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The Mediating Effect of Management Accounting System on the Relationship Between Data-Driven Innovation and Firm Performance: A Case of Egypt

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Abstract

This research aims to examine the mediating effect of management accounting system (MAS), through its traditional and strategic techniques, on the relationship between data-driven innovations (DDI) and firm financial and non-financial performance. The primary impetus for this study is the limited accounting literature that integrates DDI with both traditional and strategic management accounting techniques. Three main hypotheses were considered for analysis. First, there is an insignificant relationship between DDI and firm performance. Second, there is an insignificant relationship between MAS and firm performance. Third MAS exhibits an insignificant mediating effect on the relationship between DDI and firm performance. A survey was conducted in the first half of 2023 on a sample of various-sized Egyptian business firms operating across different industry sectors. Path analysis was used to test the research's three basic hypotheses. In addition, one way Analysis of Variance (ANOVA) test was used to explore the effect of two contingency variables; firm size and type of activity, on firm performance. Statistical results indicated a strong impact of DDI on firm performance, as well as a notable correlation between MAS and firm performance, alongside the mediating effect of MAS on the relationship between DDI and firm performance. Moreover, despite the evident effect of firm size on firm performance, no such effect is observed for the type of activity on the firm performance.

Keywords

Management Accounting System, Data-Driven Innovations, Firm Performance, Path Analysis

Article history

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1. Introduction

At present, global competition poses a significant challenge to firms of different sizes, operating across various industries, and adopting different business strategies. The Fourth Industrial Revolution has globally generated numerous changes, challenges, and transformations. Concerning firms aiming for sustainability, the adoption of mechanisms that enable their survival within the transforming business markets is essential. The Fourth Industrial Revolution has been generated by data-driven innovation (DDI), which encompasses several tools aimed at leveraging the achievements of the Fourth Industrial Revolution to implement product innovation, process innovation, marketing innovation, and organizational innovation (OECD, 2015; Sundu et al. 2022).

Regarded as a vital resource for innovation, data is essential for firm productivity and growth (Brynjolfsson et al., 2011). Effective use of data enhances firms' financial returns; moreover, data exploitation and analytics results in creating opportunities for new products and services (Brynjolfsson et al., 2011; Lush & Nambisan, 2015).

Capabilities of Firms have been recently directed to DDI and the exploitation of emerging data sources that can empower innovation activities and create competitive advantage. Due to the rapid advancements of digital transformation technologies, recent academic studies explore the impact of DDI on the creation of new products, processes, business models, and firm performance (Akter et al., 2021; Babu et al., 2021; Bresciani et al., 2021). DDI is defined as the strategic exploitation and analytics of data to develop, improve, or promote products, services, processes, and markets (Cronholm et al., 2017; OECD, 2015).

Digital transformation, as one of the DDI tools, is indispensable for firms aiming to achieve sustainability. It is considered compulsory for both economies and firms, since it entails the employment of technological tools for data exploitation and analytics, consequently increasing data accessibility, and empowering future innovation. Verhoef et al. (2021) defined digital transformation as a tool, based on digital technology and innovation, used to achieve firm development goals and growth through three evolutionary stages: digitization, digitalization, and digital transformation. The digital transformation stage is the most widespread stage, describing the change at the firm level that leads to the development of new business models, the achievement of competitive advantage, and the addition of value to both the firm and its customers.

Prior studies have addressed multiple tools for digital transformation; Big Data Analytics, Blockchain Technology, Artificial Intelligence, Robotic Process Automation (RPA), Cloud Computing System, Virtual Currencies, Machine Learning Technology, Cybersecurity, and Virtual Reality (IMA, 2019; Krieger et al., 2021; Lombardi et al., 2022; Manita et al., 2020; Tiberius & Hirth, 2019; Werner et al., 2021).

Big data promotes firms' innovation capabilities in many respects (Gobble, 2014; Manyika et al., 2011; Tan et al., 2015). The firm's ability to innovate is an essential

mechanism for adapting to the changing customer awareness and demands, and achieving the competitive advantage for business. Thus, the innovation achieved by the firm is the instrument through which it can succeed, develop sustainable performance, and outperform competing firms. Innovation is a key component of a firm's growth strategies since it enables entering new markets, thereby increasing current market share and achieving a competitive advantage. Moreover, it generates more productive manufacturing processes, new products or services which meet customers' demands, improved market performance, and better customer relationship. As a result, through innovation the firm gains competitive advantage and enhanced sustainability (Anderson et al., 2014; Kuratko et al., 2015).

Innovations are classified according to Organization for Economic Cooperation and Development (OECD) (OECD, 2005, 2018) into four groups: product innovation, process innovation, marketing innovation, and organizational innovation. For achieving the overall research objective and testing its hypotheses, the researcher relies on the OECD classification, which aligns with the OECD's definition of data-driven innovation, facilitating defining each type of innovation conceptually.

The use of big data through employing techniques such as data mining and predictive analytics, has a positive impact on new product development. The acquisition, exploitation, and analysis of vast data from different sources assist firms to determine customers' demands and competitors' behavior, develop more efficient production processes, anticipate market acceptance of new products, and facilitate product innovation (Wamba et al., 2015).

Big data analytics examine large amounts of data to reveal insights, patterns, and correlations that supports operations and process innovation; moreover, it positively impacts demand forecasting, inventory management, production processes planning, logistics, and supply chain management (Mishra et al., 2018; Park & Bae, 2022; Zhong et al., 2016).

The utilization and analysis of big data in relation to market insight, competitor information, industry trends, and regulatory updates assist companies in comprehending consumer behavior and preferences, adapting to market fluctuations, and identifying opportunities for competitive advantage. Some studies focused on the use of big data analytics in operational marketing, aiming to improve marketing agility, and elevate marketing performance (Erevelles et al., 2016; Gupta et al., 2019; Martin and Murphy, 2017; Sultana et al., 2022).

Organizational innovation refers to new and substantial improvements in firms' standard management procedures, such as human resources management, database management, distribution of responsibilities, and external relations management (Donbesuur et al. 2020; Walker et al. 2015). Although product innovations are directed to satisfy the needs of various stakeholders, organizational innovations aim at improving a firm's internal processes to maximize the added value of big data analysis. Organizational innovations alter relationships, communication, roles, procedures and structures across all levels of a firm's structure, consequently affecting its social system (Jaskyte, 2020).

Successful innovation and change initiatives usually result in lower costs and/or higher- quality products or services that appeal to the market. Management accounting system (MAS) evaluates performance, and distinguishes between the efficient innovation or change initiatives, and those requiring adjustment or discontinuation. Furthermore, it can aid firms in enhancing the decision-making process, exploiting opportunities, and managing risks to create value for all stakeholders, and achieve objectives at a minimal cost and a sustainable level.

The relationship between DDI and MAS, with regard to their techniques, can be explored by identifying the relationship between the type of innovation activity, including product, process, marketing, and organizational innovations, as proxies of DDI, and management accounting techniques, as proxies of MAS. Explaining innovation activity and its cost necessitates determining the proper cost allocation for each type of innovation, since the allocation of total innovation costs to production, sales, or administrative costs, could distort the data driven from MAS. Therefore, properly allocating each type of innovation cost to the appropriate cost object is essential for achieving the effectiveness of MAS. This indicates the significance of adopting of the OECD classification for innovation, since this classification aids in the accurate allocation of the cost of each innovation type to the corresponding activity. For a proper accounting allocation of each type of innovation cost, accurately measuring cost and assigning each cost to relevant units of activity is required. This step is necessary for evaluating innovation activity performance through comparing actual performance with target performance using management accounting techniques.

The primary impetus for conducting this research is the limited accounting literature addressing the relationship among DDI, MAS, and firm performance. Therefore, the research aims at identifying the indirect effect of MAS on the relationship between DDI and firm performance. Moreover, another impetus for this research is represented in shifting from using the regression analysis in measuring the relationship between DDI and MAS, as independent variables, and firm performance, as a dependent variable, to path analysis in order to test the relation among DDI, as exogenous variable; MAS, as a mediator variable; and firm performance, as an endogenous variable.

