Successful business intelligence implementation: a systematic literature review

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Abstract

Purpose – The purpose of this paper is to present a systematic literature review to determine the factors that relate to successful business intelligence (BI) system implementation.

Design/methodology/approach – The study has a collection of literature that highlights potential references in relation to factors for system implementation in relation to BI. There is the employment of "content analysis", given that the study purpose is the achievement of deep understanding of the variety of factors of implementation that other researchers have previously identified.

Findings – An initial investigation of 38 empirical studies on the implementation of BI led to ten factors being compiled. Difficulties in implementation were found to exist in relation to the operationalisation of large numbers of factors within organisations. The implementation factors were analysed and then sorted into a descending order based upon their frequency of occurrence.

Research limitations/implications – The research is limited to consider BI implementation factors. Moreover, literature is collected from selected databases and journals from 1998 to 2018.

Practical implications – Researchers of BI may, within the future, develop models for the measurement of the implementation level of BI within industries along with the sustaining of them. Moreover, work-based learning industries can benefit by adopting the results of this study for the effective implementation of BI. The implementation factors can be seen as key constructs upon which there may be the undertaking of more statistical analyses.

Originality/value – The original output from this research can help researchers' in the future in enhancing identification of studies that are relevant for the review of literature for their research.

Keywords CSF, Implementation, Literature review, Critical success factor, Business intelligence

Paper type Literature review

Introduction

Organisations tend to own a tremendous volume of data. However, as noted by Williams and Williams (2006), much data are poor in quality or inappropriate whether or not there has been a big investment in information technology (IT) within an organisation. Business intelligence (BI) can, however, help in delivering substantial amounts of information that is useful in a manner that is accurate and timely; such systems, therefore, can enhance decision-making processes (Williams and Williams, 2006; Yeoh and Popovič, 2016). During the last decade, significant numbers of organisations of varying sizes and within a broad range of industrial sectors, from manufacturing to health services to the financial sector, have been implementing systems for BI in order to support decision makers and help achieve improvements in the performance of organisations (Kappelman *et al.*, 2016).

Whilst it seems that BI has been accepted broadly and employed by many leading organisations across the world, there has been little research to examine the factors that lie behind successful implementation of BI (Yeoh and Popovič, 2016). The suggestion from within the literature is that various factors, such as strategy, a project champion, the approach of top-level managers, organisation resources and change management, can have a significant impact. However, there is no consensus upon what factors in particular account for success (Yeoh and Popovič, 2016; Dooley *et al.*, 2018; Villamarín and Diaz Pinzon, 2017; Nasab *et al.*, 2017). In general, most studies have undertaken explorations of the issue within the developed world in countries such as the USA or within Western Europe. As such, there is just a limited range of such studies conducted within developing countries (Acheampong and Moyaid, 2016; Bakunzibake *et al.*, 2016; Hatta *et al.*, 2017; Owusu *et al.*, 2017). As such, this research has the aim of identifying, in empirical terms, which factors may have a bearing upon BI implementation through the use approaches from multiple perspectives, the study seeks to address this current gap within the knowledge and understanding of the issue. The research output has the potential of helping researchers in the future in the clearer identification of studies from the review of literature relevant to their research. Furthermore, reviewers and editors of journals require systematic reviews when examining the degree to which a submitted article has been undertaken with a review of the research available that is sufficiently inclusive. Within the sections that follow, there will be an explanation of the chosen research methodology for the preparation of the compiled studies. There will be searching of databases and journals through the use of key terms that have been identified within a preliminary review of literature. In order to identify how important each of the factors is, there will be the conducting of an analysis of frequency for the factors. In doing so, there will be a critical discussion around the factors that have been identified and presentation of the relationships that exist between implementation-related factors and dimensions of success for BI. Lastly, this paper puts forward some conclusions as well as potential implications for research in the future.

