# Business Analytics: A Perspective

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**Abstract**

Awareness to the relevance of Business Analytics in identification of product attributes is considered significant by the market, relevance of Business Analytics in assessing factors leading to customer satisfaction, relevance of Business Analytics in Market segmentation, Market performance, relevance of Business Analytics in Finance applications and in Human Resources applications. Also a seventh construct was considered capturing the keenness of managers to incorporate Business Analytics in their company operations. Using the last construct as grouping variable, Analysis of Variance, ANOVA, was applied to assess which of the first six constructs significantly led to managers' keenness to incorporate Business Analytics in their company operations. The empirical study concluded that out of the six awareness constructs, awareness was already significant for Identification of product attributes, market segmentation issues and customer satisfaction. However, for the other three constructs, awareness was not yet significant. From the ANOVA one may conclude that awareness to: (a) Market segmentation, (b) market performance and (c) HR applications would highly significantly (2% level of significance) lead managers to incorporate Business Analytics in their company operations. The three other awareness constructs, product attributes, finance and H.R. applications do not yet lead to the keenness of managers to incorporate Business Analytics in their company operations at such high degree of confidence.

**Keywords:** Business Analytics, Managerial Decision Making.

## INTRODUCTION

In his research article, "Competing on Analytics the New Science of Winning", Thomas Davenport defines Business Analytics as "the extensive use of data, statistical, and quantitative analysis, exploratory and predictive models, and fact-based management to drive decisions and actions" (Davenport & Harris, 2007). In a similar line Business Analytics also refers to skills, technologies, applications, and practices to investigate past and current business performance to gain insight and drive business processes to more efficient and effective business planning in the future (Panda, 2013).

In a very broad perspective Business Analytics today refers to different approaches for modeling different business situations and arriving at assessing and predicting risk, predicting market preferences, project feasibility, customer segmentation, inherent and underlying dimensions in consumer preferences, factors leading to probability of purchase, preferred segments in financial and credit card industry, probability of attrition in large organizations etc.

The modeling approaches may constitute:

1. Statistical approach like logistics regression, factor & cluster analysis, Monte Carlo simulation, conjoint analysis and structural equation modeling
2. Heuristic approach, such as RFM analysis
3. Data mining approach such as CHAID. Chi-square automatic interactive detection and other classification tree approaches.

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Business Analytics can be applied to virtually any business or business process. Whether a company is dealing with a niche product, a commodity, a monopoly or a competitive market, there is huge potential for very effective analytical application. In fact, in the next few years analytics will be a very important priority in most organizations (Gartner, 2011). However, some industries are clearly more amenable to analytics than others. If a business generates a lot of transaction data such as financial services (banks, credit cards, insurance, loans), telecom, retail, travel, logistics, gaming, hospitality etc., competing on analytics is a natural strategy. (http://jigsawacademy.com).

The interest and awareness to Business Analytics have been quite a recent phenomenon in India. Even a few years back it did not have a visibility as it has today. Neither did it emerge as a field of study with a high level interest from academia as well as industry. A few large companies such as GE and American Express had started widespread applications of modeling procedures falling under Business Analytics, applying them to the huge databases they had created. All the same, though the industries were waking up to the fact that they had started creating extensive business databases which could be perhaps harnessed to help optimal decision making, was not really thinking of an entirely new field managerial decision making based and rooted on quantitative modeling, which could be termed Business Analytics.

What indeed is happening in our country today is widespread use of computers and internet and is leading to what can be called an explosion of data. Outside of the internet - retailers, telecom companies, healthcare, airlines, hotels and even the sports industry are collecting and analyzing massive amounts of data. What is most remarkable is that the world now looks at data as an opportunity ready to be handled for projection and predictions of how things will be evolving in the future (Panda, 2013).

Today most of the biggest international companies have centers in India and many Indian companies have sprung up starting to offer analytics to global clients. Analytics is one of the fastest growing segments in the KPO (knowledge process outsourcing) industry in our country. However, proper harnessing of the data has become a challenge for businesses. It is here that Business Analytics can help companies synthesize data into insights that can be applied for the benefit of the business. ( http://Jigsawacademy.com).

