Journal of Open Innovation: Technology, Market, and Complexity

Article

Business Intelligence and Analytics (BIA) Usage in the Banking Industry Sector: An Application of the TOE Framework

Ashraf Bany Mohammad [1], Manaf Al-Okaily [2,*], Mohammad Al-Majali [1] and Ra'ed Masa'deh [1]

[1] School of Business, The University of Jordan, Amman 11942, Jordan
[2] School of Business, Jadara University, Irbid 733, Jordan
* Correspondence: m.alokaily@jadara.edu.jo or manaf.alokaily@gmail.com

Abstract: This study aims to examine the factors that influence business intelligence and analytics (BIA) usage in the banking sector. Based on a comprehensive literature review, a theoretical model was developed to explore the impact of three key factors on business intelligence and analytics adoption and usage in the banking sector, namely technological, organizational, and environmental factors. The study used the Statistical Package for the Social Sciences (SPSS) to analyze data collected from 120 employees of Jordan Arab bank. The results revealed the critical impact of not only the existence of data and technology infrastructure but also the importance and availability of management and human resources support and capabilities. This study suggests that, more importantly, successful planning for business intelligence and analytics should go beyond the technology aspects to gain the full benefits of such technology, especially in the banking sector. Yet, we argue that more research needs to be conducted, especially in the context of developing countries, to fully understand how banking sectors can successfully implement and utilize business intelligence and analytics.

Keywords: business intelligence and analytics; intelligence systems; information technology; banking-industry sector; jordanian context; TOE

check for updates

Citation: Bany Mohammad, A.; Al-Okaily, M.; Al-Majali, M.; Masa'deh, R. Business Intelligence and Analytics (BIA) Usage in the Banking Industry Sector: An Application of the TOE Framework. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 189. https://doi.org/10.3390/joitmc8040189

Received: 11 September 2022
Accepted: 14 October 2022
Published: 17 October 2022

1. Introduction

Business intelligence and analytics (BIA) is considered one of the most critical technologies, systems, practices, and applications that help organizations develop a deeper understanding of business data and gain a competitive advantage while improving operations and product development and strengthening relationships with customers [1,2]. BIA has an even more important role in the banking sector by enabling experts and managers to make better, accurate, timely, and relevant decisions so as to increase the productivity and profitability of the bank and be able to comply with the different regulatory and environmental dimensions of this sector [3].

BIA, nowadays, is a trendy issue and a compulsory prerequisite for creating an outstanding corporate image, which goes in line with implementing a successful plan regarding using technology extensively. Thus, this supports business decisions and gains a competitive advantage in today's dynamic environment, which requires outstanding efforts for dedicating massive budgets to research and development (R&D). Data are a focal point and are considered the fuel of the future since they can be processed efficiently and used effectively in supporting risky occurrences and decisions that can be heavily reflected in the performance of corporates [4,5].

Business intelligence (BI) is an umbrella term that includes structures, tools, databases, applications, and methodologies to analyze data by converting raw data into meaningful and helpful information to support business managers' decisions [6]. Banking areas, such as branch performance, sales, risk assessment, electronic banking, customer segmentation, and retention, are generally excellent for applying various business concepts and analytics, technologies, and tools, including data mining (DM), data warehousing, and decision

support systems (DSS). Therefore, top management must constantly focus on solving challenging problems and seizing opportunities for the banking sector to succeed and excel in today's business environment. This requires computerized support for managerial decision making, thereby implying a need for decision support, business intelligence, and analytics systems [7]. Business intelligence systems (BIS) emerged from technical solutions that provide data integration, analytical capabilities, and data mining to provide stakeholders at various levels with valuable information to make their decisions effectively and successfully.

In this regard, data analyses can contribute to solving and developing banking problems and reaching the best results for decision making [8]. Managers cannot see the correlation between different variables in business data because the volume of data is constantly increasing, and it is substantial. Moreover, managers need additional work to reach a conclusion related to the behavioral pattern and the wants and needs of customers. In addition, many additional works are needed to understand and retain the right customers and acquire new ones; consequently, business intelligence through data analyses helps managers and product managers identify different categories of customers, develop products or services aligned with customer needs, define competition and pricing strategy, improve revenue management, increase sales, and expand the customer segment [5].

Researchers have defined business intelligence as the ability of businesses to think, plan, predict, solve problems, understand, devise new ways to improve business and decision-making processes appropriately, enable effective actions, and help create and achieve business goals [9]. Accordingly, the processes, technologies, tools, applications, data, databases, dashboards, scorecards, and online analytical processing (OLAP) are stated to play a role in enabling the capabilities that define business intelligence [10]. BIA practices and tools are seen as critical enablers for data-driven decision making and provide the framework and support banks' needs to make accurate and fact-based decisions and do business successfully and distinctively [11].

Even though the research interest in business intelligence and analytics usage in the banking-industry sector is increasing, past studies supporting the area cannot be considered as highly grown. Further, the existing literature does not provide satisfactory evidence as to what factors affect business intelligence and analytics usage in addition to the inconsistencies in the results. At the same time, banks' use of business intelligence and analytics remains high, especially with the availability of huge data sets on customers that can help better decision making in this context. Thus, this study seeks to examine what factors affect the use of business intelligence and analytics in the banking sector in an effort to help this sector plan for better business intelligence and analytics use and adoption.

The following section presents a review of key related literature, and, after that, Section 3 explains the theoretical framework and hypotheses development. Data collection and methodology are presented in Section 4, whereas Section 5 presents the research results. After the discussion of the results in Section 6, Section 7 presents the research contributions, and the last section presents the conclusion along with the limitations and directions for further research.

2. Literature Review and Background

2.1. Business Intelligence and Analytics (BIA)

The term business intelligence (BI) was popularized during the 1990s and could be considered a term encompassing a wide variety of processes and software used to collect, analyze, and disseminate data in the interest of better decision making [12] that includes infrastructures, tools, technologies, databases, applications, and methodologies. BI has been used as an umbrella term to describe concepts and methods for improving business decision making using fact-based support systems [5].

The main goals of business intelligence are to enable interactive and easy access to diverse data, data processing, and transformation to create meaningful and valuable information that can support business managers and analysts in making decisions [13,14]. BI

technically entails various software solutions and technologies from extract transform and load (ETL) tools, data warehouse, OLAP technology, data extraction, reporting applications, and an interface that supports the user and web access [1,15]. In its basic form, the BIA process will extract the data needed using ETL technologies, stores them in DW, and the generated reports with the help of OLAP, data mining. Other reporting tools are accessed by end-users through the user interface [16].

