Business Intelligence Capabilities and Effectiveness: An Integrative Model

Thiagarajan Ramakrishnan  Jiban Khuntia  Abhishek Kathuria  Terence Saldanha
Prairie View A&M University  University of Colorado Denver  University of Hong Kong  Washington State University
ram@pvamu.edu  jiban.khuntia@ucdenver.edu  kathuria@hku.hk  terence.saldanha@wsu.edu

Abstract

Organizations may not be equally predisposed towards successful adoption and implementation of business intelligence (BI) initiatives and applications. A key to understanding the success or failure of BI within an organization, termed as BI Effectiveness, is the identification and assessment of BI Capabilities and their constituent dimensions. Using this theoretical foundation, we develop a conceptual framework that identifies four BI Capabilities, comprising of eleven dimensions, and offer three propositions that illustrate their effect on BI Effectiveness. To facilitate empirical research, we develop and cross-validate a questionnaire instrument to measure these new constructs, which can serve as a diagnostic tool through which organizations can assess the effectiveness of their BI initiatives. We thus provide a definitional and empirical context for assessing key BI Capabilities that directly impact an organization’s effectiveness at BI implementation and use.

1. Introduction

Business Intelligence (BI) refers to a set of tools and techniques that help to transform large amount of data from disparate sources into meaningful information to support decision-making and improve organizational performance. In the past decade, BI has emerged as a major driving force for organizational performance [28].

Information week reports that investments in BI services is predicted to double from an estimated $54.5 billion in the year 2012 to $96.9 billion in the year 2016 [34]. Within the decision-support environment, BI has improved decision making at various organizational levels [26] and has permeated different industry sectors including airlines, banking, insurance, finance and securities, manufacturing, telecommunications, and retail [28], and remains a top priority for many organizations [14].

Although many organizations have successfully implemented BI to support decision-making and organizational performance, not all organization can boast of such success [28]. For example, in a survey conducted by Information Week on 385 business technology professionals using BI tools, only 19% commented being very successful in using BI to support improved business performance in their organizations [12].

Prior research notes the importance of BI for organizations. Some highlight that successful implementation of BI is highly imperative for the organizations who want to leverage BI [7, 14, 32, 36]. However, there is a dearth of research relevant to BI benefits and impact on organization performance [26, 35]. Moreover, a huge research gap exists in guiding the organizations towards assessment and identification of BI capabilities at granular levels. While extant research provides some insight into the role of BI capability, there is a need to better understand the concept of BI capabilities (e.g., what are BI capabilities) as well as the content of BI capabilities (e.g., which BI functionalities comprise a BI capability). Further, BI Effectiveness, which we define as the degree to which BI contributes in making the organization effective in meeting changes in market demands and environmental volatility, is specifically under-examined. In this study we address two research questions;

RQ1: What are the BI capabilities that influence BI effectiveness?
RQ2: What are the BI functionalities that constitute different BI capabilities?

To address these questions, we develop a theoretical framework that builds on the literature on IT capabilities. We identify three BI capabilities, consisting of BI functionalities, and offer three propositions that illustrate their effect on BI effectiveness. These propositions are intended to provide a theoretical basis for future empirical studies to develop testable hypotheses that could further advance IS research. To facilitate these advancements, we also develop measures for our new constructs. This proposed instrument, which was cross validated with chief information officers and senior business
executives, can serve as a diagnostic tool through which organizations can assess the effectiveness of their BI initiatives. The findings of this study will thus help managers effectively use BI within their organizations and thereby improve the performance of their organization.

The rest of paper is organized as follows. The next section is our theoretical development section where we develop the conceptual model and offer our propositions. In section three we present a methodology that can be used to collect data and test the conceptual model along with detailed measures for each construct. The survey instrument is illustrated in the end of the paper. Finally, we conclude with limitations and directions for future research.

