Strategic Impact of Business Intelligence : A Review of Literature

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Abstract

Review of literature is a very critical part of the research journey. The tenacity of this research was to explain a step-by-step guide to expedite understanding by presenting the critical components of the literature review process. We collected and synthesized business intelligence specific research papers from relevant journals with the help of web aggregator. This research paper discussed the strategy of analyzing 553 business intelligence research papers published from 2007 – 2018. We utilized exploratory research methodology to analyze the research conducted on BI solutions during the defined period. The research ripened a holistic, theoretically grounded, and relevant approach for reviewing the literature on business intelligence. It specified, defined, and positioned the existing BI solution research and helped identify the areas which need further exploration.

Keywords : **business intelligence, business intelligence solutions, literature review**

JEL Classification Codes : M15, O32, O33

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Business intelligence (BI) solutions comprise of a technological ecosystem aggregating different business dimensions for the accomplishment of organizational objectives through effective decision making and knowledge management (Han, Kamber, & Pei, 2012). This can be facilitated by institutionalizing and predicting future results based on data-driven technological models (Turban, Aronson, & Liang, 2005) or by incorporating business analytics, thereby supplying anticipated results to the management (Witten & Frank, 2005). Business intelligence (BI) tools assist the organizations by providing business insights, allowing them to take a real-time decision and empowering the management to drive operational efficiencies, identify newer opportunities, and differentiate them in the competitive market. The literature review reveals the existence of a gap with respect to whether BI tools impact the operational efficiency and strategic decision making. Business intelligence (BI) is an eco-system comprising of databases, architecture, business applications, and methodologies facilitating timely decision making for managers through analysis of available data (Turban, Sharda, & Delen, 2010).

The contemporary business environment is quite complex, complicated, competitive, and continuously fluctuating ; the executive management needs to respond swiftly to market dynamics in order to survive and to

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stay competitive, which in turn demands taking effective, efficient, timely, speedy, and quality decisions. The ability to optimize company performance typically depends on the decision-maker's skills to analyze and measure business performance and to take timely action based on the information. The operational, competitive, and regulatory complexity of today's business environment affects the manager's decisions, and the manager requires analyzed and summarized information in a timely manner for effective decision-making. Due to the improvements in technology, innovations in communication, and globalization of workforce, managements have to consider numerous alternatives and dimensions while taking a decision. The information needs of managements have changed, and they require new, reliable, and quality information at speed to support quality decision-making within organizations. The accuracy and speed with which decisions are made operational is long recognized as an important dimension of organizational performance in modern, dynamic, and volatile business environments (Kownatzki, Walter, Floyd, & Lechner, 2013 ; Srivasatava & Bagga, 2014) and an organization's performance deteriorates when decision-makers are not able to respond quickly to the business situation due to lack of information and the decisions related to revenue and profitability as well as compliance and risk management should be taken faster as the outcome of the same results in a competitive edge.

Over the last few decades, business data volumes have increased tremendously due to rise of business information systems such as ERP, CRM, etc. and are going for further explosive growth. International Data Corporation (IDC) highlighted in the 6th Annual Study that the digital universe comprising of structured and unstructured data will grow 300 times to 40,000 exabytes from 130 exabytes by 2020, and the size of data will double every 2 years from 2012 onwards (Gantz & Reinsel, 2012).

Literature Review Strategy

Analysis of literature takes a substantial amount of researchers' time, though it helps in exploring the present state-of-the-art on a given area and facilitates future research (Moro, Cortez, & Rita, 2015). With the introduction of new technologies and research specific search engines, researchers are able to analyze multiple research papers at a time (Sekaran & Roger, 2016). With the help of keywords, researchers can find the relevant research papers in leading journals. Keywords (Isenberg, Isenberg, Sedlmair, Chen, & Möller, 2014) omit results which may be not relevant. To eliminate the irrelevant research papers, state-of-the-art technology centered online library databases provide the advantages of anywhere – anytime accessibility to their pool of available research articles. By querying the search platform on the required research title provides researchers with the available articles on their researching area, however, a large number of articles thus returned from the search makes the task more complicated as reading the contents of every research paper is enormously challenging and time consuming. This problem, to a large extent, can be overcome by reading the important contents of a research paper like title, abstract, and keywords.

For this study, we examined the distribution of business intelligence research papers published in leading journals. During the analysis, we identified gaps in the research which would allow us to discuss a research agenda that will facilitate the progression of business intelligence and associated key words (Webster & Watson, 2002). We hope to paint a representative landscape of the current business intelligence literature (Fitriana, Eriyatno, & Djatna, 2011) base in order to encourage the roadmap of future research efforts.