In the extract (ETL) process, ETL packages extract data from internal and external sources, eliminate data errors and redundancies, and provide tailored data for access and analysis to be loaded to data warehouse [17]. The data warehouse is a type of database in which data are collected from different databases in different business units, and then are organized and validated to help make decisions within the organization [18]. Later, and depending on the organizations' needed OLAP technologies—which are multidimensional models that include relational databases and report writing—data mining will produce business reporting for sales, budgeting, and even forecasting [16]. Data mining (DM), which is a fundamental technology that supports BIA, uses a quantitative data analysis tool to identify patterns and rules in data resources and find logical relationships that summarize data in a new, understandable, and useful way to support organizational business intelligence and management decisions [19–21]. A key value of data mining in business intelligence and analytics is to anticipate a particular behavior or outcome based on data models, in what is known as predictive analytics, thus giving the most likely outcome leading to better management decisions and future planning [6,22].

2.2. Business Intelligence Application in the Banking Industry Sector

Banks have always been the leading organizations in using the latest technologies, applications, and tools that can improve their business or increase productivity, profits, sales, or give them a competitive advantage among competitors. Similar to other technologies, business intelligence and analytics promises to help the bank acquire much more and better insights than the classical report technologies and provide more accurate and precise data analyses. In fact, BIA enables them to raise both operational and management levels of data underrating and analysis that can lead to increased sales and profits [7,23].

Yet, how banks run and use business intelligence and analytics is a factor of success and differentiation. Business intelligence needs to not only integrate customer information all through the bank to improve efficiency and improve customer service but also needs to enable the bank to utilize all data sources and business intelligence applications. According to [16], business intelligence and analytics have a very significant and critical role on bank performance, product marketing and promoting strategies, risk management, and customer acquisition and retention.

In summary, the literature review of the strategic impact of business intelligence made by [24] clearly shows the important role of business intelligence and analytics. However, more research is needed to understand not just the benefit of such technologies in the banking sector but also how banks are adopting and using such technologies in this sector.

3. Theoretical Framework and Hypotheses Development

Although technology adoption is very well structured, very few studies have been conducted to determine the influencing factors associated with the adoption of BI systems [25]. Following [26], this study uses the technology–organization–environment (TOE) framework developed by [27] to examine those three elements that influence how banks adopt and implement business intelligence and analytics technology, namely the technological, the organizational, and the environmental contexts. Consequently, this study expanded the TOE framework by including new vital additional elements based on the recommendations of [28], namely technology-supporting infrastructure and the presence of a champion, as represented in Figure 1. The following sections explain in detail the theoretical framework and its key elements.

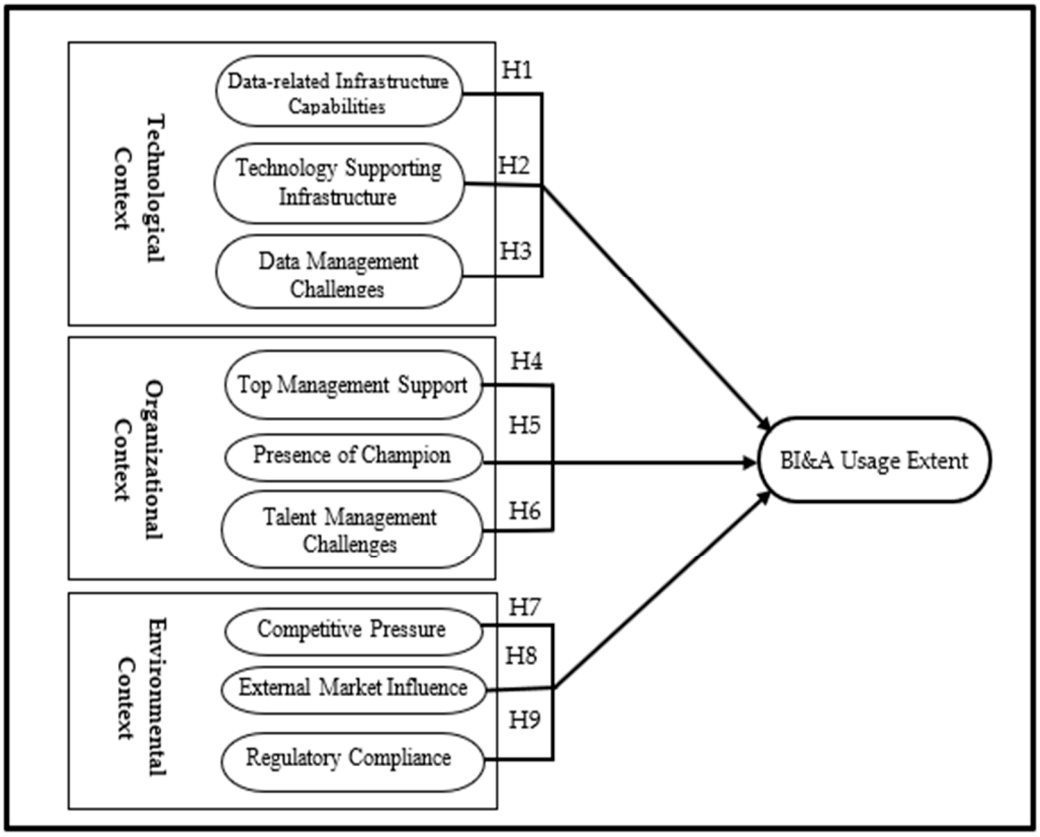

Figure 1. Theoretical Framework.

The main reason for applying the TOE framework in the current study context is due to the mentioned framework and is one of the most holistic frameworks that can explain technology adoption in organizations [24]. In addition, the TOE framework looks more into the organization as a whole, not only on the individual level on how the organization adopts and accepts the use of new technologies. Hence, this framework can give more details in all terms. This is why numerous researchers used the TOE framework as a theoretical foundation for studying organizational adoption and use of new technologies since it was introduced in 1990 [26]. Not only this, but it agrees with Awa et al. [25], who claimed that the TOE framework brings both human and nonhuman actors into the network, which is a strength that handles the illusion of accumulated traditions and technocentric predictions of most other frameworks (e.g., TAM, TRA, UTAUT, and TPB). Hence, we believe that the TOE framework will help to achieve a more complete understanding of business intelligence and analytics adoption and use in the banking sector in Jordan.