The remainder of this research comprises various sections. Section (2) addresses the literature review and hypotheses development. Section (3) describes the methodology employed in this research. Section (4) presents the results, hypotheses testing, and discussion. Finally, the conclusion is provided.

2. Literature Review and Hypotheses Development

Many firms employ different methods to enhance profitability through investigating the impact of DDI on firm performance. Accounting literature exhibits inconsistency regarding the relationship between DDI and firm performance. The relationship between DDI and firm performance can be explored from three

perspectives: (1) the direct relationship between DDI and firm performance, (2) the relationship between DDI and MAS, and (3) the mediating role of MAS in the relationship between DDI and firm performance.

2.1. DDI and Firm Performance

In literature, many perspectives have addressed the relationship between DDI and firm performance. Some studies have examined the overall relationship between DDI, without distinction between the types of resulting innovation, and firm performance. Conversely, other studies have discussed the relationship between each type of resulting innovation and firm performance.

Several studies indicated the existence of a relationship between DDI and several aspects of firm performance including innovation capability, productivity, improved performance, competitive advantage, better customer relations, and sustainability (Babu et al., 2021; Belaud et al. 2014; Davenport et al. 2012; Lamba & Singh, 2017; Prescott, 2016). Other studies indicated a positive relationship between firms' innovations and their financial and non-financial performance (Hua & Wemmerlov, 2006; Prajogo, 2006). However, some accounting literature, as demonstrated by Ram and Jung (1991) as well as Hultink et al. (2000), revealed contradicting results, suggesting the absence of a significant relationship and a probable presence of a negative relationship between firms' innovations and their performance.

Relative to the relationship between types of innovation, as proxies of DDI, and firm performance, differently measured across firms, several accounting and management studies were conducted. Tung (2012) indicated that when firms allocate resources to product innovation activities, they expect to gain more competitive advantages and improved performance. The study revealed that continuous product innovation increases the firm's ability to fulfil consumer demands, thereby maintaining customer loyalty to the firm. The study's results confirm the significance of product innovation for firm performance and sustainability.

Likewise, Lin et al. (2013), Mitrega et al. (2017), Ramadani et al. (2019), and Hutahayan (2020), confirm the positive and significant relationship between product innovation activities and firm performance. These studies measured firm performance using different indicators. Lin et al. (2013) adopted four indicators; improved market position, improved sales volume, improved profitability, and improved firm reputation. Mitrega et al. (2017) assessed profitability and market share to measure firm performance. Ramadani et al. (2019) utilized a variety of indicators including, profitability, sales volume, firm growth rate, productivity, efficiency, stock market prices, firm's ability to enter new markets, and exports volume. Hutahayan (2020) examined the direct relationship between innovation activity, without distinguishing between different types of innovation, and firm performance, revealing a direct relationship between innovation activities and firm performance.

Conversly, Artz et al. (2010) demonstrated an inverse relationship between patents resulting from product innovation activities and firm performance, as measured by the rate of return on assets (ROA) and sales growth. These results are

based on the expectation that the cost of product innovation activities will result in long-term future benefits, and thus should be allocated to relevant periods. The author asserts that the inverse relationship between research and development (R&D), or product innovation activities and firm performance could be attributed to the accounting treatment of R&D costs. These R&D costs are often treated as period costs, fully allocated to the accounting period, invetibly reducing profits during product innovation, which consequently leads to lower profitability and hence, a lower rate of return on assets.

In addition to Artz et al. (2010), other studies revealed an insignificant or negative relationship between product innovations and firm performance. Amores-Salvado et al. (2014) revealed an insignificant positive relationship between product innovations and firm performance, implying that such positive relationship reached by the study cannot be relied on or generalized. The following three indicators were adopted as measures of firm performance: (1) the rate of return on assets (ROA), representing the ratio of net profit after taxes and before expenses, including extraordinary income relative to total assets, (2) the return on sales ratio (ROS), denoting the ratio of net profit before taxes to ordinary activity income, and (3) the rate of return on capital employed (ROCE), signifying the ratio of net profit before taxes, and interest to equity and long-term liabilities.

Relevant to the relationship between process innovations and firm performance, Akgüna et al. (2009) indicated a positive relationship between process innovations and firm performance, measured by seven indicators: rate of return on investment (ROI), market share, sales volume, profitability, income, contribution margin (profitability/total assets), and market value. Hashi & Stojcic (2013) also confirmed a positive relationship between process innovations and firm performance. In addition, Saleem et al. (2020) revealed the relationship between process innovations and firm performance, measured by four indicators: increase of sales growth, increase of market share growth, increase of pre-tax profit growth, and the achievement of a high level of cash flow. Many studies explored product and process innovations in relation to firm performance (Awan et al., 2021; Saleem et al., 2020; Xie et al., 2019; Wang et al., 2021).

Regarding the relationship between marketing innovations and firm performance, Tsourvakas et al. (2016) suggested a positive relationship between marketing innovations and the performance of non-profit firms, as measured by two sub-variables. The first variable, economic performance of the non-profit business firm, was assessed through membership contributions, donations, and sponsorship returns. The second variable, cultural performance, was assessed through the firm's vision for learning and growth, recreational activities, and the level of social engagements.

Aligning with the same perspective, Aksoy (2015) indicated a positive relationship between marketing innovations and firm marketing performance, assessed by five indicators: the target marketing performance achievement rate, new customer attraction rate, marketing objectives achievement rate, the efficiency of sales management, and the target market share achievement rate. Similarly, Shergill &

Nargundkar (2005) revealed a positive correlation between marketing innovations and firm performance, with business performance assessed through three indicators: market share, profitability, and sales growth rate. Furthermore, Mieres et al. (2012) confirmed this positive relationship, based on three indicators: sales volume, market share growth rate, and profitability.

In the context of examining the relationship between organizational innovations and firm performance, Hervas-Oliver et al. (2014) confirmed a positive relationship between organizational innovations and the productive performance of firms. Likewise, Illmudeen et al. (2021) emphasized this positive relationship through three sub-variables. The first variable, financial returns was evaluated by three indicators: rate of return on investment (ROI), rate of return on equity (ROE), and rate of return on assets (ROA). The second variable, operational excellence, was determined through various indicators, including: the firm's productivity level compared to its competitors, the firm's speed at servicing its customers relative to its competitors, and the efficiency of the firm's production cycle in relation to that of rivals. The third variable, marketing performance, was evaluated based on several indicators including the firm's outperformance in: sales growth, market share, as well as product and market development, relative to its competitors.

Previous studies investigating innovations, as proxies of DDI, in relation to firm performance have yielded mixed results. While many indicate a positive relationship between all types of innovation and firm performance, the measurement of this relationship varies across studies. Some studies assessed firm performance through certain indicators such as productive performance, financial performance, or marketing performance, whereas others incorporated both financial and non-financial metrics in their assessment. The conflicting results of previous studies regarding the relationship between DDI, as measured by innovations, and firm performance leads to the first hypothesis of this research:

H_{01} : *There is no statistically significant relationship between DDI and firm performance.*

2.2. DDI and MAS

Some accounting studies addressed the relationship between MAS and both big data and blockchains. However, the accounting literature addressing the relationship between MAS and big data is relatively more extensive compared to the studies exploring the relationship between MAS and blockchains. This disparity can be attributed to the earlier emergence of big data before blockchains. With regard to the relationship between cost accounting, as an element of MAS, and big data, Fahlevi et al. (2022) confirmed that the absence of detailed cost information has not only hindered further evolvement of management accounting changes, but may strain the relationship between financial management staff and other staff as well.