Research methodology

This research offers a thorough review of potential references in relation to factors having a bearing upon the implementation of BI. Since this study has the purpose of achieving an in-depth understanding of the variety of factors of implementation that other researchers have identified already, the correct approach was considered to be the undertaking of "content analysis". It was claimed by Harris and Attour (2003) that it was appropriate to use the content analysis method when the observed phenomena relate to communication, i.e. contact, message and statement, as opposed to physical objects or behaviour. For Patton (1990), content analysis could be seen as a process for the identification, coding and categorisation of the primary data pattern. There was the following of a systematic approach in order to select relevant publications with an initial search of the literature taking place in March 2018 through the use of 11 search engines/databases. As such, to ensure that every relevant article was identified from the previous 20 years, i.e. from 1998 to 2018, the following search engines/ databases were utilised: Elsiver's, ProQuest, Emerald Insight, EBSCO host, SwtsWise, Taylor & Francis, JSTOR, Ingenta Connect, Wiley Interscience, Google Scholar and Meta Press. Before conducting the search, two more criteria were applied to determine the target publications. The first criterion is the publication language should be in English, and the second criterion is that to assure the quality of the publication, only peer-reviewed articles were adopted. To conduct the search, the key words used were "business", "intelligence" and "implementation". Those key words were selected as they aligned with the primary research object concepts and various combinations and variations were used. A variety of chains of key words were tried so that there could be identification of a version that would give results that were most effective without involving a high number of irrelevant publications. Finally, the chains of key words that were chosen for the systematic review of literature were as

follows: BI and success, BI and implementation, BI and implementation, BI and success, BI and critical success factors, BI and success factors, BI and critical success factors, BI and success factors. The key words chosen for the search were selected from those supplied by authors of a number of relevant articles that had been identified within the preliminary review of literature. Finally, the total downloaded articles from the databases were 38 articles.

Results and discussion

A total of 38 articles were reviewed for this study, of which 9 were conference proceedings and 29 were journal articles. It was revealed that the research interest related to BI within SMEs had been gradually increasing; in 2016, there was a maximum of six publications. Figure 1 shows the distribution of research methods. From the studied articles, it could be seen that surveys were obviously the methods used the most; other types of method are less frequent though comparable in the level of use.

As Figure 2 showed, within the literature, developed and western countries are those that have been targeted the most.

Figure 3 depicts frequency statistics for a variety of factors of implementation from papers attempting to provide an analysis of success in implementation of BI; the implementation factors that are most common can be seen, with clarity provided, in Figure 3 Within the literature there are 10 factors of implementation reported repeatedly, and these may be considered as essential factors for the implementation of BI. Those practices, as well as a selection of studies that support the relationship lying between dimensions of success and factors of implementation, are briefly discussed next.
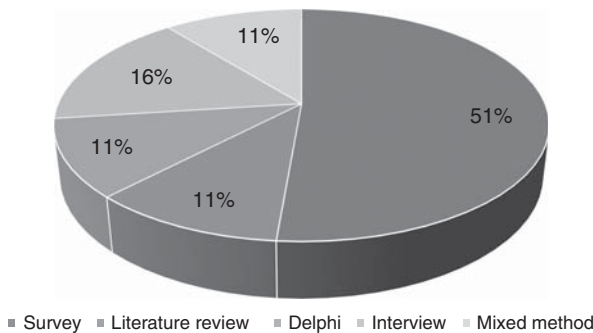

■ Survey ■ Literature review ■ Delphi ■ Interview ■ Mixed method

Figure 1.
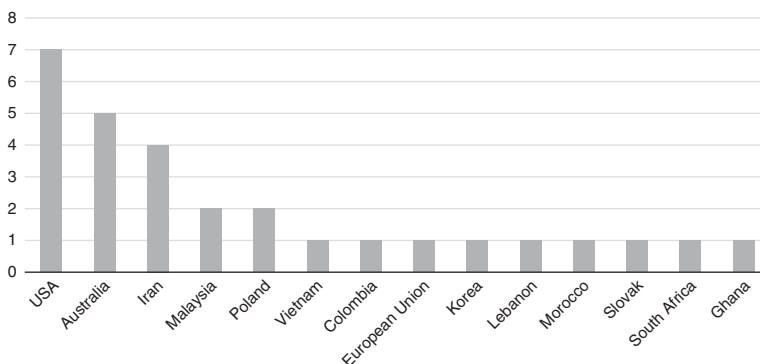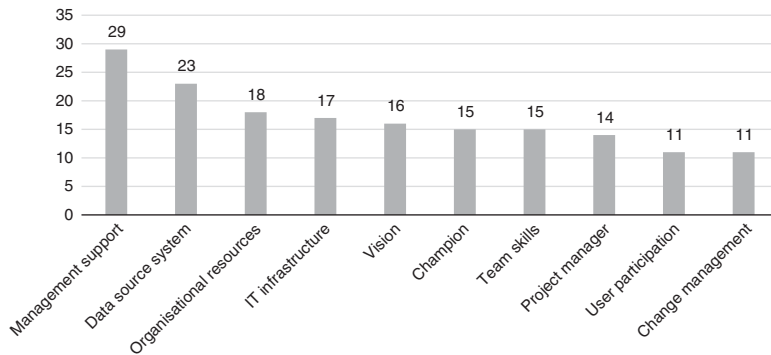Research methods