2. Theoretical Development

Researchers and professionals have viewed BI from different perspectives. Some researchers examine BI as a tool or from a technical perspective [8], whereas others look at BI as an approach or heuristic for supporting decision-making [21]. The effectiveness of BI is situated in its ability to support decision-making within an organization and providing decision-makers with timely and relevant information [6, 20, 28]. Therefore, in this paper, we look into the BI organizational effectiveness as our endogenous variable. Organizations are struggling to make sense of the growing variety, velocity, and volume of data produced by internal and external sources [14]. BI capabilities play an important role in making sense of huge volume of data and helping organizations to improve its performance [14].

In this article, we draw on existing information systems literature to develop a comprehensive conceptual model that highlights the different BI capabilities and the role they play in improving BI effectiveness in organizations. Specifically, we build upon prior research, which asserts IT capabilities are developed through the combination of IT resources, such as IT functionalities, with other resources. Formally, IT capabilities are defined as “the ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities.” [5, p. 160] and are valuable, rare, non-imitable, non-substitutable and heterogeneously distributed across firms [3]. IT functionalities refer to IT assets (or IT resources) that are deployed to help with and execute business processes; when deployed in combination with other business resources, these give rise to IT capabilities [27]. Deriving from this literature, we define BI Capabilities as the ability to mobilize and deploy BI functionalities in combination or co-present with other resources and capabilities.

We propose four specific BI capabilities that positively impact BI Effectiveness – namely, BI Innovation Infrastructure Capability, Customer Centric BI Process Capability and B2B Centric BI Process Capability which together form BI Process Capability, and BI Integration Capability. These capabilities are formed of underlying BI functionalities along different dimensions. Next, we elaborate on the dimensions of BI Capabilities.

2.1. BI Innovation Infrastructure Capability

BI Innovation Infrastructure Capability reflects on the foundational ability to mobilize and deploy BI functionalities to support innovation in the organization through infrastructure, culture and technological improvements. This capability constitutes three dimensions: technical, structural and cultural (see Figure 1). BI technology is the degree and extent of technological readiness to adopt BI in the organization, such as data communication systems, modules of large BI systems, information systems’ linkages help in bringing together and integrate the fragmented flow of data and intelligence across difference parts of the organization to a seamless organized structure. The technology dimension may also include business intelligence, collaboration, distributed learning, discovery, mapping, opportunity recognition and generation as well as aspects related to security and privacy of the data and analytics.

![Figure 1: BI Innovation Infrastructure Capability consisting of Technology, Culture and Structure](image)

Structural element of BI Innovation Infrastructure refers to the modular organizational design that helps to facilitate the technical architecture and subsequent functions and innovations relevant to BI. Often organizational structures a logical structure of functions or units within an organization. However, the logically divided structures may lead to a siloed organization where sharing of information and collaboration across unit boundaries may not happen; thereby leading to a sub-optimal function of the organizational structure for effective BI usage. Although prior research has been equivocal in favor of different organizational structures, such as a modular structure modular product design [19], and a hypertext organization that enables seamless information
exchange and collaboration through a non-
hierarchical, self-organizing organization structure
[23]; the effects of these structure on BI Is not
explored. Nevertheless, the structural adaptation that
an include the formal hierarchical structure, but can
add the flexibility of coordination and collaboration
for data, information and intelligence collation and use
seems to have a direct bearing on motivating the
organization towards an BI innovating organization.

Along with technology and structure, culture that
facilitates a firm’s ability to manage data, knowledge
and intelligence; and espouses interaction between
individuals and groups is a basis of the creation of new
ideas and innovation. Thus, a more interactive and
collaborative culture is a pre-cursor for converting the
data or fact based tacit information to more explicit
intelligence, and move it from an individual to an
organizational level. Employees in such a cultural
 glue within the organization can develop an ability to
self-organize their knowledge and practices to
facilitate solutions to new or existing problems,
thereby fostering innovative activities.

Thus, in sum, we posit that BI infrastructure
capability that can be innovative or foster innovation
consists of three dimension of BI technology involving
infrastructural elements, an organizational structure
that add the flexibility of coordination and collaboration
across the units of an organization [15, 16, 33], and a more inclusive and interactive culture
for data, ideas and subsequent BI oriented innovation.

