Deep Science Publishing
https://doi.org/10.70593/978-93-49910-54-6_8

DeepScience
Open Access Books

Chapter 8: Deploying artificial intelligence-based decision support systems to elevate efficiency in public financial management

8.1 Introduction

The use of ICT tools has influenced various life sectors, providing tangible and intangible benefits. These tools have revolutionized the approach in various contexts and have made work easier; it is necessary to review how this influence can be extended, in this case, to the area of Public Financial Management (PFM) because the potential benefits are numerous. Advances in Artificial Intelligence (AI) development, and robots to automate areas of work traditionally carried out by humans have made opinion leaders from different fields consider this perspective as the next industrial revolution, which has been called Industry 4.0. On the other hand, and without contradiction, PFM is an important component of public management and affects the quality of life of citizens. Even a bad PFM can endanger democracy, peace, and social stability. In this regard, public management is nothing particularly novel, since organized societies, such as ancient Greece, already practiced them. But it is from the Second World War that control and regulation by the state of the country's finances is normalized. From that moment on, its importance grew to influence the evolution of all countries until reaching the present situation (Sivarajah & Irani, 2017; Luna-Reyes & Gil-Garcia, 2020; Scholl & Chatfield, 2020).

It is important to mention that various practices are recognized in the area of PFM, among which we can list the formulation of a multiannual budget with programmatic content; establishment of expenditure controls, fiscal rules and regulation of the internal and external control bodies of public management; popular approval of the budget; citizen audits; intervention of other control bodies. In the area of PFM, it is necessary to

distinguish the management of private organizations from that of public organizations. The first is based on the pursuit of profit or the maximization of shareholder value, with decisions focused on increasing expected income at the least possible cost in order to guarantee the dividends to be received by the shareholders. In the case of a public organization, whose purpose is to satisfy the public needs of the citizens(Smith & Wong, 2022; Wamba & Queiroz, 2021).

8.1.1. Context and Significance of Public Financial Management

Public financial management (PFM) is the pillar that supports the foundations of an accountable society, enabling the government to efficiently deliver essential public goods and services. It encompasses all the financial transactions undertaken by the government and its agencies, impacting the overall state of the economy. By establishing the groundwork for a country's economic outcomes, how a government earns, spends, and manages its money decisively influences economic performance. Inadequate financial management can produce deficits that are untenable and lead to economic stagnation or even disaster. Conversely, effective and sound financial management is critical to ensuring that states are prepared to absorb shocks when necessary and invest in the public goods essential for economic growth.

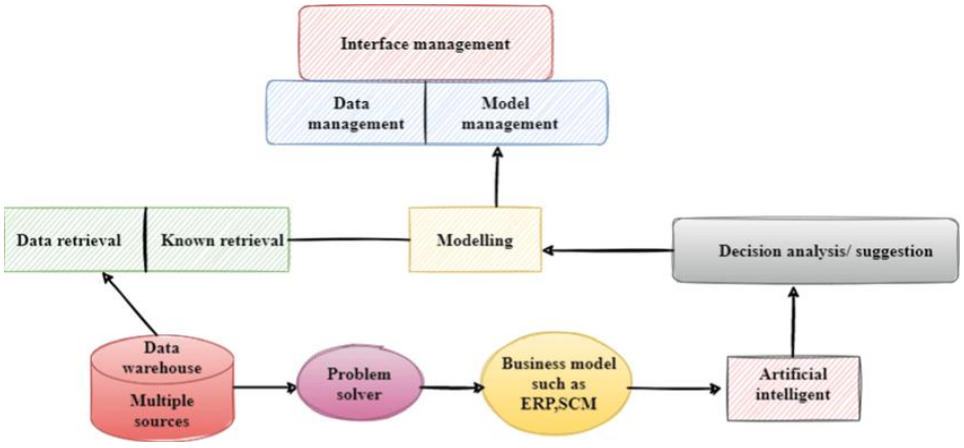

Fig 8 . 1 : A decision support systems framework with artificial intelligence

Public financial management (PFM) is about how governments raise money and decide how to use it on behalf of citizens. PFM links, and shapes, the relationship between citizens, politicians, and civil servants. Citizens expect that the government will raise enough money to fund the public services they need, and they have an interest in how much money is raised, how it is sort of gained, and how it is spent. Politicians need to be elected on a platform that promises specific programs and services while balancing the need to ensure the country meets its fiscal targets. Civil servants are accountable to

their ministers, who are elected. They need effective PFM systems to be able to allocate expenditure, operate budgets, and report effectively to drive toward the delivery of results and achieve the policy objectives. PFM is also a key driver of effective service delivery through the operation of the development budget but also through the operation of the recurrent budget, where ensuring that adequate funding is available is critical to enabling effective service delivery in a country.