To facilitate the smooth progression of the research on the present state of business intelligence solutions, we (see Straub, 1989) divided the analysis phase as per the below sub-parts :

(i) Accumulation of the articles, research papers, e-books, and theses.

(ii) Selection of the research papers specific to business intelligence solutions' implementation and its impact on business process automation, operations, and automation.

(iii) Classification of the research papers based on: (a) research paper focus, (b) year of publication.

(1) Accumulation of Article Pool : Business intelligence is one of the trending topics among researchers. To analyze the gap (Fitriana et al.,2011) amongst recent research studies around the BI solution implementation (De Mesquita Fetzner & Freitas, 2011; Pratt, 2017) and its operational and strategic impact (Rouhani, Ashrafi, Zare Ravasan, & Afshari, 2016), we collected the research papers published in leading research journals during 2007 – 2018 (Jourdan, Rainer, & Marshall, 2008). We did not select BI specific research papers considering the exclusive nature of the research. Research papers got extracted from the leading journals (Craig, Ferguson, & Finch, 2014) like *MIS Quarterly*, *Science Direct, Information System Research, Communication of the ACM* and conference reports specific to business intelligence solutions (Webster & Watson, 2002). For other journals, Google Scholar (López-Cózar, Orduna-Malea, & Martín-Martín, 2017) was utilized as the richest informant of the secondary data (Anderson & Shattuck, 2012 ; Greenhoot & Dowsett, 2012). With the help of Boolean ranking model (El Mohadab, Bouikhalene, & Safi, 2018 ; Zhang, Wang, Lou, & Zhang, 2015), key words like business intelligence solution, BI solution implementation, adoption of BI solutions, BI solution implementation strategy, etc. were used to extract the relevant journals from Google.

(2) Research Papers Examined : Analyzing a pool of articles on a given research area is centrifugal for recognizing the present state and future researching trends, enabling the researchers in identifying research gaps, leading to newest studies and discoveries (Vom Brocke, Simons, Niehaves, Niehaves, Reimer, Plattfaut, & Cleven, 2009). This works as a fundamentally critical step for generating and developing research insights, thus enabling new findings and driving new studies. Such relevance is derived by studying numerous publications by conducting an extensive review of literature (Cronin, Ryan, & Coughlan, 2008) across different areas of sciences (Jesson & Lacey, 2006). Searching and classifying the research papers depending on individual words is not promoted, as it is incomplete and prone to errors (Moro et al., 2015) because terms searched for are an aggregation of a series of words, that is, "business intelligence" or "BI solution adoption." This can be overcome by analyzing the sequence of research publications called *n-grams* over a specific period of time, that is, from 2000 – 2010 (Soper & Turel, 2012). Once accurately and precisely gathered from large texts, these *n-grams* aggregate to form an important dimension of analyzing research publications.

The research article classification process (Rashid Al-Azmi, 2013) started with the short listing of the journals based on research topic and published year. Post analyzing the major topics encountered during accumulation, the research papers were categorised (Taheriyan, 2011) into seven categories. To analyze the articles, we performed content analysis. The content analysis was performed based on the research methodology. Each research paper was reviewed deeply to understand the research process of each objective.

Once the research articles were segregated, research strategies and approaches used by the individual researchers were examined and article categorization was initiated with reference to the strategies employed. Secondly, content analysis was performed on the articles in synergy with the subjective and specific nature of the research methodologies adopted. The current research adopts the research methodology presented by Scandura and Williams (2000) as an extension of the research methodology introduced by McGrath (1982).

Figure 1. Literature Review Analysis Process Flow

(3) Focus Based Research Paper Categorization

(i) Business Intelligence Solutions : Researching trends affirmed that most literature focusing on BI is available on justifying the business value of BI (Ghazanfari et al., 2011). Business intelligence, frequently insinuated as BI, is a disseminated, umbrella term commenced by Howard Dresner of the Gartner Group in 1989 to describe a set of concepts and methods to recuperate business assessment making by exercising fact-based computerized support systems. The term is occasionally used interchangeably with briefing records and business information systems. A business intelligence solution is a data driven DSS that primarily supports querying of a historic database and fabrication of intermittent summary reports, executive information systems, online analytical processing systems (OLAP), and business intelligence systems (Power, 2007; Rouhani, Asgari, & Mirhosseini, 2012).

The concept of business intelligence is an aggregation of models & theories, tools, and methodologies and an architecture of closely related IT solutions synthesizing huge volume of primary and historical data into performance indicator matrix for enterprises. Reports, charts, and tables are used to present the generated information (Ionescu & Podaru, 2014). We reviewed 122 research papers focusing on business intelligence from 2007 – 2018.