Abdullah et al. (2022), in their qualitative study conducted in a manufacturing company operating in Malaysia, revealed that big data enhance the implementation of

customer accounting, as one of the strategic management accounting practices. The authors confirmed that such achievement can be feasible through the rationalization of the analysis process, timely data location, and increased data accuracy, consequently leading to improved decision making, predictions, as well as firm profitability. Moreover, Sundu et al. (2022) suggested that the integration between management and financial accounting, based on big data analysis, can effectively promote the financial management effect of the firm. Finally, Lin et al. (2022) proposed that the assessment of financial risks in the company's MAS may eliminate risks through the use of big data.

In investigating the relationship between innovation and MAS, studies yielded contradictory results. Cabrilo et al. (2014), Lin (2015), Pool et al. (2017), and Scarpellini et al. (2017) demonstrated a significant positive relationship between the firm innovation activities and MAS. Likewise, Le et al. (2020) investigated this relationship, emphasizing a positive significant impact of management accounting information systems on firm's ability to innovate and improve firm performance. However, some studies limited the relationship between MAS and innovation to the product aspect only (Bisbe & Otley, 2004; Varaniute et al., 2022). Other studies revealed an insignificant relationship between firm's innovation activities and MAS (Huthayan, 2020; Prajogo & Oke, 2016).

Disagreement across accounting literature is recognized regarding the direction of the relationship between MAS and firm innovation activities. Some accounting literature investigate the impact of MAS on the level of firm innovation, with MAS representing the independent/exogenous variable, and the achieved level of innovation representing the dependent/endogenous variable (Bisbe & Otley 2004; Craighead et al., 2009; Heneri & Wouters 2020; Le et al., 2020; Miftah, 2020). On the contrary, other accounting studies examined the significant impact of firm innovation on MAS (Chenhall & Moers, 2015; Huthayan, 2020; Rasyid, 2017), where the level of the achieved innovation represents the independent/external variable, and MAS represents the dependent/internal variable.

The relationship between some of the management accounting techniques, as proxies of MAS, and the four types of innovations, as proxies for DDI, is indicated in Table 1 which demonstrates the relationship between each type of management accounting techniques – traditional (TMATs) and strategic (SMATs)- and type of innovation.

The divergent results of previous studies regarding the relationship between MAS, as measured by management accounting techniques, and firm innovation activities highlight a research gap that requires further practical studies to reveal the direction, whether positive or negative, and significance of such relationship. The varying results summarizing the relationship between MAS and innovation activities can be attributed to several factors. These factors include differences in empirical settings, concerning whether the application was in advanced or developing economies. There are also differences in the used statistical methods, with some focusing only on the direct impact of MAS on innovation activities, while others

consider both direct and indirect impacts, with MAS acting as a mediator or moderator variable. Finally, there are differences in the type of data used in statistical analysis, whether primary or secondary.

Table 1 *TMATs and SMATs in Relation to Different Types of Innovations*

	MAS	DDI Proxies				Author
		Product	Process	Marketing	Organizational	
TMATs	Budgeting				√	Beuren et al. (2021)
	Standard Costing		√		√	Choong & Islam (2020)
	Volume Based Costing	√				Potkany et al. (2019)
	Cost-Volime-Profit Analysis				√	Nworie et al. (2023)
SMATs	Activity Based Costing		√			Cescon et al. (2019)
	Customer Accounting				√	Foss et al. (2011)
	Quality Cost	√				Cescon et al. (2019)
	Just-in-Time		√			Cescon et al. (2019)
	Balanced Scorecard	√	√	√	√	Jarrar & Smith (2011)
	Product Life Cycle Cost	√	√	√		Cescon et al. (2019)
	Traget Costing	√				Cescon et al. (2019)
	Kaizen Costing		√			Cescon et al. (2019)
	Value Engineering	√				Cescon et al. (2019)
	Benchmarking				√	Guimaraes & Langley (1994)

The researcher's attempt to bridge this gap by applying the study in the Egyptian business environment may be another essential addition to the accounting literature that addresses this relationship. Based on the above discussion, the second hypothesis is:

H_{02} : There is no statistically significant relationship between DDI and management accounting systems.

2.3. DDI, MAS and Firm Performance

Despite the accounting literature addressing the relationship between the four types of innovations and firm performance, or the relationship between MAS and innovations (Cescon et al., 2019; Exposito & Sanchis-Llopis, 2018; Ramadani et al., 2019), there are few studies exploring the impact of big data or Blockchain utilization mechanisms on enhancing firm performance, or investigating the interrelationship between MAS, DDI, and firm performance. Moreover, it is recognized that studies examining the relationship between one or more types of innovations and the firm performance, or the relationship between MAS and types of innovations, have been conducted since the last century. However, studies addressing the interrelationship between the three variables DDI, MAS, and firm performance, have primarily emerged during the current decade.

Studies incorporating the three main variables in this research: DDI measured by the four types of innovations, MAS, and firm performance, relied mostly on constructing regression equations to demonstrate the relationship between each two variables. These regression equations were resolved simultaneously using the Path Analysis method.

Saleh and Al-Nimer (2022) examined the mediating role of MAS in the relationship between innovation and firm financial performance of 358 surveyed industrial firms in Jordan. The authors used Structural Equation Modeling (SEM) to investigate the interactions between variables. The results revealed that the mediating role of MAS in the relationship between innovation activities and financial performance was insignificant. The study recommended that firms should adopt contemporary or strategic MAS practices to maintain competitiveness.

Tsai et al. (2020) explored the impact of MAS on the relationship between innovation activities and firm performance in technology firms operating in Taiwan by employing the Path Analysis. The results revealed a positive impact of product innovation on firm performance mediated by the use of MAS, which is higher in firms operating under high uncertainty conditions. Their study recommended that managers should use SMATs with product innovations due to the challenges associated with applying TMATs in today's changing dynamic business environment.

In examining the relationship between the three variables – innovation activities, MAS, and firm performance - Hutahayan (2020) demonstrated the absence of a mediating impact of MAS on the relationship between innovation activities and firm performance.

The results of Miftah (2020) suggested that innovation activities significantly assist in improving firm performance. Additionally, the study's results emphasized the mediating role of MAS in the relationship between innovation activities and firm performance, indicating that MAS could serve as a mediating variable between management's innovation activities orientation and firm performance.

Pasch (2019) used Structural Equation Modeling to examine the mediating effect of evolving role of MAS on the relationship between firm strategy and exploratory innovation, utilizing survey data collected from 244 firms from German-speaking countries. The results indicated that MAS impacts strategy implementation in firms that are oriented toward exploratory innovation. In this context, the author highlights the differing orientation of the relationship between MAS and innovation activities.

In Le et al study (2020), MAS was regarded as an independent or external variable, whereas the firm's innovation activity was regarded as a dependent or internal variable. Conversely, in Miftah (2020), MAS was considered a dependent variable in its relationship with innovation activities which represented the independent variable.

This research aims to determine the extent to which MAS (whether traditional or strategic) mediates the relationship between DDI (measured by the four types of innovations) and firm performance, whether financial or non-financial, according to the four perspectives specified in the Balanced Scorecard. Consequently, the third hypothesis is represented as:

H_{03} : *There is no statistically significant mediating impact of MAS on the relationship between DDI and firm performance.*

Based on previous literature, the researcher identifies the research gap for this study. First, the knowledge gap, since more studies are required to address the relationship between DDI and management accounting systems, and the impact of such relationship on firm performance. Second, a considerable part of the accounting literature addressing the relationship between these three variables relied on regression analysis, which examines the direct relationship between a dependent variable and one or more independent variables. Conversely, current research addresses the relationship between DDI and firm performance through MAS as a mediating variable. Therefore, it can be stated that the current research aims to bridge both the knowledge gap and the methodological gap in addressing the relationships between DDI, MAS and firm performance, as well as the directions of these relationships.

