Original Research   **Open Access**

Identifying the Most Critical Factors to Business Intelligence Implementation Success in the Public Sector Organizations

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Abstract

The BI is a new trend in public sector organizations that requires investigating the critical success factors (CSFs) which would provide a sound guidelines for determining the criteria to be considered during BI implementation. However, there is no sufficient empirical evidences that provide better understanding of the CSFs for the BI implementation in public sector organizations. This paper aims to identify the CSFs for BI system in the context of public sector organizations. This study adopts a mixed method approach using survey research method and qualitative interview using Jordanian public sector organization case. The findings of this research revealed that top management support, clear vision and strategic planning, team skills, user participation, organizational structure, user access and development technology are the most critical factors to BI implementation success in the public sector organizations. The findings of this study could assist the practitioners in the public sector organizations in planning, managing and implementing their BI projects properly by focusing on those CSFs of BI systems that provide them a better understanding to address issues and concerns related to BI implementation.
Keywords: CSFs; Business Intelligence; Public sector organizations; Developing countries.

1. Introduction

The rapid growth in technological innovations and internet revolution in the past decades have significantly contributed in emerging a new advanced Information and Communication Technology (ICT) applications which increased the volume and complexity of business globally (Brown-Liburd et al., 2015; Hackney and Parrish, 2015; Minelli et al., 2012). This in turn had led to generate a huge amount of information from multiple sources which become recently known as a pervasive phenomenon of "Big Data" (Al-Htaybat and Von, 2017; Flyverbom et al., 2017). Big data is seen as a complex and massive volume of data that is difficult to analyze using traditional analytical tools which requires a more sophisticated analytical tools to manage, sort and analyze the information (Ahmed, 2016; Raghupathi and Raghupathi, 2014).

Big data and its related field of analytic tools have gained much attention among academia and practitioners over the past two decades (Chen et al., 2012; Lim et al., 2013). This explains the emergence and development of technology-based information systems as a solutions that have been designed to meet the business needs from the information which so-called "Business Intelligence" (BI) systems (Petrini and Pozzebon, 2008). The BI systems and analytics are perceived as an important analytical tool and techniques in the big data era to support a well-informed and smart decisions in terms of providing more reliable and comprehensive information in timely manner that is gather, sort and analyze from numerous internal and external data sources (Chen et al., 2012; Lim et al., 2013). According to Olszak and Ziemba (2012), the BI system is technological and functional tools including software, architectures, databases, analytical IT tools and business processes that are collecting, storing, accessing, sorting, analyzing data from different sources and transform it into information and knowledge required for stakeholders to make a well-informed and minute decisions.

Public sector organizations usually deal with a huge volume of daily transactions and activities that generate millions of data from many actions (Nasab et al., 2015). Therefore, in the recent years many public organizations worldwide have increasingly sought to adopt and implement BI systems to enhance decision making process based on more informed information from numerous data sources (Binti and Bin Mohamed, 2012; Gaardboe and Svarre, 2017).

Many researchers affirmed that the implementation of BI systems in public sector has several benefits. These benefits include assisting public sector in setting strategic plans, facilitating access to a decipherable and inclusive information, improving decision-making process, increasing productivity based on more efficient processes and eliminating duplication in procedures (Coman, 2009; Hartley and Seymour, 2011). According to Nasab et al. (2015), BI system has a great potential for public sector in terms improving service delivery and achieving the planned goals of public organizations. It also contributes to reduce costs and assists in identifying the preferences

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of citizens (Binti and Bin Mohamed, 2012). In addition, the BI system enhances transparency and responsiveness to the needs and demands of stakeholders (Chen *et al.*, 2012).

Although the BI system has a great potential for public sector, its implementation is not easy task that requires considering many organizational and technology aspects (Binti and Bin Mohamed, 2012). Nasab *et al.* (2015) noted that the BI systems are still a new trend in public sector domain that need to further research, specifically, in identifying the critical success factors (CSFs) to assist public organizations for implementing BI successfully.

Literature has recently witnessed many research attempts that identified a variety of CSFs for BI systems from different perspectives. However, several researchers emphasized that these research attempts are not at a satisfactory level, as the body of literature, in general, still lacks the CSFs for BI success (Adamala and Cidrin, 2011; Dooley, 2015; Gaardboe and Svarre, 2017; García and Pinzón, 2017; Hackney and Parrish, 2015; Isik *et al.*, 2011; Mungree *et al.*, 2013; Olszak and Ziemba, 2012; Puklavec *et al.*, 2018; Sangar and Iahad, 2013; Yeoh and Popovič, 2015; Zaied *et al.*, 2018). According to Yeoh and Popovič (2016), "academic research on the CSFs of implementing BI systems is scarce". They also added "existing research provides quite a limited breadth and depth of analysis with limited scope" (Yeoh and Popovič, 2016).

While the literature abounds with several studies that address the CSFs for BI, these studies are limited to the context of private sector indicating there is a gap in the BI literature in investigating the CSFs in the context of public sector (Binti and Bin Mohamed, 2012). Some scholars stated that the CSFs for BI system are not necessarily agree with all contexts which in turn requires from the researchers to carefully identify the CSFs that fit with the context under investigation (Olszak and Ziemba, 2012; Sangar and Iahad, 2013; Yeoh and Koronios, 2010).

