

Emerging trends and impact of business intelligence & analytics in organizations: Case studies from India

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Abstract

Business Intelligence & Analytics (BI&A) has an increasing impact on decision making and business performance within most organizations today. These organizations regularly invest in resources required for BI&A. What is the impact of this investment? Which functions of the business does BI&A impact? Are there any trends seen in the usage and effectiveness of BI&A? Are these trends different across organizations with different levels of BI&A capability maturity? The purpose of this study was to discover patterns in the usage and effectiveness of BI&A across organizations which are at different levels of BI&A maturity. In the first phase of the study, the data sample was taken from 145 organizations in India. It was analyzed using the data mining technique – k-means clustering. The organizations were grouped into six clusters based on factors influencing BI&A capability maturity. In the second phase of the study, one case organization is taken from each cluster to gain deeper insights. In-depth interviews were conducted with a respondent from each case organization to understand the state of BI&A, the usage and effectiveness of BI&A. The interviews were analyzed using thematic analysis method in NVIVO 12 plus. The study identified the key characteristics which represented the state of BI&A capability maturity in the organization cluster. Findings show that groups of organization which had higher maturity of BI&A capability were using BI&A across larger number of functional areas and also experiencing the effectiveness of BI&A in more areas than the organizations which had lower maturity of BI&A capability.

Keywords

Business Intelligence & Analytics (BI&A) capability maturity, BI&A usage, effectiveness of BI&A, impact of BI&A, India, k-means clustering, NVIVO 12 plus, thematic analysis

1. Introduction

BI&A solutions have proved to be of immense use in understanding how to analyze data, align results with the business objectives and improve the overall efficiency of business (Popescu, 2012). According to Saeed Rouhani et al. (2016), although a variety of benefits are expected to arise from BI&A, it is important for organizations to recognize which functions are benefited and where is the effectiveness seen. In the book ‘Profit impact of Business Intelligence’, by Williams and Williams (2010), the authors describe BI&A as a powerful new management approach, which can deliver information, knowledge, better decisions, efficiency and profit to an organization if done the right way.

Most organizations today invest considerable resources in the area of BI&A in response to the increasing awareness of importance of data driven decision making for better business performance. As per Gartner’s CIO agenda for BI&A in India, BI&A ranks as the topmost technology area attracting new or additional funding in 2019. This is indicative of the strategic importance that organizations are placing on BI&A usage. Not only is BI&A strategic, but it is becoming a necessity to remain competitive in the

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market (Davenport, 2013). While studies have shown that the adoption of BI&A positively influences business process performance (Aydiner et al., 2019), there is insufficient empirical research about how organizations can translate their BI&A use into value for the organization (Fink et al., 2017). Is the investment in BI&A creating an impact? Which are the topmost functions or areas of BI&A usage? Which areas is the information being used?

The objective of this paper is to understand characteristics of organizations in different clusters, where is the effectiveness of BI&A seen and which areas or functions is it used for. In the first phase of this study, the data was taken from 145 organizations in India using a questionnaire. The organizations were selected across various industry sectors. These 145 organizations were grouped into six clusters based on maturity of six factors which were found to be influencing BI&A capability, using k-means clustering method. These six factors are data management, enterprise processes, people skills, organizational culture, strategic alignment with BI&A and infrastructure & technology. They have been obtained from extant literature and consolidated with the help of an expert factors has been described in another paper in press by the authors.

Each cluster was further analyzed based on the centroid values of the six factors. The strength, weakness and key characteristics of organizations were identified. The clusters were then reorganized based on the cluster centroid values for the six factors. An ascending pattern based on the maturity of the six factors was found to be seen for the usage and effectiveness of BI&A across the six clusters. This was validated using the qualitative inputs from the case study method.

The rest of the paper is organized as follows: Section 2 describes the literature review. Section 3 describes the research methodology which includes k-means clustering and case study method. Section 4 describes the results and discussion thereof. Section 5 concludes with the summary, practical implications, limitations and scope of future research.

2. Literature review

Business Intelligence and Analytics (BI&A) capability is the ability to derive insights from data and use them for decision making. This has become an important capability for organizations today as mentioned in a special issue of MIS Quarterly on transformational issues on Big Data and analytics in networked business (Baesens et al., 2016).

And on the other hand, evaluating the effectiveness of BI&A is vital to an organization's understanding of the value of management actions and investments. As mentioned by Viaene and Den Bunder (2011), to achieve maximum enterprise value, BI&A projects should be approached as partnerships between Business and IT.

Leaders of companies are increasingly investing in analytics as a means of improving business performance (Anthony Marshall et al., 2015). Trieu (2017) has studied literature to conclude that there is a lot of research from BI investments to BI assets to BI impact to improved organizational performance. There is not enough research on processes or conditions required to link these together. Hence research is unable to provide a full picture of how business value is generated from BI&A. As per a study conducted by Fink et al. (2017), there is a dual approach to BI&A value creation, that of operational value and of strategic value and for both of these, BI&A capabilities play a pivotal role.