3.1. Technological Context

The technological context consists of three key elements:

3.1.1. Data-Related Infrastructure Capabilities

Data can be viewed as a large-scale local need, an essential component, and a driver of innovation; they can be considered an asset for any organization, especially banks. Since they mainly help in the development of any products, it is recommended to understand them in a unique and innovative way. According to [29], the use of intelligent data tools is an important component for effective data mining and is an indispensable enabling factor for using BIA. Hence, the following hypothesis will be tested:

Hypothesis 1 (H1). There is a statistically significant effect of the level of data-related infrastructure capabilities on the level of BIA usage extent.

3.1.2. Technology Supporting Infrastructure

Information Technology (IT) Infrastructure is a broad set of supporting technologies and necessary standards that enable organizations to share data and manipulate resources through a compatible and interconnected manner [1,28]. The availability and compatibility of the IT infrastructure allow companies to obtain and share real-time information and analyze customer data, develop products, analyze competitive markets, and share data and process resources across business units through a compliant, interconnected, and unified IT infrastructure [4]. Hence, we argue that a proper IT infrastructure can heavily enhance the use of BIA in the banking industry. Therefore, the following hypothesis will be tested:

Hypothesis 2 (H2). There is a statistically significant effect of the level of technology-supporting infrastructure on the level of BIA usage extent.

3.1.3. Data-Management Challenges

Data management is one of the challenges of using BIA. It is crucial to use BIA data that are reliable, current, relevant, predictable, and accurate [30–32]. Data quality is a fundamental issue in the selective investigation of data and refers to the consistency and breadth of the data [33,34]. Today's business intelligence frameworks can work with different types of data, such as mathematical and nonmathematical data, and their quality is very critical. In fact, data quality explains why some correlations are effective with their BI engine while others are not. Examination indicates that clean, actionable data may be key factors for achieving business intelligence [35,36]. Yet, the task of ensuring data quality is an unpredictable endeavor and requires sustained effort [31]. Thus, the following hypothesis will be tested:

Hypothesis 3 (H3). There is a statistically significant effect of the level of data-management challenges on the level of BIA usage extent.

3.2. Organizational Context

The organizational context comprises three key elements:

3.2.1. Top-Management Support

Senior-management support ranks highly as a critical success factor (CSF) for BIA [37]. In fact, senior-management support is essential to the success of BIA, according to Ref. [38], and is, perhaps, the biggest barrier to using business intelligence. High-level hierarchical management needs to deliberately focus on the use of business intelligence and business to maximize its benefits [39]. In addition, BIA must be driven from the most important levels within banks, and the inability to do so leads BIA drivers to be unable to reach the maximum capacity [39]. Senior-management support helps drive the use of business intelligence and intelligence by overseeing change measures, acquiring core assets, and supporting collaboration between specialized units [30,40]. Accordingly, the following hypothesis will be tested:

Hypothesis 4 (H4). There is a statistically significant effect of the level of top-management support on the level of BIA usage extent.

3.2.2. Presence-of-Champion

It refers to a highly enthusiastic person with in-depth knowledge of the organization's business processes and the technological innovation being discussed and committed to the innovation. Champions promote innovation by providing information, creating awareness, providing material resources, providing political support, and gaining organizational acceptance of the innovation, which are crucial for the successful adoption and implementation [5]. We believe that the presence of a champion that leads and supports the adoption

and use of BIA in banks will have a huge impact. Thus, the following hypothesis will be tested:

Hypothesis 5 (H5). There is a statistically significant effect of the level of presence of the champion on the level of BIA usage extent.

3.2.3. Talent-Management Challenges

To execute BIA adequately, a mix of business and IT experts is considered significant [31]. Experts who have the necessary abilities, especially the logical capacities, are needed to utilize the full potential of BIA tools and technology [41]. Hence, we argue that the presence of talent in both business and technology aspects will play a key role in the use and utilization of BIA in the banking sector. Therefore, the following hypothesis will be tested:

Hypothesis 6 (H6). There is a statistically significant effect of the level of talent-management challenges on the level of BIA usage extent.

3.3. Environmental Context

The environmental context comprises three key elements:

3.3.1. Competitive Pressure

It refers to the pressure factor that the bank feels from its competitors in the financial field. This competition makes banks look for better technologies to raise their efficiency, increase their efficiency and deals, and increase the number of customers [42]. In fact, technology adoption and usage in the banking sector are heavily driven by competition [43]. Hence, the following hypothesis will be tested:

Hypothesis 7 (H7). There is a statistically significant effect of the level of competitive pressure on the level of BIA usage extent.

3.3.2. External Market Influence

In addition to the competition, the banking sector is always under the external pressures of new products (services) and demanding customers. Hence, banks always rely on new technologies, such as data warehouses and BIA, as strategic initiatives to counter these factors [44]. In [45], it is noted that banks facing environmental uncertainties "engage in greater advisory and research activities" to understand their internal and market activities better. In addition, [26] emphasized that banks have a higher use of IT and technologies, such as business intelligence, which can greatly impact their effort to address external market influences [12]. Consequently, the following hypothesis will be tested:

Hypothesis 8 (H8). There is a statistically significant effect of the level of external market influence on the level of BIA usage extent.

3.3.3. Regulatory Compliance

The banking-industry sector is a very regulated sector, and compliance with laws and regulations requires achieving a high level of accuracy in data collection and analyses [44]. For example, in the United States, the Foreign Account Tax Compliance Act (FATCA) expects banks to meet the requirements of explicit monetary details. In the context of the current study, the value of BIA usage in this setup, it is very important to collect and analyze accurate and productive data to meet the administrative disclosure requirements and other compliance regulations [44,46]. Thus, the following hypothesis is suggested:

Hypothesis 9 (H9). There is a statistically significant effect of the level of regulatory compliance on the level of BIA usage extent.

Building on previous discussions and based on the TOE framework, the conceptual model is summarized in Figure 1, which presents the factors considered for this study within the technological, organizational, and environmental contexts of the TOE framework.

4. Research Methodology

4.1. Population and Sample Study

The study population consists of Jordanian commercial banks that use business intelligence and analytics on a large scale. After communicating with the banks, it was clear that the Arab Bank is the distinguished and pioneering bank in this field in Jordan, namely in using business intelligence and analytics programs. However, other banks are still at the beginning of their use and establishment of such technology. Hence, basically, the study population consists of all employees in the risk-management department, compliance department, information-technology department, branches, and sales department at the Arab Bank. However, due to the difficulty of involving all of the study population in all 81 branches of the Arab Bank, the study used a convenience sampling of the population.