8.2. Overview of Public Financial Management

Public Financial Management (PFM) encompasses the set of laws, policies, and practices that govern the planning, budgeting, control, and oversight of public sector financial resources. PFM ensures that financial resources are used efficiently and effectively in pursuit of government goals and that the accountability of government for its revenues and expenditures is visibly enacted. PFM is also important for understanding where government priorities lie, how much effort will be required to meet them, and how the policies will be implemented. Further, because these government priorities have an important bearing on the macroeconomic environment, PFM both influences and is influenced by the overall economic environment. PFM develops, implements, and reviews systems — on a continual basis — that monitor, measure, and ensure the effective and efficient utilization of resources held by governments and other entities acting on behalf of the people.

PFM consists of a cycle of activities that provides a framework to ensure that government resource allocation and use is effectively controlled. The most important thing to be aware of are some important features of the PFM cycle. Each of the activities — policy linkages and their importance, resource allocation, execution, and the like — are affected by the current microeconomic environment. The chosen policy framework governs the relationship between a country's PFM systems, resources used in the provision of government services, government outcomes, and the macro and micro environment of the economy. The PFM cycle serves to concentrate on the managing of resources at the country macro level. There are also role changes — from legislatures preparing budget policy frameworks, to executives managing the allocations in line with performance targets determined by the legislature. Thus, the cycle works best if the three micro-level actors work in an environment which has established good and enforceable budgetary rules.

8.2.1. Key Components of Public Financial Management

Public Financial Management (PFM) is a discipline that focuses on how the government is funded and financed. It involves the process of budgeting and appropriation, which

provides funds for implementing government programs, the process of revenue collection, which funds government programs and activities, the process of moving money around, which provides the means for implementing government programs on a daily basis, and the process of reporting and analyzing how well the government carried out plans, which helps government officials improve future performance. Effective PFM ensures the right resources are used in the right way, at the right time, and for the right results. Budgeting and appropriation involve the submission by the executive branch of the government of a proposed budget to the legislature in advance of the fiscal year, and the subsequent approval by the legislature of this budget, which is allocated among programs and activities in accordance with government priorities and results. Revenue collection includes the many predictable and unpredictable, recurrent and one-off revenue sources that the government draws on to fund its operations, including tax revenue, business profit transfers, official development assistance, and other forms of revenue transfer. Cash flow management is the function of moving money into and out of government bank accounts to ensure that sufficient cash is available to implement programs at particular points in time. Expenditure management includes executing transfers of cash or goods, monitoring program performance, following rules designed to ensure transparency, accountability, and value for money, and implementing internal and external auditing processes designed to ensure compliance with these rules. Finally, reporting and analysis involve preparing and disseminating reports designed to provide reliable and meaningful information on budget implementation, program performance, and the government's financial situation.

8.3. The Role of Decision Support Systems

Decision Support Systems (DSS) are computer-based systems that help decision-makers use data and models to solve unstructured problems. They are often used to support management decisions in semi-structured and unstructured problem areas at the management level of an organization. DSS are a group of systems that generally serve the planning and control needs of upper and middle levels of organizations. In addition to the specific characteristics that define DSS, these systems have a number of features that indicate their main purpose: They are used primarily by individual decision-makers; they support tense or ill-structured decision-making problems; they support decision-makers, not replace them; they help decision-makers deal with problems that have a high time, cost, or risk associated with them; they assist decision-makers in finding solutions.

DSS combines the descriptive models of decision analysis and operations research with the capabilities of computer and information systems to produce a flexible and adaptable system that is responsive to a decision-maker's needs. DSS are also capable of interactive model building, enabling users to develop custom-built models that are

sensitive to their specific requirements. Decision-making tools are used to a greater or lesser extent in many areas of the world, when difficult, high-risk, non-routine decisions are to be made. Common pre-planned decision rules are often inappropriate. The choice of the most appropriate tool for public sector decision-making should reflect, as far as possible, consensus views about formal comparative evaluations of alternative methods of decision-making. It should also take account of the strengths, weaknesses and status of currently employed tools as well as the perceptions, experience and motivation of decision-makers.