2.2. BI Process Capabilities

The context of business intelligence and its
applications extend beyond the organization to
external entities. As much as it is critical for an
organization to develop its intelligence and analytical
capabilities internally, it is highly critical that such
capabilities extend to service customers and partners
in different relationships.

We conceptualize that BI Process Capability
reflects the penetration of BI into the firm’s business
processes. “A process identifies a set of logically
related tasks performed to accomplish a defined goal.”
[11, p. 2]. The main focus of the processes is on the
global business goals [11]. Thus, in our study we
conceptualize BI Process Capability to consist of two
dimensions: Customer Centric BI Process Capability,
and B2B Centric BI Process Capability.

Formally, we define BI Process Capability as the
ability to mobilize and deploy BI functionalities to
support and to accommodate customer centric and
B2B centric activities. Customer Centric BI Process
Capability pertains to how BI enables the firm to be
customer-oriented, have customer retention focus, and
implement customer-oriented applications. B2B
Centric BI Process Capability refers to the ability of
BI to enhance B2B engagement and supply chain
visibility. Thus BI Process Capability is a higher order
capability comprising of two capabilities (see Figure
2).

![Figure 2: BI Process Capability consisting of Customer
Centric and B2B Centric Dimensions]

We posit that Customer Centric BI Process
Capability is formed of three distinct BI oriented
functionalities. First, BI for Customer Orientation
reflects the way BI is oriented to meet the firms’
customer needs and serve them. This enables the
organization to perceive and respond to customer
enquiries and requirements. Second, BI for Customer
Retention comprises of elements that enhance
customer satisfaction and loyalty by providing insights
regarding customers’ long term goals and
requirements. Hence it reflects the way BI is oriented
to retain customers and increase loyalty. Third, BI and
Customer Application provides processes to absorb
customer oriented information/intelligence into the
organization using BI. This reflects the ability of the
organization to absorb and learn from its experiences
with customers to improve future interactions.

Similarly, we posit that B2B Centric BI Process
Capability is formed of three distinct BI
functionalities. BI for Supply Chain Visibility is the
way BI is used to meet the needs related to supply
chain integration. It reflects the ability of BI to provide
a unified view of inter-firm logistics, in terms stocks
and flows of both inventory as well as events. BI in
B2B Engagement is the usage of BI to engage new
B2B partners and improve
coordination with existing
B2B partners. This functionality focusses on the
ability of BI to enhance integration, engagement and
synchronization with B2B partners. BI in B2B Levels
of Organizations captures the process coordination
and operational improvements due to BI. This
functionality reflects the ability of BI to enhance
process level coordination and integration across
different channels and varied groups of stakeholders.

Overall, Customer Centric BI Process Capability
enables responsiveness to customer needs, awareness
of customer goals and the ability to learn from information generated during customer interactions. B2B Centric BI Process Capability aids activities with B2B partners due to insights through visibility of goods and information, business level integration, and process-level coordination across channels. Together, we posit that Customer Centric BI Process Capability and B2B Centric BI Process Capability provide firms with the capacity to derive analytical insights in its business processes which in turn enhance organizational performance.

2.3. BI Integration Capability

To utilize the BI capabilities, an organization needs to build and integrate such capability; and develop ways to acquire and covert business intelligence towards organizational improvement. Prior literature, has shown BI integration to be very important and critical for the successful utilization of BI [14]. Integration refers to combining different types of explicit data and information into novel patterns and relations [13]. In this regards, we conceptualize BI integration capability to comprise of acquisition, conversion and integration of data, analytics and other related tools and capabilities to be used for business intelligence. Formally, we define BI Integration Capability as the ability to mobilize and deploy BI functionalities to acquire and integrate business intelligence within its systems.