The myriad of modeling and other analytical approaches which constitute Business Analytical applications in Indian Industry today include predominantly:

- Predictive Modeling by Factor and Cluster Analysis
- Predictive Modeling by Logistics Regression and Discriminant Analysis
- Segmentation of primary target market by Heuristic Modeling such as RFM (recency, frequency, monetary) analysis
- Segmentation of target market based on large databases using Decision Tree approaches such as CHAID (Chi-square Automatic Interaction Detection ) and other Classification and Regression Trees
- Predicting Project Risk and Business Risk using Monte Carlo Simulation
- Predicting Linkages between unobserved constructs such as customer satisfaction and factors leading to it, using Structural Equation Modeling (SEM).

Many of the above approaches have been applied in the field of Marketing Research to analyze data collected on consumer preferences, lifestyle variables etc. However such applications have been carried out in the past in the marketing field to optimize marketing decisions. Business Analytics, on the other hand, considers applications to all managerial functions, on financial databases, HRM databases, banking databases and on overall company performance databases.

So, the potential for applying Business Analytics to databases available with companies, is relatively huge indeed. However, the awareness level to such possible applications is not widespread in the industry yet. There are some companies who have been applying these approaches already but there are many more who are aware that Business Analytics applications might be highly applicable to their databases but are not clear as to what kind of applications are appropriate.

The current paper endeavors to provide an overview of awareness to Business Analytics applications in the Industry today.

## Some Applications of Business Analytics in Industry Setting

### Predicting Probability of Delinquency by Discriminant/Logistics Regression.

Consider a company offering small and medium sized loans to help individuals to own homes in various parts of greater Chennai region. When an individual applies for a home loan, he/she is required to provide personal information based on which the company tries to find out who are the applicants who are least likely to default. To formalize this process to determine what profile for applicants can lead to delinquency and thereby not grant them any loan, the company has set up a data base, including data fields for different customer accounts, collected over a few years. They use Oracle Database to store the data of their customers.

The company has set up the database keeping in mind the 5Cs of credit management:

- Character
- Capacity
- Capital
- Collateral
- Condition

The actual database includes:

a. Borrower profile comprising various data fields pertaining to demography such as age, income group, amount of loan required, location of property for which the loan is applied for, sources of income, state of current residence ownership (whether rented, owned, mortgaged ), length of stay in current residence, etc.

b. Financial/employment profile comprising GMI, gross monthly income; and GMI Leverage/Ratio (in %) =monthly amortization/gross monthly income. The lower this ratio is, the smaller is the chance of default. Employment/business tenure, which refers to the number of years the applicant has been in the current job. In case the applicant is an entrepreneur, this refers to the number of years the applicant has run his/her business.

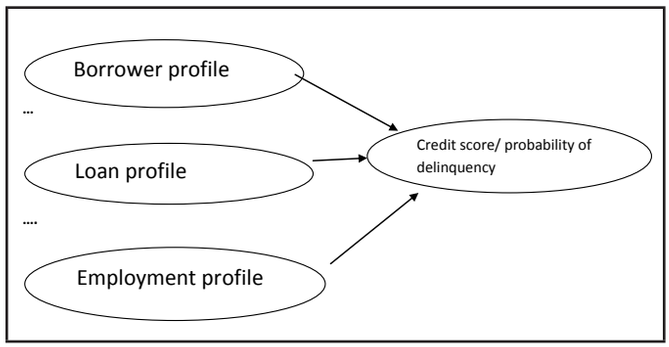
c. Loan profile comprising Loan purpose (personal or investment purpose), equity paid etc.

d. Credit profile comprising credit payment history.

Using above constructs as predictor variables and using Discriminant Analysis or Logistics Regression the company arrives at probability of delinquency and also profile of individuals who have higher propensity to be non-delinquent and also credit score which mirrors probability or propensity to be non-delinquent.