8.3.1. Importance of Data-Driven Decision Making in Public Financial Management

Financial systems are designed and constructed to support transactions and provide information to the state, citizens, and the economy as a whole. The function of these financial systems and the information they provide to relevant governmental and non-governmental institutions and organizations forms the basis of financial planning, budgeting, preparing, administering, controlling and accounting of state and municipal budgets, financial reports, financial statements, and indices of the economy and its sectors. The system of indicators, their quantitative values, issued financial statements, and indices of the economy can become a powerful tool for monitoring and forecasting the socio-economic situation in the state and its sectors, that form the basis of decision-making and support procedures practiced by individual institutions. Various types of decisions, including tactical, administrative, and strategic ones affecting the activity of state authorities and institutions may be made based on reports and monetary and financial indicators. These quantitative values reflect the balance of money receipts to and expenditure from the budget, showing the government's actual capabilities and forms a basis for rational implementation of the functions imposed on it. However, the most informative data is the indices of the financial condition of the government, showing the use of the country's economic potential and the actual financial and monetary capacity of the state. The notification of the executive authorities, parliament, and the public about the government's financial position, the trends and prospects of its development, ratio values of various indices, and other data, compare the sources of information with the data of previous periods, draw various tendencies and conclusions from the discrepancies observed, are only part of the process designated "financial control".

8.4. Artificial Intelligence in Decision Support

In recent years, we have witnessed an explosion of interest and research activity in the area of Artificial Intelligence (AI), especially in its machine learning variants. This is due to newly acquired capabilities in the realms of data acquisition and storage and processing power, as well as the emergence of new methods. These factors have contributed to large and increasing amounts of data becoming available for analysis. The shift in the balance of these factors towards data availability has meant that large numbers of traditional statistical models are becoming obsolete. With ever smarter decision support systems equipped with intelligent agents, it is becoming less relevant to ask what a particular policy tool is likely to achieve. Rather, the focus is shifting towards encouraging the agent, usually a public sector decision maker or administrator, to adopt the right policy tool for the right context at the right time – the policy strategy.

AI-based decision support systems can play a crucial role in further raising efficiency levels across the board. Such systems can provide advice on addressing issues such as choice of policy instruments particular to the country. A second area is in the determination of the timing of the implementation of policy measures throughout the economic cycle and the sequencing of structural measures so that they newly positioned in the technology space occupy the government's most binding constraint. Lastly, agent-based policy modelling enables a new approach to the design of the macroeconomic architecture that hosts this decision-making. Empirical observation indicates that this architecture is far from perfect in many economies and in particular that important issue, second best, relates or develops toward macroeconomic stability.

8.4.1. Machine Learning Techniques

In recent years, machine learning (ML) techniques, a subset of artificial intelligence (AI), have gained immense prominence as efficient data-driven algorithms learning directly from data and generating models for use in predictive and descriptive analysis. Some of the key components of ML include supervised learning, unsupervised learning, reinforcement learning, semi-supervised learning, automated machine learning, deep learning, and transfer learning. ML algorithms rely on training data to make predictive assessments or learn from data without any specific training. Two crucial types of learning in ML are predictive and descriptive modeling. Predictive modeling is primarily utilized in applications that require a prediction, such as forecasting future events, assessing a score, classifying a case, or recognizing a voice or image.

Algorithms generally used in predictive modeling include regression, nearest neighbors, support vector machines, naive Bayes methods, artificial neural networks, and ensemble methods. Predictive modeling can be applied in use cases, for example, fraud detection,

credit scoring, risk assessment, and maintenance forecasting. Descriptive modeling, on the other hand, involves answering questions to extract patterns from a database. The questions can range from basic data organization questions to complex association or sequence detection questions. ML algorithms based on descriptive modeling include clustering, associative rule learning, and sequence discovery. Some of the commonly used applications of descriptive modeling in ML include market research, credit card transaction analysis, customer segmentation, and customer timelines.

ML techniques can either be based on a single learning algorithm or model the data distribution using a mixture of two or more different models. The former approach models the data within a single learning algorithm to solve the task, while the latter approach partitions the entire life cycle of the task into two or more stages, thus optimizing these mixtures. The technique of mixture-based learning has gained popularity in resorting to a collaborated solution, as certain basic tasks during the life cycle can be performed by other simple or specialized techniques, thereby improving efficiency.