BI Integration Capability comprises of two BI functionalities: BI Acquisition and BI Conversion. BI acquisition consists of gathering data from different types of sources across the organization and beyond, in addition to data aggregation, rollup and partitioning. Data extracted from operational systems need to be cleansed and transformed in order to make it suitable for use without errors [28]. This conversion is critical for effective use of BI in organizations. Thus BI Integration consists of the acquisition of data from various sources, followed by the conversion of data to the right format and quality in order to be used effectively in the organization.

2.4. An Integrative Model of BI Capabilities and BI Effectiveness

Existing analytics and intelligence capabilities is a precursor to a firm’s competitive ability. To accomplish the capacity to compete and leverage on the BI aspect, firm should be able to use the prior experience and intelligence to recognize the new information, assimilate and apply it to create new capabilities and opportunities. To enable such an environment, where the firm acquires BI and uses it to leverage on innovation and efficient process improvements is the key of the conceptual framework of this study that we present in Figure 2. The integrative model suggests that a firm can leverage BI towards organizational effectiveness by mapping the BI activities in three dimensions: (1) integrate BI within the organization, (2) align BI towards innovation, and (3) use BI to improve both customer centric and business partner centric processes.

Elaborating on the three dimensions, as illustrated before, the BI integration capability consists of BI acquisition and BI conversion process towards organizational objectives. The BI innovation infrastructure capability relies in creating or adopting appropriate BI technology, creating an organizational culture, where BI related activities are fostered, and having an organizational framework or structure to support and incentivize BI activities.

![Figure 3: BI Integration Capability consisting of Acquisition and Conversion Dimensions](image)

![Figure 4: Integrative Model of Dimensions and Functionalities of BI Capabilities](image)

An organization need to develop and set up BI customer-centric process capabilities that should help the organization to be more customer centric, work on the parameters of BI to help in higher customer retention, and develop and align a set of customer application tools and applications that can then leverage on the BI to improve customer satisfaction. In addition, the firm also need to apply and orient BI to achieve higher supply chain visibility, use BI for higher B2B engagements, and orient BI to achieve higher B2B levels of operations, such as improving different levels of transactional capabilities, or seamless flow of information with appropriate security...
etc. Together, the perspectives of infrastructure, process orientation and integration capabilities provide a useful theoretical foundation of defining important aspects of organizational capabilities that can use and leverage BI towards higher effectiveness.

We illustrate the positive influence of B2B Centric BI Process Capability on BI Effectiveness through the example of the supply chain functionality provided by UPS to global manufacturing firms, such as HP. UPS provides HP with the ability to trace its products and events affecting their flow all along the supply chain, from production planning to production, all the way to warehouses and then their final retail destinations. This capability provides HP with complete visibility, the ability to add and remove partners along the supply chain, as well as deep insight into the operations of its partners [30]. Consequently, HP is able to leverage BI to effectively react to changes in market demand or environmental contingencies. Hence we propose:

**P1**: BI Process Capability positively influences BI Effectiveness.

Innovation infrastructure capability examines the organizations’ readiness to implement BI functionalities to support innovation. As elaborated earlier (section 2.1), innovation infrastructure capability comprises of technical, structural, and cultural dimensions. A good technical infrastructure will ensure that organization can easily adapt and integrate the latest BI tool available with existing systems. Structural element of innovation infrastructure will allow data and information to be exchanged seamlessly between different business units, thus improving the effectiveness of BI. Further, having a culture that will facilitate the interaction between individuals and groups to exchange information and intelligence generated by BI to come up with new innovative ideas will make the BI more effective.