The fact of BI implementation in the public sector is increasing (Nasab *et al.*, 2015). However, there is lack of experiences among public sector to handle this new trend of technology or deal with the complexity of its implementation as they are unaware of the key factors contributing the BI success (Binti and Bin Mohamed, 2012). Therefore, this study aims to identify the CSFs for BI system in the context of public sector organizations using the case of Jordanian public sector. The findings of this study would assist the practitioners in the public sector organizations in planning, managing, and implementing their BI projects properly by focusing on those CSFs of BI systems that provide them a better understanding to address issues and concerns related to BI implementation.

2. Literature Review
2.1. Business Intelligence (BI)

The term *"Intelligence"* has been used by scientists in the field of artificial intelligence in the 1950s (Chen *et al.*, 2012). While, the *"Business Intelligence"* (BI) became a common term in the business and IT landscape only since the 1990s (Wixom *et al.*, 2014). It is widely believed that the BI systems are not new technology, but it evolved over time from the previous decision support systems in the IT and IS portfolio as a result of changing business needs for more predictive and well-informed decisions, improving competitiveness, growing the complexity of information requirements and increasing availability of computing power (Gray, 2003; Hackney and Parrish, 2015).
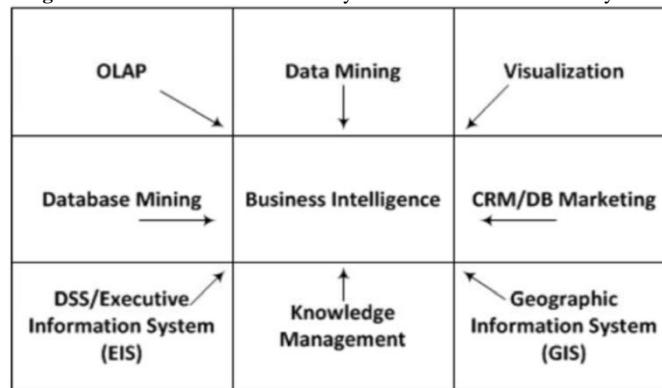
Several scholars (Ponelis and Britz, 2013; Zhang *et al.*, 2009) claimed that the term BI was used since the middle of the last century by Luhn (1958); who separately defined the terminology of *"Business"* and *"Intelligence"* as follow Luhn (1958):

> *"Business is a collection of activities carried on for whatever purpose, be it science, technology, commerce, industry, law, government, defense, et cetera. The communication facility serving the conduct of a business (in the broad sense) may be referred to as an intelligence system".*
> *"The notion of intelligence is also defined here, in a more general sense, as the ability to apprehend the interrelationships of presented facts in such a way as to guide action towards a desired goal".*

Other researchers believe that the BI is relatively new concept coined by Dresner (1989) of Gartner Research who described BI as a "concepts and methods to improve business decision making by using fact-based support systems" (Dresner 1989 cited in Müller *et al.* (2010). This definition is in line with definition proposed by Luhn (1958) in terms of providing organizations with tools to assist in data management and promote communication among individuals by providing them with required information for their decisions in an effective and timely manner.

The BI is a broad umbrella concept of intelligence, it includes a set of terms related to information analysis (Lönnqvist and Pirttimäki, 2006). The BI combines both business IT applications and technologies including transactional operational systems to collect, store, access, analyze, and provide information to assist decision makers for more insight decisions (Negash and Gray, 2008; Ranjan, 2008). Figure 1 illustrates the BI system includes other operational information systems.

Figure-1. The Relation between BI System and other Information Systems

OLAP	Data Mining	Visualization
Database Mining	Business Intelligence	CRM/DB Marketing
DSS/Executive Information System (EIS)	Knowledge Management	Geographic Information System (GIS)

Source: (Negash, 2004).

2.2. Critical Success Factors (CSFs) for BI system

The critical success factors can be defined as the areas that should be set to make things moving toward the right direction for the business success (Eid, 2007; Jan *et al.*, 2011). However, the most common cited definitions presented by Rockart (1978), who defined the CSFs as "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization". The CSFs emerged in the early sixties of the last century in the administration science by Daniel (1961) work. It gained a considerable recognition since Anthony and University (1965) and Rockart (1978) asserted that the CSFs should be carefully and constantly managed by organization to survive and prosper. They determined four key sources for CSFs which are: (i) industry, (ii) environmental, (iii) temporal, and (iv) geographical, competitive, and industry position factors. Since then, the CSFs has been widely used in various disciplines, and discussed in many researches using different synonyms such as key success factors, critical value factors, readiness factors, strategic factors and key result areas (Jan *et al.*, 2011).

Many scholars affirmed that the CSFs is an imperative aspect to understand the success of BI system (Adamala and Cidrin, 2011; Khojasteh *et al.*, 2013; Mungree *et al.*, 2013; Sangar and Iahad, 2013; Yeoh and Koronios, 2010). According to Olszak and Ziemba (2012), organizations should be aware of and learn about the CSFs in order to identify the key areas and actions that affect the success of BI implementation and put it in the right path, as well as to minimize negative influences, and to plan activities and resources to achieve the desired goals from BI implementation which would lead ultimately to success of BI projects.