3. Research Method

3.1. Research Model

The research model identifies the set of variables that the researcher investigates to test the three proposed hypotheses. These variables can be classified into two types: main variables and contingency variables. The main variables include DDI, MAS, and firm performance, whereas contingency variables include firm size and the type of activity or industry to which the firm belongs.

The inclusion of two contingency variables in the research model emphasizes that the research is based on contingency theory, as firm size and the type of activity significantly influence the DDIs applied in a firm, as well as the adopted management accounting system . In this context, the researcher extends beyond the contingency theory, which establishes the current research, and adopts the institutional theory, which is confirmed by demonstrating the pursuit of numerous firms to the success factors realized by leading firms. Moreover, the researcher relied on dynamic capabilities theory as a rational for examining the relationship between DDI and MAS, since firm capabilities and adopted systems can either contribute to or hinder successful DDIs. Thus, the current research is established on the contingency theory, the institutional theory, and dynamic capabilities theory. Figure 1 elaborates the research model.

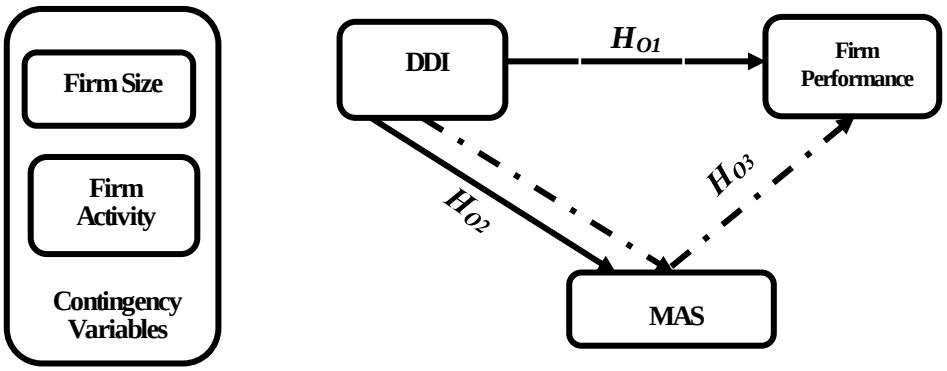


Figure 1 *Research Model*

3.2 Research Design

For identifying the impact of DDI on the performance of Egyptian firms, the relationship between DDI and MAS, and the mediating effect of MAS on the relationship between DDI and firm performance, a survey was employed. A questionnaire was developed and distributed during the first half of 2023, comprising 69 statements representing the proxies of the main and contingency variables. These statements were designed for data collection, analysis and hypotheses testing. Finally, a draft questionnaire was prepared and discussed with a group of experts from various firms, and faculty professors from Egyptian universities. Thus, the survey underwent testing through 10 pilot interviews to ascertain the appropriateness, coordination, clarity, logical sequence, and suitability of the survey's questions for data collection.

3.2.1 Population and Sample Selection

The survey participants consist of top management, CEOs, CFOs, and management accountants of different-sized Egyptian firms operating in various industry sectors. The sampled firms include textile companies, chemical industry companies, metal manufacturers, electrical household equipment and appliances, construction companies, automobile industries, service companies, and commercial companies. A total of 500 questionnaires have been sent to respondents in sampled firms. 122 forms were received, with a response rate of 24.4%, among which nine were excluded for not responding to many questions in the survey. This led to a statistical analysis of 113 questionnaires, resulting in a final usable rate of about 22.6%. Table 2 presents the results of frequency analysis conducted on the final sample of the 113 participating firms to summarize their distribution across main industry sectors groups included within the questionnaire.

Table 2 *Distribution of Sample Across Industry Sectors Groups*

Industry Sectors Groups	Frequency	%
Commercial	7	6.2
Industrial	51	45.1
Services	30	26.5
Real Estate	16	14.2
Others	9	8.0
Total	113	100%

3.2.2 Variables Measurement

Table 3 indicates research variables, proxies and measures.

Table 3 *Variables, Proxies and Measures*

Research Variables	Proxies	Measures
DDI	Process Innovation	Quality of material
		Material cost reduction
		Product improvement
		Numbers of new product(s)
		New materials in new products
	Product Innovation	Eliminating non-value-added activities
		Reducing product components

		Quality of product processes
		Eliminating non-value-added delivering activities
		Efficiency of logistics activities
	Marketing Innovation	Enhancing product shape, size, and packing
		Introduction of new distributing channels
		Implementation of new promotion activities
		Updating product price
	Organizational Innovation	Improving routine operations
		Enhancing supply chains
		Enhancing TQM process
		Improving human resources management
		Developing MIS
		Adjusting organizational structure
MAS	TMAT	Using cost behavioral classification
		Using machine or labor hours as cost allocation
		Using allocation base for each cost center
		Budgeting is used as planning and control tool
		Using long term budget for long term planning
		Using cost volume profit analysis
		Using flexible budget as planning and control tool
		Using financial measures to performance evaluation
		Using net present value as a decision-making tool
		Extent of using variances analysis as control tool
	SMAT	Learning curve has an impact on cost reduction
		Using quality control reports
		Using competitors' prices and target income to set target cost
		Using activity-based allocation base
		Using activity- based budgeting
		Using benchmarks as performance measurement tool
Firm Performance	Financial	Achieving target ROT Achieving target ROE Achieving target operating cash flow
		Achieving target current and liquidity ratios
		Achieving standard cost
	Customer	Achieving customer satisfactions
		Reducing customers complains
		Achieving target sales growth
		Enhancing firm reputation
	Internal Business Process	Achieving target employees' satisfaction
		Accepted employees Drop-out rate
		Achieving target operating income
		Achieving target process quality
	Learning & Growth	Budget of improving technology
		Budget of improving employee's efficiency by training program
		Setting and reviewing firm vision, mission, and strategy
		Research and development budget
Firm Size	Number of Employees	Categories include: Small; < 50, Medium; 50 -250, Large; > 250
Type of Activity	Industry Sectors	Categories include:(Commercial, Industrial, Service, Real Estate, or Other)

4. Results, Hypotheses Testing and Discussion

The data collected are analyzed using the following statistical analyses: (1) Exploratory Data Analysis, (2) Stability Analysis, (3) Confirmatory Analysis, (4) Path Analysis and test of hypotheses, and (5) One way Analysis of Variance (ANOVA) for testing the effect of contingency variables.

4.1 Exploratory Data Analysis

Exploratory Data Analysis includes Outliers Data Test and Normality Distribution Test. Outliers Data Test is implemented by calculating Mahalanobis distance in SPSS through comparing the values D_i^2 to the critical value of the distribution of Q^2 at 85 degrees of freedom and the probability level of 0.025, equivalent to 122.39. This indicates the absence of multiple anomalies in the data. Regarding Normality Distribution test, our analysis indicate that the data collected do not exhibit a normal distribution, due to its deviation from the diagonal line, and its random distribution.