(ii) Acceptance & Adoption of Business Intelligence Solutions : Amongst all the research papers of business intelligence, 65 of them categorically discussed about the importance of adoption & acceptance of the business intelligence solutions. During the analysis, it was observed that business intelligence (BI) solutions are being incorporated by business organizations to manage data and make decisions centred around facts. Contemporary business organizations laden with state-of-the-art information and communications technologies (ICT) solutions have transformed the way most businesses and industries operate to satisfy the growing requirements of their customers (Preko & Kester, 2015).The technology acceptance model (TAM) by Davis is possibly one of the most frequently used models in conducting technology research (Viswanath & Davis, 2000). The technological capabilities e.g. data quality, end user access, and the integration of business intelligence solutions with other systems are necessary for BI success, regardless of the policymaking environment. The decision making affects the relationship between business intelligence success and capabilities, such as the extent to which BI supports flexibility and risk in decision making (Gupta, Seetharaman , & Raj, 2013 ; Işık, Jones, & Sidorova, 2013).

(iii) BI Solution Implementation, Implementation Strategy, & Benefits of BI Implementation : We reviewed 64 research papers of this category. The managerial approach sees business intelligence implementation as a process in which data gathered from inside and outside the company are integrated to generate insights (Chee, Chan, Chuah, Tan, Wong, & Yeoh, 2009). Amongst all existing constraints, enterprises' ability to finance the implementation of BI solutions and state-of-the-art expensive IT systems come first (Ranjan, 2008). Additionally, associated factors like managerial and organizational support during the process of BI systems implementation pose serious questions on the adoption of BI systems. BI "creation" and BI "consumption" are two of the most interactively critical stages in business intelligence system implementation (Olszak & Ziemba, 2007 ; Ranjan, 2009).

(iv) Business Process Automation : The fitment between business environment and business processes is the key to perfect process automation (Trkman, 2010). Project integration, controlling, and stakeholder management were found to be the major factors (out of 117 single impact factors & 64 success factors) in business process improvement followed by factors of organization culture and risk management (Lückmann & Feldmann, 2017 ; Tracy, 2007). Two dominant approaches witnessed for business process automation are centered rule specifications and graphical models (Lu & Sadiq, 2007).These factors have been derived from research based on

empirical pieces of evidence providing initial justification into key associated factors for implementation of modern BI solutions, and process restructuration as a combination can help significantly in process improvement. It improves the performance visibility which further increases an organization's efficiency (Küng & Hagen, 2007), though process-centered modelling of business processes is a key initiative. It suffers from the constraints of huge money and time investments, posing serious challenges to managements regarding the adoption and implementation of automation (Indulska, Green, Recker, & Rosemann, 2009 ; Vishnoi, Tripathi, & Bagga, 2019). Thirty five research papers about business process automation were analyzed in this research paper.

(v) Decision Making & Knowledge Management : Organizational knowledge management and managerial decision making have been very trending topics among the researchers and 83 research papers were categorized under the umbrella. In highly flexible and competitive business environments, business intelligence systems (BIS) are found to be positively associated with decision making. Based on empirical investigation of 181 medium and large organizations using SEM (structural equation modelling), it got segregated into two most important dimensions, that is, information quality and information content. An organizational culture incorporating statistical and analytical tools for decision-making propagates the tenets of the highest use of available information (Popovič, Hackney, Coelho, & Jaklič, 2012). It is imperative for BI solutions to access precise and accurate data for enterprise decision making. The solution is to form strategic, tactical, and operational ventures between the business units and enterprises, thereby implementing BI solutions in business organizations. Top management leadership support is prerequisite and indispensable for the efficacious adoption and implementation of BI tools (Hedgebeth, 2007).

An organizational culture incorporating statistical analysis for decision-making improves the use of available information, but dilutes the content and quality of information (Bagga, Bansal, Kumar, & Jain, 2016 ; Bagga, 2017 ; Hou, 2012). On analysis, it was observed that the decision making ecosystem provides direction to the capabilities of business intelligence (BI). Business intelligence (BI) solutions play a fundamental role by uncovering the internal and external sources of knowledge. Instead, the process called knowledge management (KM) positively influences the performance of businesses by integrating the tools for learning, creating, and distributing knowledge amongst employees. In lieu with the same, the primary objective of BI is to raise employee information and deepen their knowledge, making them capable of taking timely and accurate decisions in sync with the organizations' mission and vision.

