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Modern Financial Tools' Impact on Public Financial Management: The Case of Egypt

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ABSTRACT

The purpose of this study is to **examine** the managerial impacts of applying modern public financial management (MPFM) tools in financial reform programs on the efficiency of public financial management (PFM) in developing countries, considering the case of the Egyptian reform program implemented during 2005–2015. **Applying** MPFM tools could improve the efficiency of PFM in developing countries if institutional factors are available to ensure their successful implementation in reform programs. The study adopted a descriptive-analytical **method** to describe the managerial impact of applying MPFM tools in the financial reform experiences in developing countries. It **employed** a case study approach on the Egyptian reform experiment to estimate the correlation between applying modern financial tools and the managerial efficiency of PFM assessed through three elements: operational efficiency, allocative efficiency, and financial discipline. The practical study used the IBM SPSS package and MS-Excel to process the data. The **results** found a positive correlation between the application of modern financial tools and the rate of improvement in the efficiency of PFM in the Egyptian reform program. The study **developed** a specific model for a deeper understanding of the impacts of MPFM tools on the efficiency of PFM. The model **highlighted** a strong positive correlation between the successful application of modern PFM tools and the efficiency of PFM and **underscored** that the availability of the required real-time financial information about governmental revenue and more control over public spending led to achieving financial discipline.

Keywords: modern public financial management tools; public financial management; financial reform programs; developing countries; Egypt; financial discipline; allocation efficiency; operational efficiency

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INTRODUCTION

Public financial management (PFM) efficiency is one of the main objectives for developing countries seeking financial stability. However, public finance management in these countries carries challenges owing to outdated financial systems, slow paper procedures, and legacy administrative tools. This leads to inefficiency in allocating and operating public financial resources and an imbalance of financial discipline. Therefore, these countries seek to apply advanced solutions to modernize PFM systems by implementing financial reform programs (FRPs) adopting modern methodologies and methods to achieve PFM efficiency.

Consistent with this approach, international financial institutions since the mid-1980s have developed new public financial management systems based on information and communication technology (ICT) to improve the PFM efficiency — modern public financial management (MPFM) tools. The most important of these were the Treasury Single Account System (TSA), Government Financial Management Information System (GFMIS), and Government E-Payment System (GPS) The World Bank (WB) and International Monetary Fund (IMF) have contributed significantly to designing and formulating these modern financial tools.

Since the mid-1990s, WB and IMF experts [1] have published many studies and research indicating that these modern tools are advanced technological systems that can create an appropriate administrative work environment. These systems facilitate the organization and flow of financial information on government activities and provide technological capabilities enabling governments to achieve the required efficiency in operating and allocating resources and conducting financial discipline that may lead to PFM efficiency improvement. Moreover, international financial institutions encouraged developing countries to apply FRP to implement MPFM tools and provided financial and technical support to use these tools, reform public finance, and improve PFM efficiency [2].

Following the multiple recommendations issued by international financial institutions regarding the advantages of MPFM tools, developing countries have

responded diligently, applied FRP, and implemented MPFM. However, a literature review analyzing the results of these countries' reform experiences indicates that the results varied and were inconsistent with these recommendations.

Research problem

Although many developing countries have followed the recommendations issued by international financial institutions, particularly from the WB and IMF, emphasizing the importance of applying MPFM tools in FRP and improving PFM efficiency, many developing countries have committed to using these MPFM tools since the beginning of this century. However, the results of the reform programs were varied and did not always succeed in applying or improving PFM efficiency. Conversely, developing countries faced many challenges and failures during the application and use of these MPFM tools. A discrepancy in the results emphasized why studying the application mechanism of MPFM in FRPs in developing countries more in-depth to identify the factors leading to successful application in some countries. Additionally, by building a more specific model that can enhance the mechanisms of applying these modern tools in the future, we hope this model can help to avoid the causes of failure experienced by other countries and benefit from these lessons.

Study question

What are the impacts of the application of MPFM tools on FRP in developing countries on PFM efficiency considering its three elements — operational efficiency, allocative efficiency, and financial discipline — and how can the outcomes of this application be improved?

Significance of the study

The study highlights the implementation of MPFM tools in FRP. It defines success and failure institutional factors in the application and lessons learned from application experiences in some developing countries. Additionally, the study introduced a model that may explain the relationship between applying a specific modern financial tool and a specific element of PFM efficiency. The model applied a field study on the Egyptian reform program applied during 2005–2015 to measure the impact of the application and use of these modern tools on the FRP and PFM efficiency in Egypt.

LITERATURE REVIEW

We identify how studies and research addressed new concepts of MPFM tools and their applications in FRPs in developing countries and PFM efficiency. Here, the author monitored two main trends. The first trend is the literature focused on the concept of MPFM tools, while the second focused on how these tools are implemented in FRPs in developing countries. However, according to chronological order, the most important of these studies are the following:

A. Chowdhury [3] analysed the management of financial sector reform policies. They found some improvements in competition and efficiency due to the reform process. However, efficiency was lacking, and bias was present in the loan distribution and diversion of resources away from the rural sector and obstruction of loan recovery owing to political intervention. Our study concluded the importance of using MPFM tools to achieve efficiency in resource management by providing information that can earn equity and equality of distribution.

I. Pattanayak and S. Fainboim [1], studying the importance of applying new MPFM tools, highlighted the concept of TSA and described its features, discussed design issues, implementation conditions, and how can address fragmented government banking arrangements. Our study reached a group of results: fragmented governmental structures hindered cash management efficiency. TSA aims to ensure effective total control over governmental cash balances. Strengthening monetary resources by implementing TSA helps avoid governmental borrowing. Paying a substantial interest fee helps finance government agency expenses.