4.2. Data Collection Methods

This study used the questionnaire as a tool for the field study through the preparation of the questionnaire. Its axes and items are based on the theoretical framework of the study as well as previous studies related to the subject of the study. The questionnaire included three main sections with 61 questions. A five-point Likert scale was used, which consists of strongly agree (5), agree (4), neutral (3), disagree (2), and strongly disagree (1) in answering the questions of the survey. Later, online questionnaires were sent through email (Google Form), due to the precautionary conditions and measures applied during the COVID-19 pandemic. Out of all online questionnaires distributed, 120 questionnaires were retrieved and defined as valid and were verified.

To ensure the minimum sample size, [47] suggested that the sample size should be ten times the largest number of structural paths directed at a particular latent variable in the structural model. The research model has nine structural paths directed to the BIA usage variable; the minimum sample size required is 90. For more accuracy, we ran the statistical analysis software G*Power, the most known and commonly used free software, which allows approximating power parameters for the research design by applying different methods and various user interfaces. Based on the criteria of an effect size $f^2 = 0.15$, error probability $\alpha = 0.05$, number of predictors 9, and power $(1 - \beta) = 0.80$, the results indicate that a sample of 114 is required in this study. Consequently, our final sample of 120 in this study is suitable for SPSS analysis purposes.

4.3. Validity and Reliability Test (Pretest)

In order to ensure clarity of the questionnaire and validate the accuracy of the instrument and the responses provided [48], the content-validity test was conducted with 30 experts and professors from the study community. In addition to determining the extent of the internal homogeneity of the study tool, the correlation coefficients between each statement and the degree of the phrase contained in the axis to which it belongs was used. Next, a reliability test was carried out using Cronbach's Alpha test to measure the internal consistency of the study tool. The results of the Cronbach's Alpha test were as follows:

As the results in Table 1 show, the value of Cronbach alpha for all measures of the study tool is high and above 0.70, which indicates that the study tool is of a high degree of reliability and stability and is sufficient to achieve the purposes of the study [49,50].

Table 1. Results of research tool reliability.

Dimension	Number of Measurements Items	Cronbach Alpha
Technological context	15	0.975
Organizational context	15	0.982
Environmental context	15	0.990
BIA usage extent	16	0.971
Total Questions	61	0.995

5. Research Results

This study used SPSS to analyze the data collected through the questionnaire. Descriptive analyses have been used to underhand the demographic characteristics of the sample, whereas the mean, standard deviation, and relative weight were used to analyze the questionnaire statements and understand the attitudes of the respondents toward the statements of the study instrument. In addition, Pearson's correlation coefficient was used to determine the level of internal homogeneity of the study tool. Finally, a simple-regression coefficient was used to test the relationships between the independent variables and the dependent variable.

5.1. Demographic Characteristics of the Sample

Table 2 shows the key analysis of the demographic data that describe the sample. In this study, the respondents were 78 males (65%) and 42 females (35%), whereby most of them were above 40 years old. In addition, most of the respondents were bachelor's degree holders (73%) with more than 5 years of experience. Interestingly, most of the respondents were managers or heads of sections (totaling 75.83%).

Table 2. Demographic characteristics of the study sample.

	Categories	*N*	%
Gender	Male	78	65
	Female	42	35
Age	Less than 30 years old	14	11.67
	From 30 to 40 years old	41	34.17
	From 40 to 50 years old	30	25.00
	From 50 to 60 years old	35	29.17
Academic qualification	Bachelor's	88	73.34
	Master's	22	18.33
	PhD	10	8.33
Current functionality	Employee	29	24.17
	Manager	37	30.83
	Head of section	54	45.00
Years of Service	Less than 5 years	28	23.33
	From 5 to less than 10 years	44	36.67
	From 10 to less than 15 years	28	23.33
	15 years and over	20	16.67

5.2. Results of the Measurement Items Analysis

The results of the mean average score, standard deviation, and relative weights, which were computed for all the study statements (items) of the independent and dependent

variables to understand the attitudes of the respondents toward the statements of the study instrument.

5.2.1. The First Dimension: The Technological Context

As Table 3 shows, all measurements items of the data-related infrastructure capabilities were high, and it shows the high level of the data-related infrastructure capabilities in the Arab Bank from the viewpoint of the study sample, with a mean of 3.827 and a standard deviation of 1.070. The same can be said about all expressions of the technology-supporting infrastructure and shows the high level of the technology-supporting infrastructure in the Arab Bank from the viewpoint of the study sample, with a mean of 3.825 and a standard deviation of 1.096. In addition, all statements (items) of the data-management challenges revealed the high level of the data-management challenges in the Arab Bank from the viewpoint of the study sample, with a mean of 3.730 and a standard deviation of 1.244. Overall, Table 3 shows the high level of the dimension of the technological context in the Arab Bank from the viewpoint of the study sample, with a general mean of 3.794 and a standard deviation of 1.137.

Table 3. Mean average score, standard deviation, and relative weight of the technological-context measurements items.

No.	Subdomains/Measurements Items	Mean	S. D	Relative Weight	Degree	Arrangement
	Data-related Infrastructure Capabilities					
1	The data-management systems used in the bank are characterized by the automatic ability to detect any tampering with them	3.833	1.147	0.767	High	3
2	The systems and devices used in analyzing the data contribute to finding solutions to all the various problems facing the bank	3.783	1.024	0.757	High	4
3	Methods of analyzing data and information assist managers in the process of planning and making various decisions within the bank	3.867	1.028	0.773	High	2
4	The data-analysis methods used can adapt to the knowledge environment within the bank	3.633	1.081	0.727	High	5
5	Business analysis and data systems within the bank are linked together in an integrated and interactive manner	3.900	1.071	0.780	High	1
	Technology-Supporting Infrastructure					
1	The bank has all the human qualifications of the highest level in achieving the tasks required of them	3.733	1.113	0.747	High	4
2	The bank's management provides all protection methods for the information system used	3.833	1.024	0.767	High	3
3	The bank works to provide all modern technological methods in the field of business analysis	3.933	1.104	0.787	High	2
4	The bank's management is interested in providing technology that contributes to the ease of flow of necessary information in all directions	3.717	1.217	0.743	High	5
5	The devices and equipment used by the bank are compatible with business intelligence systems and programs	3.967	1.020	0.793	High	1
	Data-Management Challenges					
1	The information system used in the bank provides all the requirements of the beneficiaries	3.783	1.231	0.757	High	1
2	The information system available in the bank seeks to keep pace with technological and technical developments	3.717	1.298	0.743	High	3
3	The administration is concerned with achieving the highest possible level of efficiency of the information system	3.767	1.221	0.753	High	2
4	The administration seeks to reach the information system to the highest level of effectiveness of performance	3.700	1.234	0.740	High	4
5	There is a communication system at the highest level of efficiency between the information system and the beneficiaries	3.683	1.237	0.737	High	5