Thus, BI infrastructure capability that fosters innovation through technical elements for adapting the latest BI tools, structural elements for facilitating flexibility and coordination among different business units, and cultural elements that can ease the exchange of information and intelligence between individuals and groups and originate novel ideas will improve BI effectiveness. Therefore, we propose:

**P2**: BI Innovation Infrastructure Capability positively influences BI Effectiveness.

We propose that BI Effectiveness is positively influenced by BI Integration Capability. This is due to three reasons. First, the acquisition and integration of business intelligence from various sources is a prerequisite for the utilization of other BI Capabilities. For example, Customer Centric BI Process Capability requires the acquisition of business intelligence regarding customer behavior and experience, which in turn would provide insights regarding goals and requirements. Second, the gathering and aggregation of data from different types of sources across the organization and beyond enables the organization to leverage BI to adequately respond to market and environmental changes. This BI can provide insights regarding the nature of change to which the organization needs to adapt, as well as the internal changes required to do so. Third, aggregation, cleansing and transformation of this data can make this data more substantive and insightful, thereby making subsequent decisions faster and more effective.

Thus the integration capability of BI that facilitates the gathering and cleaning of disperse data from disparate data sources and providing the decision-makers with timely and usable information will make the BI more effective. Therefore we propose:

**P3**: BI Integration Capability positively influences BI Effectiveness.

### 3. Proposed methodology

To further examine the nature of these BI capabilities and their underlying functionalities, and to provide a means to operationalize the proposed conceptual framework for future research, we developed multi-item scales for measuring each of these BI Capabilities and BI Effectiveness. These scales were designed after reviewing existing literature and developing measurement items for each construct. Initial instrument items have been cross-validated with scholars and industry respondents.
which include heads of IT, marketing and operations functions involved with BI implementation and use. We followed three steps to refine the initial questionnaire during the pre-test. First, respondents were asked to fill out prototype questionnaires. Second, respondents were interviewed and asked questions on their interpretation of the items. Their comments on content validity, appearance, terminology, clarity of instructions, organization and response format were solicited. Third, adjustments were made to the questionnaires based on the comments. A preliminary conceptualized instrument for testing the research model consisting of reworded items that reflect the feedback from the scholars and the industry experts is included in Table 1. The table provides construct names, the definition, or description of the constructs, and the measurement items. In the questionnaire, all the items are measured on a five-point Likert scale where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, and 5 = strongly agree, unless specified otherwise.

The instrument will be further pilot tested with a small sample from the targeted population for reliability, convergent and discriminant validity, and predictability. This step will occur prior to the large-scale test. Items will be dropped or revised based on the results of the pilot test. Additional items may be added to make sure that each construct has at least three to four items.

The target population will be CIOs, CTOs, and senior managers from different organizations. For the successful implementation of BI it is important to have support from upper level management [21], thus, CIOs, CTOs, and senior managers who have implemented BI or in the process of implementing BI within their organization will be able to provide better insight into the required BI capabilities and its effectiveness. The survey will be administered on a voluntary basis and in an anonymous format. The respondent’s identity will not be collected for data analysis purpose. The minimum sample size required to successfully analyze data using SEM technique is 200 [14, 22].

Data will be analyzed by following Anderson and Gerbing’s [1] two-step approach and will use Structural Equation Modeling (SEM) technique. AMOS will be used to analyze the data using SEM. As we are using a theory driven approach for developing the constructs, confirmatory factor analysis will provide the suitable means for evaluating the effectiveness of the measurement of the scale items. SEM provides with measurement model, which represents the relationship between the observed variables and their latent variables and the structural model, which provides the relationships between the latent variables of interest [17, 22]. The measurement model will be assessed with statistics and structural equation modeling (SEM) techniques for descriptive statistics, reliability, convergent validity, and discriminant validity of the variables/factors [24]. Second, with the satisfactory overall results of the measurement model, hypotheses will be tested with structural equation model technique.

The means, standard deviations, Skewness value, and Kurtosis value of each variable in the model will be assessed for the normal distribution assumption of the variable [10]. Construct reliabilities are assessed with Cronbach’s alpha (α) with the value of 0.7 or above is considered acceptable [24, 29].

Convergent validity is an assessment of how well measurement items load on their latent variable. Item-factor loadings equal to 0.60 or greater indicate good convergent validity [2].

Average variance extracted (AVE) has been suggested as an alternative measure of convergent validity as well. An AVE value of 0.50 or higher indicates that the variance captured by the items measuring the intended construct is greater than the variance due to the measurement error, suggesting convergent validity [9].