A study by Arefin et al. (2015) indicates that BI&A systems make organizational processes more effective. As explained by Janssen et al. (2017), today big data also offers new insights and has the potential to improve decision-making. Success in BI&A is a complex matter as mentioned by Vidgen et al. (2017). It depends on an organization's capability to harness multiple resources including data in the business context simultaneously. Ashrafi et al. (2019) in their study has mentioned that although BI&A capabilities play an important role in enhancing the organization's performance, it is not clear how and in which way is it done.

3. Research methodology

The authors found 29 BI&A maturity models in extant literature and 108 dimensions across these models. These 108 dimensions were reduced to six critical success factors with the help of an expert panel. The process of arriving at these six factors has been described in a paper in press by the authors.

A questionnaire was designed based on these six critical factors and data was collected from 145 organizations in India. The organizations selected were based on size based on number of employees in the organization ≥ 100 . These organizations were considered to have sufficient operations, data analysis and hence a setup for BI&A capability. The organizations were classified into two main sectors: Manufacturing and Services and within services, further classified into Financial services and Non-financial services (See Table 1).

The respondent profile had the following roles – 59% were business users using BI&A to make business decisions, 31% were business analysts who used tools for data exploration and visualization, 11% were data scientists and 8% were from IT support. Some respondents had overlapping roles.

First factor analysis was carried out for combination of relevant and meaningful measurement items for each factor. Based on the factor analysis scores, k-means clustering was used to group the organizations into six clusters. Bowler and Datar (2018) describe k-means clustering technique as a unsupervised technique used to group items

together by similarity. In this study the similarity is for the maturity level of the six factors of the organizations. Hence organizations having similar maturity of the six factors were found to be in the same cluster. The elbow method as explained by Bholowalia and Kumar (2014) was used to find the optimum number of clusters which was found to be six. The clusters were then reorganized based on an ascending pattern in the cluster centroid values of the six factors (see Table 2). This has been described in a study done by the authors in a paper currently under review.

This study uses the case study methodology which is used to examine a phenomenon in its natural setting to collect information from people, groups, or organizations. Case studies offer in-depth understanding of contemporary phenomenon within their organizational context (Aberdeen, 2013; Yin, 2003, 2012). This methodology provides better explanations and understanding than the examined

phenomenon which would otherwise be lost in using other quantitative methods (Miles and Huberman, 1994). As mentioned by Božič and Dimovski (2019), semi-structured, in-depth interviews are considered to be the most effective method of gathering information as these are flexible and accessible. As mentioned by Chawla and Sondhi (2015), this kind of an interview has a more defined format and only the broad areas to be investigated are formulated.

The case study method was used here to know more about the characteristics of organizations in each of the clusters. An in-depth interview was conducted with a respondent from one organization in each cluster. The organization chosen was based on convenience sampling largely depending on the availability of the respondent.

The questions brought out insights for understanding the state of BI&A, the functions it is used for and where is the effectiveness of BI&A seen. The questions in the interview were semi-structured and exploratory in nature about the following:

- How is the data used for decision-making in your organization?
- What is the state of BI&A in your organization?
- Which functions is BI&A used in?
- Is BI&A making business more effective?
- Where do you see the effectiveness of using BI&A?

The methodology for data collection was based on the underlying assumption that findings would emerge from the data collected through in-depth interviews. Inductive approach is the method commonly used to find concepts, themes or any other categories from the data that has been collected, to satisfy the emergent nature of a qualitative study (Thomas, 2006).

The qualitative data from the in-depth interviews for each of the case organizations was analyzed using an inductive approach with the Thematic analysis method. The thematic analysis involves searching across a dataset (Braun and Clarke, 2006), in this case – the interviews taken, to find repeated characteristics emerging out of the data. A step by step phase wise iterative process similar to the one suggested by Braun and Clarke (2006) was followed for thematic analysis with the following phases:

Table 1. Respondent organizations with sector & segment.

Sector	Segment	No. of Organizations
Manufacturing Total = 42	FMCG & Consumer products	9
	Automobile	7
	Chemicals, Paints & Plastic	6
	Oil & Gas	4
	Engineering Products	4
	Cement & Construction	3
	Others	9
	Banking	9
Financial Services (BFSI) Total = 31	Financial Services	7
	Investment Management	7
	Fintech	3
	NBFC	3
	Insurance	2
	IT Infrastructure & Services	21
Non-Financial Services Total = 61	E-commerce	8
	Management Consulting	6
	Retail	5
	Media & Entertainment	5
	Telecom*	4
	Engineering Services	3
	Others	9
Other Sectors		11
Total no. of organizations		145

Table 2. Final cluster centers.