5.2.2. The Second Dimension: The Organizational Context

As can be seen in Table 4, all measurement items of the top-management support were high, and it demonstrates a high level of top-management support in the Arab Bank from the viewpoint of the study sample, with a mean of 3.817 and a standard deviation of 1.051. The same can be seen for all statements (items) of the presence-of-champion, with a mean of 3.792 and a standard deviation of 1.196. Further, all statements (items) of the talent-management challenges were with a mean of 3.730 and a standard deviation of 1.177. Overall, the organizational context from the viewpoint of the study sample was high with a mean of 3.779 and a standard deviation of 1.141.

Table 4. Mean average score, standard deviation, and relative weight of the organizational-context measurements items.

No.	Subdomains/Measurements Items	Mean	S. D	Relative Weight	Degree	Arrangement
	Top-Management Support					
1	Management encourages group discussion of working methods	3.842	1.021	0.757	High	3
2	The administration encourages individual initiatives and creative ideas	3.858	1.031	0.773	High	2
3	The heads meet regularly with employees to discuss required business goals	3.742	1.081	0.727	High	5
4	The organizational structure of the department corresponds to the general objectives of the bank	3.900	1.016	0.780	High	1
5	The organizational structure followed in the bank facilitates the speedy completion of work	3.742	1.104	0.747	High	4
	Presence-of-Champion					
1	Employees are interested in performing all duties and tasks assigned to them quickly and enthusiastically	3.717	1.217	0.743	High	4
2	Employees use their powers effectively	3.967	1.020	0.793	High	1
3	Employees appreciate the responsibility that is assigned to them	3.783	1.231	0.757	High	2
4	Employees are interested in providing innovative ideas that contribute to improving work methods	3.725	1.290	0.743	High	4
5	Workers seek to raise their capabilities and skills	3.767	1.221	0.753	High	3
	Talent-Management Challenges					
1	The bank periodically provides material and moral incentives to its employees and encourages them to develop their skills	3.683	1.209	0.737	High	3
2	The management carefully follows the talents' trends and attitudes and supports their talents by conducting workshops to develop these talents	3.733	1.098	0.743	High	2
3	Future training courses are determined based on the actual needs of the institution's personnel	3.683	1.277	0.737	High	3
4	The bank management knows the capabilities of their employees towards developing the institution and the capabilities of their colleagues	3.650	1.255	0.730	Medium	4
5	The bank's management provides several options for talented people to advance their career path and develop the capabilities necessary to succeed in their career path.	3.900	1.048	0.780	High	1

5.2.3. The Third Dimension: The Environmental Context

Table 5 shows that all measurement items of the competitive pressure were high, with a mean of 3.827 and a standard deviation of 1.145. The same can be seen for the external market influence and regulatory compliance, with means of 3.917 and 3.842 in addition to standard deviations of 1.079 and 1.123, respectively. Overall, Table 5 shows a mean of 3.862 and a standard deviation of 1.116.

Table 5. Mean average score, standard deviation, and relative weight of the environmental-context measurements items.

No.	Subdomains/Measurements Items	Mean	S. D	Relative Weight	Degree	Arrangement
	Competitive Pressure					
1	The institution depends on providing it with the most important modern technologies and keeping pace with technological development and progress	3.900	1.080	0.780	High	1
2	The corporation has a well-thought-out annual plan to achieve the goals of the organization according to its capabilities	3.867	1.181	0.773	High	2
3	The corporation seeks leadership in its field and constantly updates all its administrative systems	3.850	1.034	0.770	High	3
4	The bank seeks innovation and creativity through training courses and workshops for its employees	3.783	1.245	0.757	High	4
5	The bank has a clear vision and a well-thought-out plan to be able to be at a leading level and achieve a competitive advantage	3.733	1.186	0.747	High	5
	External Market Influence					
1	The bank seeks to increase its market share from the rest of the competitors	4.067	0.968	0.813	High	1
2	The bank provides the banking services they want at the right time and the right cost	3.950	1.091	0.790	High	2
3	The bank takes care of all the financial and banking affairs of customers	3.767	1.262	0.753	High	5
4	The bank is interested in providing all banking services to customers in an easy and simple way	3.933	1.113	0.787	High	3
5	The bank provides a high degree of security and confidentiality to all customers	3.867	1.181	0.773	High	4
	Regulatory Compliance					
1	The bank's management is keen to provide all information with transparency and clarity	3.933	1.113	0.787	High	1
2	The bank publishes financial data following local and international standards	3.833	1.147	0.767	High	3
3	The management of the bank provides all the information on the financial transactions it carries out	3.783	1.024	0.757	High	4
4	The bank's management enjoys independence in decision making	3.867	1.028	0.773	High	2
5	The bank's management personnel are obligated not to conflict with the bank when carrying out their business.	3.633	1.081	0.727	High	5

5.2.4. The Dependent Variable: The BIA Usage Extent

As can be seen in Table 6, all measurements items of the BIA usage extent were high, with a mean of 3.795 and a standard deviation of 1.126.

Table 6. Mean average, standard deviation, and relative weight of the BIA-usage-extent measurements items.