Discriminant validity is assessed by examining whether the measurement items share more variance with their intended construct than any variance that the construct shares with other constructs [9]. A construct has discriminant validity if the square root of its AVE value is greater than the correlations between this construct and other constructs. The values of χ², NNFI, CFI, and RMSEA will be used to assess the model-data fit of the measurement model and structural model [4].

With the acceptable construct reliability, convergent validity, and discriminant validity of the measurement model, the model-data fit will then be assessed for the structural model.

As the next future step, we propose to propositions and research hypotheses based on the research model. The propositions and/or hypotheses will be evaluated by examining the structural coefficients between exogenous variables and endogenous variables or the one among the endogenous variables. We will be using the organizational size, the industry type, organizational experience, BI experience, and BI orientation as the control variables.

Further, as the data is self-reported and collected in one point of time there is a potential for common method bias [25]. We will conduct a Harmon one-factor test to assess the severity of common method bias [25, 31].
4. Discussion

This study proposes a research framework for exploring different BI capabilities and the role they play on improving BI effectiveness in organizations. The focus is to address a multidimensional capabilities perspective that can be helpful to assess the readiness of an organization to leverage on BI capabilities. We conceptualize that for BI to be effective in an organization, at least three sets of capabilities are important: BI infrastructure oriented towards innovation, BI process capabilities consists of customer-centric and B2B centric capabilities, and BI integration capability. We then identify and elaborate on different dimensions of these three main capabilities. The study aims at developing propositions as a future step, based on the research model. In the current version, we have introduced to research methodology that will be helpful to test the propositions and/or hypotheses.

The conceptual model suggested in this paper establishes three groups of variables, relevant to the structural, process-oriented and integration aspects of BI in the organization. It details a set of variables to explore the antecedents and proposes that these will lead to the consequence of effective BI implementation in an organization.

Two theoretical contributions can be drawn from this study. First, the scope of BI organizational effectiveness has not been elaborated in the existing literature, that this study is trying to establish with a very granular and theoretical view [18]. Second, until now, BI has been considered as a tool or artifact in IS literature, than suggesting a capability oriented perspective on BI. However, recently organizations are using BI from a systems perspective to provide continuous feedback on different avenues of their operations or customer oriented approach. Such an approach demands that BI need to consider as a business function or system for the organization. This study inherently takes this view with the integrated framework. Thus, our conceptualization provides a novel approach to apply the process-capability oriented theoretical concept to the BI context.

This study also has practical implications. The conceptual model and validated instrument provide a framework for both IS and business executives to understand and assess their BI capabilities and how they should pursue their further development. This study provides a direction to managers for implementing BI within their organization. As organizations pursue to develop its BI deployment for analyzing the huge amount of data, it is important for them to focus on the goal for implementing BI and the BI capabilities that is required for achieving these specific goals. Further, from a managerial perspective this study also provides with antecedents that needs to be leveraged in order to achieve the specific BI capability.

In terms of limitations, the conceptual framework needs to be validated with empirical data that remains as a future scope of this ongoing research. Further, as a limitation to the conceptual model of this study, a firm’s positioning in an industry sector, and subsequent embeddedness in the sectorial dynamics was excluded as it can be an environmental determinant. For example, some industry sectors, such as retail or airlines have a rich and positive environment towards leveraging BI—partly driven by the realization that BI can be helpful to provide some insights to the dynamics and complexities associated in that sector. Whereas, healthcare or real estate sectors have not been able to leverage BI. Finally, the industry-oriented competitive implications of the BI are out of the scope of this model, although the model includes some expected outcomes. As such, following the exploratory effort of the current study, additional research is warranted to extend this body of knowledge. Thus future studies may focus on exploring some of these limitations, and extending the model to other contexts by developing specific testable hypothesis on particular settings.