Factor	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6
Strategic alignment	−2.07	0.54	−0.46	0.19	1.46	−1.08
Data Management	−1.93	0.72	−0.84	0.14	1.35	−0.754
Enterprise Processes	−2.16	0.86	−0.33	0.08	1.39	−1.33
Organizational culture	−2.89	0.86	−0.44	0.05	1.45	−1.13
People Skills	−2.42	0.64	−0.40	0.04	1.73	−1.13
Infrastructure & Technology	−2.34	0.73	−0.40	0.05	1.57	−1.16

- Familiarization with the data
- Generating line by line coding
- Identifying themes
- Reviewing, defining and naming themes
- Making sense out of the analysis

Familiarization with the data

The interviews were recorded and transcribed. The process of transcription proved to be helpful and created a thorough understanding of the data. These were then read repeatedly to identify any patterns emerging from the six cases.

Generating line by line coding

Line by line coding was done using the tool NVIVO 12 plus. Each case was read line by line to identify codes. This gave an initial list of ideas about the respondent's views on BI&A in his organization. This gave a good understanding about the data. As each case was being read, the codes were revisited, modified and subtracted to give with more accurate codes which gave clarity in the data.

Identifying themes

Once all the data was coded, a broader level of themes was identified. Several codes were sorted and merged into a larger theme. This gave an idea about the relationship between codes, between themes and different levels of themes. It was observed that there were different levels of an emerging theme (for eg: overall alignment with business strategy and goals). Some respondents had mentioned high alignment while some had mentioned low or yet developing alignment.

Reviewing, defining and naming themes

Next, the themes were reviewed and finalized. This was the third iteration. Meaningful and short names were given to these emerging themes which identified the essence of what the theme is all about. These represented the characteristics within each cluster. The list of these themes is seen in Appendix 1.

Making sense out of the analysis

The themes which had the highest number of references and were coded in the highest number of interviews which are those that were repeated again and again emerged as the key characteristics as shown in Table 7. The interviews for the six organizations clearly showed a pattern in the key characteristics identified, based on the maturity of six factors. They validated the results obtained from the quantitative analysis.

4. Analysis & discussion of results

The 145 organizations were grouped into six clusters based on the maturity of the six factors. The six factors were data management, enterprise processes, people skills, organizational culture, strategic alignment with BI&A, infrastructure & technology.

Reorganizing the clusters

On observing the cluster centroid values (seen in Table 2), a clear pattern emerges where the values of the six factors are increasing across clusters. The six clusters obtained were reorganized in an ascending pattern based on the centroid values to better understand the cluster characteristics.

On reorganizing the clusters, we observe that all the factor values increase in the following order – cluster 1 < 6 < 3 < 4 < 2 < 5. Clusters 1, 6 and 3 are found to have lower factor values whereas clusters 4, 2 and 5 are found to have higher values. These values indicate the maturity of six factors. Reorganizing the clusters in this manner throws up interesting patterns in the observed behavior of organization toward usage of big data in organizations, investment in BI&A, annual budget spent on BI&A. Organizations with higher maturity of the six factors had a higher usage of big data, higher IT budget spend on BI&A and invested in BI&A annually – cluster 4, 2 and 5 as seen in Table 3.

Table 4 shows the usage of BI&A in organizations across the six clusters. The percentages indicate the number of organizations using BI&A in the respective function. BI&A use cases in Sales seemed to be the topmost for organizations across all clusters. With the ascending order

Table 3. Cluster wise Analysis (in ascending pattern).

Cluster No	No. of organizations	Organizations invest in BI&A annually	% of IT Budget spent on BI&A	Organizations with usage of Big data	Factor with lowest centroid value
1	3	None	NA	NA	Organization culture (OC)
6	26	34%	5–10%	31%	Enterprise Processes (EP)
3	28	64%	1%	33%	Data Management (DM)
4	43	76%	2–20%	49%	People Skills (PS)
2	29	79%	2–20%	62%	BI&A strategic alignment (SA)
5	16	100%	2–20%	100%	Data Management (DM)

Table 4. Trends in BI&A usage across clusters.

Usage/Cluster No.	Cluster-1	Cluster-6	Cluster-3	Cluster-4	Cluster-2	Cluster-5
Marketing	0%	65%	57%	65%	79%	94%
Customer Analytics	33%	58%	68%	51%	76%	100%
Supply chain	0%	15%	21%	47%	55%	50%
Supplier Relationship	0%	4%	14%	12%	31%	38%
Inventory management	67%	19%	32%	37%	52%	50%
Production	0%	8%	14%	30%	34%	31%
Sales	67%	62%	61%	58%	83%	88%
Procurement	0%	8%	14%	21%	45%	50%
Projects	0%	8%	29%	33%	24%	56%
Human Resources	0%	23%	11%	23%	45%	75%
Information Technology	0%	23%	25%	47%	66%	63%
Risk Management	0%	12%	29%	28%	45%	50%
Finance	0%	23%	50%	44%	66%	81%

Table 5. Effectiveness of BI&A seen in organizations across six clusters.