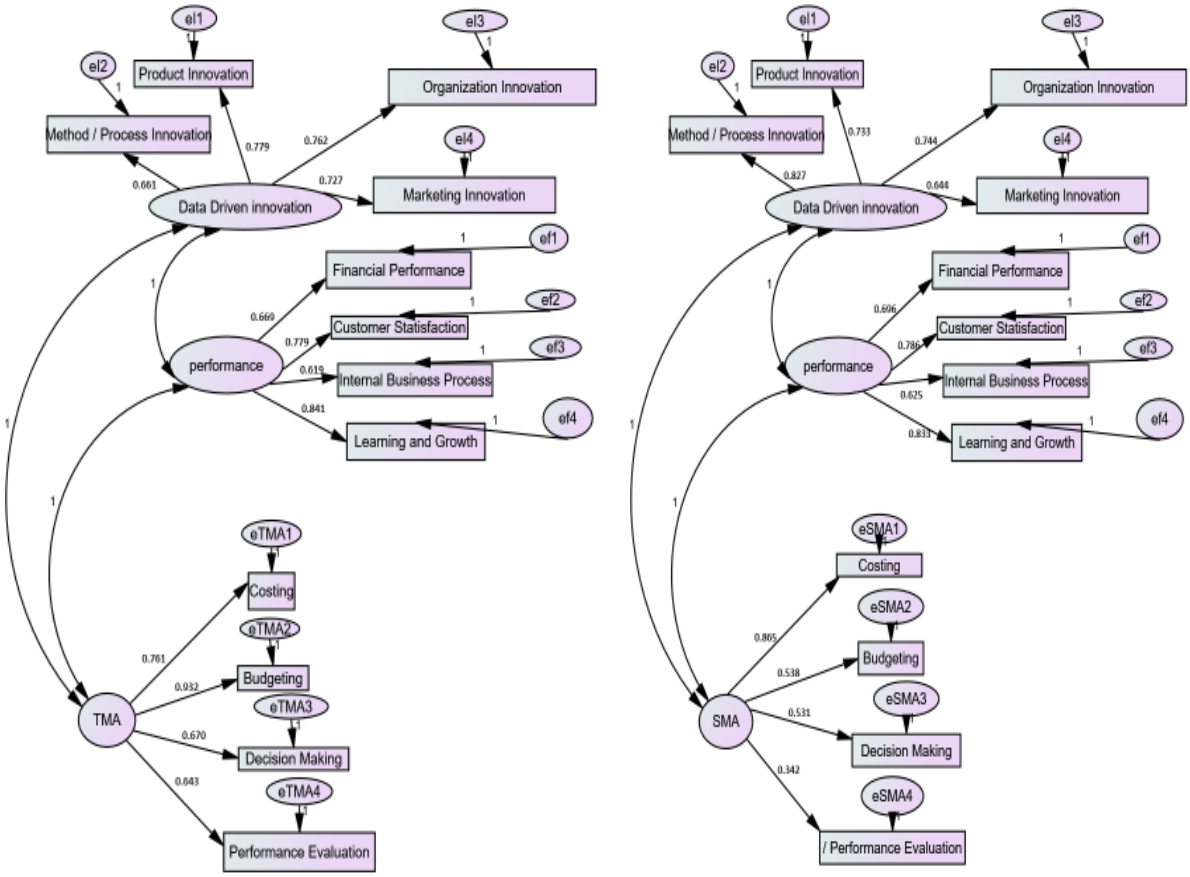
4.2 Stability Analysis

Stability Analysis is made by using Cronbach Alpha (α). The alpha coefficient of DDi equals 0.907, indicating relatively high internal consistency for the measures of the DDI variable. Similarly, the alpha coefficient of MAS equals 0.902, suggesting relatively high internal consistency for the measures of the MAS variable. Additionally, the alpha coefficient of firm performance equals 0.864, also indicating relatively high internal consistency for the measures of the firm performance variable.

4.3 CFA

CFA allows for testing the existence of the relationship between observed variables and their underlying latent constructs. The high stability of the variables DDI, MAS, and firm performance, as addressed in the survey, assisted in constructing a confirmatory factor model to ascertain compatibility and alignment of the proposed theoretical model with the data collected. In conjunction with the CFA of the study's variables, the CFA are conducted for both TMATs as well SMATs, as MAS serves as the intermediate and fundamental variable of the research model.

Given the importance of the MAS in the research model, only the confirmatory factor model of both TMATs and SMATs were formulated individually. In both confirmatory models, it was assumed that (a) firm performance, as a latent variable, is measured by four proxies representing the four original perspectives of the balanced scorecard, (b) a covariance or correlation exists between the three main variables of the research model: DDI, MAS, firm performance. Figure 2 shows the two confirmatory models. Table 4 shows the results of Q^2 test and Root Mean Square Residual Index (RMSRI).



Confirmatory Factor Analysis Model for TMATs

Confirmatory Factor Analysis Model for SMATs

Figure 2 *The Two Confirmatory Models*

Table 4 *Q^2 Test and Root Mean Square Residual Index Results*

MAS	Q^2	RMSRI
TMATs	p-value=0.124	0.025
SMATs	p-value=0.197	0.032

Using Q^2 test at a level of significant of 0.05 and with 51 degrees of freedom, the p-value in the TMATs and SMATs models (0.124, 0.197, respectively) are greater than 0.05; therefore, the null hypothesis is accepted. The null hypothesis of the conformity test shows that the assumed probability model accurately describes the distribution of data in population. Conversely, RMSRI test reveals the differences between the observed data values and the predicted values from the model. The AMOS output indicates that the RMSRI value in both TMATs and SMATs is close to zero, suggesting that both models fit well. Since the lower the RMSE suggests a better alignment with the data for a given model, this implies that TMATs demonstrates a higher degree of alignment.

4.4 Path Analysis and Test of Hypotheses

After Exploratory Data Analysis, stability test, and validity analysis, data is ready for hypotheses testing. To test the first hypothesis, a regression equation is formulated, with firm performance as the dependent variable and DDI as the independent variable. Table 5 shows the result of coefficient of the regression equation.

Table 5 *Coefficient of the Regression Equation: The Relationship Between DDI and Firm Performance*

Model	Coeff	SE	t	P
Constant	0.8919	0.1942	4.5931	0.000
DDI	0.7060	0.0543	12.9957	0.000

* Dependent Variable: firm performance.

Table 5 shows that the impact of DDI on the firm performance is statistically significant with a coefficient value of 0.7060, which is significant (p-VALUE < 0.05). Pearson correlation coefficient between the two variables (R) is 0.7768, indicating a strong relationship between the two variables. The determination coefficient (R^2) is 0.6034, which means that 60% changes in the firm performance can be explained by the DDI variable. Based on these statistical results, the first hypothesis is rejected, demonstrating a strong impact of DDI on firm performance. This result aligns with prior studies which suggested a significant positive impact of DDI on firm performance, competitive advantage, and sustainability (Babu et al., 2021; Belaud et al. 2014; Davenport et al. 2012; Lamba & Singh, 2017; Prescott, 2016).

Figure 3 shows the impact of DDI on each perspective of firm performance: financial performance, customer satisfaction, internal business process, and learning and growth. DDI regression coefficient on financial performance is 0.6713, on customer satisfaction is 0.5554, on internal business process is 0.2993, and on learning and growth is 0.6257. Therefore, financial performance is the most affected perspective of DDI, followed by learning and growth, then customers satisfaction, and finally internal business process

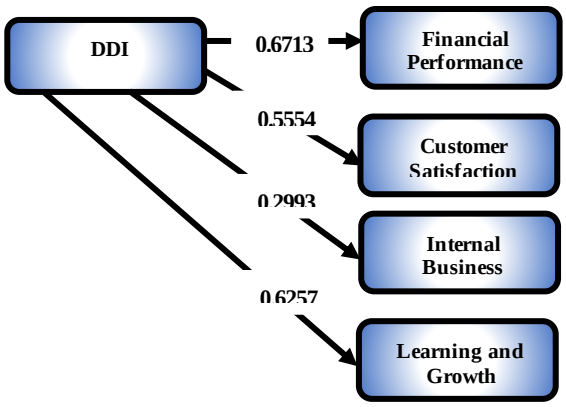


Figure 3 *Regression Coefficient on Each Perspective of Firm Performance*

Testing of the second hypothesis was conducted through investigating the regression coefficient of MAS on firm performance. Table 6 presents the coefficient of this regression equation, indicated as 0.875, with a p-value of 0.000 < 0.05, which

denotes a significant relationship between MAS and firm performance. Moreover, statistical analysis shows the determination coefficient equals 0.539, with a standard error of the estimate of 0.30071, implying that 53.9% of the change in the firm performance can be attributed to MAS. As a result of this statistical analysis the second hypothesis is rejected. The identified significant relationship between MAS and firm performance is consistent with prior literature, suggesting that MAS provides both financial and non-financial information that aids managers in decision-making, business planning and control, as well as strategy formulation, consequently leading to enhanced firm performance (Ezirim et al., 2010).