In conclusion, this study provides a conceptual model for antecedents of BI Effectiveness in organizations. Three propositions provide a theoretical basis for future empirical studies, for which we developed an empirical research methodology consisting of new measures. This cross-validated instrument, can also be used to assess the effectiveness of BI initiatives. Overall, this study is contributed to the emerging literature focused on information systems literature in business intelligence areas.

5. Survey Instrument

The suggested constructs and items are developed keeping in view that the model is relevant to:
1. A focal organization that is in the process or has already implemented BI.
2. In reference to a set of organizational capabilities that are important for BI. The respondents will be given a description about BI and its context relevance in an organization.
3. Suggested scale: a 5-point Likert scale where 1=strongly disagree and 5= strongly agree.
Table 1. Constructs and Measurement Items for the Research Model

<table>
<thead>
<tr>
<th>BI Organizational Effectiveness (The degree to which BI has contributed in making the organization effective in meeting changes in market demands and environmental volatility.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question: Because of BI over the past 3 years,</td>
</tr>
<tr>
<td>1. My organization has improved its ability to innovate new products/services.</td>
</tr>
<tr>
<td>2. My organization has improved its ability to identify new business opportunities.</td>
</tr>
<tr>
<td>3. My organization has improved its ability to anticipate market opportunities.</td>
</tr>
<tr>
<td>4. My organization has improved its ability to adapt to volatile industry/market changes.</td>
</tr>
<tr>
<td>5. My organization has become responsive to market demands.</td>
</tr>
<tr>
<td>6. My organization has improved its ability to reduce redundancy in knowledge-centric driven efforts.</td>
</tr>
<tr>
<td>7. My organization has improved its ability to reduce market response times</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI Innovation Infrastructure Capability (The ability to mobilize and deploy BI functionalities to support innovation in the organization through infrastructure, culture and technological improvements).</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is a second order construct consisting of: (1) BI Technology, (2) BI Culture, and (3) BI Structure</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI Technology (The degree to which BI technology is implemented in an organization).</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My organization uses BI technology for documenting, formatting, and categorizing the product knowledge.</td>
</tr>
<tr>
<td>2. My organization uses BI technology for documenting, formatting, and categorizing the process intelligence.</td>
</tr>
<tr>
<td>3. My organization uses BI technology to retrieve and use intelligence about products and processes.</td>
</tr>
<tr>
<td>4. My organization uses BI technology to retrieve and use intelligence about market and competition.</td>
</tr>
<tr>
<td>5. My organization uses BI technology to collaborate with individuals inside and outside the organization.</td>
</tr>
<tr>
<td>6. My org. uses BI tech. to search for new knowledge and map specific types of knowledge (for e.g., Individual system or database)</td>
</tr>
<tr>
<td>7. My org. uses BI tech. to allow employees in multiple locations to learn as a group from a single (multiple) source at a single (multiple) point of time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI Culture (The way the use of BI for decision-making has become the norm within an organization)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. In my organization employees understand the importance of BI for the success of organization.</td>
</tr>
<tr>
<td>2. Employees are encouraged for intelligence exploration and experimentation</td>
</tr>
<tr>
<td>3. Senior management support the role of BI in our firms’ success</td>
</tr>
<tr>
<td>4. My organization expects high level of participation in intelligence capture, share, and transfer</td>
</tr>
<tr>
<td>5. My organization has an underlying value of on-job training and learning around BI</td>
</tr>
<tr>
<td>6. In my organization the vision and objective around BI are clearly stated and understood</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI Structure (The degree to which BI structure is defined within an organization, including rules, policies, procedures, processes, hierarchy of reporting patterns and relationships within the firm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My organization structure of departments inhibits exchange and sharing of intelligence</td>
</tr>
<tr>
<td>2. My organization promotes collective intelligence rather than individualistic acumen</td>
</tr>
<tr>
<td>3. My organization facilitates creation and discovery of new intelligence</td>
</tr>
<tr>
<td>4. My organization Incentivizes performance based on BI intelligence</td>
</tr>
<tr>
<td>5. My organization has processes to facilitate exchange and sharing of intelligence</td>
</tr>
<tr>
<td>6. My organization facilitates the transfer of intelligence across structural boundaries</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI Process Capability (The ability to mobilize and deploy BI functionalities to support accommodate both customer-centric and B2B-centric activities).</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is a construct consisting of:</td>
</tr>
<tr>
<td>1. BI Process Capability- Customer Centric</td>
</tr>
<tr>
<td>1.1. BI Customer orientation</td>
</tr>
<tr>
<td>1.2. BU Customer retention focus</td>
</tr>
<tr>
<td>1.3. BI Customer application</td>
</tr>
<tr>
<td>2. BI Process Capability-B2B Centric</td>
</tr>
<tr>
<td>2.1. Supply chain visibility</td>
</tr>
<tr>
<td>2.2. B2B engagement</td>
</tr>
<tr>
<td>2.3. B2B levels of operations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI for Customer Orientation (The way BI is oriented to meet the firms’ customer needs and serve them)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Our BI focuses on meeting customer needs.</td>
</tr>
<tr>
<td>2. The goals of the customers are met through our BI system.</td>
</tr>
<tr>
<td>3. Our BI system helps employees in solving customer issues.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI for Customer Retention Focus (The way BI is oriented to retain customers and increase loyalty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The use of BI in our organization has improved customer retention.</td>
</tr>
<tr>
<td>2. The use of BI in our organization has improved customer satisfaction.</td>
</tr>
<tr>
<td>3. The use of BI in our organization has helped us meet the long-term needs of the customers.</td>
</tr>
<tr>
<td>4. The use of BI in our organization has improved customer loyalty.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI and Customer Application (Process to absorb customer-oriented information/intelligence in the organization using BI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My organization has processes for applying BI learnt from customer handling experiences</td>
</tr>
<tr>
<td>2. My organization has processes for applying BI learnt from customer handling mistakes</td>
</tr>
<tr>
<td>3. My organization has processes for using BI in development of new customer oriented channels.</td>
</tr>
<tr>
<td>4. My organization has processes for using BI for solving problems associated with new customers</td>
</tr>
<tr>
<td>5. My organization has processes to take advantage of knowledge acquired from customers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BI for Supply Chain Visibility (The way BI is used to meet the needs related to supply chain integration.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Our BI focuses on meeting supply chain needs.</td>
</tr>
</tbody>
</table>
2. The goals of our supply chain partners are met through our BI system.
3. Our BI system helps in resolving supply chain integration issues.
4. Our BI facilitates the transfer of information across downward supply chain.
5. Our BI helps in upward management of supply chain.

