CHAPTER 6

CONCLUSIONS, LIMITATIONS AND FUTURE SCOPE OF WORK

The summary of this study has been presented in this chapter. Significant contributions of this study have been highlighted and important implications to research and organizational practice have been discussed. In this study, a questionnaire survey, descriptive analytics, cluster analysis and case study method have been applied to address the objectives of the research. Limitations of this study and directions for future research have been stated in this chapter.

6.1 CONSOLIDATION OF THIS STUDY

This study has attempted to identify the factors which influence the maturity of BI&A capability. This study has been built on prior research of BI&A maturity models, their maturity levels and dimensions. All the dimensions in BI&A Maturity Models were examined and consolidate into a set of six factors in the Indian context. This study attempts to determine the maturity level of BI&A, the usage of BI&A and effectiveness of BI&A of organizations in India. A unique aspect of this study is that besides a quantitative analysis performed for 145 organizations in India, an attempt has been made to study six case organizations using qualitative in-depth interviews.

There are multiple challenges faced by organizations in building BI&A capabilities which include difficulty in understanding how to and where to use analytics, insufficient analytical skills, diverse business priorities, challenges in getting good quality data and information sharing (Evans, 2015). Hence, the aim of this study is to help managers identify the focus areas for building BI&A capabilities. There are 29 BI&A Maturity Models originating from literature and practice. Each of these have multiple dimensions. Are these models and dimensions relevant to the current era of Big Data? It has been observed from literature

review that characteristics of data such as data type, data accessibility, data context and data sources have changed over the last two decades ushering in an era of Big Data. The organizational capability to deal with Big Data has also undergone change. Hence it was important to find the critical factors required to build BI&A capability. Six critical factors have been identified as those influencing BI&A capability maturity. These factors are relevant for India and the current era of big data and changing data architectures, as they were consolidated with the help of an Expert Panel from organizations in India. These factors are Data Management, Enterprise Processes, People Skills, Organizational Culture, Strategic Alignment with BI&A and Infrastructure & Technology. This set of six critical factors are a contribution to the BI&A practice in organizations as well as to the research body of knowledge.

A questionnaire was developed using these six factors. This questionnaire was administered to 183 organizations from which responses were obtained from 145 midsize to large organizations in India. Data was collected from respondents who are either business users, analysts, IT support personnel or data scientists with average experience of 13.7 years. Factor analysis was used to reduce measurement items of each factor into a smaller set to facilitate easier and meaningful interpretations. The responses were analysed to determine the level of BI&A capability maturity in these organizations, in two phases:

- Firstly, by grouping organizations into Industry-sector and segments
- Secondly, by grouping organizations using cluster analysis, based on similarity in maturity of the six factors.

A perceived BI&A Maturity (BIAM) score was calculated based on the perceived maturity score of all six factors obtained from the data collected. This score had a range from 6-30. It

was used to determine the BI&A capability maturity of each organization, each industry segment and each cluster of organizations.

In the first phase of analysis, organizations were grouped into different industry sectors and segments based on the categorization of GDP of India - Manufacturing sector, Financial Services and Non-financial services with multiple segments in each of these. In the second phase of analysis, organizations were grouped into six clusters based on similarity in maturity of the six factors. These clusters were found to have an ascending pattern based on the cluster centroid values of the maturity of the six factors. These six clusters were given names as follows: 'Sitter', 'Walker', 'Hiker', 'Trekker', 'Climber' and 'Mountaineer'.

One case organization is taken from each cluster to gain deeper insights using in-depth interviews. Seven case studies have been presented from this study – one organization from the each of the six clusters and one organization from the Cement Industry. The Cement Industry case was presented to validate the finding from quantitative analysis that Cement Industry had the highest BI&A maturity level in the sample. Each case was analysed using thematic analysis method. This brought out the key characteristics of each case organization which were further generalized for all the organizations in the respective cluster. The case study method has validated the findings from the quantitative data analysis about characteristics of each cluster.

Based on the findings from qualitative analysis and the results from cluster analysis, we have proposed a roadmap for an organization to move to higher levels of maturity as seen in Figure 6.1 and explained in the next section.