Cluster No.	Cluster-1	Cluster-6	Cluster-3	Cluster-4	Cluster-2	Cluster-5
Better access to data	33%	50%	57%	53%	59%	44%
Better informed decision making	33%	69%	79%	77%	93%	88%
Improved efficiency of internal processes	33%	31%	46%	65%	79%	56%
Increased employee productivity	33%	23%	11%	33%	41%	50%
Reduced operational costs	33%	19%	25%	53%	66%	63%
Improved customer service	67%	23%	46%	58%	59%	75%
Transparency of Information	0%	31%	46%	37%	34%	44%
New way of doing business	0%	35%	39%	35%	52%	44%
Reduction of lost sales	33%	42%	36%	28%	41%	56%
Enhanced profit margin	0%	12%	29%	21%	28%	38%
Increased return on investment (ROI)	0%	8%	21%	28%	31%	44%
Improved competitive advantage	0%	19%	39%	35%	28%	69%

Table 6. Case organizations.

Case study No.	Organization	Industry segment	Cluster No.	Cluster Description	Cluster names
1	Organization A	Medical Equipment Manufacturing	1	Non starters	Sitters
2	Organization B	Financial Services	6	Beginners	Walkers
3	Organization C	NBFC	3	Fair performers	Hikers
4	Organization D	FMCG	4	Average performers	Trekkers
5	Organization E	IT Infrastructure	2	Good Performers	Climbers
6	Organization F	ITES	5	High Performers	Mountaineers

of the clusters, the number of uses cases of BI&A were seen to be increasing. Hence organizations with a higher level of maturity of BI&A capability had a higher number of BI&A use cases across functions as seen in Table 4 by the shaded portions.

With the ascending order of maturity of the clusters, the overall effectiveness of BI&A is seen to be increasing as seen in Table 5 as seen by the shaded portion. While the effectiveness is not seen directly in enhanced profit margins and increased return on investment (ROI), more than 50% of the mature organizations believe that BI&A is

effective in getting better access to data, making better informed decisions, improving efficiency of internal processes, reducing operational costs and improving customer service.

Description of the case organizations

One case from each of the six clusters ie: from ‘Sitters’ to ‘Mountaineers’ is described here in three parts: description of organization, the state of BI&A and usage and effectiveness of BI&A. The interviewee’s comments are shown in

Table 7. Key characteristics of organizations.

Cluster Names & Description	Data analysis with reliable data	Top management support & mind-set	Advanced Tools for BI&A	Standard processes across enterprise	Skilled employees	Alignment with business objectives
Sitters (The non-starters)	Minimal	–	–	–	–	–
Walkers (Beginners)	Minimal	Developing	–	–	–	–
Hikers (Fair performers)	Developing	Developing	–	–	–	–
Trekkers (Average Performers)	Established	Developing	Developing	Established	–	–
Climbers (Good performers)	Established	Established	Established	Established	–	–
Mountaineers (High Performers)	Established	Established	Established	Established	Established	Established

italics. Details of the case organizations are shown in Table 6.

Case study-1: Organization A

This organization was from cluster-1 – the ‘Sitters’ cluster. The chosen organization in this cluster is from the medical equipment manufacturing segment, which was founded 15 years ago. It is an India-based, global medical device company that is dedicated to the innovation, design and development of novel, clinically relevant and state-of-the-art devices. The organization aim is to champion the alleviation of human suffering and improve quality of life. They are committed to R&D, innovation in manufacturing medical technology, scientific communication, and contemporary distribution avenues. Headquartered in India with a manpower of more than 4000, this organization currently conducts business in more than 100 countries globally. The interviewee is a General Manager with a rich experience of 24 years.

State of BI&A in Organization A. This organization does not have a culture of using data for decision making. The employees are accustomed to experience based and intuitive decision making.

There is no formal BI&A practice. There is only an MIS team which collates and disseminates information based on accounting data (e.g. Sales, Costs, Working Capital, etc.). People are not skilled for use of analytics. Data analysis is done using excel sheets only.

An MIS team may manage data and treat it like their property for wielding power with the Top Management.

There was lack of awareness and no strategic sponsorship and drive in this organization. Availability of consistent high quality data was a challenge. Business units operate in silos where individuals consider data as power and are reluctant to share it.

Effectiveness & usage of BI&A. In this organization, there is a tactical rather than a strategic approach to using data for decision making. There is found to be reluctance to invest in data management as it is considered expensive and an overhead. As there is no culture, mind set and resources for BI&A, the question of effectiveness of BI&A is irrelevant here.

Case study-2: Organization B

This organization was from cluster-6 – the ‘Walkers’ cluster. The organization is from the financial services segment. It was set up three decades ago by leading financial/investment institutions, commercial banks and financial services companies as an independent and professional investment credit rating agency. The interviewee for this organization is a Vice President with 9 years of experience. The services of this organization are designed to provide information and guidance to institutional and individual investors/creditors; enhance the ability of borrowers/issuers to access the money market and the capital market for tapping a larger volume of resources from a wider range of the investing public, assist the regulators in promoting transparency in the financial markets and provide intermediaries with a tool to improve efficiency in the funds raising process.

State of BI&A in Organization B. As per the interviewee, ‘making decisions is more people centric rather than data

centric. The software used is dated and there is a lack of experienced and skilled people’.