No.	Measurements Items	Mean	S. D	Relative Weight	Degree	Arrangement
1	Business intelligence and analysis programs increase the efficiency and effectiveness of performance	3.900	1.071	0.780	High	3
2	Business intelligence and analysis programs are designed to handle administrative and financial events and processes	3.733	1.113	0.747	High	8
3	Business intelligence and analysis programs are used to improve the decision-making process in organizations through the information stored in databases	3.833	1.024	0.767	High	5

Table 6. *Cont.*

No.	Measurements Items	Mean	S. D	Relative Weight	Degree	Arrangement
4	Business intelligence and analysis programs help in acquiring knowledge from the reality of the databases stored in the systems in the areas that support the capabilities of the higher management in the organization	3.933	1.104	0.787	High	2
5	Business intelligence and analysis programs work to increase the bank's ability to achieve all required goals	3.717	1.217	0.743	High	9
6	Business intelligence and analysis programs clearly represent symbolic knowledge such as graphs, semantic networks, and texts	3.967	1.020	0.793	High	1
7	The business intelligence and analysis programs used can extract information from complex data	3.783	1.231	0.757	High	6
8	Business intelligence and analysis software allow for fast and adequate storage of knowledge	3.717	1.298	0.743	High	9
9	The knowledge and inferences used in the business intelligence and analysis programs are represented according to criteria defined by the bank	3.767	1.221	0.753	High	7
10	The knowledge and inferences used in business intelligence and analysis programs are kept safe to keep them from any manipulation	3.700	1.234	0.740	High	10
11	Business intelligence and analysis programs provide all the bank's needs for information and data on banking operations	3.683	1.237	0.737	High	11
12	Business intelligence and software systems within the bank are working on updating themselves periodically and automatically	3.842	1.021	0.757	High	6
13	Business intelligence and analysis systems and software handle logical and programmatic errors	3.858	1.031	0.773	High	4
14	Business intelligence and analysis software automatically maintains a copy of the data in the event of a sudden failure in the bank's network	3.742	1.081	0.727	High	12
15	Specialized companies perform periodic maintenance of the bank's business intelligence and analysis programs' devices	3.900	1.016	0.780	High	3
16	Specialized companies regularly update the programs related to the bank's business intelligence and analysis programs	3.742	1.104	0.747	High	8

5.3. Results of the Regression Coefficient Analysis

Finally, Table 7 shows the results of simple-regression test results and the coefficient related to each factor and the relationships between each independent variable and the dependent variable. The results reveal the significance of the model as a whole, as the F value was significant at the level 0.01 for all main variables. In fact, the results reveal a significant effect of the level of data-related infrastructure capabilities, the level of technology-supporting infrastructure, the level of data-management challenges, the level of top-management support, the level of presence-of-champion, the level of talent-management challenges, the level of competitive pressure, the level of external market influence, and the level of regulatory compliance on the level of BIA usage extent at the level 0.01, thereby supporting all hypotheses of this study. However, it is worth noting that the level of effect of each variable on the level of BIA usage extent varies from 2.505% to 3.222%.

Table 7. Results of hypotheses testing.

No.	Hypotheses	B	T	F	*P*
H1	Data-related infrastructure –> BIA usage extent	2.991	79.311 **	6920 **	0.000
H2	Technology-supporting infrastructure –> BIA usage extent	2.957	73.948 **	5468 **	0.000
H3	Data-management challenges –> BIA usage extent	2.935	36.563 **	1337 **	0.000

Table 7. *Cont.*

No.	Hypotheses	B	T	F	*P*
H4	Top-management support –> BIA usage extent	3.222	40.466	1637 **	0.000
H5	Presence-of-champion –> BIA usage extent	2.505	27.455 **	753.76 **	0.000
H6	Talent-management challenges –> BIA usage extent	2.921	71.448 **	5181 **	0.000
H7	Competitive pressure –> BIA usage extent	2.624	39.578 **	1566 **	0.000
H8	External market influence –> BIA usage extent	2.716	36.534 **	1335 **	0.000
H9	Regulatory compliance –> BIA usage extent	2.944	55.816 **	3115 **	0.000

** Statistically significant at the level of significance ($\alpha = 0.01$).

6. Discussion

This study examined the factors affecting business intelligence and analytics use in the banking sector. The factors analyzed in this study were organized in three dimensions that include technological, organizational, and environmental contexts based on the TOE framework. The results showed that data infrastructure and data-management capabilities have a significant effect on the extent to which business intelligence is used, and business and technology-supporting infrastructure has a significant impact as well. In fact, organizations, especially banks, need to have a robust data infrastructure that serves as the base layer for business intelligence, with an advanced IT infrastructure to better deploy business intelligence applications across business functions to have higher rates of BIA usage.

One of the most important factors that is necessary to adopt and use business intelligence in the banking context was the support of senior management, and the results showed that such support has a significant impact, as expected. Senior management and a great "champion" can initiate the use of business intelligence within their organizations, not only through providing the necessary resources, but also by encouraging their use and utilization in all bank operations and management decisions. In fact, resilient and sound senior management has a huge impact on BIA adoption, whereby the higher level of talent management results in the higher pioneering of the bank in the use of BIA.

The results clearly show the importance of the environmental dimension on the level of using BIA. The higher the competitive pressure and the greater the competition between sectors, the more banks will increase their BIA usage. Moreover, the results revealed the influence of the external market factors on increasing the adoption and usage of business intelligence as a way to create competitive advantages. Organizations view the effective use of BIA as a strategy that drives organizational performance and uses their critical data to outperform competitors. Thus, the strategic use of business intelligence adds advantages to organizations. Finally, the results show the impact of regulatory compliance on the level of BIA usage, whereby the higher the rate of regulatory compliance, the higher the rate of BIA usage. In fact, BIA represents an important tool for banks to comply with not only local and internal regulations but also international standards and regulations.

7. Contributions

First of all, this research contributes to the literature on business intelligence and analytics by attempting to explore the impact of the TOE framework on business intelligence and analytics usage in developing-country contexts. This comprehensive framework, which has guided numerous studies in the developed world, has revealed some interesting insights on how different this can be in a developing-country context such as Jordan. In addition, another key contribution of this study arises from the empirical analysis of this framework, which revealed some practical and comprehensive guidelines that can help banks in such a context plan better for their business intelligence and analytics projects. Finally, we argue that this research will be the foundation that can help other researchers dig deep into understanding how banks, especially those in developing countries, can utilize business intelligence and analytics.

8. Conclusions

Business intelligence and analytics is a key tool that deals with large amounts of diverse data, whether structured or unstructured [2], thus providing banks with the huge value of achieving better operations and great competitive advantages. With the dynamic environment we are facing nowadays, every bank should emphasize the importance of implementing a massive business-intelligence system to keep up with the fast pace of technology. In this study, we studied the factors that influence the use of business intelligence and analytics in the banking sector. Different factors have been examined, including technical, organizational, and environmental dimensions. The results of the analysis confirmed not only the importance of these factors on business intelligence and analytics adoption and use but also on the huge value for the banking sector that can be achieved by such technology. In fact, it is extremely important to understand the dynamics of these factors, not only to achieve better usage of business intelligence, but also to better plan and implement such technologies in the banking sector.