6.2 MAJOR FINDINGS FROM THE RESEARCH

The major findings from this study were as follows:

- This study identified six critical factors influencing the maturity of BI&A capability of organizations in India. An acronym has been suggested - 'DEPOSIT' where D stands for Data Management, E for Enterprise Processes, P for People Skills, O for Organisation Culture, S for Strategic Alignment with BI&A and IT for Infrastructure & Technology. The acronym makes it convenient and easy for managers to remember the critical success factors required for BI&A adoption and implementation.

- The results of the study informed us about the level of BI&A capability maturity in the organizations in India. Findings from the sample taken indicate that 20% of the organizations have a lower level of BI&A capability maturity, 49% have average maturity and 31% have a high maturity of BI&A capability. Hence only 20% of organizations in India have low BI&A capability maturity. 80% of organizations are on a growth path for BI&A capability maturity.

- Findings revealed that organizations in the Cement & Construction, E-commerce, IT Infrastructure & Services and Financial services segments were found to have highest level of BI&A capability maturity. Media & Entertainment, NBFC and Engineering Services segments were found to have lowest level of BI&A capability maturity amongst the samples taken from organizations in India.

- The results of the study indicated that the functions which used BI&A extensively were marketing, sales and customer analytics. Also, higher the maturity of an organization, larger was the number of functions found to be using BI&A.

- The results suggested that BI&A effectiveness is seen in the ability to make better informed decisions and in improving efficiency of internal processes. Higher the maturity

level of BI&A in an organization, higher is the effectiveness, leading to increased employee productivity, reduction in operational costs, reduction in lost sales, improved customer service and improved competitive advantage.

- The results inferred that the business managers perceived their organizational BI&A capability to be lower than its current actual capability status. This was due to the level of existing people skills for BI&A capability. People skills was perceived to be the least mature factor in organizations in the sample.

"To move from one level of maturity to another requires changes in all of the factors that make up the stages. While all of the stages of the factors do not have to be exactly in sync, they should be approximately at the same stage of evolution" (Denbu Wilhelmsson and Eriksson, 2013). Hence, to move to the next level of maturity, the weakest factor has to be strengthened at every level, for example: Organizational Culture (OC) in the Sitter cluster has lowest value hence to move to next higher level, the organizations in this cluster should focus on OC (see Table 6.1). This was validated from the case study – the Sitter organizations are the ones which have no culture and mind-set for BI&A.

Table 6.1: Cluster-wise factors with lowest maturity value

Cluster No: Name	Factor with lowest maturity value
1 :Sitter	Organizational Culture (OC)
6 : Walker	Enterprise process (EP)
3 : Hiker	Data Management (DM)
4 :Trekker	People skills (PS)
2 : Climber	Strategic alignment with BI&A (SA)
5 : Mountaineer	Data Management (DM)

Similarly, the findings from quantitative analysis and case study for each of the six clusters have been examined to propose the roadmap to move to higher level of BI&A maturity. The critical factor which has to be strengthened to build BI&A capability has also been identified.

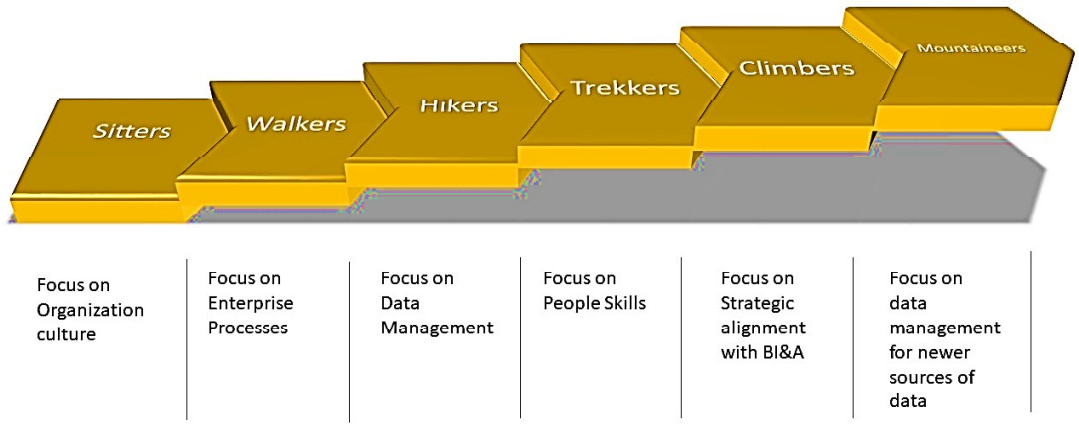

Figure 6.1 Roadmap for organizations to move to higher level of BI&A maturity

This is seen pictorially in Figure 6.1. Based on the results and findings from this study we proposed a roadmap and plan of action for BI&A managers based on the clusters their organization belonged to. The suggested observations and corresponding roadmap is as follows:

- The 'Sitter' organizations do not have a culture of analytics. They can only start on the journey of adopting and implementing BI&A once they bring in the culture in their organization. Top management needs to consider developing analytics capabilities on high priority and give a lot of support towards building data literacy and the culture of pursuing BI&A across the organization. Employees should be made familiar with using information, analytical frameworks and quantitative analysis and there should be norms in the organization towards systematic use of gathering, analysing and disseminating data. All of this would bring in the culture of analytics in the organization to start with.

- The 'Walker' organizations need to focus on enterprise wide spread of BI&A across all business processes to make it an integral part of the organization's culture and decision making process. For this they need to have an enterprise wide BI&A facilitating team with clearly defined roles and responsibilities, seamless processes across different business units, mechanisms for managing the use of BI&A resources enterprise wide,

standard operating principles for developing, testing and deploying BI&A functionalities and standard service level agreements in place to mediate between business decision makers and IT service providers and well defined & documented processes for implementing change arising from BI&A

- The 'Hiker' organizations need to focus on capture of good quality data, all departments should have a strong data orientation and maintain data consistency. They should make provisions for accurate, integrated and common data in central warehouse/data lake with multiple data marts which provide well-defined access to data domains for each function and process. They should have procedures, implementation methods, tools and defined data steward role to manage the master data.

- The 'Trekker' organizations need to focus on people skills which include spreading awareness about the potential of BI&A and big data among their employees and encouraging them to pick up new skills required for BI&A. They need to recognize and appreciate the ones who have high learnability to encourage the culture of picking up new skills. They need to hire analytically oriented people and cultivate amateur analysts and self-served analysts across the organization.

- For 'Climber' organizations, the focus on strategic alignment with BI&A would mean building an overall strategy and vision for BI&A, building a strong cohesion and alignment between the business, IT and BI&A strategy as well as engaging with business stakeholders on a continued basis for developing the BI&A strategy. They will need to ensure that newer technologies for Big data are sponsored by top management and aligned at all levels with the overall organizational strategy. In this era of big data, these organizations need to focus on using big data in the organizational, operational and decision-making processes to achieve the business strategy.

- The 'Mountaineer' organizations may further enhance their data management to explore newer data sources and varied data types. They need to build resources to access real time data for decision making. While these organizations maybe good at predictive analytics, they should be focusing on moving up to prescriptive analytics as per the Analytics Continuum or Value chain model for analytics by Gartner (Koch, 2015).

The above findings have led to important implications for academics and practitioners.

6.3 IMPLICATIONS FOR ACADEMICS

This study has provided relevant academic insights and overview.

- This study gives insights and an overview about 29 BI&A Maturity Models ranging from 2001 – 2018. The 29 MMs examined had multiple dimensions with lack of focus on critical dimensions. The MMs before the year 2011 do not consider the environment of big data and hence cannot be applied in organizations with changing data characteristics today. Some of the MMs seem incomplete and ambiguous, with not enough documentation available for them. Some of them do not have an instrument to determine the BI&A capability. Combining the literature for all these 29 MMs, there is rich theoretical information. This study has consolidated the 108 dimensions found in 29 MMs to arrive at six critical factors which combine the robustness of the earlier models and the agility of the more recent ones. These factors have an Indian context and are relevant to organizations in India as they have been identified with help of an Expert Panel working in the BI&A practice in organizations in India. These six critical factors denoted by the acronym 'DEPOSIT' are a contribution to the Body of Knowledge for BI&A.

- The study also introduces a unique method of analysing BI&A capability maturity in organizations using k-means clustering to group the organizations into clusters based on the similarity in maturity of the influencing factors.
- The case study method has used thematic analysis with a tool NVIVO 12 Plus for coding qualitative data.
- The findings from the study may be added to curriculum in B-schools to understand the state of BI&A in organizations in India and the critical success factors would aid the students with understanding the focus areas for building BI&A capability in organizations.