8.4.2. Natural Language Processing Applications

Natural language processing methods allow the interaction between a computer and human natural language. Users input unstructured data using written or spoken words. Vast data stores of documents reflecting human opinion can be transformed into structured analytical information. This study materializes those capabilities by summarizing critical research discovered on the potential ability to digest citizen input on taxes and spending currently found in public comments on Budget proposal and

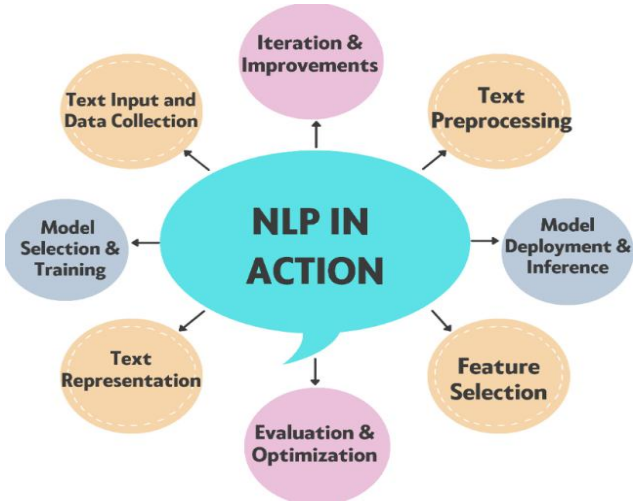

Fig 8 . 2 : Advancements in natural language processing

execution. Selected representatives provide recommendations based on annual Budget reviews. Sentence segmentation and tokenization, part of speech tagging and morphological analysis, word sense disambiguation, parsing, coreference resolution, relation extraction, and lexical semantics are processes mentioned to address such inseparable challenges. Word embeddings using neural networks build on iterated learning processes to represent hidden unit structures completing challenging question tasks.

Sentiment analysis is another identified critical decision support response for NLP transforming unstructured data. Sentiment attributes sentiment polarity, sentiment subjectivity, sentiment target, and opinion holder. A relevant and exciting unexplored area with the potential to support decisions is sunsetting and introducing new taxes. Large public participation is expected, but silence can also be present. Enormous unstructured stakeholder opinion data can enhance decision support by estimating tax revenue impacts of the different tax alternatives.

8.5. Benefits of AI-based Systems in Public Finance

Public finance management is intricate and complicated due to its diverse activities, types, sectors, and temporal, geographical, and institutional influences. Through continuous observations, technological advancements, and institutional developments, the functions of public financial management have reached new heights. Supporting complex decisions made by economists or finance departments is one of the many uses of AI in finance. AI-based Decision Support Systems are widely regarded as a way to speed up decision-making in the PFM field. The department can hire many experts from various sectors to apply cutting-edge heuristic learning techniques for various types of investigations. Stakeholders, including the general public, funding agencies, the economy, etc. would expect reports regarding investment in infrastructure adhering to all guidelines in specific timelines.

1. Improved Data Analysis. The size and volume of revenues and expenditures by the government is enormous; however, traditional and innovative frameworks provide no insights for optimal operational utilization. Econometric models cannot structure more dynamic and novel measures; however, with techniques like natural language processing, optical character recognition, and regression, many search methodologies can be explored to build optima. Expert economists, accountants, and managers would not have time to visualize the reams of data built by government-expend-funded policies in developmental timelines or periods.

2. Enhanced Predictive Capabilities. The patterns that drive an organization’s external space change periodically, such that predictive capabilities cannot account for unusual

shifts. Compare this to an organization that employs AI to assess market or industry changes through the processing of a greater number of risk variables, including geopolitics, policy risks, and macroeconomic indicators, and receives performance predictions days or weeks ahead of their typical schedules. In this situation, risk measures can offer a tailored strategy for risk response according to predictability.

8.5.1. Improved Data Analysis

One way to leverage AI's agile analytical capability in public financial management is to expand the voluminous pool of transaction and procurement data by marrying it with private sector data mined. Enhanced due diligence is advisable in such a big-data scenario to enhance both the credibility of the sources and the selection of relevant datasets. Acts of bribery and malfeasance leave a signature trail, even if indirect. Frequent reseller purchases by government vendors of precisely what they sell to the government could call for further investigation. Tightening or relaxing market forces could prompt an uptick or downtick in governmental vendor sales. These conditions could selectively signal an inquiry into a vendor's legitimacy. Authorities systematically compare business transactions with publicly available registration data and follow automated flags to investigate suspicious changes recorded when contracts are awarded or amended, like quantities of research chemicals sold by laboratories with access to precise specifications.