R.P. Jr. Beschel and M. Ahern [4] conducted extensive research for assessing the PFM reform process in the Middle East and North Africa region. They aimed to understand the type of fiscal reforms implemented during the first decade of the current century, specifically how these countries deal with PFM problems and the tools they used to manage FRP. They found that, in this region, it is the presence of individual leadership with a reform vision. This was key in the application of FRPs with MPFM tools. However, this success depended on the existence of this charismatic individual, and his capabilities enabled it to succeed.

A. Lawso [5] evaluated public financial management reform in Burkina Faso, Ghana, and Malawi in 2001–2010. Through a comprehensive assessment of the

FRP implemented in those countries by the African Development Bank, the Swedish Development Agency, and the Danish International Development Agency, they answered the following questions: Why and where do PFM reforms work? Where and how can donors support effective PFM reform contributing to the results? Our study concluded that financial reform results are good when strong commitment exists at the political and technical levels. Additionally, the reform application and design models are well designed to fit the context and use modern tools in the reform process.

A. Muhammed [6] sought to analyze the positive and negative aspects of reforming PFM in Ethiopia and Tanzania. It focuses on the systematic treatment of weaknesses in financial control. The study then found successful financial reforms in Ethiopia and Tanzania, and all reform paths were selective. Reform procedures in Ethiopia have focused on several aspects, such as reforming existing systems, focusing on the legal framework, reports, and budgeting, establishing strong manual controls on commitments of the procurement systems, and mechanization of operations. In Tanzania, FRP has focused on using ICT and MPFM tools.

S.K. Aitaa [7] examined the efficiency of GFMIS implementation and found that many institutions in Uganda use different financial transaction systems. Conversely, some financial transactions are performed outside the GFMIS. After implementing the system, the performance of financial management has improved, and the financial reporting process has improved timing and accuracy; the percentage of applying the system has increased from 47% to 50%. Although the system can solve some problems, concerns regarding plans that face many challenges in system implementation (e.g., frequent system and network downtime, insufficient training for users, power outages, and inefficient computers) are increasing. In addition to role the misallocation affecting the implementation of the operations of the GFMIS and the operational constraints of the system, the study found that the GFMIS in Uganda did not achieve the expected results entirely because of weak human resources technological capabilities.

W.A. Abdulaziz [8] highlighted the impact of the application of the GFMIS on the PFM efficiency in Egypt. This study sought to determine the reasons for poor PFM efficiency in Egypt attributable to traditional methods in public budget preparation that suffered from a lack of transparency and disclosure in governmental transactions. They concluded that the application of MPFM tools, such as the GFMIS, may help agencies and ministries conduct PFM functions efficiently by raising accuracy level in budget estimates, improving self-control, taking preventive measures, controlling financial operations, and providing financial information related to the preparation of financial plans and budgeting.

Comments on Literature Review

The author produced the following results: confirming the hypothesis that the application of MPFM tools was not successful in all application experiences; however, its impacts vary based on country-specific conditions. To achieve success, it is imperative to consider key institutional factors. This study focuses on these institutional factors to clarify them. Most of the studies tackled the application of a single tool and its impact on only one element of PFM efficiency. Multiple tools have not been studied either holistically or simultaneously. Measuring impact and analyzing the results of MPFM tools was applied in general, without linking or determining the effect of a particular device on a specific dimension or element of PFM efficiency.

Realizing this dispersion in the measurement and analysis of the impact of MPFM tools on PFM, we present a new theoretical framework for the compound application of MPFM tools simultaneously and measuring its effects on the PFM efficiency. We designed a proposed model for the relationship between each of the three MPFM tools for each of the three dimensions of PFM efficiency in the application phase (implementation of FRP) and then in the use phase (managing PFM). Thus, it measures the direct impact of each specific modern financial tool on the related dimension concerned with the PFM efficiency, which is designed to achieve this particular goal. We aggregated the values of the averages of the results to estimate the total combined effect of the MPFM tools on the FRP and PFM efficiencies. The author has applied this proposed model to the experience of FRP implemented by Egypt during 2005–2015 to verify the validity of the model through a questionnaire completed by Egyptian Ministry of Finance employees who applied these MPFM tools in Egypt. This model attempted to measure the degree of correlation between the application of MPFM tools and PFM efficiency. Details of the model and field study results are obtained after presenting the

theoretical framework of MPFM tools and how they are applied in FRP.

MPFM TOOLS

MPFM tools generally refer to automating the financial operations of the public budget, treasury, and payment units in PFM by implementing modern and comprehensive technological applications, leading to the transformation of PFM paper-based work environments to electronic bases. MPFM was built based on work rules and procedures and developed by international financial institutions (e.g., WB and IMF). Moreover, they have been designed and established as foundations and business processes since the beginning of the 1980s.[1]

MPFM tools are vital in tracking financial events, recording all transactions, summarizing information, supporting reporting and policy decisions, and incorporating ICT elements, personnel, procedures, controls, and data. MPFM tools are generally built around a core treasury system supporting essential budget execution functions (e.g., accounts payable and receivables, commitment and cash management, general ledger and financial reporting, debt management, and public investment management modules). MPFM tools require a large technological project implementation in the form of FRP, which ends with the availability of these tools for PFM to achieve efficiency [9]. The essential MPFM tools and how they are implemented in FRP are as follows:

TSA is a unified structure of government bank accounts enabling consolidation and optimum utilization of government cash resources providing the government with a consolidated view of monetary resources. The country's financial resources are pooled with the central bank to demonstrate the true picture of the state balance of revenues and expenditures, with a careful and transparent follow-up of cash flows for achieving the rational management of the country's fiscal resources [1].