The fact of BI system implementation in public sector is relatively new trend, where there is a lack of empirical evidence of the CSFs for BI system (Binti and Bin Mohamed, 2012; Yeoh and Koronios, 2010). Moreover, the adoption and implementation of such systems transform the way of which the data is processed which often involves several complex processes including technological, organizational and process aspects that must be well understood (Yeoh and Koronios, 2010). Therefore, this complexity in BI systems necessitates the need to understand the CSFs and its influence on the BI success which would provide a good guideline for stating what criteria need to take into consideration during the implementation of BI projects (Grublješič and Jaklič, 2015; Hackney and Parrish, 2015; Hou, 2012; Zhou and Sun, 2009). Yeoh and Popovič (2015), stressed that understanding of the CSFs that affect the BI systems is very important to enable the organizations to optimal use of their resources and efforts towards the success of BI implementation, and to avoid the potential risks and obstacles that prevent the achievement of the system objectives. Additionally, Isik *et al.* (2011) believe that the reason for BI failure can be attributed to lack of understanding the CSFs that define the BI success, and how these factors contribute in achieving the perceived benefits of BI system.

Recently, several research in the existing literature have examined and identified a variety of CSFs for BI system from different perspectives. Hawking and Sellitto (2010), identified a number of CSFs that related to BI system in the context of ERP systems; which are management support, source systems, championship, development technology, team skills, user participation and resources. Moreover, Jamaludin and Mansor (2011) provide two groups of CSFs for the successful implementation of BI systems, are technical and organizational factors. The technical factors include data quality, data management, technology being adapted, training and expertise to develop and manage systems, development methodology, having adequate and sufficient technical skills. While organizational factors involve operating and executive sponsorship, clear vision that aligns with business goals, user-oriented factors like user engagement, meet business needs, support and expectations, organizational politics and planning for system evolution. Meanwhile, Khojasteh *et al.* (2013) point out that an extensible technical framework (software and hardware), appropriate technology and tools, integration among BI systems and other systems, data quality and system quality are the critical technological and technical factors for success of BI implementation.

Mungree *et al.* (2013), have conducted in depth interviews with 16 BI consultants who have substantial experience in BI, in order to identify and understand the CSFs of BI implementation. They concluded 9 CSFs that are important for the successful implementation of BI systems; namely: committed management support, team skills, appropriate resources and technological framework, project scope management, effective data management, align BI strategy with business objectives, committed and informed executive sponsor, clear vision and well defined information and systems requirements, user-oriented change management. In another study, Schieder and

Gluchowski (2011) determined the functional coverage, technical sustainability, and organizational maturity as a main success factors that measure the success of BI systems.

Additionally, Işık et al. (2013) have outlined the success factors of BI capabilities and decision environment which are data quality, systems integration, user access, flexibility, and risk management. Also, Popovič et al. (2012) identified CSFs for maturity of BI systems, they believe that the BI maturity affect information content quality and information access quality which ultimately led to successful use of BI system implementation. They found the data integration, analytical capabilities, and analytical decision-making culture are CSFs of BI maturity for success use of information in BI.

Yeoh et al. (2008),Yeoh and Koronios (2010), (Yeoh and Popovič, 2015) with other scholars have conducted series of research to identify the CSFs for success criteria of BI system. In their work Yeoh et al. (2008) they assert that the CSFs for BI are committed management support and championship, user-oriented change management, business vision, project planning, team skills and composition, infrastructure-related issues, data-related issues. Meanwhile, Yeoh and Koronios (2010) found that the top management commitment and support, clear vision and well-established business case, business-centric championship and balanced team, composition, business-driven and iterative development approach, user-oriented change management, business-driven, scalable and flexible technical framework, and sustainable data quality and integrity are the CSFs for BI success. While, in last study, Yeoh and Popovič (2015) determined the CSFs of BI as a committed management support and sponsorship, clear vision and a well-established business case, business-centric championship and a balanced team composition, business-driven and iterative development approach, user-oriented change management, business-driven, scalable and flexible technical framework, and sustainable data quality and integrity.

Bargshady et al. (2014), found that the success factors for BI readiness are: clear business vision and planning, committed management support and sponsorship, map the solution to the users, balance team composition, data quality and management issue, robust and extensible framework.

Furthermore, Sangar and Iahad (2013) examined the CSFs that affect the stages of BI implementation. They stated that top management support, change management, stakeholders active involvement, clear goals and objectives, effective project management, organizational culture , user education and training, sponsorship, business oriented championship, balanced team composition, well established business case, sustainable data quality and quantity, data accuracy and integrity, IT infrastructure and legacy system, suitability of hardware and software, system reliability and flexibility, perceived usefulness and system ability to learn are the key CSFs for success of all stages of BI implementation.

Olszak and Ziemba (2012) show that the CSFs of BI implementation in the SMEs are an adequate budget, past experience and collaboration with supplier, top management support, clear vision and plan, competent project manager, staff competency (well-skilled and qualified staff, team and managers), well-defined business problem and processes, identification of users' expectation from information requirements properly, well-adapted a BI solution with users' expectation, effective change management, integration between BI system and other systems, usability of BI system, appropriate technology and tools, data quality, responsiveness to users' requirements and BI flexibility. Additionally, Dawson and Van Belle (2013) noted that the CSFs for BI system implementation in the financial services sector are top management support, user participation, championship, resources, and data quality.

In the context of BI user satisfaction, only very few studies have investigated the effect of CSFs on user satisfaction with BI implementation. For instance, Isik et al. (2011) investigated the relationship between successful BI capabilities and BI user satisfaction, and they identified the technological factors that affect user satisfaction with BI systems which are data quality, data source quality, data reliability, interaction with other systems, user access, flexibility, risk management support. Similarly, Pedyash et al. (2013), examined the impact of BI capabilities and organizational structure on the success of BI implementation. They found the critical success factors related to BI capabilities are user access, data type, data source, interaction with other systems, BI system flexibility. While the organizational structure includes two success factors are centralization and formalization.