(vi) Critical Success Factors, Framework, and Modelling : Deriving critical success factors, framework, and modelling are the topics which got our attention during the considered years and 82 research papers have been considered under this category. BI solutions play a centrifugal role in initiating, implementing, and supervising sustainable business practices (Baars & Kemper, 2008). Furthermore, BI systems employing the advantages of consolidating, transforming, and analyzing large volumes of data are being incorporated as added extensions of enterprise resource planning (ERP) (Hawking & Sellitto, 2010).

BI solution implementation guarantees the success of businesses on the condition of continuously reinventing and upgrading their business and decision-making processes in sync with present & future needs and requirements of reporting. Need assessment will then be processed using modelling for successful execution and introduction of new BI capabilities. The learning quotients and skillsets of solution implementation team and end users are of primary factor for BI solution implementation (Olszak & Ziemba, 2012). The key parameters for successful implementation of BI solutions are user training and their educational skillset, lack of which will result in BI solution failure (Sangar & Iahad, 2013). Through observations, reusability has been highlighted as an area of concern for adoption and implementation of BI solutions. To improvise the efficacy of business process modelling, reusing business process models is highly advocated (Aldin & De Cesare, 2011). BI solution

implementation model should focus on information quality to extract the maximum benefits for a business enterprise (Popovič, Coelho, & Jaklič , 2009).

(vii) Data Quality and Data Analytics : One hundred and two research papers around data quality and analytics were considered under this category. Contemporary business processes monitor user activities through website tracking, financial transactions, point of purchase, and point of sale interactions, thereby generating large volumes of data (Wang, Kung, & Byrd, 2018). Descriptive analytics is being used to analyze the past data to recognise existing patterns and creating executive reports. Alternatively, predictive analytics help in forecasting the future by analyzing the present and historical datasets. Further, prescriptive analytics initiate decisions based on actions and simultaneously determining their impact on business requirements, objectives, challenges, and constraints (Provost & Fawcett, 2013 ; Phillips - Wren, Iyer, Kulkarni, & Ariyachandra, 2015). The 5V's of big data – volume, variability, velocity, variety, and value put forth many challenges (Katal, Wazid, & Goudar, 2013). Business choices in the marketplace are multiplied as being driven by globalization, innovation, and artificial intelligence driven marketing solutions (Sahay & Ranjan, 2008 ; Vishnoi, Bagga, Sharma, & Wani, 2018). The BI ecosystem consists of an architecture called data warehousing (multiple data-marts) consolidating information from multiple active data-marts to serve the purpose of front-end querying, analytics, and reporting (Dayal, Castellanos, Simitsis, & Wilkinson, 2009). Competitive intelligence and customer relationship management are two important factors to define the BI implementation framework (Baars & Kemper, 2008). Many research, event, and market valuation studies also analyzed the impact of investment in information technology on business performance using archival data. Further studies also included in their domain the effect contingencies bring on improved payoff (Elbashir, Collier, & Davern, 2008 ; Masli, Richardson, Sanchez, & Smith, 2011).

(4) Distribution of the Research Papers

(i) Topic Wise Distribution : Figure 2 represents the percentage distribution of the research papers according to the topics covered in it. The total number of research papers considered in the graph are 553.

(ii) Year Wise Distribution : Figure 3 displays the distribution of 553 papers across the years. The papers have been categorized into seven key topics followed by the topic distribution each year. The graph displays the year wise research on the seven topics.