**BI in B2B Engagement** (Usage of BI to engage new B2B partners and improve coordination with existing B2B partners)
1. The use of BI has streamlined B2B engagement.
2. The use of BI has increased engagement with business partners.
3. The use of BI has enhanced approachability with our business partners.
4. The use of BI has provided synchronized coordination with our business partners.

**BI in B2B Levels of Operations** (Process coordination and operational capability improvement due to BI)
1. BI has provided us capability to be compatible with e-commerce capability.
2. BI has provided us capability to be compatible with different channels.
3. BI has provided us capability to be compatible with different stakeholders.

**BI Integration capability** (The ability to mobilize and deploy BI functionalities to acquire and integrate business intelligence within its systems). This is a second order construct consisting of:
- BI Acquisition
- BI Conversion

**BI Acquisition** (Processes to acquire business intelligence)
1. My organization has processes for acquiring intelligence about our business.
2. My organization has process for generating new intelligence from existing data and information.
3. My organization has processes for distributing intelligence throughout the organization.
4. My organization has processes for acquiring intelligence about new product/services/innovation.

**BI Conversion** (Processes to convert business intelligence)
1. My organization has processes for converting intelligence into new product design/service offering.
2. My organization has process for converting intelligence into plan of action.
3. My organization has processes for transferring organizational intelligence to individual employees.
4. My organization has processes for absorbing intelligence from individual employees into organizational frameworks.

6. **References**