Arefin et al. (2015), investigate the influence of organizational factors on the effectiveness of BI system. They affirmed that the organizational structure, strategy, culture and process are the key organizational factors that positively effect on the effectiveness of BI system. Additionally, Hackney and Parrish (2015) investigates the system quality and information quality factors for BI success that affect user satisfaction. He states that the critical system quality factors that influence on BI user satisfaction are integration flexibility and reliability, while the critical information quality factors are representational, accessibility and intrinsic. Moreover, Hung et al. (2016), identified a set of the key factors that enable successful implementation of BI system in enterprises. These factors include relative advantage, complexity, compatibility, top management support, organization size, Knowledge integrate, competitive pressure, consultant ability and training.

In the most recent studies, Lautenbach et al. (2017) examined the factors that influence on the actual BI usage extent. They noted that data-related infrastructure capabilities, top management support, external market influence and regulatory compliance are among the key factors that positively influence on BI usage extent. In addition, Kulkarni et al. (2017) perceived the user participation, analytical decision making orientation and top management championship as the key success factors that effect on building BI capability. Furthermore, Puklavec et al. (2018) investigated the determinants affecting the adoption stages of BI system in the SMEs. They revealed that the determinants of BI system adoption are relative advantage, cost, BI is part of ERP, management support, rational decision making culture, organizational data environment, organizational readiness and external support.

García and Pinzón (2017) have reviewed the BI literature and identified 13 CSFs affect the success of BI system, namely: directives and top management, business linking, project leader or championship, clear vision and

strategy, change management, project management, human talent team, learning and skills, suitable technology and tools, technologies development, suitable resources, metrics, organizational culture and cooperation with BI suppliers. Likewise, Gaardboe and Svarre (2018) have reviewed 43 studies in the BI literature with the aim of identifying the CSFs for BI system. They discovered 26 CSFs related to BI success, are: technology experience, attitude toward change, trust, user expectations, subjective norms, image, peer support, visibility, management support, vision and strategy, external environment, management processes, IT infrastructure, IS governance, organizational structure, organizational competence, organizational size, organizational culture, project management, user involvement, competency development, third-party interactions, developer skills, development approach, expert domain knowledge, voluntariness.

Similarly, Zaied et al. (2018) have articulated 16 CSFs of BI system based on review the previous studies. They classified the CSFs into four categories are organizational, process, technology and environment factors. Organizational factors include top management support, Clear vision, adequate resource, organizational culture and BI strategic alignment. Process factors contain champion and balanced team skills and composition, user oriented change management and project management. Technology factors comprise data quality, integration between BI system and other systems, scalable and flexible system, compatibility, complexity and relative advantage. Environment factors involve selection of vendors and competitive pressure. Table 1 summarizes the CSFs for BI system identified in the pre-existing studies.

Table-1. The CSFs for BI System Discussed in the Existing Literature

#	CSF for BI	Amott (2008)	Qidin & Adamala (2011)	Dawson & Belle (2013)	Hawking & Sellitto (2010)	Olszak & Ziemba (2012)	Sangar and Iahad (2013)	Yeoh et al. (2008)	Yeoh and Koronios (2010)	Olszak (2016)	Pham et al. (2016)	Yeoh and Popovič (2016)	Grublješić and Jaklič (2015)	Hasan et al. (2012)	Kohnke et al. (2011)	Nasab et al., (2015)	Popovič et al., (2012)	Sparks & McCann (2015)	Olbrich et al. (2011)	Bischoff et al. (2015)	Kulkarni & Flores (2013)	Kulkarni & Popovic (2017)	Rhoesan and Saoji (2014)	Gonzales et al. (2015)	Wieder et al. (2012)	Woodside (2011)	Gaardboe (2017)	Salmasi et al (2016)	Isik et al. (2013)	Isik et al. (2011)	Mungree (2013)	Khojasteh et al. (2013)	Holin & Wang (2013)	Bangshadya (2015)	Jamaludin & Mansor (2011)	Pedyash et al. (2013)	Arefin et al. (2015)	Lautenbach et al. (2017)	Villamarin & Rinzon (2017)	Frequency
1	Top Management Support	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x						x	x			x				x	x		x	x	26
2	Data Quality		x			x	x	x			x			x	x	x	x				x	x	x		x		x		x	x	x	x	x	x	x	x			x	23
3	Project Leader and Champion	x	x	x	x	x	x	x	x			x	x		x			x				x	x	x	x	x	x											x	x	19
4	Clear Vision and Strategic Planning	x	x	x		x	x	x	x	x	x		x			x						x					x				x			x			x		x	18
6	Flexible and Appropriate Technological Framework (Development Technolgy)	x			x	x	x		x			x			x										x	x	x	x	x	x	x	x	x			x			x	17
5	Team Skills	x			x	x	x	x	x	x	x	x	x			x											x				x			x	x				x	16
7	Management Processes	x	x			x	x	x			x	x	x		x	x	x				x						x												x	14
9	IT Infrastructure	x	x			x	x				x			x							x				x	x	x				x	x						x	x	13
8	Change Management	x	x			x	x	x	x		x	x					x				x						x			x									x	12
10	User Participation		x	x							x	x		x		x				x		x	x	x			x							x					x	12
11	Adequate Resources	x			x	x		x						x							x				x	x	x			x				x					x	10
12	Integration with Other Systems				x											x	x	x		x				x			x		x	x		x				x			x	10
14	User Access				x									x	x	x								x			x		x	x		x			x		x			9
13	Project Planning	x	x			x	x	x				x								x							x							x					x	8
15	Development Approach	x				x		x			x								x								x							x					x	7
16	IS Governance																		x		x	x	x	x	x														x	7
17	Competency Development											x		x		x			x	x	x	x																	x	7
18	Project Management	x					x															x		x				x		x				x				x	7
19	Well Defined a Business Problem, Needs and Processes	x			x										x			x								x								x	x		x		x	7
20	Data Management	x						x																x			x			x					x	x	x	x	7
21	Developer Skills												x	x					x		x						x										x		x	5
22	Well Defined Users' Expectation				x											x				x							x				x						x		x	5
23	Organizational Culture				x		x		x		x						x						x				x										x			5
24	Third-Party Interactions								x											x					x		x									x			x	4
25	Sponsors	x																						x			x				x				x					4
26	External Consultant													x			x								x		x												x	4
27	Risk Management																				x						x	x	x											3
28	Voluntariness										x												x				x													3
29	User Education and Training						x					x															x												x	3
30	Coordination between IT and Business Units													x		x									x															3
31	Attitude Toward Change										x														x		x													3
35	Organisational Structure											x																									x	x		3
32	Organisational Competences																								x														x	2
33	Peer Support																			x							x													2
34	Task Compatibility																						x				x													2
36	Map the Solutions to the Users																																				x			1