TSA advantages: IMF highlights that this financial tool is one of the most important MPFM tools. It is used to "improve the management of government resources in financial reform processes" and is critical for pooling and managing government cash resources. Therefore, in countries with multiple banking arrangements for government resources, implementing this tool should be prioritized in the financial reform agenda for their overall role in reducing borrowing costs and maintaining and managing limited financial resources efficiently and effectively. However, applying this system requires professional, technical, and political will in countries that have used traditional systems of financial reform for a very long time. Challenges and difficulties in technological infrastructure make it more difficult in developing countries. The planning and implementation of TSA are also some of the essential factors in application success [10].

GFMIS is a set of solutions to automate public financial operations. Moreover, it unified and integrated accounting and information systems linking all governmental organizations to support informed decision-making. The system considers the ERP or back-office system for the government; it is not in direct contact with citizens, but is used by governmental employees for internal transactions and budgeting processes. Moreover, it assists in prioritization, implementation, and reporting expenditures and monitoring and reporting revenues, leading to PFM efficiency and equity [11]. GFMIS can also be identified as a set of process mechanization solutions that enable governments to plan, implement, and monitor the budget.

Advantages of GFMIS: Countries can acquire many benefits from implementing GFMIS. According to the United States Agency for International Development

The essential advantages of system implementation are the following [12]:

- Inclusiveness: All government financial transactions were recorded. Moreover, it allows tracking economic events and presents them in a normative form.
- Flexibility: Customized to work according to the needs and specifications of the government environment wherein it is installed.
- Integration: By combining all the needs of government financial information into a single integrated platform.

GFMIS components: The system comprised of two main components: *the core systems,* a set of modules that must exist to make the system functioning, and called treasury systems or budget execution systems. The general ledger system represents the heart of the system. It records all the accounting processes and restrictions conducted on the system and contains a chart of accounts, which

[1] International Monetary Fund. Fiscal Monitor — Public Expenditure Reform. Washington: Making Difficult Choices. 2014;11–17.

is its backbone. *Sub-Systems*: It is the other modules that may be part of the system or exist in an external autonomous system but require an interface to the GFMIS through a process of integration, such as collection, debt management, and asset management systems [13].

GPS: Payment system is the set of means, procedures, and rules for transferring funds between members participating within the system following an agreement between all members participating in the system and the system operator. Transfer of funds using a technical infrastructure should be done following the agreed technology. Modern economies currently have three types of payment systems. In the banking payment system, banks make payments. The non-banking payment system uses public networks, such as the Internet or private networks of payment providers. The government e-payment system, a system newly introduced by the WB and IMF, is a new government channel for collecting revenues and paying government liabilities to the beneficiaries [14].

Advantages of GPS: Governments implementing GPS accelerate payment and collection operations in budget units, facilitate the management of transfers to budget units and vice versa for budget operations, reduce cash in circulation and provide advanced channels for the government to collect revenues and pay its obligations securely. GPS is critical as it created an integration that was missing between government strategic plans at the MoF and the real cash balances available in government accounts. Moreover, it enhanced the efficiency of government financial information, wherein each payment to or from the government accounts is recorded with a unique identification number [15].

FRP is a specific plan with a time frame based on scientific rules, designed by setting clear goals to be implemented according to an identified period before initiating implementation. The extent to which the plan achieves, what has been targeted, is monitored to ensure that the required activities are implemented in specified times and at the estimated cost and to work on correcting any deviations that may occur for any reason. FRPs typically have specific goals or goals, such as reducing the public budget deficit at the end of the program to 3% of GDP. There must be a mechanism to measure the extent to which the program achieves the goal (objectives) for which it was implemented. FRP's importance originates from the potential to drive economic growth, and evidence indicates that if FRP succeeds in achieving its goals (e.g., financial discipline), it leads to better economic outcomes. Many studies have highlighted that the FRP could raise economic growth by about three-quarters of the percentage point in developed countries, particularly in the ten years following FRP [16].

Challenges of applying FRP in developing countries

Typically, developing countries face many challenges due to their historical circumstances when applying FRP. Therefore, studies have asserted that the fundamentals of reform should be established. A "preparation process" for the reform climate must be implemented well before applying FRP based on MPFM tools. The rush to implement MPFM tools in an undeveloped environment often fails the reform process. The application process and reform program being implemented are likely subject to the risk of political volatility, which may affect the reform process outcome. Conversely, studies analyzing the results of the reform experiments in developing countries over a quarter-century found that completing the basic requirements is crucial [17].

On the other hand and according to C. Dener et al. [11], FRP must be implemented through a long-term strategic framework for a comprehensive financial reform state strategy and not a government program. At the same time, N.M. Alsharari and M.A.E.-A. Youssef [18] found that the long period of the reform program implementation must be subject to and followed up by independent bodies directly (e.g., state audit and control) to ensure continuity of application over time the event of political changes. The pavement of the legal environment for FRPs is crucial, and developing countries must adopt the necessary laws to support the reform process.

APPLICATIONS OF MPFM TOOLS IN INTERNATIONAL EXPERIENCE

These applications are evident from the analysis of some incidents of applying MPFM tools in developing countries that can produce several lessons for benefiting both successful backgrounds and failure experiences in either way, which will be presented in the following examples.