The higher the credit scores for a client the more he/she will be considered as preferred customer. Also based on the equation for credit scores, a new applicant will be assigned a credit score. If this score is high the new applicant will receive a loan of lager value and with smaller interest rate.

**Figure 1.**




### Predicting probability of Attrition by Discriminant/Logistics Regression

Consider an organization, say a contact center/BPO which has an extensive database for all employees, currently working in the organization as well as those who have left. The database includes data-fields pertaining to employee such as age, academic background, education in years, growth opportunities as perceived by employee, culture of appreciation as perceived by employee, training received by employee in months, salary/benefits received by employee etc. Using discriminant or logistics regression the company can determine the probability that the employee will leave the organization or the probability that the employee will stay on. This can be computed for each employee and based on such a probability a "loyalty score" may also be determined. The higher the Loyalty score the more will be the probability that the employee will stay on in the organization. Thus the Loyalty score would help the company to determine the preferred employee segment in an organization.

## Predicting Preferred Segment in the Customer Base by RFM

Consider a company engaged in manufacturing and selling specialty ayurveda (herbal) products through different marketing efforts involving a variety of channels including media advertising such as TV, magazines, newspapers, billboards and posters on DTC/ private buses and lamp posts.

The ayurvedic herbal products dealt with by the company include ayurvedic medicines, ayurvedic cosmetics, herbal oil, herbal shampoos, ayurvedic slimming medicines, and ayurvedic drug formulations. Based on customer vouchers maintained by the company a simple database has been set up with fields as follows.

**Table 1.**

| *Customer Identification Number:* |
|---|
| Name : |
| Address : |
| (X1) Month last purchased from company (R) |
| (X2) Total number of times customer purchased from company over last 5 years (F) |
| (X3) Total amount of money spent on company products over the last 5 years (M) |
| (X4) Total amount spent on Ayurvedic pain relieving oils over last five years |

Then using the Heuristic approach of RFM Analysis as implemented by using the variables above, the company can categorize its customer base into most preferred customers, not-so-preferred customers, least preferred customers, and so on. The most preferred customers may also be looked upon as most likely buyers (MLB) etc.

## Assessing Project Risk by Monte Carlo Simulation using Crystal Ball

A Textile company wishes to set up a subsidiary to export garments to different countries in East Asia. The company expects the sales revenue to grow in the future years at a mean rate of 5% per year with the growth rate each year determined randomly based on a normal distribution with mean 5% and standard deviation of 1%. Thus growth rate is different for different years, generated from the Normal distribution. Sales revenue in year1 is estimated at Rs. 120,000 and operating expenses is a certain percentage of sales revenue.

The initial investment is determined to be Normal with known mean and standard deviation. Using Monte Carlo simulation and using Crystal Ball, the company can determine the mean and standard deviation of IRR, the probability distribution of IRR and the probabilities such as IRR > 20%, probability (18% <=IRR <=24 %). etc.

## Predicting the Profile of people Supporting Political Candidate Using CHAID

Suppose, in a certain year a very powerful and influential Political Figure was charged on issues in moral corruption. More than 300 MPs were asked to vote Guilty or Not Guilty on him.

After the case was over the following database was available containing data fields pertaining to the profiles of MPs. MP's ID, age in years, education in years, sex, number of cars owned by senators, alignment to political party (Party 1 or Party 2) having degree of lineage to conservative theme or liberal, as perceived by general public, percentage of votes obtained by the Political Figure in MP's home state etc. Upon carrying out CHAID analysis the classification tree as below was obtained, which helped to identify the profile of MPs who voted Guilty to the Political Figure.

The tree above concluded that senators belonging to Political Party 2, having a high degree of conservatism and having age less than or equal to 63 years were most prone to vote Guilty to the Political Figure.

