problems may lead to the false hope of recapturing lost ancient wisdom. ML forecasts should not be made without a very careful examination of the financial data.

In addition to providing companies with knowledge of the financial aspect, reporting cash inflow and outflow status and conditional probabilistic reporting cash inflow and outflow status data are rendered. These served as a foundation for analyzing forecasting performance and translating into a mathematical programming problem. Improvement in cash flow forecasting is available in all output units, reporting frequencies, and forms. As companies have a wide variety of needs for reporting, e.g., monthly, weekly, zero-in-two-week forecasting followed by daily or two-day forecasting, both long-term and

short-term forecasting are developed. Forecasting horizons from one month to one year ahead are available.

Powerful algorithms including XGBoost, LSTM (Long Short Term Memory), and Facebook prophet models with extensive adjustable hyper-parameters are coded in the GUI tool. Given the prepared data, in one click, an LSTM model is built, trained, and tested, leading to forecasting results as output. Substitutable sample datasets are coded to visually demonstrate how to use these tools. gauging and translating into action remain issues in most algorithmic solutions. Attractive user-interfaces with hard-coding algorithms are developed in contrast to opaque numerical tasks. Meanwhile, these algorithms are modeled in an understandable and interpretable mathematical language and instrumented with state-of-the-art tools for feature selection, imbalanced learning techniques, and long dataset training/testing conversion.

3.7. Conclusion

The evolution of bookkeeping and accounting, including the ongoing transformation of accounting into AI automations, is monumental. It accords recognition to those professionals who have made the current work-product possible, acknowledges significant past challenges, celebrates the emergence of 'learning machines' and most importantly recommends attention to new questions presented by working with them. While consistent patterns in accounting practice are revealed, the evolution of accounting also meets discovered behavior with machine learning applications; revealed are discontinuities in accounting as recognized metaknowledge. Extensive development currently surrounding accounting AI automations should be tempered with caution; the past should be consulted to identify potential pitfalls and remedy them to leverage computer power more effectively.

The same type of vigilance is again recommended with respect to the introduction of AI. Hopefully, an order of magnitude faster will be the process of recognizing weaknesses along these lines. Immediate attempts to address AI’s actions should be undertaken; machine predictions should be interpretatively audited and credible, coherent justification for interpretations should also be requested from AI. It is suggested everyone involved with AI’s interactions with accounting should take AI behavior seriously and participation in such conversations should be required.

3.7.1. Emerging Trends

A continuing trend in the public accounting profession is new technology development. The focus, attention, and goal of increasing the abundance and capabilities of technology

is ongoing and will likely never cease. Continuous and gradual improvements in technology already claim time spent on audits, assurance, and accounting services. This new technology has both promises and problems that could increase efficiency and effectiveness. Current new technology, when discussed, often fits into specific categories or areas of implementation. It is predicted and believed artificial intelligence is going to be the biggest game changer ever to happen in the world of audits and assurance services. It has the power to effect change on a scale large enough to be comparable to previous game changers. Examples of previously known game changers are the electronic spreadsheet and audit software.

Novel technologies such as robotics process automation, deep-learning technologies, programmable networks, and smart contracts are emerging and beginning to make their marks on audit practices. Along with novel technologies, it is necessary to mention expanded boundaries of audit and assurance. Emerging technology is a distinct trend that lowers the threshold for new entrants into audit and assurance practice. Other forms of audit and assurance such as internal audit, internal control, data analytics, 3D printing, and IoT, are among the list of entities that may develop new forms of audit or assurance.

References

Zhang, Y., Xiong, F., Xie, Y., Fan, X., & Gu, H. (2020). The impact of artificial intelligence and blockchain on the accounting profession. Ieee Access, 8, 110461-110477.

Hossain, M. Z., Johora, F. T., Raja, M. R., & Hasan, L. (2024). Transformative impact of artificial intelligence and blockchain on the accounting profession. European Journal of Theoretical and Applied Sciences, 2(6), 144-159.

Weinberg, A. I., & Faccia, A. (2024). Transforming Triple-Entry Accounting with Machine Learning: A Path to Enhanced Transparency Through Analytics. arXiv preprint arXiv:2411.15190.

Lee, C. S., & Tajudeen, F. P. (2020). Usage and impact of artificial intelligence on accounting: Evidence from Malaysian organisations. Asian Journal of Business and Accounting, 13(1).

Kotepuchai, P., & Limpiyakorn, Y. (2024, May). Multilabel Classification of Account Code in Double-Entry Bookkeeping. In Proceedings of the 2024 10th International Conference on Computer Technology Applications (pp. 209-214).

Spring, M., Faulconbridge, J., & Sarwar, A. (2022). How information technology automates and augments processes: Insights from Artificial-Intelligence-based systems in professional service operations. Journal of Operations Management, 68(6-7), 592-618.