Although the literature abounds with studies addressing the CSFs for BI implementation, the majority of these studies are limited to private sector (Barakat et al., 2013; Doom et al., 2010; Foshay and Kuziemsky, 2014; Hou, 2012; Mettler and Vimarlund, 2009; Nguyen et al., 2014; Robert et al., 2014). Only few studies investigated the CSFs for BI in the context of public sector (Binti and Bin Mohamed, 2012; Nasab et al., 2015). This is particularly true in investigating the CSFs for BI implementation in developing countries. While the potential benefits of BI systems for the public and private sector are similar, the CSFs for BI success may be differ among contexts (Olszak and Ziemba, 2012). Some scholars noted that the CSFs for BI system are not necessarily agree with all contexts

which in turn requires from the researchers to carefully identify the CSFs that fit with the context under investigation (Olszak and Ziemba, 2012; Sangar and Iahad, 2013; Yeoh and Koronios, 2010).

As a matter of fact, public sector still suffers from a lack of experiences to handle this new trend of BI technology and its complexity, they remain unaware about the factors that contribute to its success (Binti and Bin Mohamed, 2012; Nasab *et al.*, 2015) Therefore, this study contributes to investigate the CSFs for BI success in the context of public sector to assist public sector organizations to optimal use of their resources and efforts, treat the complexities, and avoid the potential risks and obstacles facing implementation.

3. Methodology

This study adopts a mixed method approach using survey research method and qualitative interview using Jordanian public sector organization case. The fact of BI implementation is complex and still new phenomenon (Götz *et al.*, 2010; Olszak and Ziemba, 2012), particularly in the context of public sector (Nasab *et al.*, 2015). Mixed method is a more suitable approach to investigate and develop a firm understanding of complex and new phenomenon(Creswell, 2012). Moreover mixed method approach enables the researcher to understand the reality of context in holistic manner(Creswell, 2012). According to Foley (2010), combining both survey and interview research method assists the researcher to explore a program, event, activity, process, or one or more individuals in detail.

The survey instrument was developed to identify the most appropriate CSFs for BI implementation in public organizations. Through an extensive efforts in review the literature of the CSFs for BI success, 36 critical success factors for BI were identified. Table 1 lists these CSFs for BI discussed in the existing literature which have been ordered based on frequency. The degree of criticality of each of these factors were assessed in a survey administered to 24 BI's experts. The participants in this study are: IT managers in Jordanian public sector organizations (4), software development manager (3), BI vendors (4), team members of BI projects (5), business analysts (4), and BI users (4).

Likert scale (A 5-point) was employed for rating the factors, with values ranking between 1= (Neither critical nor important for BI success), and 5= (Extremely critical and important for BI success). A higher value reflects a greater level of respondent's agreement with criticality and importance of factor. The mean score of respondent's answers are classified based on Likert scale as shown in Table 2.

Table-2. Mean Score

Mean Score	Interpretation
4.21 – 5.00	Extremely critical and important for BI success (rating = 5)
3.41 – 4.20	Critical and important for BI success (rating = 4)
2.61 – 3.40	Somewhat critical and important for BI success (rating = 3)
1.81 – 2.60	Important but not critical/necessary for BI success (rating = 2)
1.00 -1.80	Neither critical nor important for BI success (rating = 1)

The qualitative approach using interviews was adopted as a complementary data collection method to support and confirm survey findings and to add further interpretation on how the CSFs are effectual for BI success in public sector organizations. Semi-structured interviews with open-ended questions were used to acquire and comprehend the interviewees' opinions and experience about the survey findings. As shown in table 3, interviews involved 5 individuals with 6:30 hours of interviews. The participants of interviews were selected from Jordanian public sector organizations, academics and BI vendors who are BI experts. This variety of selection enables to understand the phenomenon from different perspectives, and eliminate any potential bias that might exist in one specialist (Yildiz, 2007). The interviewed experts were questioned on their experience and opinions about the CSFs for BI systems and their understanding on how the CSFs are effectual for BI success in the public sector organizations.