The capacity to process data at equal speed and uniform precision allows for rapid review of documents that used to take long hours or days of motley human review, providing up to possible AI-generated content identity clues. Akin systems can help detect financial misconduct internally or within used-service partners. Firms can even program AI-enhanced search engines to look for disparate images that tag firms for issues like share price prediction for succession and use the indices as a contrarian barometer of investor sentiment. Nations can likewise deploy "content mines" for keywords to explore citizen perceptions of potentially key socio-economic issues for possible failure points, targeting and fine-tuning remedial responses by authorities.

8.5.2. Enhanced Predictive Capabilities

AI-based decision support systems utilize advanced algorithms to identify relationships between explanatory variables that influence a specific response, as well as defining the functions through which these variables are related. This aspect of these automated systems differentiates them from standard econometric models in that, unlike in econometric modeling, there is no need for the user to pre-determine the form of the function that links the response to the explanatory variables; the definition of the model

is internally generated. Therefore, the identification of various machine learning models can substantially improve predictive capabilities. Explaining results is not the main focus of these models. Explaining the relationships is important in econometric models but the predictive power of the econometric model is not automatically validated using non-contiguous data. Econometric estimation often involves the user's subjective choices such as selection of variables, specification of a functional form, parameter estimation, and hypothesis testing.

AI-based prediction models are entirely data-driven. They seek to find useful patterns in data to build a model that can predict the response of out-of-sample observations. This enables a data-driven approach to forecasting. The power of AI-based prediction models have been validated using non-contiguous years of holds for many datasets. These models have been found both to reduce error at least as much as econometric models. Both model identification procedures can be explored in tandem to maximize predictive performance. That helps to perform both datasets and models to jointly explore predictive power. In fact, it is necessary to have a large dataset available to train the model.

8.5.3. Increased Transparency

Transparency is a key precondition for improved accountability since it allows stakeholders to establish causal links between policy actions and their effects. Increased accountability can build trust and a partnership ethos among citizens and other stakeholders. Some AI systems may generate transparency gains, at least potentially, due to their ability to analyze large amounts of information in short time spans and identify patterns that are not always unambiguously interpretable even by skilled professionals. AI systems may quickly detect outliers and provide policy analysts with average trends, seasonal adjustment, and trends. This shortens the time for designing accountability reports and filtering the vast amount of transactions individuals, firms, and public operators conduct throughout the year for the increasing complexity of tax rules. Technological speed gains help to tackle issues of "tunnel vision," a phenomenon whereby experts may concentrate on a narrow range of indicators for an extended period because of changes in political or social emphasis. Institutions can share dashboards based on well-selected and interpretable indicators with civil society actors. Using AI decision support tools helps internal organizations make better and possibly more uniform judgments. The availability of reliable checks that can continuously monitor key activities mitigates the vagueness-misleading bias which can lead key stakeholders to hide or misrepresent important information. However, AI-based tools cannot replace human judgment or institutional context. Interpreting, contextualizing and acting on the information produced by AI-based tools is a human, organizational and institutional task.

8.6. Challenges in Implementation

As with any new technology, the integration of AI-based decision support systems into public financial management systems is not without challenges. This section discusses the primary difficulties. The deployment of decision support systems requires that huge quantities of quantitative and qualitative data are drawn from different sources which, in turn, requires a legal and technological framework regarding data privacy issues. Guaranteeing that the private information of citizens from whom data is collected is protected must be a priority of governments. Any flow of information between public administration institutions needs to respect data owned by citizens. How to ensure data privacy is among the hottest unresolved issues regarding the implementation of AI.

Also, governments have put in place and invested extensively in financial management information systems that cover budget preparation, execution, control and reporting, and that generate vast amounts of data that support government decision-making. It is critical that AI-based decision support systems can be successfully interfaced with existing financial management information systems to guarantee that the quality of the financial data that feeds the decision support system is sound and reliable. Data reliability will be crucial in order to ensure the quality of information that the AI system generates and to establish a high level of trust in the decision support system outputs. This applies both to technical and financial data, as decision support systems require not only the typical technical and financial quantitative data inputs but also a range of information regarding the quality of government investments, especially regarding social objectives and environmental impacts. The success of deploying AI-based decision support systems will depend largely on their ability to interface existing financial management information systems.