Applying MPFM tools in Iraq

Iraq applied FRP based on MPFM tools on two occasions. The first in 2003 was when USAID implemented MPFM tools in Iraq to attempt to modernize Iraq's PFM and

comply with IMF requirements so that Iraq could qualify for IMF assistance and cancel debts from the Paris Club by May 2007. GFMIS was implemented in 132 nationwide spending units, accounting for more than 80% of government spending. In June 2007, USAID ended the program after five civil service consultants were abducted, among other difficulties encountered in adapting the systems for the Iraqi government. Despite applying MPFM tools in FRP, the first FRP failed to achieve real reform of the PFM. This reform experience was not completed due to several political problems encountered during the reform process and systems application. However, with the persistent imbalance in the public expenditure structure favouring operating expenses, Iraq was forced in 2014 to eliminate technical aid from the WB to start a new reform program with MPFM tools. To avoid the failures of 2003, a supportive environment was created through the Government of Iraq's commitment to prepare and implement the GFMIS, updating TSA. A step toward modernizing public investment management systems and operating public procurement to create a more transparent and efficient government system that can provide better services while creating a viable environment by laying the groundwork before beginning the financial reform process and enhancing a sense of real ownership the project. Although the second FRP is still ongoing, it faces many challenges due to Iraq's current political circumstances.[2]

Applying MPFM tools in South Africa

At the beginning of 2005, applying MPFM tools became a unified financial and administrative system in nine South African regions. According to C.J. Hendriks [19] MPFM tools took seven years before application, and the project was finally implemented as a priority initiative led by the National Treasury Authority to review and develop information technology. The project was aimed to enhance government expenditure management integrity and provide performance reports to ensure effective service and PFM efficiency. FRP began by implementing GFMIS with the modernization and interdependence of existing financial management systems. South Africa was guided by reasoning and rationality in the application, especially in choosing the "application approach". Our choice was between a phased implementation or comprehensive application of all system components once and debugging regularly, compared to an extensive application system with high risks that can lead to complete project failure. South Africa adopted a phased approach, which improved PFM efficiency.

Applying MPFM tools in Guatemala

In 1997, Guatemala launched three FRPs with the World Bank's support to enhance PFM efficiency. The first financial reform modernization project was established under the "Integrated Public Financial Reform Program", or SIAF I. Following the implementation of two additional reform programs under SIAF II and SIAF III. Our reform aimed to integrate all government units of the new system and add new capabilities to increase budget cycle efficiency, enhance transparency and accountability, and automate the collection of basic information at various government levels. The main principle of the system focused on the transition to centralized control and the development of basic budget and treasury functions. Guatemala's MoF developed a management unit called SIGES for supporting entities in implementing administrative processes (e.g., purchasing goods and services, recording inventory movements, and debt management). Guatemala's fiscal reform programs are implemented through an internal national strategy based on a combination of local cadres and capabilities and international expertise only as a consultant, especially in project management and organization of work procedures. This reform approach has prevailed in most FRPs in Latin American countries [9].

Lessons learned from applying MPFM tools in international experiences

After two decades of financial reforms in developing countries using MPFM tools, targeted improvement in PFM has not been successful in all the reform experiences implemented despite a commitment by applying modern tools. Moreover, this failure may result from all or some of the following factors [8]:

- The application of MPFM tools was partial and dispersed.

[2] World Bank. Iraq Public Expenditure and Institutional Assessment, Volume 2: Public Expenditure and Financial Accountability Assessment, Public Financial Management Report. Washington, D.C.: The World Bank. 2008;15–25. URL: http://elibrary.worldbank.org/doi/book/10.1596/28210 (accessed on 02.12.2022).

- The implemntation was conducted in a sequential rather than a parallel manner.
- Missing the integration mechanism in the scope of the project.
- A particular tool was applied to fix a specific financial defect without considering the integrated implementation of a comprehensive FRP based on MPFM.

FIELD STUDY FOR EGYPTIAN FRP 2005–2015

To identify how MPFM tools affect the efficiency of FRP and PFM, practically and more thoroughly, the author conducted a field study for Egyptian FRP using MPFM tools implemented during 2005–2015. The study sought to measure the degree of correlation between the application of MPFM tools and efficiency of FRP and PFM in the Egyptian case, particularly on the following details of the field study:

Study hypothesis

From a literature review, the author found that there are two basic stages in the reform process, as follows [21]:

- *Application phase*: This stage implements new technological systems within the FRP framework leading to improved FRP efficiency.
- *Usage phase:* After completing FRP implementation and using MPFM tools in PFM, which improves PFM efficiency.

Study model

The following relationship between the study variables was also monitored (*Fig.*):

- The *Independent variable* is the "application of MPFM tools" implemented independently to improve FRP efficiency. Within the scope of the study, it includes three tools: TSA, GFMIS, and GPS.
- *The dependent variable* is the "PFM efficiency", which is affected by the use of MPFM tools that have been implemented in FRP. The PFM efficiency can be identified by measuring the improvement in the following three dimensions or three dependent PFM sub-variables as follows [20]:
- *Operational efficiency* means providing a specific level of public services with the least financial resources while achieving the best possible services.
- *Allocative efficiency:* This refers to the allocation of public revenues according to public priorities and the efficiency of government programs, and the continuation of funding government activities of the highest priority in light of any decline that may occur in government flows and liquidity.
- *Fiscal discipline:* This generally means that total government spending does not exceed its amount in the general budget. The fiscal deficit does not exceed a certain percentage of GDP.