Table-3. Interviewees' Profile

No.	Interviewee	Exp. (Years)	Duration (Hours)
I1	Information Technology Director (CIO).	24	1:15
I2	Systems Analyst	7	1:30
I3	Head of IT Division	12	1:15
I4	BI vendor (Software Development Manager).	7	1:30
I5	Assistant Professor (MIS)	9	1:00
Total			6:30

4. Findings and Discussion

Thefindings of this study revealed that the most seven critical factors for BI implementation in public sector identified by the BI's experts were top management support (mean 4.542), clear vision and strategic planning (mean 4.292), team skills (mean 4.250), user participation (mean 4.125), organizational structure (mean 4.083), user access (mean 3.958), flexible and appropriate technological framework/ Development technology (mean

3.917). Table 4 shows the CSFs for BI implementation in public organizations which ranked based on experts' perceptions.

Table-4. CSFs for BI Implementation in Public Organizations from Experts' Perceptions

CSFs for BI	Extremely critical & important	Critical & important	Somewhat critical & important	Important but not critical	Neither critical nor important	Mean	%	Rank
Top Management Support	15	7	2	0	0	4.542	90.83%	1
Clear vision and strategic planning	11	10	2	1	0	4.292	85.83%	2
Team Skills	10	11	2	1	0	4.250	85.00%	3
User Participation	12	7	2	2	1	4.125	82.50%	4
Organizational structure	10	8	4	2	0	4.083	81.67%	5
User access	7	11	4	2	0	3.958	79.17%	6
Flexible and appropriate technological framework (Development Technology)	7	11	3	3	0	3.917	78.33%	7
Project management	6	7	7	3	1	3.583	71.67%	8
User education and training	3	7	12	1	1	3.417	68.33%	9
IT infrastructure	6	2	9	7	0	3.292	65.83%	10
Well defined users' expectation	4	2	13	5	0	3.208	64.17%	11
Peer support	5	3	8	7	1	3.167	63.33%	12
Development Approach	6	2	6	9	1	3.125	62.50%	13
Integration with other systems	3	5	9	6	1	3.125	62.50%	14
Adequate Resources	1	7	9	6	1	3.042	60.83%	15
Project Leader and Champion	1	7	9	6	1	3.042	60.83%	16
Data quality	3	5	6	9	1	3.000	60.00%	17
IS governance	4	4	6	8	2	3.000	60.00%	18
Sponsors	3	3	10	6	2	2.958	59.17%	19
Risk management support	1	3	14	6	0	2.958	59.17%	20
Coordination between IT and business units	4	4	4	10	2	2.917	58.33%	21
Data management	3	3	8	8	2	2.875	57.50%	22
Task compatibility	3	2	8	11	0	2.875	57.50%	23
Attitude toward change	2	2	10	10	0	2.833	56.67%	24
Organizational competences	3	2	8	9	2	2.792	55.83%	25
External consultant	4	2	6	9	3	2.792	55.83%	26
Management processes	0	5	10	7	2	2.750	55.00%	27
Well defined a business problem, needs and processes	3	4	8	9	2	2.708	54.17%	28
Change Management	1	3	7	11	2	2.583	51.67%	29
Competency development	1	2	8	11	2	2.542	50.83%	30
Third-party interactions	3	3	6	12	2	2.542	50.83%	31
Project planning	0	4	7	11	2	2.542	50.83%	32
Map the solutions to the users	0	3	6	12	3	2.375	47.50%	33
Developer skills	0	2	5	16	1	2.333	46.67%	34
Voluntariness	0	1	7	14	2	2.292	45.83%	35
Organizational culture	0	0	8	14	2	2.250	45.00%	36

The following discussion provides further interpretation on how the CSFs are effectual for BI success in public sector organizations based on the findings of interviews.

4.1. Top Management Support

All interviewees affirmed that top management support is one of the key critical factors for BI success in public sector organizations. They stressed that the willingness and belief of top management in the capabilities of BI system in extracting more informed decisions and improving the overall performance has significantly

contributed to support the adoption and implementation of BI system in public sector organizations. According to (I1):

> "I think that the most important factor for BI success is the availability of willingness to implement this system and the willingness of our manager for improve performance in the work and he believes it constitutes a good tool for well-informed decisions".

Another interviewee discussed in similar way and added (I3):

> "Our management promoted the adoption and implementation of BI systems in our work to improve overall performance believing that BI system is the best way to obtain more informed decisions".

The findings of interviews revealed that the commitment of top management plays a significant role in the adoption and implementation of BI system in public sector organizations. The interviewees explained that the BI projects in public organizations often involve many challenges and require a time to be implemented successfully. It also need budgets allocation, adequate resources, training and effective change management. Therefore, the support by the highest level of management plays a vital role in addressing these issues and managing this change in terms of provide financial support, eliminate administrative obstacles and reduce the resistance to change. The following quotes support this point:

> "There is no doubt that the top management support has a considerable role in the success of BI systems throughout all stages of the implementation by providing all required resources including financial support" (I5).

> "In fact the implementation of BI project is not easy, it faces several challenges. I can't imagine a successful BI system without management support" (I4).

> "The BI system faced resistance by some officers in the beginning, but our Director-General forced them to implement this system, and he only accept reports extracted from the BI system. I think this is one of the key reasons for the success of BI system in our department" (I3).