8.6.1. Data Privacy Concerns

The role of AI-based decision support systems in public financial management endeavors is two-way. The systems help professionals in effectively performing high-volume and time-consuming works, thus improving the performance of the systems. Conversely, the department accumulates a wealth of fiscal data from across different organizations. This data, especially when linked to taxpayers or taxee organizations, is rich in sensitive or personal information. Such information is targeted by malicious actors for fraudulent gains. The government has the responsibility to safeguard such data and disallow any compromise or leak. This safety concern for the provided sensitive datasets influences how and what organizations share with the government. Certain sections of data privacy laws and guidelines worldwide prohibit organizations from sharing identifiable personal information with unintended recipients, irrespective of whether it is being used for government or academic purposes. When public

organizations need help in effective client management, they engage private firms for surveys. However, these firms aggregate the responses by grouping individuals by demographic attributes like age, gender, and postal address to prevent identification of individuals. Aggregate values are then shared with the requesting organizations, while individual-level data floats with the private party. A similar approach is needed for governments and respective departments when collecting data from new or existing organizations on the expenditures incurred or payments made.

8.6.2. Integration with Existing Systems

AI-based decision support systems have the potential to elevate the efficiency of public sector management but integrating these systems into existing processes and systems can be extremely challenging. Disparate data silos and vertical departmentalization, which fosters distrust in shared data, are hallmarks of public sector organizations as they are structured around public policy goals rather than customer-centricity. Integrating AI functions like forecasting, decision optimization, or anomaly detection, that must harvest data from these disparate silos, changes the nature of how public sector organizations manage financial data making adoption extremely sensitive to politics. It is worth noting that even if the right architecture is in place with effective interoperability and integration capabilities, public sector organizations may still be hesitant to integrate AI capabilities into critical governance systems on a widespread basis.

While technology-wise it's possible to integrate AI and optimization modules into the existing platforms used by public sector organizations, for example, treasury systems that aim to support the day-to-day fiscal operations, organizations may be reluctant to do so. The budgeting, auditing, and payment processes provide safeguards against misallocation and misuse of public funds. Over-reliance on AI may be considered unsafe and there might even be a loss of institutional memory or amendment of internal systems such as legitimacy-seeking rationalities, functional ceremonies, collaborative bureaucratic processes, and accounting-driven risk aversion. Additionally, the integrated system may not even provide value. Public service organizations must still generate revenue and the marginal increase in value provision through the AI addition to systems may not be vast. Innovation is messy and unpredictable. Some organizations may even consider it a high-risk option to add AI capabilities into existing, steady-state operations.

8.6.3. Resistance to Change

Implementing any new technology in an organization may meet some reluctance from employees to change the existing working environment. Artificial intelligence (AI) is bound to raise more concerns of adapting to the new technological adoption. Moreover,

in public financial management, an additional hurdle may be the existence of pre conceptual distinction between the public and private sectors. The first, in regard to traditional functions of budget formulation and execution supervision, is commonly thought to be based on legality, while the second relates to the effectiveness and efficiency of services provision. Some employees may find it difficult to accept the difference, hence the reluctance with the adopted technology. This is more so as, in today's world, there are many private sector companies joining the competition with the provision of public services such as health, education, transport etc.

The questions raised by performance sceptics belong to the following categories. Are budget activities carried out as intended in documents? Are expenditures sufficient in relation to the expected performance? Are the outcomes generated at least commensurate with the resources spent? A possibility to respond adequately is that of predicting the results of existing programs and possible new ones, in regards to what the organization wants to achieve. However, it is not easy for public organizations, due to budget formulation based on legality, to abandon the old logics and let the AI predict the intended objectives without taking into account the budget legibility. There are also questions which are specific to the sector or organization. AI can lend help to provide answers to many of these questions.

8.7. Policy Implications

Efforts and resources dedicated to the effective deployment of AI technologies are only meaningful when supportive in advancing the broader pre-defined goals and missions of public financial activities. This may require a national or international policy commitment to elevate the use of technologies, such as AI, in the work of public finance. Such policy commitments facilitate the effective support from relevant public financial management authorities in all countries, such as ministries of finance, supreme audit institutions, and oversight legislative bodies. Supportive policies also facilitate the use of dedicated operational funding from national as well as regional and local levels of governments in a country, as well as international organizations, toward the use of AI for automating and improving the quality of services delivered by public financial activities. From the perspective of regulators, the above policy commitment implies clear value statements which prioritize dedicated funding and activities aligned with the relevant missions. Such statements must ensure that the specific AI technologies deployed in various areas of public finance have relevant safeguards in place. Such safeguards concern data protection and privacy policies, ethical standards for AI deployment, regulation of potential bias in trained AI systems, as well as the need for human oversight of the management of AI outputs. Prioritizing these governance areas of the AI regulatory framework enhances the independence and trust areas of the public

financial sector, ensuring that the relevant activities of safeguarding the public interest are optimally fulfilled.