Figure 2.
Research targeted
countries

Figure 3.
Most common
implementation
factors

Management support
Management support was one of the most widely cited implementation factors. The variable is a reflection of the level of support that the management offers in promoting, sponsoring or championing the use of IS, as well as a willingness to ensure sufficient allocation of resources (Petter *et al.*, 2013). However, the gaining of commitment within an organisation and from the management can also be seen as one of the greatest challenges that a BI implementation team faces (Yeoh *et al.*, 2008). It was noted by Olbrich *et al.* (2012) that strong support from the management is the factor that has most importance for success of BI; they also noted its controllability. Management support may however vary considerably over time. Moreover, organisational strategy from top management may transform BI (Olszak and Ziemba, 2012). Overall success in the implementation of BI is affected significantly by management support (Arnott, 2008; Yeoh *et al.*, 2008; Yeoh and Koronios, 2010; Woodside, 2011; Olszak and Ziemba, 2012; Anjariny and Zeki, 2013; Dawson and Van Belle, 2013; Sangar and Iahad, 2013; Puklavec *et al.*, 2014, 2018; Grublješič and Jaklič, 2015; Nasab *et al.*, 2015; Acheampong and Moyaid, 2016; Mesaros *et al.*, 2016; Pham *et al.*, 2016; Yeoh and Popovič, 2016; Villamarín and Diaz Pinzon, 2017; Lautenbach *et al.*, 2017; Rezaie *et al.*, 2017). Other dimensions of BI success are also affected by management support such as the following: organisational implementation (Wixom and Watson, 2001), system use (Xu and Hwang, 2007), system quality (Hwang and Xu, 2008), decision making (Hasan *et al.*, 2012), productivity (Hasan *et al.*, 2012) and user satisfaction (Hung *et al.*, 2016). Overall, it is considered that there cannot be effective implementation of BI if the management does not offer sufficient support.

Data sources systems
Data sources may be defined as places where data employed in analysis is kept and from where it is drawn for use (Hostmann, 2007). Data sources employed for retrieval of information are technological BI capabilities that may be either external or internal (Harding, 2003). Conventionally, there has been a reliance of BI upon data that are numerical and/or structured, that is, measurable upon a numerical scale which may be analysed through the use of methods of statistics and/or the use of computing equipment (Baars and Kemper, 2008). It was summarised by Yeoh *et al.* (2008) that the assurance of the integrity and quality of data from the systems from which it is sourced impacts heavily upon BI implementation success. Numerous studies support this idea and show that sources of data positively and directly affect the success of implementation of BI (Wixom and Watson, 2001; Xu and Hwang, 2007; Arnott, 2008; Hwang and Xu, 2008; Yeoh and Koronios, 2010; Olszak and Ziemba, 2012; Anjariny and Zeki, 2013; Dawson and Van Belle, 2013; Işık *et al.*, 2013; Puklavec *et al.*, 2014, 2018; Grublješič and Jaklič, 2015; Nasab *et al.*, 2015; Mesaros *et al.*, 2016; Pham *et al.*, 2016; Salmasi *et al.*, 2016; Yeoh and Popovič, 2016; Rezaie *et al.*, 2017).

Organisational resources
As Grandon and Pearson (2004) noted, the term "organisational resources" refers to the degree of technical, financial and human resources within an organisation. It was explained by Puklavec *et al.* (2014) that BI systems tend to involve a greater degree of voluntary action which leads to greater sensitivity for the availability of resources and can be a significant aspect for the adoption of systems for BI. For Owusu *et al.* (2017), enhancement of the resources of an organisation may influence the implementation of BI systems. Numerous studies have, in fact, supported that idea; see, for example, Wixom and Watson (2001), Arnott (2008), Yeoh *et al.* (2008), Yeoh and Koronios (2010), Woodside (2011), Dawson and Van Belle (2013), Boonsiritomachai *et al.* (2014), Puklavec *et al.* (2014), Grublješič and Jaklič (2015), Acheampong and Moyaid (2016), Salmasi *et al.* (2016), Yeoh and Popovič (2016), Hatta *et al.* (2017) and Rezaie *et al.* (2017), which help to show the direct and positive impacts that organisational resources have upon the success of a BI system overall.