They believe that there needs to be adequate budget allocation for enhancing people skills for analytics. Overall they understand the importance of BI&A. They also understand their data well, but excel sheets are used for analysis rather than more advanced tools for BI&A. Each business unit has its own way of analyzing data. The data quality across business units is not consistent and a lot of time goes into data collation across business units. Although the organization culture is changing fast with respect to usage of BI&A, the mind set for adoption of BI&A across the enterprise is required.

Effectiveness & usage of BI&A. There is huge scope of work in implementation and usage of BI&A. The organization does not have the required resources. Also, data analysis is done in silos and not yet across the enterprise. Hence, assessment of effectiveness of BI&A becomes irrelevant.

Case study-3: Organization C

This organization was from cluster-3 – the ‘Hikers’ cluster. The organization in this case study is a non-banking financial company (NBFC). Launched 20 plus years ago, this organization is a leading emerging market consumer finance specialist and has built a highly scalable, portable and resilient global platform which centrally manages core technology, risk, product and funding functions while adapting to local market needs. They primarily offer convenient and affordable point-of-sales loan, cash loan, and revolving loan products to underserved borrowers in nine countries, India being one of their subsidiaries. Over their 20 plus year track record, they have accumulated a large volume of borrower behavior data which they use to refine risks and cross-selling. Hence there seems to be a huge scope for using BI&A in this organization. The interviewee is an assistant manager with 3 years of experience in this organization.

State of BI&A in the organization. While employees recognize the need for BI&A systems, and there is a mind-set for analytics, there is lack of management will for complete enterprise level adoption of BI&A.

Operational level employees have the desire to use data for decision making but top management does not have the willingness to take the plunge, although their requirements for BI&A are very ripe.

This organization uses data in silos. Data is segregated department wise. Each department has good quality data but data is not shared across business units. Since different departments have their own data, one of the challenges faced is getting real time access to single source of reliable data.

Not having enough good quality data and an associated data dictionary is a huge challenge especially owing to the nature of the work.

Each Business Unit or department has its own data analysis which is not shared with other functions to have a seamless data flow.

Sometimes the MIS or the chairman office team gets totally inconsistent data from two different functions. Also, data are prepared in silos and shared with other functions only on request basis.

This completely defeats the purpose of the enterprise level data analysis. Another challenge is the time needed by employees to update, get trained and actually perform data analysis apart from their routine tasks. BI&A systems are used by only few employees based on their prior knowledge level. There is no dedicated resource for BI&A.

Rather than as an additional task, BI&A needs to be embedded into daily work. Very few employees go that extra mile to use data and extract some meaningful insights out of it.

There is a general lack of awareness and need for upgradation and training among employees regarding BI&A.

Effectiveness & usage of BI&A. Although largely MS-Excel is the tool used for data analysis, other tools like Tableau, Google Analytics and tools for behavioral analytics are also used.

BI&A is found to improve operational efficiency, risk analysis and facilitate better informed strategic decision making for several processes like new product development.

Case study-4: Organization D

This organization was from cluster-4 – the ‘Trekking’ cluster. The organization in this case study is one of the leading FMCG organizations worldwide and is in the business of producing chocolate confectionaries, gum and candy products, and popular beverages and foods that include many of India’s most popular and trusted food brands. It is ranked high among India’s Most Admired Companies by Fortune India in one of the past years. The organization has presence in India for over six decades. Their team works with farmers to improve incomes through best practices in all aspects of crop cultivation – from planting to harvesting. The organization has sales offices and manufacturing facilities at multiple locations in India. The interviewees were a Process Optimization Lead with 7 years of experience and a Data & Analytics Lead with 19 years of experience.

State of BI&A in the organization. This organization is found to have standardized platforms and processes for BI&A and shared services across business units. While the maturity of

BI&A capability is slowly and steadily growing here, the interviewee believes that the BI&A capability maturity in their organization is average. This validates the results obtained from the quantitative data analysis for this cluster of organizations.

There is good quality data generating a large number of system driven reports measuring the various KPIs for business – in fact there are too many KPIs being measured – due to easy data availability.

The interviewee highlighted several challenges as well. The people with BI&A skills are not equipped to understand business requirements. They find it difficult to align the analytical capability with business knowledge. Sometimes there is resistance to change and adoption of the evolving systems for BI&A. The reverse is also true – the people on the field do not use BI&A systems properly and there is no uniformity in the tools being used.

One more challenge is to having updated process and tools aligned with changing business needs and efficiency based on volumes. The use of BI&A tools is fragmented across different business units and functions.

Although BI&A is being used to some extent in the organizations, actionable insights feeding the business process system are still missing. Many business units use their own tools for BI&A. Data management, hardware and platforms exist but need to be utilized to full potential.

The number of touchpoints or data sources in a large organization is found to be a challenge in acquiring good quality and accurate data. Expanding BI&A to more than one function and finding good talent remains a big challenge as mentioned by interviewee from this organization.