8.7.1. Regulatory Frameworks

1. Introduction Governments are expected to provide quality, affordable and efficient services to its citizens. Governments' ability to achieve are often hindered by limited capacity and resources. The process of resource allocation however, is intrinsically complex for both local and central government and takes significant time and human effort, especially for routine functions. In some departments, for example in health and education, the rationale for funding allocation, indeed the very policies themselves, can frequently be opaque and requires input from many actors at many different levels of 'government'. Trade-offs and decisions of this nature can only be of a low quality if the information available to decision makers is of poor quality. AI/ML capabilities can facilitate and support decision making, thus serving to elevate the efficiency and quality of PFMSt. Technologies can reduce costs and provide better, faster, safer and more accurate delivery whilst drawing on shorter time frames for activities such as budget negotiation, development of medium-term fiscal frameworks as well as a wide range of routine activities such as basic disclosure and transactions. Moreover, these technologies can enable reaching more distant areas, create better synergies with other development stakeholders and the wider economy, and provide access to infrastructure services necessary to support economic activity. Deployment of these technologies has raised inexorable questions about the level of regulatory scrutiny applicable to AI/ML services, how existing regimes apply, and whether additional regulation is needed. New regulatory frameworks designed specifically to regulate high-risk uses of AI/ML technology have been proposed in an increasing number of jurisdictions and multiple such proposals are currently being debated. Our discussions can either apply directly, or can be taken to indicate something about the more general parameters which can and should apply to PFM use cases for AI/ML technology to deliver better, faster, safer and more accurate services to citizens whilst at the same time reducing the administrative burden on agencies. At the level of specific area regulation for AI/ML technology, we have specifically focused on options for treating specific types of high-risk deployments, Data Protection, Competition Law and Intellectual Property Law, Sectoral use cases of Technology 'As a Service', the regulation of Deployment and Use and the critical issue of AI/ML Safety, researching and exploring best practices and model approaches.

8.7.2. Funding and Resources

Deployment of AI systems for decision support purposes in public financial management can be resource-intensive. Funding such initiatives must therefore form a consideration at the outset. Financial and human resources alone will not guarantee success. The restrictions placed on funding may mean that financial resources must be diverted from critical areas to fund these initiatives. Engendering buy-in and commitment from all stakeholders is critical to ensuring that these systems are both successfully deployed and are sustainable over time.

Funding is needed in a number of critical areas. Resources may be required to cover the cost of software licenses and the hosting of AI systems if they are developed by external organizations. Resources are likely to be required on a recurrent basis to cover updates, continue support, and carry out maintenance work. Data comes at a cost. Data in insufficient quantities may reduce the efficacy of the AI-developed model and may lead to additional costs in validating system performance and in augmenting model performance post deployment. Human resources need to be assigned to the continuous training of AI models and ensuring that the AI model continues to produce results consistent with the initial expectations. Internal stakeholders need to be engaged with a view to stimulating acceptance and ensuring project success. Concerns around data privacy and protection need to be addressed with explicit policies on data handling and usage in organizations either developing or utilizing the AI-informed decision support system.

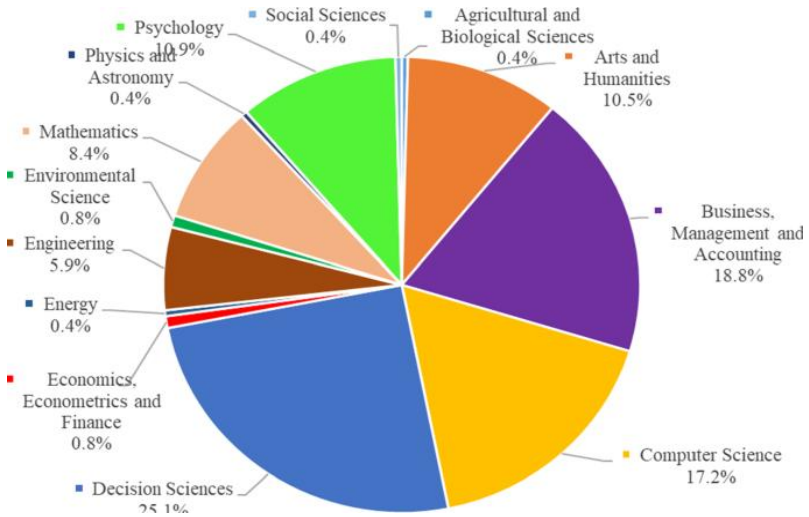

Fig 8 . 3 : Artificial intelligence for decision support systems

The consideration of funding comes much earlier in the process of creating, approving, and deploying these AI systems. These systems will not replace human decision-makers. Such systems may prompt and suggest decisions that human actors have the discretion to ignore. AI-based systems must be seen as adjuncts to the financial decision-maker's

tools. They must not be viewed unfavorably as a potential source of job loss. Concerns around human participants should be focused on ensuring that human decision-makers are not acting in manual mode when the supporting system indicates otherwise.