This finding is in line with numerous studies in the BI literature (Bargshady *et al.*, 2014; Bischoff *et al.*, 2015; Gaardboe and Svarre, 2018; Grublješič and Jaklič, 2015; Kulkarni U. and Robles-Flores, 2013; Kulkarni *et al.*, 2017; Nasab *et al.*, 2015; Villamarín and Diaz, 2017) who emphasized that top management support is one of an imperative success factors for BIsystems.

4.2. Clear Vision and Well-defined Plan

Interviewees emphasized that having a clear vision and well-defined plan is one of the key factors that contribute to success of BI system in public sector organizations. As one expert said (I1):

> "All benefits that have been gained from the BI system were studied well and developed in the strategic planning process and this is why we success in our BI project".

The findings of interviews indicated that the design and development of BI system to be consistent with business goals and needs contributes significantly to success of BI systems in public sector organizations. Therefore, the perceived benefits from the BI system is an integral part of system design and its objectives which would enable to extract a maximum benefit from BI system in order to serve an objective for the strategic plan of public organizations. As one expert said (I3):

> "The BI system assisted significantly in achieving the strategic goals of our department this is due to this system was basically designed to serve our needs and objectives for the strategic plan of our department".

Moreover, interviewees asserted that the constant review approach for strategic planning of the BI system with business goals contributes in understanding the actual business needs, achieves more realistic goals, improves the system and information quality to be aligned with the business goals which in turn improve satisfaction and usefulness. One expert commented on this point (I1):

> "Our approach depends on ongoing review for BI system with our business goals, this results in deep understanding of our real needs, and achieves balance between the BI purpose and our goals so we feel this approach achieves more realistic goals".

The former interviewee also added:

> "Such ongoing approach help us to introduce the required improvements on BI system to enhance overall quality of system and its information which improves ultimately the usefulness and user satisfaction".

Many scholars (Bargshady *et al.*, 2014; Dawson and Van Belle, 2013; Gaardboe *et al.*, 2017; Mungree *et al.*, 2013; Nasab *et al.*, 2015; Olszak and Ziemba, 2012; Olszak, 2016; Ravasan and Savoji, 2014; Sangar and Iahad, 2013; Villamarín and Diaz, 2017) affirmed that the clear vision and well-defined plan is one of the important factors for the success of BI projects.

4.3. Team Skills

Interviewees asserted that the BI team skills is among the success factors of BI system in public sector organizations. They stated that the high technical skills of BI team contributes significantly to improve the quality of service provided to the users and enhance the characteristics of information which would increase the level of users' satisfaction with the BI system. One expert explained this point when he said (I2):

> "If there is a good skills of BI team, this will improve the satisfaction of users because of having a well skilled team will support the implementation… support the users' needs and their needed

technical assistance, and help them to how use the analytical tools to develop their reports which in turn promotes the characteristics of BI information".

This finding agrees with several studies (Bargshady *et al.*, 2014; Mungree *et al.*, 2013; Olszak, 2016; Villamarín and Diaz, 2017; Watson *et al.*, 2006) who asserted that the BI team skills is among the success factors of BI system. A number of studies (Schieder and Gluchowski, 2011; Wixom B. H. and Watson, 2001; Yeoh and Popovič, 2016) noted that the team skills has a significant impact on the quality of BI system; information and service. Although the findings of this study are in line with the previous research in terms the team skills is positively influence on the service and information quality, the results of this research revealed that there is no positive significant relationship between team skills and system quality. The analysis of interviews explained this result that the role of BI team is limited to conduce adaptive maintenance, support the implementation and provide the required technical assistance for the users. The findings of interviews also showed that the architecture and capabilities of BI systems have a high level of quality such as flexibility and integration that consider one of main BI features which already embedded in the system. Therefore, the interviewees believe that the team skills in public organization is not always significantly affect the BI system quality.

4.4. User Participation

The findings of interviews showed that the user participation is one of an imperative success factors for BI systems in public sector organizations. The participants emphasized that the engagement of user in the processes of BI implementation contributes to determine the needs and preferences of BI's users and meet their expectations from the BI which increases their satisfaction with the system. As on expert noted (I1):

"We are always assiduous through engaging the users in BI implementation processes to know their needs and desires, and this is simply why we success in the BI implementation".

According to participants' viewpoints, the user participation contributes significantly to introduce improvements on the BI system, improve the quality of system, services and information by getting feedback about perceptions, new ideas and suggestions to develop the system. Therefore, the user participation provides a sound base to design and develop the BI systems to be consistent with the actual business needs and users' aspirations which consequently support the success of BI implementation. One expert illustrated this point, when he said (I4):

"I think that the user participation is amongst the critical aspects to make BI successful as it helps to take into account the needs of users when applying the system and it allows to introduce new ideas based on their suggestions and their real needs in the first place".

Similarly, another expert commented on this point (I2):

"In my opinion the BI system should be built on a correct basis by taking into account the needs of users and engaging them in all implementation phases. This is actually the secret for the success of BI system because no matter how professional the IT team may be, but they may not see particular things that could be significant for the users".

Likewise, assistant professor in MIS added (I5):

"I believe the involvement of users creates a creative opportunities for developing the quality of system, service and information".

This finding is consistent with a variety of studies in the literature (Dawson and Van Belle, 2013; Gaardboe *et al.*, 2017; Grublješič and Jaklič, 2015; Hawking and Sellitto, 2010; Jamaludin and Mansor, 2011; Kulkarni U. and Robles-Flores, 2013; Kulkarni *et al.*, 2017; Nasab *et al.*, 2015; Olbrich *et al.*, 2012; Ravasan and Savoji, 2014; Villamarín and Diaz, 2017; Yeoh and Popovič, 2016) who emphasized that the user participation is one of an imperative success factors for BI systems that improves the quality of system, information, and service.