Effectiveness & usage of BI&A. The return on investment of BI&A systems and platforms are not directly measured, but growth in sales could be seen as a consequence of using BI&A.

As part of strategic roadmap, BI&A is one of the pillars of growth for the organization.

There is heavy usage of BI&A in customer facing domains like sales & marketing. Advanced algorithms for predictive modeling are used. BI&A is also used in supply chain although a lot of investments are needed here for example, to use Internet of Things or tracking products coming from suppliers.

While the alignment of BI&A systems is high with business strategy and goals, the people do not have understanding of how to align BI&A and business. The people who have BI&A skills don't understand business and vice-versa.

Therefore, the right kind of people skills required for organizations which are trying to increase the adoption and implementation of BI&A are not found.

Case study-5: Organization E

This organization was from cluster-2 – the 'Climbers' cluster. This organization is one of the leading IT infrastructure organizations worldwide with a large presence in India. The organization delivers high-quality, high-value products, consulting and support services in a single package. That is one of their principal differentiators. They have industry-leading positions in servers, storage, wired and wireless networking, converged systems, software, services and cloud. And with customized financing solutions and strategy, they can provide the right tech solutions for unique business goals. The organization has thousands of employees working in various locations in India. The interviewee is a Technical Consultant in the organization with 23 years of experience.

State of BI&A in the organization. The organizations have a culture of data driven decision making.

Advanced tools from Salesforce are used for data capture and analysis, which automatically ensures good quality data. The strategy and planning group gather and analyze data from the market and internal sources. This analysis is used to allocate sales targets.

The challenges faced by this organization is in the area of skill building, retention and moving to modern BI&A. There are young teams with BI&A skills which need to mature. Although the skills and mind-set of employees are improving and there is a culture of analytics driven from top management, the challenge is that this does not reflect down to the last level of business users. The purpose of using BI&A does not seem to be aligned to the larger business objectives.

Effectiveness & usage of BI&A. One can see the impact of BI&A in sales forecasting, workforce planning, customer experience and marketing strategy. There is found to be enhanced operational efficiency in most of the processes which use data for decision making, for eg: to correct the sales pipeline to improve sales conversions. BI&A has been found to impact growth and operational efficiency, for eg: planning for the next year heavily depends on the data and reports obtained from BI&A.

Every quarter, effectiveness of BI&A for processes such as customer satisfaction, is measured using various tools. The fact that the organization is spending for BI&A year after year indicates that there must be returns on this investment, though these are not directly measured.

The interviewee response validated the result obtained from data collected from the survey ie: although organizations in this cluster have a culture of analytics, there needs to be more strategic alignment between business and BI&A.

Case study-6: Organization F

This organization was from cluster-5 – the ‘Mountaineers’ cluster. The organization in this case study is an Information Technology enabled services (ITES) company incorporated in 1990. They help in digital transformations and build software that drives the business of their customers; enterprises and software product companies with software at the core of their digital transformation. They have almost 9000 employees and partner with large multinational companies to deliver their solutions. Their customer companies are in the Banking, Financial and Insurance segment. They also have customers in Healthcare, Life Science and Industrial & Manufacturing segments. The interviewee is a Vice President in the organization with 26 years of experience.

State of BI&A in the organization. This organization demonstrates a culture of data driven decision making. The analytical culture is prevalent across the organization, coming down from top management. There is a significant amount of investment year on year for BI&A as well as enhancements in the data team. They have a very well developed people skills pool. The BI&A team completely aligns with each business group for strategic projects. The management provides a big budget for upskilling in the area of BI&A, data science & machine learning.

There is tremendous top management support to drive success through analytics even though the appetite varies across functions. Advanced tools are used to perform text analytics and sentiment analysis for understanding customer sentiment. We are doing a lot of predictive analytics but have yet to move to prescriptive analytics.

The employees here are ready and willing to identify new use cases and expand the usage of BI&A. This organization has an advanced state of BI&A and data is integral to all the decision making processes.

Effectiveness & usage of BI&A. This organization has observed that BI&A is effective for performance improvement in processes and capability, for example, in improved customer experience and delight, improved delivery capability. The top areas of BI&A effectiveness seen in this organization are in making better informed decisions, improved customer service and reduce operational costs.

Results of the thematic analysis

Line by line coding was done on the data collected from the interviews for all the cases. The themes that emerged after

the third iteration of coding are seen in Appendix 1. The themes which had the highest number of references and were coded in the highest number of interviews, that is; those that were repeated again and again emerged as the key characteristics as shown in Table 7.

As discussed by Eckerson (2004), each stage of maturity is defined by key characteristics. Similarly, the results from this analysis emerged as key characteristics which defined the maturity of the case organizations. The characteristics were data quality, consistency and availability, level of data analysis done in the organization, top management support, mindset and culture, use of advanced tools for BI&A, standardization of processes across enterprise, level of BI&A skills, training and upskilling and overall alignment with business strategy and goals. The level of maturity of each of these characteristics was different for each case study.