Table 6 *Coefficient of the Regression Equation: The Relationship Between MAS and Firm Performance*

Model	Coeff	SE	t	P
Constant	0.343	0.269	1.275	0.205
MAS	0.875	0.077	11.390	0.000

* Dependent Variable: firm performance.

However, testing the relationship between the two independent variables: DDI and MAS, and the dependent variable, firm performance, showed a significant positive relationship between DDI and MAS as independent variables, and firm performance. The p-values of both DDI and MAS are (0.0000 and 0.0007, respectively), which are lower than the significance level of (0.05). This relationship is reflected in table 7.

Table 7 *Analysis of Variance (ANOVA): The Relationship Between Both DDI and MAS and Firm Performance*

Model	Coeff	SE	t	P
Constant	1.2288	0.1827	6.7267	0.0000
MAS	0.3940	0.0819	4.8131	0.0000
DDI	0.2598	0.0744	3.4919	0.0007

* Dependent Variable: firm performance.

To test the mediating effect of MAS on the relationship between DDI and firm performance (the third hypothesis), Sobel Test is employed. Sobel Test reveals a p-value of 0.0000, which is lower than the significance level specified as (0.05), thus confirming the significance of the mediator variable. Table 8 shows that the DDI effect on a firm performance (excluding the effect of the mediator variable) is statistically significant, a total effect, with a coefficient value of 0.5379, where (p-Value < 0.05).

The DDI effect on firm performance with the mediator variable (the direct effect) is statistically significant, with a coefficient value of 0.2598, where (p-Value < 0.05). The indirect effect of MAS, as a mediator variable, on the relationship between DDI and firm performance is also significant, since the confidence interval of this effect does not include zero, and the value of the coefficient (the indirect effect) equals 0.2782.

Table 8 *The Total, the Direct, and the Indirect Effect*

Total Effect of DDI on Firm Performance				
	Effect	SE	t	P
	0.5379	0.5130	10.4828	0.0000
Direct Effect of MAS on Firm Performance				
	Effect	SE	t	P
	0.2598	0.0744	3.4919	0.0007
Indirect Effect of MAS on Firm Performance				
	Effect	Boot SE	Boot LLCI	Boot ULCI
MAS	0.2782	0.0578	0.1708	0.3996

Based on the statistical analysis, third hypothesis is rejected, indicating the mediating effect of MAS on the relationship between DDI and the firm performance. Although this result is consistent with the studies suggesting the significant impact of MAS on the relationship between DDI and the firm performance (Miftah, 2020; Tsai et al., 2020), it contradicts other prior studies (Hutahayan, 2020; Saleh & Al-Nimer, 2022) which indicate the absence of a mediating impact of MAS on the relationship between DDI and firm performance.

4.5 One Way Analysis of Variance (ANOVA)

ANOVA test is used to explore the effect of the two contingency variables, firm size and type of activity, on firm performance. ANOVA test shows that the p-value of the relationship between these contingency variables on firm performance are (0.0000 and 0.305) respectively. This suggests that there is an effect of firm size on firm performance, whereas there is no such effect by the type of activity on firm performance.

5. Conclusion

The accounting literature has addressed the relationship between various types of innovations and firm performance, as well as the relationship between management accounting techniques and innovations. However, few studies investigated the impact of utilizing big data or Blockchain mechanisms on enhancing firm performance, or the interrelationship among management accounting techniques, DDI, and the performance of firms.

A survey was conducted in first half of 2023 on a diverse sample of Egyptian firms to examine the mediating effect of management accounting systems, including both its traditional and strategic techniques, on the relationship between DDI and firm performance. The data collected were analyzed using Path Analysis to test the research hypotheses. The results signified the mediating role of MAS, facilitated by its traditional and strategic techniques, on the relationship between DDI and firm performance.

The research results have significant implications since DDI considerably influences the improvement of firms' competitive advantage, and is regarded as a contemporary research priority. From the practical perspective, the development of DDI is influenced by several factors including, technological readiness, data quality, metadata quality, technology-oriented leadership, skilled information technology professionals, and environmental factors within the Technology-Organization-Environment TOE framework (Hossain et al., 2024). From the managerial perspective, strategic decision making is crucial to ensure the quality of data required for DDI; furthermore, the adopted management accounting techniques should assist in evaluating the impact of DDI. From the social perspective, since DDI importance for economic advancement is recognized by research, organizations need to leverage their data resources, and adopt MAS that enhances and maximizes the value of data, and convert it into economic and social value.

The limitations of the research are primarily related to the reliance on preliminary data, collected through the survey list, rather than secondary data, which yields more accurate results. In addition, the research did not include measuring the cost of each type of innovation, and thus allocating the cost of the innovation activity to the relevant units of activity deviated from the research scope, thus, it can be addressed in future research related to firms' innovation activities. In this context, the researcher highlights that accounting literature has not addressed the dual relationship between MAS and the level of innovation achieved in firms. Examining the interrelationship between MAS and the level of innovation, and the impact of this mutual influence on firm performance represents a significant research gap that is required to be addressed through further investigation in future research.

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Appendix

قائمة استبيان لأغراض البحث الأكاديمي في المحاسبة في مجال:

التأثير الوسيط لنظم المحاسبة الإدارية على العلاقة بين أنشطة الابتكارات وأداء منشآت الأعمال المصرية

٢٠٢٣

القسم الأول: البيانات الشخصية وبيانات المنشأة محل الاستبيان

١. **الاسم :** ..... **(اختياري)**

٢. **اسم الشركة :** .....

٣. **الوظيفة :** .....

القسم الثاني: بيانات المنشأة محل الاستبيان

برجاء وضع علامة X في المربع الذي يتوافق مع المنشأة التي تنتسب إليها سيادتكم.

CV_1 **عدد العاملين :** ٥٠ فرد أو أقل ☐ أكثر من ٥٠ وأقل من ٢٥٠ فرد ☐ ٢٥٠ فرد وأكثر ☐

CV_2 **نوع النشاط :** تجاري ☐ صناعي ☐ خدمي ☐ **عقاري** ☐ أخرى ☐

القسم الثالث: أنواع الإبتكار التي تتبناها المنشأة

إلى أي مدى تم تنفيذ الأنواع التالية من الابتكارات المرتبطة بالعملية الإنتاجية بالمنشأة التي تنتسب إليها سيادتكم في السنوات الثلاث الماضية: (المقاييس المكونة من خمس نقاط تتراوح من (١) "لا تسعى المنشأة على الإطلاق"، (٢) "بدرجة ضعيفة"، (٣) "إلى حد ما"، (٤) "بدرجة عالية"، (٥) "بكفاءة عالية" جدًا.

ابتكارات المنتج

		١	٢	٣	٤	٥
PI_1	إلى أي مدى تحقق المنشأة تحسين جودة العملية الإنتاجية من خلال تحسين جودة المواد الخام الداخلة في المنتجات الحالية.					
PI_2	إلى أي مدى تحقق المنشأة خفض تكلفة العملية الإنتاجية من خلال تخفيض تكلفة المواد الخام الداخلة في المنتجات الحالية.					
PI_3	إلى أي مدى تعمل المنشأة على تطوير منتجاتها الحالية الأمر الذي يؤدي إلى سهولة استخدام المنتج، وبما يحقق زيادة رضاء العملاء.					