IT infrastructure
IT infrastructure relates to the ability for users to be provided with information and data to suitable levels of reliability, timeliness, accuracy, confidentiality and security, as well as capability for tailoring processes to emergent business directions and needs and provision of universal access and connectivity with enough range and reach (Fink *et al.*, 2017). BI systems have a number of characteristics in common with traditional development lifecycles for IT projects with their various phases (Moss and Atre, 2003). Implementation of systems for BI does not solely entail the buying of combinations of hardware and software but rather it is an undertaking that has greater complexity with requirement for suitable resources and infrastructure over longer time periods (Yeoh and Koronios, 2010). It has been noted by many authors that IT infrastructure impacts directly upon BI implementation success, for example, Arnott (2008), Yeoh *et al.* (2008), Yeoh and Koronios (2010), Olszak and Ziemba (2012), Nasab *et al.* (2015), Pham *et al.* (2016), Salmasi *et al.* (2016), Yeoh and Popovič (2016), Villamarín and Diaz Pinzon (2017), Lautenbach *et al.* (2017) and Rezaie *et al.* (2017).

Vision
Clear visions help organisations to strategise their missions. In addition, there is a requirement for organisational visions to be disseminated throughout the different organisational levels (Prijatelj, 1999). It was noted by Adamala and Cidrin (2011) that a system for BI has to be tied closely to the strategic vision of a company. A clear vision enables BI implementation to be successful. Furthermore, a vision that is long term, in terms that are primarily organisational and strategic, is essential for establishing a business that is robust and has alignment to the strategic vision in order for the needs and objectives of the business to be met (Yeoh and Koronios, 2010). Several studies have shown that the success of a BI system is greatly influenced by a vision that is clear; see, for example, Arnott (2008), Yeoh *et al.* (2008), Yeoh and Koronios (2010), Dawson and Van Belle (2013), Sangar and Iahad (2013), Nasab *et al.* (2015), Pham *et al.* (2016), Yeoh and Popovič (2016) and Rezaie *et al.* (2017). It was empirically shown by Hwang and Xu (2008) that business needs and a vision that is clear impact significantly and positively upon the quality of system.

Project champion
The requirement for a champion of the project is also considered as a relatively significant element in successful BI implementation. As Mandal and Gunasekaran (2003) note, such a project champion ought to have strong skills in leadership. In addition, such a person ought to have managerial competencies in a range of personal, technical and business-oriented ways (Kraemmergaard and Rose, 2002). Project champion is defined here as an individual at

management level who recognises ideas that are useful for his/her organisation and leads with adequate authority and resources during all the phases of development and implementation (Meyer, 2000). A champion was described by Yeoh and Koronios (2010) as a person who has high levels of enthusiasm along with an in-depth knowledge of business processes within his or her organisation, in addition to a good awareness of the technological innovations under discussion and requiring commitment. The research that exists in the area shows that project champions, when present, are able to impact upon successful BI system adoption significantly (Arnott, 2008; Yeoh *et al.*, 2008; Yeoh and Koronios, 2010; Olszak and Ziemba, 2012; Anjariny and Zeki, 2013; Dawson and Van Belle, 2013; Sangar and Iahad, 2013; Puklavec *et al.*, 2014, 2018; Nasab *et al.*, 2015; Acheampong and Moyaid, 2016; Pham *et al.*, 2016; Yeoh and Popovič, 2016; Villamarín and Diaz Pinzon, 2017; Owusu *et al.*, 2017; Rezaie *et al.*, 2017).

Team skills
Implementation of BI calls for a balance of technical skills within a team, interpersonal abilities and the capacity to work skilfully in the undertaking of tasks in ways that involve good interaction by users (Wixom and Watson, 2001). Furthermore, a project team ought to consist of members from various areas within a business in order for the sharing of ideas and so that standardisation can be potentially increased, particularly if, as part of the initiative for BI, there is to be a data warehouse that is enterprise wide (Goodhue *et al.*, 2002). Innovation and learning are stimulated by the coming together of team members that have a diverse range of perspectives and competencies, and this can help in the generation of a greater amount of alternative solutions to problems that are complex (Campion *et al.*, 1993; Lee and Xia, 2010). In addition, engaging project team by managers in the strategic planning and vision will produce an environment of employee satisfaction and enhancing the leading skills (Wall, Russell and Moore, 2017; Wall, Bellamy, Evans and Hopkins, 2017). The skills of a team significantly affect the overall success of implementation of BI (Arnott, 2008; Yeoh *et al.*, 2008; Yeoh and Koronios, 2010; Olszak and Ziemba, 2012; Anjariny and Zeki, 2013; Sangar and Iahad, 2013; Nasab *et al.*, 2015; Mesaros *et al.*, 2016; Yeoh and Popovič, 2016; Villamarín and Diaz Pinzon, 2017; Rezaie *et al.*, 2017). The skills of a team also have a bearing upon other dimensions of success of BI, such as productivity, project implementation, decision making and information quality (Wixom and Watson, 2001; Xu and Hwang, 2007; Hwang and Xu, 2008).