Figure 2. Topic Wise Categorization of the Research Papers

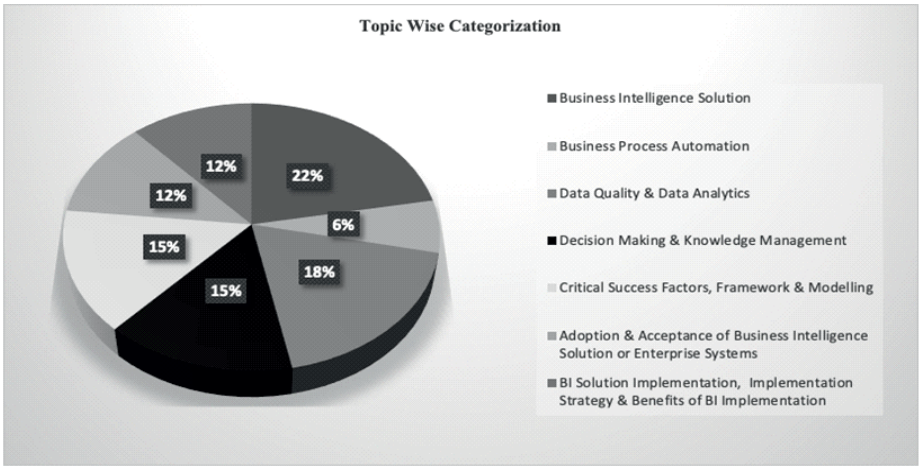
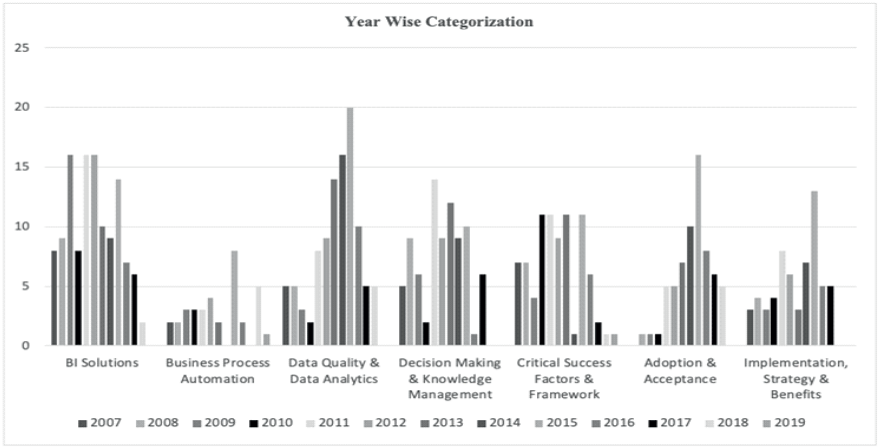


Figure 3. Year Wise Categorization of the Research Papers



Research Implications

(1) Theoretical Implications : We have been continuously exploring research studies on BI solutions with different objectives to identify the research gaps. The volume of the research around BI solutions has grown rapidly, though there is a significant lag of the research papers which talk about BI solutions, their implementation, and their key components like decision making, data quality, data analysis, etc. With the help of previous research studies, we can obtain answers of the key intent of the study, that is, gap analysis to identify the need for any future study. This study will help to identify the existing studies, conceptualize the key topics, and synthesise papers to understand the research gaps.

(2) Managerial Implications : Decision makers continuously spend hours to understand the insights out of the data received from different sources (Sriramoju, 2017). At the same time, business decision making capacity lies in the application of data logic and processes to find the business information, that is, forecasting problem solving metrics, opportunity of innovation, and long-term sustainability, etc. (Oswaldo, Sergio, Cáceres, & Schweimanns, 2016). This research paper explains the evidence of the past research on business intelligence which will help the stakeholders to understand the right mix of the business intelligence solutions based on past studies. Business intelligence includes different applications which are extensively customizable as per the need of the organizations (Kurniawan, Gunawan, & Kurnia, 2014). The digitalization of business is now transformed into "get the things done virtually". Quick decision making is the key component to get the things virtually (Azeroual & Theel, 2019 ; Horlach, Drews, & Schirmer, 2016). With the help of this research, managers will be able to identify the trends to implement the best business practices.

Conclusion

In this research paper, we have outlined the BI related research executed between 2007 – 2018. It is concluded that BI related research papers were less from 2007 – 2010. During these 4 years, only 134 research papers were written. The number of research studies exponentially increased during the next 5 years ; 326 research papers were published around BI and related topics between 2011 – 2015. After 2015, a decline was observed wherein the next 3 years, only 89 research papers were published. This paper argues that 22% of the research papers focused on

business intelligence solutions ; data quality and analytics were second on the list with 18% contribution each. Adoption of BI and BI solution implementation research papers were approx. 12% each followed by 15% papers on decision making and critical success factors. Business process automation was not explored extensively during these years, with a contribution of only 6%. Further research is required to investigate the business process automation related researches and its adoptability among researchers. The findings also highlight business process automation as the trending research technology, and it has a great potential for future research.

Limitations of the Study and the Way Forward

The research papers included in the present study are limited to the time period from 2007 – 2018, which can be further extended in future research studies. The research paper categorization can be further elaborated to include names of journals, number of citations, and incorporated methodology to understand the pattern of the business intelligence research paper publication. The "Research Methodology" can be included as a key metric in future research studies, which will help the researchers and practitioners in selecting the adequate research methodology pertaining to their research study. Future researchers can also build an argument on the popularity of business intelligence solutions based on operational, tactical, and strategic decision making in their macro and micro business environment.

Authors' Contribution

Anuj Tripathi synthesized the research papers and carried out the research under the supervision of Dr. Teena Bagga and co-supervision of Dr. Rashmi K. Agarwal.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest, or non-financial interest in the subject matter, or materials discussed in this manuscript.

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