PI_4	إلى أي مدى قدمت المنشأة منتجات جديدة ذات مواصفات ووظائف فنية تختلف جوهريا عما تقدمه المنتجات الحالية.	١	٢	٣	٤	٥
PI_5	إلى أي مدى قدمت المنشأة منتجات جديدة ذات مكونات ومواد جديدة تختلف عن تلك الداخلة في المنتجات الحالية.	١	٢	٣	٤	٥

إلى أي مدى تم تنفيذ الأنواع التالية من الابتكارات المرتبطة بالعملية الإنتاجية بالمنشأة التي تنتسب إليها سيادتكم في السنوات الثلاث الماضية: (المقاييس المكونة من خمس نقاط تتراوح من (١) "لا تسعى المنشأة على الإطلاق"، (٢) "بدرجة ضعيفة"، (٣) "إلى حد ما"، (٤) "بدرجة عالية"، (٥) "بكفاءة عالية" جدًا.

ابتكارات العملية / الطريقة

MI_1	إلى أي مدى نجحت المنشأة إلى تحديد وحذف الأنشطة الإنتاجية التي لا تضيف قيمة للعملية الإنتاجية.	١	٢	٣	٤	٥
MI_2	إلى أي مدى تحقق المنشأة خفض في مكونات أو بنود التكلفة المتغيرة للعملية الإنتاجية.	١	٢	٣	٤	٥
MI_3	إلى أي مدى تحقق المنشأة الجودة في مخرجات العملية الإنتاجية وفي برامج التصنيع.	١	٢	٣	٤	٥
MI_4	إلى أي مدى تنجح المنشأة في تحديد وحذف الأنشطة التي لا تضيف قيمة للعمليات أو الأنشطة المرتبطة بتسليم المنتج للعملاء.	١	٢	٣	٤	٥
MI_5	إلى أي مدى تنجح المنشأة في خفض التكلفة المتغير المرتبطة بتسليم المنتج، وزيادة كفاءة العمليات اللوجستية المرتبطة بالتسليم.	١	٢	٣	٤	٥

إلى أي مدى تم تنفيذ الأنواع التالية من الابتكارات المرتبطة بالعملية الإنتاجية بالمنشأة التي تنتسب إليها سيادتكم في السنوات الثلاث الماضية: (المقاييس المكونة من خمس نقاط تتراوح من (١) "لا تسعى المنشأة على الإطلاق"، (٢) "بدرجة ضعيفة"، (٣) "إلى حد ما"، (٤) "بدرجة مقبولة"، (٥) "بكفاءة عالية".

ابتكارات تسويقية

SI_1	إلى أي مدى تقوم بالمنشأة بتجديد تصميم المنتج من خلال تغييرات في التعبئة أو الشكل أو الحجم دون تغيير في المواصفات الفنية.	١	٢	٣	٤	٥
SI_2	إلى أي مدى تنجح المنشأة في إضافة قنوات توزيع جديدة، دون تغيير في العمليات اللوجستية المتعلقة بتسليم المنتج.	١	٢	٣	٤	٥
SI_3	إلى أي مدى تقوم المنشأة بتعديل أو تحسين أساليب ترويج المنتج الحالي أو المنتج الجديد.	١	٢	٣	٤	٥
SI_4	إلى أي مدى تقوم المنشأة بتحديث تسعير المنتج الحالي أو المنتج الجديد في ضوء ظروف السوق.	١	٢	٣	٤	٥

إلى أي مدى تم تنفيذ الأنواع التالية من الابتكار التنظيمي في المنشأة التي تنتسب إليها سيادتكم في السنوات الثلاث الماضية: (المقاييس المكونة من خمس نقاط تتراوح من (١) "بدرجة ضعيفة جدًا" ، (٢) "بدرجة ضعيفة"، (٣) "بدرجة مقبولة إلى حدٍ ما"، (٤) "بدرجة مرتفعة"، (٥) "بدرجة مرتفعة جدًا".

ابتكارات تنظيمية

OI_1	إلى أي مدى تنجح المنشأة في تجديد الإجراءات الروتينية بطريقة مبتكرة لتنفيذ وظائف المنشأة.	١	٢	٣	٤	٥
OI_2	إلى أي مدى تحقق المنشأة النجاح في تجديد نظم إدارة سلسلة التوريد لتوفير مستلزمات المنشأة.	١	٢	٣	٤	٥
OI_3	إلى أي مدى تحقق المنشأة النجاح في تجديد نظم إدارة الإنتاج ونظم إدارة الجودة الشاملة.	١	٢	٣	٤	٥
OI_4	إلى أي مدى تحقق المنشأة النجاح في تجديد نظم إدارة الموارد البشرية المطبق.	١	٢	٣	٤	٥
OI_5	إلى أي مدى تحقق المنشأة النجاح في تطوير نظم المعلومات الإدارية المطبق وممارسات تبادل المعلومات بين الإدارات.	١	٢	٣	٤	٥
OI_6	إلى أي مدى تحقق المنشأة النجاح في تجديد الهيكل التنظيمي بما يتوافق مع المتغيرات الداخلية والخارجية لتسهيل العمل الجماعي.	١	٢	٣	٤	٥
OI_7	إلى أي مدى تحقق المنشأة النجاح في تجديد الهيكل التنظيمي لتسهيل التنسيق بين الوظائف والأنشطة المختلفة للمنشأة.	١	٢	٣	٤	٥
OI_8	إلى أي مدى تحقق المنشأة النجاح في تجديد الهيكل التنظيمي لتسهيل الشراكات الاستراتيجية والتعاون التجاري طويل الأجل.	١	٢	٣	٤	٥

القسم الرابع: أساليب المحاسبة الإدارية تتبناها المنشاة

المحاسبة الإدارية التقليدية

إلى أي مدى تقوم المنشأة التي تنتسب إليها سيادتكم في السنوات الثلاث الماضية بتطبيق الإجراءات التالية المتعلقة بالمحاسبة عن التكلفة: (المقاييس المكونة من خمس نقاط تتراوح من (١) "غير مطبقة" ، (٢) "تتم في أحيان قليلة جدا"، (٣) "تتم في بعض الأحيان"، (٤) "تتم في كثير من الأحيان"، (٥) "تتم بصورة روتينية وتتطلبها طبيعة العمل".

TMA_{C1}	إلى أي مدى تقوم المنشأة بالفصل التام بين التكاليف المتغيرة والتكاليف الثابتة.	١	٢	٣	٤	٥
TMA_{C2}	إلى أي مدى تعتمد المنشأة على حجم الإنتاج / إجمالي ساعات العمل المباشر / إجمالي ساعات الدوران لإيجاد معدل تحميل التكاليف غير المباشرة.	١	٢	٣	٤	٥
TMA_{C3}	إلى أي مدى تقوم المنشأة بإيجاد معدل لتحميل التكلفة غير المباشرة لكل مركز / قسم إنتاجي.	١	٢	٣	٤	٥
TMA_{B4}	إلى أي مدى تقوم المنشأة بإعداد الموازنات التخطيطية لأغراض تخطيط تكاليف وأنشطة المنشأة.	١	٢	٣	٤	٥
TMA_{B5}	إلى أي مدى تقوم المنشأة بإعداد الموازنات التخطيطية لأغراض رقابة التكاليف الفعلية.	١	٢	٣	٤	٥

TMA_{B6}	إلى أي مدى تقوم المنشأة باستخدام الموازنات التخطيطية لأغراض تقييم الأداء.	١	٢	٣	٤	٥
TMA_{B7}	إلى أي مدى تقوم المنشأة بإعداد الموازنات التخطيطية الرأسمالية لأغراض تخطيط طويل الأجل.	١	٢	٣	٤	٥
TMA_{B8}	إلى أي مدى تقوم المنشأة بإعداد الموازنات التخطيطية المرنة لأغراض التخطيط والرقابة وتقييم الأداء.	١	٢	٣	٤	٥
TMA_{D9}	إلى أي مدى تعتمد المنشأة في اتخاذ القرارات الإدارية على ربحية كل منتج.	١	٢	٣	٤	٥
TMA_{D10}	إلى أي مدى تعتمد المنشأة في اتخاذ القرارات الإدارية على تحليل العلاقة بين الحجم والتكاليف والأرباح (تحليل التعادل).	١	٢	٣	٤	٥
TMA_{DI1}	إلى أي مدى تعتمد المنشأة في اتخاذ القرارات الإدارية على طريقة صافي التدفقات النقدية.	١	٢	٣	٤	٥
TMA_{E12}	إلى أي مدى تستخدم المنشأة المقاييس المالية لتحليل وتقييم الأداء بإدارات المنشأة.	١	٢	٣	٤	٥
TMA_{E13}	إلى أي مدى تقوم المنشأة بتقييم الأداء في ضوء انحرافات التكلفة الفعلية عن التكلفة المخططة / المعيارية.	١	٢	٣	٤	٥