Project management
The term "project management" is in reference to the ongoing management of the plan for implementation. As well as stages of planning it involve, therefore, the allocation of responsibilities to a variety of stakeholders, definition of critical paths and milestones, human resource planning, determination of success indicators and training (Nah and Delgado, 2006). At first, modern project management methods were intended for their application within big organisations that had systems of complexity that needed such systematic processes (Baccarini, 1999). More recently, however, they may be altered and adapted to make them suitable for addressing the needs of organisations that are smaller (Fedouaki *et al.*, 2013). As several authors have noted, the project management can have a considerable impact upon the implementation of a BI system (Arnott, 2008; Yeoh *et al.*, 2008; Yeoh and Koronios, 2010; Woodside, 2011; Anjariny and Zeki, 2013; Sangar and Iahad, 2013; Pham *et al.*, 2016; Rezaie *et al.*, 2017).

User participation
The term "user participation", related to developing specific IS, was defined by (Kearns and Sabherwal, 2006) as behaviours, tasks or assignments that users or user representatives perform whilst within the development project for IS. Accurate capture and communication of user requirements the members of the project team are ensured by good user

participation; these properties have particular importance if there is an initial lack of clarity with regard to system requirements (Wixom and Watson, 2001). It was noted by Audzeyeva and Hudson (2016) that adequate involvement of users within adjustment of the BI, within its exploitation over the long term, is likely to make a contribution to its usability within the future as well as helping match it to other processes within the organisation. Moreover, organisational change that has been enabled by BI can, in turn, help in the introduction of changes to processes for organisational control and coordination. In general, user participation has a great deal of significance for the implementation of IS projects (Hwang and Thorn, 1999). Also, in particular, user participation is significant for BI system (Wixom and Watson, 2001; Xu and Hwang, 2007; Hwang and Xu, 2008; Yeoh *et al.*, 2008; Yeoh and Koronios, 2010; Dawson and Van Belle, 2013; Grublješič and Jaklič, 2015; Nasab *et al.*, 2015; Mesaros *et al.*, 2016; Yeoh and Popovič, 2016; Rezaie *et al.*, 2017).

Change management
The term "change management" is in reference to procedures for managing change in an organisation; such changes both reinvent and revolutionise the functions and processes of government (Ndou, 2004). A programme for change management has importance since it enables there to be a reduction in any resistance to implementation that may be encountered and so it helps facilitate adoption (Hawking and Sellitto, 2010); this is especially the case if technological development is ongoing since, at these moments, the possibility for change happening are greater (Fourati-Jamoussi and Niamba, 2016; Villamarín and Diaz Pinzon, 2017). They went on to note that the absence of this factor, i.e. effective change management, from the implementation processes for BI could help provide an explanation for failure of BI projects (Williams and Williams, 2006). Numerous studies support this notion; see, for example, Yeoh *et al.*, 2008; Yeoh and Koronios (2010), Sangar and Iahad (2013), Grublješič and Jaklič (2015), Yeoh and Popovič (2016), Villamarín and Diaz Pinzon (2017) and Rezaie *et al.* (2017), all of which indicate the direct and positive impact that change management has upon the implementation of BI systems.

The compilation above, cited from the literature, offers a basis for considering the range of factors of success and associated frequencies for each of them. Additional analyses, however, undertaken with the aim of uncovering clear and obvious gaps within the relevant literature have made it apparent that there has been a lack of deep consideration given to the factors that have a bearing on implementation. In addition, there seems to be a variety of definitions for implementation factors and the concept of resources and change management. Likewise, there seems to be little explanation put forward of the particular tactics that may be employed in implementing such systems. Lastly, a further noteworthy observation was that, from the cited implementation factors, there was a lack of perspective taken on user characteristics and work-based learning. Wall (2017) stated that work-based learning enhances employee's well-being and increase organisational performance. There was either presentation of implementation factors without explaining from whom the perspective was being shown or there was provision of a user perspective though only in relation to one single factor of implementation. All too often, researchers have tended to focus upon just one particular implementation factor or one particular aspect of the process of implementation. As a result, little research has been recorded that manages to encompass all significant considerations with regard to factors of implementation.