8.8. Conclusion

This essay has explored the immense potential for AI-based Decision Support Systems (DSS) to successfully deploy AI technology. However, the "AI-based DSS" tools presented must be user-friendly with screens that would help elevate efficiency and ease user interaction. As such, in the second half of this essay we have focused on building "AI-based DSS" tools that can serve as 'agents of change' and 'intelligent collaborators' of users who have the requisite domain expertise but are not steeped in technical knowledge of AI or machine learning. Information and Communications Technology (ICT) implementation in general, and State of the Art technology, which can be used for building the "AI-based DSS" tools we present in this essay, need to be used to empower users with fast and intelligent systems that can provide support in performing mundane but necessary tasks faster, and help in focusing their resources on tasks that require knowledge and skill such as interpretation, management and decision-making.

Technology can enable the public financial sector to utilize their scarce resources and enhance productivity and service delivery. AI-based Decision Support Systems have significant potential to add value in the area of public financial management also, inter-alia, by enabling faster reporting and facilitating monitoring. Moving forward from this essay, while implementation of ICT invariably requires Public Sector transformation, it is our firm belief that the technology implementing the system should do the mundane tasks, while Education should occupy an important space in focusing on tasks that require human intervention and expertise in decision making, creative thinking and management. This is the future.

8.8.1. Final Thoughts and Future Directions

The COVID-19 pandemic has fundamentally changed the way organizations develop strategies, policies, and programs for public administration. It has even changed the way they make decisions, by having driven the digital transformation of public administration, including the use of Artificial Intelligence (AI). AI-based Decision Support Systems (DSS) have shown to be an effective means to promote organized post-pandemic recovery and economic growth in a more productive, positive, and fastest way. Because of that, the use of AI in Public Financial Management (PFM) has been experiencing genuine enthusiasm, with an increasing number of governments deploying advanced technologies and Digital Government tools in their PFM systems and tools.

This chapter builds on this argument touching on how deploying AI-based DSS can address PFM challenges as well as the antagonistic PFM dichotomy of efficiency/effectiveness, by discussing the pros and cons of using such tools in this context. The chapter then narrows down to examining more closely how employing AI-based DSS can solve some specific internal, external, and mixed PFM problems, namely fraud risk and laundered money detection, crisis regulation forecasting, risk assessment for allocated budget execution, and tax collection. The chapter then concludes that there is a provision gap in literature because the potential of using AI-based DSS to increase efficiency in PFM processes has not yet been critically addressed. Because of that, the chapter ends with twofold contributions. The first one is that it fills this demand/knowledge gap. The second one is the modeling of a heuristic framework for increased use of AI-based DSS in PFM, accordingly contributing to a more effective and insightful theoretical base for addressing the employment of such DSS in the PFM area. This heuristic should help academics in further research in that base and also policy-makers in designing their budget and financial execution paths.

References

Scholl, H. J., & Chatfield, A. T. (2020). Artificial Intelligence in Government: Towards a Public Financial Decision Support Framework. Government Information Quarterly, 37(4), 101510. https://doi.org/10.1016/j.giq.2020.101510

Wamba, S. F., & Queiroz, M. M. (2021). AI-Enabled Decision Support Systems for Public Financial Management: Benefits and Challenges. International Journal of Information Management, 60, 102383. https://doi.org/10.1016/j.ijinfomgt.2021.102383

Sivarajah, U., & Irani, Z. (2017). Decision-Making in Smart Government: Leveraging AI for Enhanced Financial Oversight. Information Systems Frontiers, 19(2), 255–269. https://doi.org/10.1007/s10796-017-9721-1

Luna-Reyes, L. F., & Gil-Garcia, J. R. (2020). AI and Public Sector Efficiency: Building Decision Support Systems for Fiscal Governance. ACM Digital Government: Research and Practice, 1(3), 25. https://doi.org/10.1145/3392373

Smith, C. J., & Wong, A. T. (2022, May). Advancements in artificial intelligence-based decision support systems for improving construction project sustainability: a systematic literature review. In *Informatics* (Vol. 9, No. 2, p. 43). MDPI.