6.4 IMPLICATIONS FOR PRACTITIONERS

This study has important implications for the BI&A practice in organizations and its managers:

- With the large number of BI&A MMs available in research and practice, it becomes difficult for managers to select the appropriate maturity model for assessment of BI&A capability maturity. Managers will find this study useful as it brings out the critical success factors which have been derived from analysing 29 MMs. These factors are relevant to the changing characteristics of data with the advent of big data. They will be able to determine the BI&A capability maturity in their organization using the proposed six factors and the questionnaire designed from them.
- This study gives a clear guideline to managers regarding the areas where they can expect to see high effectiveness of BI&A. The study also highlights the top use cases for BI&A for driving decision making which are sales, marketing and customer analytics. Managers may take a cue from this study to decide in which use cases they want to invest.

- The study indicates that with higher maturity of an organization, the effectiveness of BI&A increases across various areas. The breadth of usage of BI&A across functions also increases with increasing maturity as indicated by the clusters in this study. All this information how and where BI&A will add value to the organization based on its level of maturity becomes useful for managers looking to adopt, implement, and move to higher level of maturity of BI&A.

- The roadmap for moving to a higher level of maturity gives a guideline to managers on the way ahead and which factor to focus on. This may give an idea about the kind of investments and planning required to build the BI&A capability. For e.g.: if an organization has to focus on people skills, they will be able to plan for recruitment, training, re-skilling and building their employee skills.

6.5 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

The aim of this study has been to increase insights in understanding the maturity of BI&A capability of organizations in India. Nevertheless, there are some limitations which must be mentioned and more scope for future research. These relate to the research methods and practical implications of the study. They are as follow:

- The consolidated list of proposed six critical factors from the original 108 dimensions found in literature review was arrived at using the Expert Panel Method. This is a limitation. The reduction of 108 to six distinct dimensions could have been done using other quantitative methods to validate the results.

- While K-means clustering has been identified as one of the top ten algorithms in data mining (Aggarwal and Aggarwal, 2012), it has some limitations. It is difficult to handle empty clusters and outliers using k-means clustering technique. Fortunately, this study does not have empty cluster or outliers in the dataset. Another limitation is the difficulty

in choosing the right number of clusters "k" (Singh et al., 2011). There are several methods to identify the optimum cluster number. There is some amount of subjectivity in this. Choosing the best "k" also depends on the context and domain knowledge. Choosing the optimum number of clusters may also be done using the Calinski & Harabasz (CH) Index or the Silhouette distance.

- The BIAM score for each organization has been calculated with an assumption that perceived maturity of all six factors is equal importance. We can create differential weights for the factors using the Analytic Hierarchy Process (APH) technique by performing pairwise comparison of all six factors. Using the obtained weights, we can then calculate the BIAM score using weighted summation of factors.
- Determining the level of BI&A capability maturity of organizations in India has been done with k-means clustering technique. There is scope in future for researchers to replicate and expand this study using different methods and techniques.
- As BI&A adoption rates increase and technology matures, future research will be needed to determine if the critical factors influencing maturity are likely to remain same or change in the future. Also we can attempt to relate the behaviour of organizations to an existing organizational theory from extant literature.
- This study has been done with a cross-section of industry sectors and the corresponding segments. There are a limited number of organizations representing each segment. Future research could look at analysing each industry segment in depth with a larger sample size for each segment with regard to the maturity of the six identified critical factors and further identify specific guidelines for particular industry if any.

- Some segments from the cross section have not been covered in this study due to non-availability of responses from these organizations. This is a limitation – every industry has not been represented in this study.
- The outcome of the study can also be compared to that in other countries especially in the emerging economies to see if the breadth and depth of usage and effectiveness of BI&A are any different based on geographical differences.

6.6 CONCLUDING REMARKS

This aim of this study was to find critical success factors which influence the maturity of BI&A capability. The study also made an attempt to determine the BI&A maturity levels of organizations in India. This study has led to understanding the state of BI&A, the functions it is used in and where the effectiveness of BI&A is seen in organization in India.

The findings suggest that organizations in India are at average level and above average level of BI&A maturity. The largest use cases of BI&A are found in outward facing functions like sales, marketing and customer analytics. The highest effectiveness of BI&A is found to be in making better informed decisions and in improving efficiency of internal processes. While most organizations are promoting an analytical culture and well defined data management processes, there is a lack of adequate and right people skills. India clearly is on a growth trajectory in terms of BI&A and with most organizations increasingly becoming mature in BI&A capability.