Implications of the study
This study has drawn a lot from the already existing literature related to the implementation of BI into one single piece of research. This allows for taking stock of the current state of play with regard to knowledge in the field and helps the identification of appropriate practice and areas for further study. The study demonstrates that there is a good theoretical

understanding of the background or framework for the implementation of BI. In addition, the paper can benefit researchers through the provision of case study contexts. Through aggregation of this information into one paper, researchers may now more easily identify a focus for their own studies based upon the contexts that they can see have been explored or not. It has been argued in this study that ten distinct factors are required for successful implementation of BI, as shown in Figure 3. These factors are constructs that may be used within practice for the analysis of needs and the design of a BI initiative, as well as its implementation, monitoring, control and assessment. Consolidation of factors within the practical stages of implementation is an accurate representation of the procedures and behaviours within industry within a more clear picture on collective trials undertaken. Work-based learning industries may focus upon an exploration of these factors to establish the scenario likely to be more successful for their particular contexts. Literature related to implementation of BI is much more focussed upon organisations within developed countries within Europe, Australia and the USA. As such, little research has been undertaken into organisations based within developing countries. Studies have shown that there are additional challenges for BI systems within developing countries along with increasing levels of dependency (Owusu *et al.*, 2017). It appears that certain factors of implementation are prioritised differently within different countries. Whilst "resources" are ranked at the middle of the frequency analysis of this study, when trying to implement a BI system within a developing country, it could be a factor that is highly critical. From the study of over 38 relevant case studies within various contexts, the identified implementation factors outline the various factors created through a combination of factors scattered throughout the literature. In practical terms, this has provided a thorough overview of the factors of implementation present within the existing literature. Furthermore, since the factors were compiled through the use of existing case studies, the factors are based upon practical experience in real industrial settings. These factors may be used, therefore, by practitioners in relation to their particular industry, with concentration upon those elements that have greater prevalence in their field. This paper, then, offers an industry-oriented and practical framework to help ensure BI implementation success.

Research recommendation and limitations

Research recommendations are as useful for researchers as they are for organisations wishing to implement systems of BI successfully. The review of literature, in relation to factors that have an association with research of the implementation of BI, ought to have analysis of the factors that are used most commonly with respect to BI system implementation; this would provide researchers with a path towards proper analysis of what factors lie behind success. This review of literature can also serve as a guide for organisations seeking to take preventative measures for avoiding some of the challenges that are potentially faced whilst trying to implement a BI system successfully.

This research paper is not without limitations. First, the study can be considered as only looking at factors behind the implementation of BI; as such, lots of other themes of research related to the implementation of BI systems are overlooked. Second, there has not been exploration of the research paradigms in this study in methodological and theoretical terms. Further empirical research of that area could discover other facts in relation to factors and their impact upon success. There ought to be careful consideration and assimilation of these concerns in any further related studies.

Conclusion

This research has involved the review of literature published from 1998 to 2018 and discovered that the subject of implementation of BI was limited. Further research on the implementation of BI may be very useful for enhancement of the likeliness of success in

implementation of BI. The review of the literature with regard for BI implementation shows that in lots of cases, the factors of implementation put forward are based upon review of a limited case study example or literature already published. Previous research does not provide clear guidance in relation to which factors of implementation ought to be adopted however, because of inconsistencies and the nature of relationships for BI success dimensions. This paper has had the purpose of analysing the literature on BI implementation with particular regard for implementation factors. The study aim has been achieved through selection of thirty-eight papers related to BI implementation. The research findings are potentially useful for those who are in the process of implementing a BI system or those who have failed to implement a BI system initiative successfully. In addition, the use of the BI system is required to enhance the work-based learning process. This research has brought a degree of clarity on the topic and offers useful contributions and guidelines from and to the literature for both researchers and managers alike. The paper makes a contribution to development and understanding in the field of implementation of BI and appreciation of the impacts of particular practices upon success. Despite the inconsistencies that were identified, the literature review shows that the particular implementation factors result in significant levels of success in the implementation of a BI system (Figure 3).

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