A pattern was seen in the characteristics of each cluster (see Table 7). From ‘Sitters’ to ‘Mountaineers’, the characteristics were either minimal, developing or established. This indicated a pattern in the maturity of the clusters. The ‘Sitters’ had minimal data analysis. ‘Walkers’ had minimal data analysis but top management support & mindset was slowly developing. ‘Hikers’ were developing data analysis and top management support. ‘Trekking’ were developing usage of advanced tools for BI&A, whereas ‘Climbers’ had established standard processes across the enterprise. The ‘Mountaineers’ had all key characteristics well established.

From the data collected for the case organizations, we were able to generalize inferences for organizations in each cluster. As studied and explained by Tsang (2014) in his article, generalization does not refer to ‘external validity’ or ‘induction’. He explains that ‘*In empirical research, generalization is an act of inferring from specific observed instances, such as those in a case setting to general statements*’. He argues that results of case studies can be more generalizable than those of quantitative studies in several important respects. Taking this argument forward, characteristics of each case study have been drawn out to make a generalization for the organizations in that cluster.

Sitters: Cluster-1 – They were the non-starters who have no culture of analytics. They had minimal data analysis capability and their data analysis if any, was done using excel sheets. They yet had to start building a culture of BI&A.

Walkers: Cluster-6 – They were the beginners. They had minimal data analysis with reliable data and were yet developing top management support and change in mindset of employees for using BI&A. They had to have top management support for adoption of BI&A and focus on resources for BI&A across the enterprise which enable seamless data flow between business units.

Hikers: Cluster-3 – They were the fair performers. They were found to have good quality data, analysis and reporting practices. It was found that top management had also started recognizing the need for BI&A but all this was done

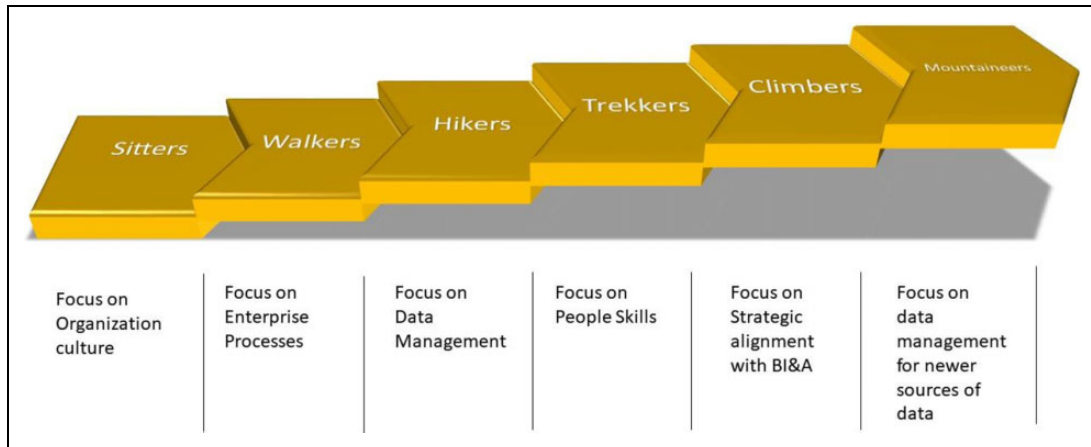


Figure 1. Roadmap for organizations.

in silos. They needed better data management for sharing across the enterprise. The data quality, consistency and accuracy for seamless flow of data across the enterprise remained a challenge in these organizations. They would do well by defining procedures, methods and tools for proper data management and sharing data across the enterprise.

Trekkers: Cluster-4 – They were average performers. They had established practices for data analysis, management and reporting and standardized processes for data sharing across business units. There was found to be a lack of people skills who would understand both – business and BI&A. One more challenge was also in adoption of latest advanced tools for BI&A. Some of the ‘Trekker’ organizations had made a good beginning and were committed to making necessary investments in BI&A as they strongly believed BI&A to be source of competitive advantage. They were seeing greater involvement of various functions resulting in good alignment. While many organizations used advanced tools like Tableau, Power BI, Teradata, SAP Hana, Oracle for managing data analysis, some organizations were found to be largely using data from excel sheets. The biggest challenge found in these organizations was finding the right talent, upgrading people skills and training for analytical skills.

Climbers: Cluster-2 – They were the good performers. They had established data analysis and reporting, top management and employees were all geared up to use data for decision making. There seemed to be standardized processes in place for data sharing and advanced tools are used for analytics. There was a central BI&A team working with different functions and business units, every function/business unit had an inclination to BI&A, however further work was needed for setting up of enterprise wide processes, standardization and alignment with centralized processes and business objectives.

Mountaineers: Cluster-5 – They were the high performers. All the key characteristics were well established in

these organizations. They were found to demonstrate a culture of data driven decision making. The analytical culture was prevalent across the organization, coming down from top management. They had a very well developed people skills pool. The BI&A team completely aligned with each business group for strategic projects. These organizations had an advanced state of BI&A and data was integral to all the decision making processes. While the ‘Mountaineer’ organizations had high levels of maturity for all six factors, the organizations in this cluster had yet to upgrade from predictive analytics to prescriptive analytics as per Gartner’s value chain model of Analytics as mentioned by Koch (2015). The respondents believed that they also need to start using real time data. For these organizations, BI&A will be more effective if they move to analyzing data on real time basis – hence exploring newer sources and types of data.