إلى أي مدى تقوم المنشأة التي تنتسب إليها سيادتكم في السنوات الثلاث الماضية بتطبيق الإجراءات التالية المتعلقة بالمحاسبة عن التكلفة: (المقاييس المكونة من خمس نقاط تتراوح من (١) "بدرجة ضعيفة جدا؛ غير مطبقة" ، (٢) "بدرجة ضعيفة؛ مقلدة من الأسواق المحلية"، (٣) "بدرجة متوسطة؛ مقلدة من الأسواق الدولية"، (٤) "بدرجة عالية؛ تم تحسين المنتجات الحالية"، (٥) "بدرجة عالية جدا؛ تم تنفيذ ابتكارات المنتجات الأصلية".

SMA_{C1}	إلى أي مدى نجحت المنشأة في تخفيض التكلفة نتيجة تكرار النشاط الإنتاجي وزيادة خبرة العمال (منحنيات التعلم).	١	٢	٣	٤	٥
SMA_{C2}	إلى أي مدى تقوم المنشأة بإعداد تقارير عن تكلفة الجودة للاستفادة منها في تخفيض التكلفة وتحسين الأداء.	١	٢	٣	٤	٥
SMA_{C3}	إلى أي مدى تستخدم المنشأة أسعار المنافسين والربح المستهدف لتحديد الحد الأقصى للتكلفة الواجبة الحدوث (التكلفة المستهدفة) لإنتاج منتج جديد.	١	٢	٣	٤	٥
SMA_{C4}	إلى أي مدى نجحت المنشأة في تخفيض التكلفة نتيجة تكرار النشاط الإنتاجي وزيادة خبرة العمال (منحنيات التعلم).	١	٢	٣	٤	٥
SMA_{C5}	إلى أي مدى يتم إيجاد تكلفة كل نشاط من الأنشطة الإنتاجية لغرض إيجاد معدل تحميل تكلفة النشاط بهدف تحميل التكلفة غير المباشرة.	١	٢	٣	٤	٥

SMA_{B6}	إلى أي مدى تقوم المنشأة بإعداد موازناتها التخطيطية على أساس النشاط.	١	٢	٣	٤	٥
SMA_{D7}	إلى أي مدى تقوم المنشأة بتحديد ربحية كل عميل والمحاسبة عن العملاء لأغراض اتخاذ القرارات.	١	٢	٣	٤	٥
SMA_{D8}	إلى أي مدى تقوم المنشأة باتخاذ القرارات في ضوء التدفقات النقدية المخصومة.	١	٢	٣	٤	٥
SMA_{E9}	إلى أي مدى تستخدم المنشأة مقاييس الأداء غير المالية في تقييم الأداء.	١	٢	٣	٤	٥
SMA_{E10}	إلى أي مدى تستخدم المنشأة مقاييس الأداء في المنشآت الرائدة كأساس للمقارنة وتقييم الأداء (المقاييس المرجعية).	١	٢	٣	٤	٥

القسم الخامس: الأداء المالي وغير المالي للمنشاة

إلى أي مدى تم نجحت المنشأة التي تنتسب إليها سيادتكم في السنوات الثلاث الماضية في تحقيق ما هو مستهدف من المؤشرات التالية: (المقاييس المكونة من خمس نقاط تتراوح من (١) "لم تتحقق على الإطلاق"، (٢) "بدرجة ضعيفة"، (٣) "إلى حد ما"، (٤) "بدرجة عالية"، (٥) "بكفاءة عالية" جدًا.

FP_{F1}	إلى أي مدى نجحت المنشأة في تحقيق معدل العائد على الاستثمار المستهدف.	١	٢	٣	٤	٥
FP_{F2}	إلى أي مدى نجحت المنشأة في تحقيق معدل العائد على حقوق الملكية المستهدف.	١	٢	٣	٤	٥
FP_{F3}	إلى أي مدى نجحت المنشأة في تحقيق التدفقات النقدية من النشاط التشغيلي المستهدف.	١	٢	٣	٤	٥
FP_{F4}	إلى أي مدى نجحت المنشأة في تحقيق في تحقيق معدلات ونسب السيولة المستهدفة.	١	٢	٣	٤	٥
FP_{F5}	إلى أي مدى نجحت المنشأة في تحقيق معدلات التكلفة المخططة دون زيادة.	١	٢	٣	٤	٥
FP_{C1}	إلى أي مدى نجحت المنشأة في تحقيق معدل رضاء للعملاء المستهدف.	١	٢	٣	٤	٥
FP_{C2}	إلى أي مدى نجحت المنشأة في تحقيق معدل في شكاوي العملاء عن المعدل المستهدف لشكاوى للعملاء.	١	٢	٣	٤	٥
FP_{C3}	إلى أي مدى نجحت المنشأة في تحقيق النسب المستهدفة لزيادة العملاء الجدد.	١	٢	٣	٤	٥
FP_{C4}	إلى أي مدى نجحت المنشأة في تحقيق معدل انخفاض في شكاوى العملاء.	١	٢	٣	٤	٥
FP_{C5}	إلى أي مدى نجحت المنشأة في تحقيق تحسين في سمعتها لدى العملاء والسوق مقارنة بالمنافسين.	١	٢	٣	٤	٥

الجانب المالي

جانب العملاء

جانب النواحي الداخلية	FP_{IB1}	إلى أي مدى نجحت المنشأة في تحقيق معدل رضاء للعمال والموظفين.	٥	٤	٣	٢	١
	FP_{IB2}	إلى أي مدى نجحت المنشأة في تحقيق معدل منخفض للغاية لترك العمال والموظفين العمل بالمنشأة.	٥	٤	٣	٢	١
	FP_{IB3}	إلى أي مدى نجحت المنشأة في تحقيق التدفقات النقدية من النشاط التشغيلي المستهدف.	٥	٤	٣	٢	١
	FP_{IB4}	إلى أي مدى نجحت المنشأة في يحقق العمال والموظفين الإنتاجية المستهدفة والمطلوبة منهم.	٥	٤	٣	٢	١
	FP_{IB5}	إلى أي مدى نجحت المنشأة في تحقيق درجة جودة المنتجات أو الخدمات المستهدفة.	٥	٤	٣	٢	١
جانب النمو والتعلم	$FP_{L\&G1}$	إلى أي مدى تخصص المنشأة من اعتماداتها لأنشطة تطوير التكنولوجيا على اختلاف إدارات المنشأة.	٥	٤	٣	٢	١
	$FP_{L\&G2}$	إلى أي مدى تخصص المنشأة من اعتماداتها ومواردها لأنشطة تدريب العمال والموظفين على اختلاف إدارات المنشأة.	٥	٤	٣	٢	١
	$FP_{L\&G3}$	إلى أي مدى نجحت المنشأة في خفض معدلات ترك العمال العمل بالمنشأة.	٥	٤	٣	٢	١
	$FP_{L\&G4}$	إلى أي مدى نجحت المنشأة في توصيل استراتيجية ورؤية وأهداف المنشأة لجميع العمال والموظفين بالمنشأة.	٥	٤	٣	٢	١
	$FP_{L\&G5}$	إلى أي مدى تخصص المنشأة من اعتماداتها ومواردها المتاحة لأنشطة البحوث والتطوير.	٥	٤	٣	٢	١