The results presented in this study reveal that to achieve better fact-based decision making, business-intelligence technologies require the presence of quality-level data-related infrastructure capabilities, great senior-management support and better "market environment" awareness. Yet, the researchers believe that more factors with more comprehensive and larger populations need to be studied in order to fully understand the critical success factor of BIA usage and utilization. That is, further research can test the proposed model in different contexts, such as the Jordanian public-shareholding firms as they invest heavily in BIA systems, and, in turn, more generalizable results can be obtained. In addition, future research could apply the model to developed countries to compare the results with those of developing counties. Finally, the researchers examined the impact of BIA on firm performance and innovation capabilities, but more research is needed to examine the BIA adoption on organizational effectiveness in a holistic view. To conclude, the results of this study are of supreme implication to the literature in this research area and can motivate additional crucial studies to shed more light on their standings.

Author Contributions: Conceptualization, M.A.-O. and M.A.-M.; methodology, M.A.-M.; software, M.A.-O.; validation, M.A.-M., M.A.-O. and A.B.M.; formal analysis, M.A.-O.; investigation, M.A.-O.; resources, A.B.M.; data curation, A.B.M.; writing—original draft preparation, M.A.-O., R.M. and M.A.-M.; writing—review and editing, R.M.; visualization, A.B.M.; supervision, R.M.; project administration, M.A.-O. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgments: The authors would like to acknowledge the valuable contributions of the reviewers and editors who have provided critical suggestions to improve the quality of the article. The suggested comments have helped in improving the quality of the article considerably.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Al-Okaily, A.; Al-Okaily, M.; Teoh, A.P.; Al-Debei, M. An Empirical Study on Data Warehouse Systems Effectiveness: The Case of Jordanian Banks in the Business Intelligence Era. *EuroMed J. Bus.* 2022, *ahead-of-print*. [CrossRef]
2. Ajah, I.A.; Nweke, H.F. Big data and business analytics: Trends, platforms, success factors and applications. *Big Data Cogn. Comput.* **2019**, *3*, 32. [CrossRef]
3. Nithya, N.; Kiruthika, R. Impact of Business Intelligence Adoption on performance of banks: A conceptual framework. *J. Ambient. Intell. Humaniz. Comput.* **2021**, *12*, 3139–3150. [CrossRef]
4. Al-Okaily, A.; Al-Okaily, M.; Teoh, A.P. Evaluating ERP systems success: Evidence from Jordanian firms in the age of the digital business. *VINE J. Inf. Knowl. Manag. Syst.* 2021, *ahead-of-print*. [CrossRef]

5. Al-Okaily, M.; Al-Okaily, A. An Empirical Assessment of Enterprise Information Systems Success in a Developing Country: The Jordanian Experience. *TQM J.* 2022, *ahead-of-print*. [CrossRef]
6. Turban, E.; Sharda, R.; Delen, D. *Decision Support and Business Intelligence System*; Prentice Hall: Englewood Cliffs, NJ, USA, 2011.
7. Moro, S.; Cortez, P.; Rita, P. Business intelligence in banking: A literature analysis from 2002 to 2013 using text mining and latent Dirichlet allocation. *Expert Syst. Appl.* **2015**, *42*, 1314–1324. [CrossRef]
8. Al-Madadha, A.; Al Khasawneh, M.H.; Al Haddid, O.; Al-Adwan, A.S. Adoption of Telecommuting in the Banking Industry: A Technology Acceptance Model Approach. *Interdiscip. J. Inf. Knowl. Manag.* **2022**, *17*, 443–470. [CrossRef]
9. Aws, A.L.; Ping, T.A.; Al-Okaily, M. Towards business intelligence success measurement in an organization: A conceptual study. *J. Syst. Manag. Sci.* **2021**, *11*, 155–170.
10. Wells, D. Business Analytics—Getting the Point. BeyeNetwork. 2008. Available online: http://www.b-eyenetwork.com/view/7133 (accessed on 5 January 2022).
11. Shollo, A.; Galliers, R.D. Towards an understanding of the role of business intelligence systems in organisational knowing. *Inf. Syst. J.* **2016**, *26*, 339–367. [CrossRef]
12. Davenport, T.H. Competing on analytics. *Harv. Bus. Rev.* **2006**, *84*, 98.
13. Wixom, B.H.; Watson, H.J.; Werner, T. Developing an enterprise business intelligence capability: The Norfolk Southern journey. *MIS Q. Exec.* **2011**, *10*, 61–71.
14. Turban, E.; Sharda, R.; Aronson, J.E.; King, D. *Business Intelligence: A Managerial Approach*; Pearson Prentice Hall: Upper Saddle River, NJ, USA, 2008; pp. 58–59.
15. Al-Khatib, A.W.; Al-ghanem, E.M. Radical innovation, incremental innovation, and competitive advantage, the moderating role of technological intensity: Evidence from the manufacturing sector in Jordan. *Eur. Bus. Rev.* **2022**, *34*, 344–369. [CrossRef]
16. Rao, G.K.; Kumar, R. Framework to integrate business intelligence and knowledge management in banking industry. *Rev. Bus. Technol. Res.* **2011**, 4. [CrossRef]
17. Vassiliadis, P. A survey of extract–transform–load technology. *Int. J. Data Warehous. Min. (IJDWM)* **2009**, *5*, 1–27. [CrossRef]
18. Kimball, R.; Ross, M. *The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling*; John Wiley & Sons: Hoboken, NJ, USA, 2011.
19. Jackson, J. Data mining; a conceptual overview. *Commun. Assoc. Inf. Syst.* **2002**, *8*, 19. [CrossRef]
20. Han, J.; Kamber, M.; Pei, J. *Data Mining: Concepts and Techniques*, 3rd ed.; The Morgan Kaufmann Series in Data Management Systems; Morgan Kaufmann: San Francisco, CA, USA, 2011.
21. Bhasin, M.L. Data mining: A competitive tool in the banking and retail industries. *Chart. Acc. New Delhi* **2006**, *55*, 588.
22. Al-Qudah, A.A.; Hamdan, A.; Al-Okaily, M.; Alhaddad, L. The impact of green lending on credit risk: Evidence from UAE's banks. *Environ. Sci. Pollut. Res.* **2022**. [CrossRef] [PubMed]
23. Curko, K.; Bach, M.P.; Radonic, G. Business intelligence and business process management in banking operations. In Proceedings of the 2007 29th International Conference on Information Technology Interfaces, Dubrovnik, Croatia, 25–28 June 2007; pp. 57–62.
24. Mortezaei, A.; Sangari, M.S.; Nazari-Shirkouhi, S.; Razmi, J. The Impact of Business Intelligence (BI) Competence on Customer Relationship Management (CRM) Process: An Empirical Investigation of the Banking Industry. *J. Inf. Technol. Manag.* **2018**, *10*, 209–234.
25. Awa, H.O.; Ukoha, O.; Emecheta, B.C. Using TOE theoretical framework to study the adoption of ERP solution. *Cogent Bus. Manag.* **2016**, *3*, 1196571. [CrossRef]
26. Rouhani, S.; Ashrafi, A.; Ravasan, A.Z.; Afshari, S. Business intelligence systems adoption model: An empirical investigation. *J. Organ. End User Comput. (JOEUC)* **2018**, *30*, 43–70. [CrossRef]
27. Malladi, S.; Krishnan, M. Determinants of usage variations of business intelligence & analytics in organizations—An empirical analysis. In Proceedings of the Thirty Fourth International Conference on Information Systems, Milan, Italy, 15–18 December 2013; pp. 1–22.
28. Tornatzky, L.; Fleischer, M. *The Process of Technology Innovation*; Lexington Books: Lexington, MA, USA, 1990.
29. Tassey, G. The Roles and Economic Impacts of Technology Infrastructure, Version 3. National Institute of Standards and Technology; 2008. Available online: https://www.nist.gov/system/files/documents/2017/05/09/Measurement_Infrastr_Roles_Impacts_v3.pdf (accessed on 18 June 2022).
30. Al-Bashayreh, M.; Almajali, D.; Altamimi, A.; Masa'deh, R.E.; Al-Okaily, M. An Empirical Investigation of Reasons Influencing Student Acceptance and Rejection of Mobile Learning Apps Usage. *Sustainability* **2022**, *14*, 4325. [CrossRef]
31. Mungree, D.; Rudra, A.; Morien, D. A framework for understanding the critical success factors of enterprise business intelligence implementation. In Proceedings of the 9th Americas Conference on Information Systems, Chicago, IL, USA, 15–17 August 2013.
32. Yeoh, W.; Koronios, A. Critical success factors for business intelligence systems. *J. Comput. Inf. Syst.* **2010**, *50*, 23–32.
33. Ramamurthy, K.R.; Sen, A.; Sinha, A.P. An empirical investigation of the key determinants of data warehouse adoption. *Decis. Support Syst.* **2008**, *44*, 817–841. [CrossRef]
34. Al-Okaily, M.; Alghazzawi, R.; Alkhwaldi, A.F.; Al-Okaily, A. The effect of digital accounting systems on the decision-making quality in the banking industry sector: A mediated-moderated model. *Glob. Knowl. Mem. Commun.* 2022, *ahead-of-print*. [CrossRef]
35. Giovinazzo, W. BI: Only as Good as Its Data Quality. Information Management Special Reports. Available online: http://www.information-management.com/specialreports/2009_157/business_intelligence_bi_data_quality_governance_decision_making-10015888-1.html (accessed on 3 December 2021).