Roadmap for organizations

Based on the findings from the case organizations and on the results from cluster analysis (Table 2), we have proposed a roadmap for an organization to move to higher levels of maturity as seen in Figure 1.

As mentioned in literature review, to move from one stage 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). Therefore, to move to the next level of maturity, the focus should be to strengthen the factor having the lowest value in a given level. for example, Organization culture (OC) in the Sitters cluster has lowest value (see Table 3). This had also been validated from the case study – the Sitter organizations had no culture and mindset for BI&A. Therefore, to move to next higher level, the organizations in this cluster should focus on Organization Culture.

The suggested roadmap is as follows:

To be able to adopt and implement BI&A, the ‘*Sitters*’ will have to bring in the analytical culture in their organization. For that, top executives should consider developing Analytics capability as top priority and should give a lot of support toward building a mindset for analytics.

The ‘*Walkers*’ have 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. This includes, 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 ‘*Hikers*’ require to focus on capture of good quality data, all departments should have a strong data orientation and maintain data consistency. They should have procedures, implementation methods, tools and defined data steward roles to manage the master data.

The ‘*Trekkers*’ require a focus on people skills which include spreading awareness about the potential of BI&A and big data among employees and encouraging them to pick up new skills required for BI&A. They need to hire analytically oriented people and cultivate amateur and semi-professional analysts across the organization.

For ‘*Climbers*’, the focus should be on strategic alignment with BI&A. This includes 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.

The ‘*Mountaineers*’ 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.

5. Conclusion

This article builds on prior research for BI&A capability maturity to explore the key characteristics of organizations in the area of BI&A, the areas where effectiveness of BI&A is seen and the functions which use BI&A. The data has been collected using a questionnaire from 145 organizations in India across the manufacturing, financial services and non-financial services sectors. The organizations were grouped into six clusters using k-means clustering based on similarity of maturity of six factors. The six factors are data management, enterprise processes, people skills, organization

culture, strategic alignment with BI&A and technology & infrastructure. Data was also collected through in-depth interviews for six organizations – one from each cluster and analyzed using thematic analysis.

The findings from this study highlight several trends emerging across organizations with different levels of BI&A maturity. The clusters which had a higher maturity of the six factors had a higher usage of big data, IT budget spend on BI&A and invested in BI&A annually. Sales seemed to be the topmost area where BI&A was being used across all clusters. With the ascending order of the clusters, the number of uses cases of BI&A were seen to be increasing. Hence organizations with a higher level of maturity of BI&A capability had a higher number of BI&A use cases across functions. More than 50% of the organizations in higher maturity clusters believe that BI&A is effective in getting better access to data, making better informed decisions, improving efficiency of internal processes, reducing operational costs and improving customer service.

Based on the findings from the case organizations and on the results from cluster analysis we further suggested a roadmap to move to higher levels of BI&A capability maturity. The roadmap 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.

This study has been done across various industry sectors. Future research could look at analyzing each industry sector in depth regarding the maturity of the six identified factors to identify specific guidelines for the industry if any.

Appendix I

Themes emerging after third iteration of coding

Sr. No	Themes emerging after third iteration of coding
1	Challenges - Challenge – Data quality and accuracy - Challenge – enterprise wide penetration - Challenge to have updated tools and processes - Challenges – skill building
2	Data quality, consistency & availability - Data quality & consistency is an issue - Good quality data available
3	Dedicated resource availability - Dedicated resources for BI&A not adequate - Good resources available for BI&A - Infrastructure potential yet not optimum
4	Effectiveness and use of BI&A - BI&A Impact in functions - Enhanced operational efficiency & risk analysis - Performance improvement in processes
5	Level of BI&A skills - Lack of skilled people - Well-developed skilled people

(continued)

Sr. No	Themes emerging after third iteration of coding
6	Level of Data analysis - Data analysis in Excel sheets
7	Overall alignment with business strategy and goals - Actionable insights for business process can be better - Strategic Alignment is high between business and BI&A - Strategic alignment with BI&A developing - Strategic alignment with BI&A not seen
8	Resistance to change due to BI&A systems
9	Standardization of processes across the enterprise - Business units operate in silos - Data not shared across enterprise - Enterprise wide processes are yet developing - Tools usage fragmented in business units and functions
10	Top management support, mindset and culture - Change in mindset required for adoption of BI&A - Lack of top management support - No culture of using data driven decision making - Organizational culture for BI&A favorable - Top management support is high
11	Training and Upskilling - Big budget given for training and upskilling - Training for latest techniques needed for BI&A
12	Use of advanced tools - Advanced tools are used for BI&A - Tools are used for measuring effectiveness for BI&A

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