4.5. Organizational Structure

Organizational structure refers to a "formal framework whereby the authority is delegated to managers and other officials at different administrative levels in the hierarchy to make a critical decisions about organization resources" (Arefin *et al.*, 2015). Interviewees affirmed that the delegation of authority in decision making process is critical success factor for BI system. As one expert stated (I5):

"Of course, the BI system requires an adequate delegation level of authority to be implemented successfully".

Another expert supported this point when he said (I4):

"As you know, the BI is decision support system, and thereby without power delegation in decision making process at all administration levels, the BI will have no value".

Some experts perceived the delegation of authority in decision making process as one of success factor to improve the BI system and information quality. As he said (I2):

"This enables the users to design and develop a new and creative reports in the system that fit with the level of their authorities which would improve the system and information quality of BI".

In addition, another expert believes the delegation of authority in decision making process promotes the level of satisfaction and usefulness from BI system. He said (I5):

"I think that the level of freedom or decentralization in decision making process would enhance the satisfaction and usefulness from BI".

4.6. User Access

From the point of viewof interviewees, the user access to the BI system is restricted by legislations in public sector organizations. They believe that each category of users cannot see all information they need from BI system because of the privacy and confidentiality issues. Therefore, the BI systems in public organizations are being designed to provide limited access to information. The interviewees perceived the protection of privacy and confidentiality as one of the key issues that undermines the accessibility of information and detrimental the success of BI systems. As one expert said (I1):

> *"In fact the BI system does not allow accessibility to all information in many public institutions because they basically believe that this will expose the privacy! or they may not have a legal framework supports the access to all relevant information. In my opinion, this is very important issue and should be addressed as it undermines the accessibility and it has a negative impact on the success of BI system".*

4.7. Development Technology

The interviewees affirmed that availability of an appropriate and flexible technology that supports the BI implementation is among the success factors for BI systems in public sector organizations. As one expert said (I2):

> *"Undoubtedly, the BI requires an extendable and flexible infrastructure including the operating software and hardware to be compatible with the BI implementation".*

Another interviewee noted:

> *"Lack of an adequate IT infrastructure will hinder the BI implementation successfully".*

This finding concurs with many scholars (Bargshady *et al.*, 2014; Gaardboe and Svarre, 2017; Hawking and Sellitto, 2010; Isik *et al.*, 2011; Işık *et al.*, 2013; Khojasteh *et al.*, 2013; Mungree *et al.*, 2013; Nasab *et al.*, 2015; Olszak and Ziemba, 2012; Sangar and Iahad, 2013; Villamarín and Diaz, 2017; Yeoh and Koronios, 2010; Yeoh and Popovič, 2016) who affirmed that the development technology is among the success factors for BI systems that has a significant impact on system, information and service quality.

5. Conclusion

This study aimed to identify the CSFs for BI system in the context of public sector organizations using the case of Jordanian public sector. The findings of this research revealed that top management support, clear vision and strategic planning, team skills, user participation, organizational structure, user access and development technology are the most critical factors to BI implementation success in the public sector organizations.

This study contributes to enrich the body of literature by identifying most critical factors to the BI implementation success in the public sector organizations. Despite the literature abounds with studies addressing the BI implementation, the majority of these studies paid much attention to private sector (Barakat *et al.*, 2013; Doom *et al.*, 2010; Foshay and Kuziemsky, 2014; Hou, 2012; Mettler and Vimarlund, 2009; Nguyen *et al.*, 2014; Robert *et al.*, 2014). Yet there is a very limited research investigated the CSFs for BI in the context of public sector in developing countries. Evidence from previous studies indicated that the implementation of BI systems and the factors that influence on its success in context of public sector in developing countries are still poorly understood, which requires further investigation (Abdel Rahim and Zabadi, 2015; Alhyasat and Al-Dalahmeh, 2013; Binti and Bin Mohamed, 2012; Hartley and Seymour, 2011; Nasab *et al.*, 2015; Petrini and Pozzebon, 2008). Therefore, this research could assist public sector organizations in the developing countries to optimal use of resources and efforts towards the BI success, treat the complexities and avoid the potential risks and obstacles facing BI implementation by concentrating on those CSFs that most likely help in implementing the BI system successfully.

Moreover, the empirical findings revealed that the protection of privacy and confidentiality is one of the key issues that undermines the accessibility of information and detrimental the success of BI systems in public sector organizations. We suggest that to ensure the successful implementation of BI system, public organizations need to develop legislations that enable the BI users to access all relevant information while maintaining the privacy and confidentiality. Therefore, future research could investigate the privacy and confidentiality issues that restrict the BI users' access to the relevant information.

In addition, this research is limited to investigate the CSFs for BI in the context of Jordanian public sector organizations. Hence, the findings of this study may be applicable only to this context. Therefore, further research could be conducted to compare the findings of this study with other different contexts including developed and developing countries. This could provide a better understanding of the CSFs for BI systems. Moreover, the small sample size is the main limitation of this study (only 24 experts) and drawn from one context, the findings of this study cannot be generalized over other contexts without conducting further research. Consequently, our findings could be beneficial for the researchers to replicate this study in other settings.

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