Field study questions

To what extent did the application of MPFM tools improve the efficiency of FRP and the PFM efficiency in Egypt?

Branching off from the main question, the following three sub-questions:

- How did the application of TSA improve the results of FRPs and achieve the ***operational efficiency*** of public financial resources in Egypt?
- To what extent did the implementation of GFMIS improve the results of the FRP and achieve the ***allocation efficiency*** of financial resources in Egypt?
- What is the impact of applying GPS on the results of FRPs and on achieving government ***financial discipline*** in Egypt?

Study methodology

This study utilized a descriptive-analytical methodology to describe the general information and analyze the responses of the study sample members regarding whether efficiency was achieved in managing FRP due to the application of MPFM tools and their perceived level of achieving efficiency PFM. We calculated the averages and standard deviations and compared the average responses of the sample members. Their assessment of the efficiency level achieved compared to the default average was [3] degrees (average of Likert scale five). The impact of applying each financial reform axis in FRP on PFM was analyzed and presented separately. The combined effect of using the three MPFM tools on the efficiency of FRP and PFM was then calculated. The degree of correlation was measured between the application of MPFM tools and the PFM efficiency.

Study limitations and data collection tool design

The questionnaire form used the five-point Likert scale in the questionnaire and included the following parts (*Table 1*):

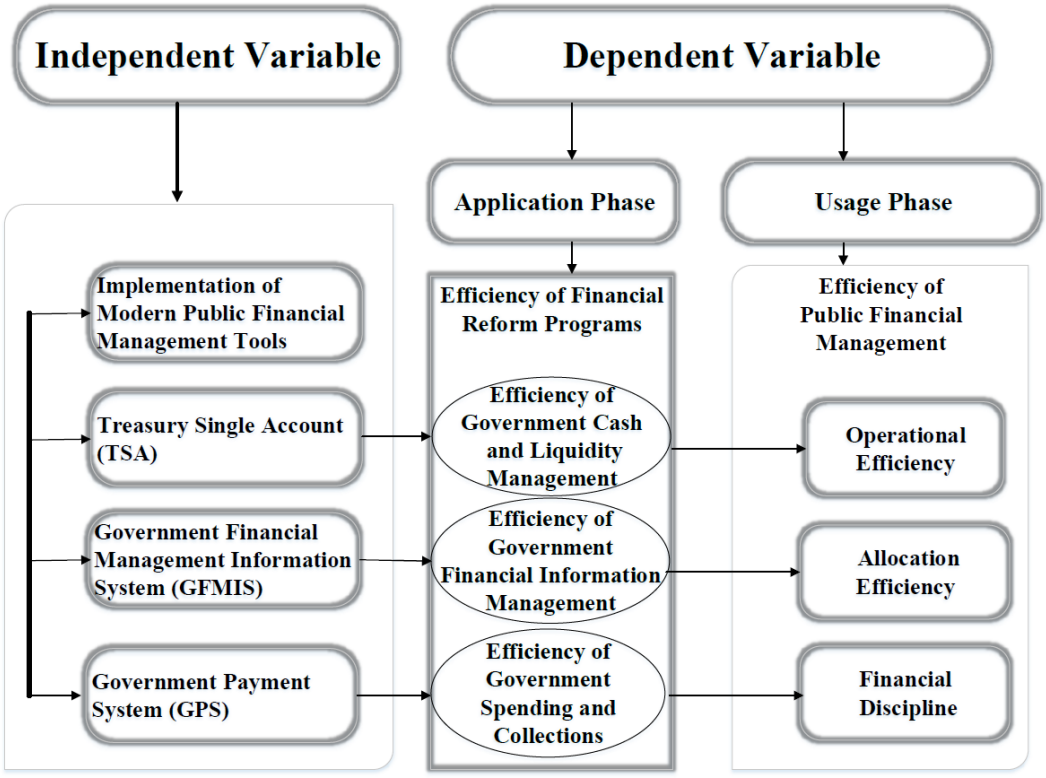

Fig. **Study model depicting hypothesized relationships among variables**

Source: author's original design.

The *first part* included seven phrases addressing the sample demographic characteristics.

The *second part* included thirty phrases to collect data from the study population on their opinion regarding the application and use of MPFM tools.

The study sample included employees of the Egyptian Ministry of Finance (2600 employees), and data were collected from July 11, 2021 to October 27, 2021 (*Table 2, 3*). Our sample was calculated according to the following formula [22]:

$$n = \frac{x^2 NP(1-P)}{D^2(N-1)+X^2P(1-P)} = \frac{(1.96)^2 \times 2600 \times 0.5 \times (1-0.5)}{(0.05)^2 \times (2600)+(1.96)^2 \times 0.5 \times (1-0.5)} = 335.$$

Here, n is the sample size, N is the size of the study population, P is the percentage of the maximum availability of characteristics to be studied in any community, D is the degree of accuracy reflected in the allowable error, and X2 is the standard degree (the value of the Ka2 test) corresponding to the confidence coefficient, which is 95% at a degree of freedom = 1. Hence, the corresponding standard degree is 1.96.

Data ***analysis methods:*** The author used the following statistical methods:

- ***Cronbach's alpha coefficient*** was used to estimate the stability of the internal consistency of the study tool.
- ***Frequencies and percentages***: Learn about the distribution of respondents, depending on demographic factors.
- ***Averages and standard deviations***: To obtain the answers of the sample respondents on passages for the study tool.
- ***Pearson's correlation coefficient determines*** the nature and strength of the relationship between the independent and dependent variables.