36. Hujran, O.; Alarabiat, A.; Al-Adwan, A.S.; Al-Debei, M. Digitally transforming electronic governments into smart governments: SMARTGOV, an extended maturity model. *Inf. Dev.* **2021**. [CrossRef]
37. Eckerson, W. Smart companies in the 21st century: The secrets of creating successful business intelligence solutions. *TDWI Rep. Ser.* **2003**, *7*, 1–38.
38. Bijker, M.; Hart, M. Factors influencing pervasiveness of organisational business intelligence. In *BUSTECH 2013, the Third International Conference on Business Intelligence and Technology*; European Research Institute in Service Science (ERISS): Valencia, Spain, 2013; pp. 21–26.
39. Watson, H.J.; Wixom, B.H. The current state of business intelligence. *Computer* **2007**, *40*, 96–99. [CrossRef]
40. LaValle, S.; Lesser, E.; Shockley, R.; Hopkins, M.S.; Kruschwitz, N. Big data, analytics and the path from insights to value. *MIT Sloan Manag. Rev.* **2011**, *52*, 21–32.
41. Luftman, J.; Derksen, B.; Dwivedi, R.; Santana, M.; Zadeh, H.S.; Rigoni, E. Influential IT management trends: An international study. *J. Inf. Technol.* **2015**, *30*, 293–305. [CrossRef]
42. AL-Khatib, A.W. Can Big Data Analytics Capabilities Promote a Competitive Advantage? Green Radical Innovation, Green Incremental Innovation and Data-Driven Culture in a Moderated Mediation Model. *Bus. Process Manag. J.* 2022, *ahead-of-print*. [CrossRef]
43. Al-Omoush, K.S.; Al Attar, M.K.; Saleh, I.H.; Alsmadi, A.A. The drivers of E-banking entrepreneurship: An empirical study. *Int. J. Bank Mark.* **2019**, *38*, 485–500. [CrossRef]
44. Alsmadi, A.; Alfityani, A.; Alhwamdeh, L.; Al_hazimeh, A.; Al-Gasawneh, J. Intentions to use FinTech in the Jordanian banking industry. *Int. J. Data Netw. Sci.* **2022**, *6*, 1351–1358. [CrossRef]
45. Themistocleous, M.; Irani, Z.; Kuljis, J.; Love, P.E. Extending the information system lifecycle through enterprise application integration: A case study experience. In Proceedings of the 37th Annual Hawaii International Conference on System Sciences, Big Island, HI, USA, 5–8 January 2004.
46. Ramakrishnan, T.; Jones, M.C.; Sidorova, A. Factors influencing business intelligence (BI) data collection strategies: An empirical investigation. *Decis. Support Syst.* **2012**, *52*, 486–496. [CrossRef]
47. Masrek, M.N.; Jamaludin, A.; Hashim, D.M. Determinants of strategic utilization of information systems: A conceptual framework. *J. Softw.* **2009**, *4*, 591–598. [CrossRef]
48. Solomon, J.; Maroun, W. *Integrated Reporting: The Influence of King III on Social, Ethical and Environmental Reporting*; LThe Association of Chartered Certified Accountants: London, UK, 2012.
49. Sekaran, U.; Bougie, R. *Research Methods for Business*, 6th ed.; John Wiley & Sons: Hoboken, NJ, USA, 2010.
50. Hair, J.F.; Ringle, C.M.; Sarstedt, M. PLS-SEM: Indeed a silver bullet. *J. Mark. Theory Pract.* **2011**, *19*, 139–152. [CrossRef]