***Stability of the study tool*:** To ensure validity and reliability of the questionnaire and reach a high level of internal honesty in the study and identify the ability of the questionnaire to measure these variables and test their suitability for collecting data and information. The author has subjected the study tool to several tests, including Cronbach's alpha coefficient for internal consistency. *Table 4* shows that the stability coefficients by Cronbach's

Table 1

Distribution of degrees, percentages, estimation, and ranking of the five-point Likert scale

Degree	Percentages	Evaluation	Rank
From 1 to less than 1.8	From 20% to less than 36%	Do not agree entirely	Very low
From 1.8 to less than 2.6	From 36% to less than 52%	Do not agree	Low
From 2.6 to less than 3.4	From 52% to less than 68%	Neutral	Average
From 3.4 to less than 4.2	From 68% to less than 84%	Agree	High
From 4.2 to 5	From 84% to 100	Highly agree	Very high

Source: prepared by the author.

Table 2

Sampling method and determining study sample size and response rate

Random probability sampling method	Sampling method
Simple random sample	Sample type:
335 single	Sample volume:
350 forms	Number of questionnaire forms distributed:
327 forms	Number of survey forms retrieved:
93.4%	Response rate
307 forms	Number of valid questionnaire forms:
Egyptian MoF Towers — Headquarters	Sampling location:
July 11, 2021, till October 27 2021	Time frame of the study:

Source: prepared by the author.

Table 3

Distribution of respondents depending on demographic factors

Item	Level	Redundancy	Percentage
Qualifications	Bachelor's degree	219	71%
	High diploma	9	3%
	Master's degree or MBA	64	21%
	PhD	15	5%
	Total	307	100%
Position	Researcher C	73	24%
	Researcher B	67	22%
	Researcher A	97	32%
	General manager	70	23%
	Total	307	100%
Years of experiences	Less than 10 years	73	24%
	From 10 to 20 years	134	44%
	More than 20 years	99	32%
	Total	307	100%

Source: prepared by the author based on SPSS V. 26 output.

alpha ranged for TSA between 0.744 and 0.854, for GFMIS 0.739–0.858, and GPS 0.794–0.856 to the phrase.

The stability of the questionnaire's axes was also ensured by the split-half and Getman methods in the following table. *Table 5* shows the axial stability coefficients by the Cronbach's alpha, the split-half, and the Getman. Moreover, it shows that the values of the stability coefficients using the alpha Cronbach and split-half methods are high (greater than 0.8), indicating the stability of the scale.

FINDINGS

Impact of application MPFM tools on Egyptian FRP 2005–2015 efficiency

The following three (*Tables 6–8*) present the responses of the study sample to the impact of applying TSA, GFMIS, and GPS on Egyptian FRP efficiency (2005–2015), while (*Table 9*) presents aggregate responses of the study sample as follows:

The total arithmetic mean value of the axes of applying MPFM tools in Egyptian FRP has reached (4.43 out of 5) with a 0.640 standard deviation (*Table 9*). This average falls within the fifth category of the five-point Likert scale (4.2 to 5). There is a high percentage of agreement among the sample members that the application of MPFM tools in Egyptian FRP 2005–2015 has achieved very good results and achieved high efficiency FRP results. This category refers to a highly available option, and this percentage indicates that study sample responses were very high.

Impacts of usage of MPFM tools on the efficiency of Egyptian PFM

The following (*Tables 10–12*) show the responses of the study sample to the impact of the usage of TSA, GFMIS, and GPS on the use of MPFM in PFM in Egypt after FRP.

Answer on the main study question

To what extent has the application of MPFM tools improved the efficiency of FRP implemented in Egypt from 2005 to 2015 and then achieved PFM efficiency? The total arithmetic mean value of the axes of using MPFM tools in PFM reached (4.22 out of 5), with a 0.650 standard deviation (*Table 13*). This average falls within the fifth category of the five-point Likert scale (4.2 to 5). This category refers to a highly available option. There is a high percentage of agreement among the sample members that use MPFM tools in PFM has achieved very high efficiency. This percentage indicates that the responses of the study sample were very high.

Answer to the sub-questions

- How did applying TSA improve the results of FRPs and achieve the ***operational efficiency*** of public financial resources in Egypt? ***TSA*** succeeded in achieving the operational efficiency of public financial resources by 82.8% by providing the required information in real-time, increasing its ability to control resources, improve investment returns, reduce expenses, improve government liquidity management, improve oversight, and correct operations errors immediately.
- To what extent did implementing GFMIS improve the FRP results and achieve the ***allocation efficiency*** of financial resources in Egypt? ***GFMIS*** represented a quantum leap in achieving the allocative efficiency of public financial resources by 84.6% by recording all expenditure items in the budget of the system. Moreover, it allowed classification according to their importance and allocating the resources to items of strong importance while providing flexibility in responding to emergencies.

What is the impact of applying GPS on the results of FRPs and on achieving government ***financial discipline*** in Egypt? ***GPS*** succeeded, with an 86.2% success rate in improving in the most important element of financial discipline, wherein total government spending does not exceed the amounts specified in the budget. GPS controlled public spending completely; hence, units may not spend any amount unless it is included in the budget.

Analysis of the correlation degree between the study variables

A strong (positive) correlation relationship with statistical significance exists between the independent (using MPFM tools) and dependent variables (PFM efficiency) at the macro level (*Table 14*), as well as at the sub-axis level and dimensions. Table 14 shows the Pearson correlation matrix between each ax of MPFM tools and the corresponding dimension in PFM. This correlation ranged between (0.521 and) at its minimum and (0.826) at its maximum values, respectively. Therefore, the greater the success rate of applying MPFM tools during the implementation of FRP, the greater the improvement rate in the PFM efficiency.

Table 4

Reliability coefficients (Cronbach's alpha) for all study paragraphs

1st Axe: TSA		2nd Axe: GFMIS		3rd Axe: GPS	
Item Number	(Cronbach's alpha) coefficient	Item Number	(Cronbach's alpha) coefficient	Item Number	(Cronbach's alpha) coefficient
1	0.854	10	0.803	21	0.802
2	0.844	11	0.813	22	0.847
3	0.802	12	0.810	23	0.839
4	0.843	13	0.809	24	0.794
5	0.767	14	0.804	25	0.856
6	0.805	15	0.827	26	0.846
7	0.817	16	0.848	27	0.817
8	0.839	17	0.831	28	0.844
9	0.744	18	0.739	29	0.854
		19	0.858	30	0.824
		20	0.816	21	

Source: prepared by the author based on SPSS V. 26 output and MS-Excel.

Table 5

Axial stability coefficients by Cronbach's alpha, split-half, and Getman

MPFM Axes	No of Phrases	Alpha stability coefficient	Split half coefficient	Getman's stability coefficient
1st Axe: TSA	9	0.869	0.814	0.897
2nd Axe: GFMIS	11	0.877	0.813	0.897
3rd Axes: GPS	10	0.871	0.815	0.897
Total stability	30	0.887	0.828	0.906

Source: prepared by the author based on SPSS V. 26 output and MS-Excel.

CONCLUSION

The application of MPFM tools in FRP forms the most recent trends in PFM reform practices in developing countries. It has many benefits, such as automating work procedures and effective control over public finances, enhancing transparency and accountability, transforming the work environment from paper- to electronic-based, and automating the business process. This allows financial policymakers to centralize government spending and good management of public financial resources and maintain financial discipline, which achieves PFM.

The technical implementation of MPFM tools is challenging and requires the development of country specific solutions to meet a number of functional and technical requirements associated with the FRP vision. If reforms were assessed properly and a time action plan was developed with realistic sequencing of reform activities tend to produce more effective results in FRP.

The success of applying MPFM tools requires the provision of a set of basic factors, including laying the foundations of reform, creating a suitable climate for reform, and providing the necessary resources, especially human resources. The fundamental causes of failure are

Table 6

Responses of the study sample to the impact of applying TSA on Egyptian FRP efficiency 2005–2015

Phrase No.	Phrase	Mean	Standard deviation	Percentage	Rank
8	TSA application led to the provision of sufficient information in real time on government financial revenues	4.23	0.748	84.60	V. High
9	TSA application led to an improvement in the ability of MoF to control disbursement from government accounts and control budget units	4.21	0.727	84.20	V. High
10	TSA applications have reduced the need to maintain cash reserves	4.06	0.743	81.20	High
11	TSA application led to improved control during budget execution and flexibility in change in expenditure items according to urgent changes	4.18	0.740	83.60	High
12	TSA application led to a reduction in implementation errors and the possibility of correction	4.17	0.723	83.40	High
Overall average of the impact of applying TSA on Egyptian FRP efficiency		4.17	0.730	83.40	High

Source: prepared by the author based on SPSS V. 26 output and MS-Excel.

Table 7

Responses of the study sample to the impact of applying GFMIS on the efficiency of Egyptian FRP 2005–2015

Phrase No.	Phrase	Mean	Standard deviation	Percentage	Rank
17	GFMIS application led to the provision of sufficient information, which raised the level of accuracy in the estimates of the budget	4.47	0.561	89.40	V. High
18	GFMIS application led to efficient financial resource allocation decisions according to its relative importance	4.35	0.647	87.00	V. High
19	GFMIS application resulted in saving time and effort in the regulation of government financial revenues	4.34	0.683	86.80	V. High
20	GFMIS application led to raising the efficiency of monetary planning	4.27	0.662	85.40	V. High
21	GFMIS application led to regulation of government procurement and the rationalization of public spending	4.02	0.720	80.40	High
Overall average of the impact of applying GFMIS on the efficiency of Egyptian FRP		4.29	0.550	85.80	V. High

Source: prepared by the author based on SPSS V. 26 output and MS-Excel.

Table 8

Responses of the study sample to the impact of applying GPS on the efficiency of Egyptian FRP 2005–2015

Phrase No.	Phrase	Mean	Standard deviation	Percentage	Rank
28	GPS application led to the rapid collection of government fees and dues	4.30	0.612	86.00	V. High
29	GPS application led to the efficient collection government revenues	4.22	0.731	84.40	V. High
30	GPS application reduced the difference between the book proceeds and the actual government revenue proceeds	4.23	0.721	84.60	V. High
31	GPS application enabled the inclusion of government revenues in the government account on the same value working day	4.36	0.612	87.20	V. High
32	GPS application achieved accuracy and speed in paying government dues to beneficiaries and suppliers using transfers	4.12	0.668	82.40	High
Overall average of the impact of GPS application on FRP		4.23	0.660	84.92	V. High

Source: prepared by the author based on SPSS V. 26 output and MS- Excel.

Table 9

Aggregate responses of the study sample to the three-axis phrases related to the impact of the application of MPFM tools on Egyptian FRP 2005–2015

Axes of applying MPFM tools in FRP	Mean	Standard deviation	Percentage	Valuation
1st Axe: TSA	4.17	0.730	83.40	V. High
2nd Axe: GFMIS	4.89	0.550	97.8	V. High
3rd Axe: GPS	4.23	0.660	84.80	V. High
Total MPFM impact	4.43	0.640	88.66	V. High

Source: prepared by the author based on SPSS V. 26 output and Microsoft Excel.

political changes that occur during the application. Further, obstacles such as a lack of capacity, commitment, and institutional and technical challenges pose a risk to the successful implementation of MPFM tools.

The most important value that MPFM tools have achieved is providing detailed and immediate "information and data" about financial operations. Using this structured information led to the identification of input quantity, the measurement of an output quantity, and the adjustment of using ratios to prevent wastage of financial resources. Thus, controlling the inputs and outputs and identifying and measuring the extent to which they have achieved an efficiency in PFM is possible [23].

The application and use of MPFM tools in Egyptian cases led to a high-efficiency rate in managing Egyptian FRP 2005–2015. Additionally, a high improvement rate in the PFM efficiency reaches 84.5%. These ratios are particular for the Egyptian case FRP 2005–2015. The rate of improving PFM efficiency differs per country depending on the circumstances and environment of the application and the context of reform.

Table 10

Responses of the study sample to the impact of TSA usage in PFM

Phrase No.	Phrase	Mean	Standard deviation	Percentage	Rank
13	TSA usage led to improved efficiency of government payments and reduced idle government balances in commercial banks	4.19	0.703	83.80	High
14	TSA usage led to reduced commissions and interest paid by government and its bodies for its accounts side of the commercial banks	4.10	0.804	82	High
15	TSA usage led to improving financial settlements efficiency and reducing outstanding restrictions, which reduced the risks of operations	4.09	0.708	81.80	High
16	TSA usage significantly improved government cash management through the concentration of dispersed balances in one bank account at the central bank	4.19	0.704	83.80	High
Overall average of the impact of using TSA on Egyptian PFM		4.14	0.720	82.8	High

Source: prepared by the author based on SPSS V. 26 output and MS- Excel.

Table 11

Responses of the study sample to the impact of the usage of GFMIS

Phrase No.	Phrase	Mean	Standard deviation	Percentage	Rank
22	GFMIS usage succeeded in raising efficiency of budget preparation and implementation process through the automation of work procedures	4.42	0.590	88.40	V. High
23	GFMIS usage helped expedite the preparation of the final account for the general budget	4.28	0.605	85.60	V. High
24	GFMIS contributed to raising financial claim payment efficiency to beneficiaries and suppliers on their due dates	4.10	0.702	82.00	V. High
25	GFMIS led to improvement of self-monitoring and reduced errors	4.16	0.676	83.20	V. High
26	GFMIS promoted transparency by providing data. Statistics on the budget for all concerned parties	4.21	0698	84.20	High
27	Generally, GFMIS usage has resulted in enhanced institutional performance in PFM	4.25	0.685	85.00	V. High
Overall average of the impact of using GFMIS on the PFM efficiency		4.23	0.650	84.73	V. High

Source: prepared by the author based on SPSS V. 26 output and MS- Excel.

Table 12

Responses of the study sample to the impact of GPS usage

Phrase No.	Phrase	Mean	Standard deviation	Percentage	Rank
33	GPS usage has led to improving government cash management and reducing the risk of moving the money	4.43	0.557	88.60	V. High
34	GPS usage contributed to reducing government transactions cost	4.21	0.610	84.20	V. High
35	GPS has succeeded in improving managing government liquidity and reducing the need to borrow	4.22	0.587	84.40	V. High
36	GPS usage has improved the ability of the MoF to control and monitor the disbursement of government dues	4.37	0.584	87.40	V. High
37	Integrate GPS with TSA led to more efficiency and effectiveness in the government finance department	4.35	0.592	87.00	High
Overall average of the impact of using GPS on PFM		4.31	0580	86.30	V. High

Source: prepared by the author based on SPSS V. 26 output and MS- Excel.

Table 13

Aggregate responses of the study sample to the three axes phrases related to using of MPFM tools on Egyptian PFM efficiency

Impact of using MPFM tools on Egyptian PFM	Mean	Standard deviation	Percentage	Valuation
Operational efficiency	4.14	0.720	82.80	V. High
Allocation efficiency	4.23	0.650	84.73	V. High
Financial discipline	4.31	0.580	86.30	V. High
Total MPFM impact	4.22	0.650	84.40	V. High

Source: prepared by the author based on SPSS V. 26 output and MS- Excel.

Table 14

Pearson correlation matrix between the use of each axes of MPFM tools and the correspondent dimension in PFM

Study variables		Dependent variable			
		Operational Efficiency	Allocation Efficiency	Financial Discipline	PFM efficiency
Independent variable	TSA	0.807**	0.509**	0.521**	0.610**
	GFMIS	0.617**	0.826**	0.722**	0.720**
	GPS	0.525**	0.609**	0.771**	0.630**

Source: prepared by the author based on spss v26 output and microsoft excel.

(**) indicates that the correlation is significant at the significance level (α = 0.01).

Limitations and future scope

Given the scope of the article and the nature of the data available, it is not possible to address the many important questions about the MPFM tool implementation in developing countries. The analysis is limited to the data and information within the Egypt case study, not without recognizing the importance of other country experiments. To that end, future studies might usefully explore the significantly higher failure rate for financial reforms using MPFM in the Middle East and Africa.

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