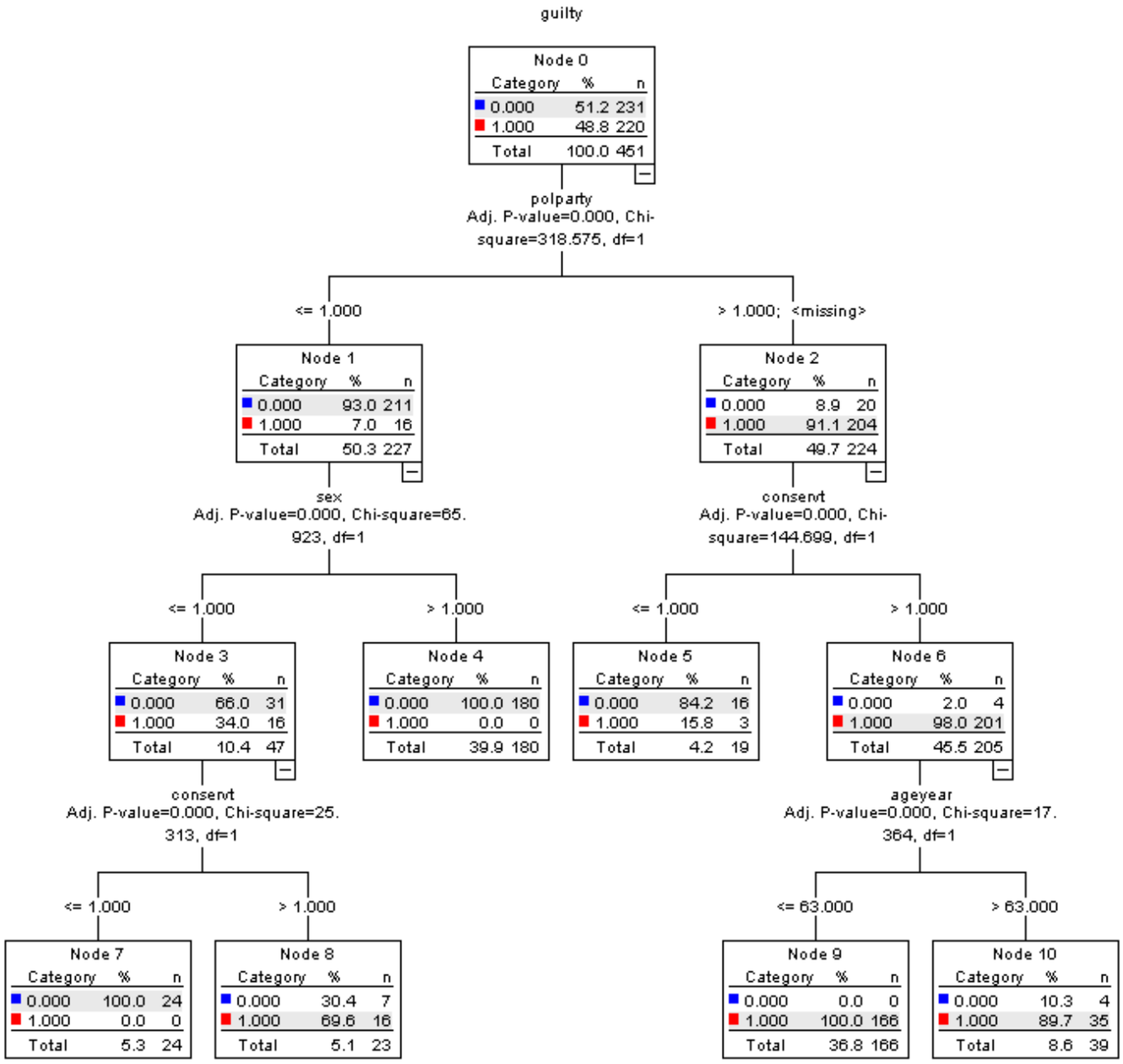
## Predicting the Factors Leading to Customer Satisfaction in Banking Service

There may be different approaches to determine critical factors affecting customer satisfaction in a banking sector. However structural equation modeling, SEM provides a very appropriate approach towards the determination of such factors using composite variables called latent constructs or unobserved variables.

Predicting Linkages between Unobserved Constructs such as Customer Satisfaction and Factors Leading to it, Using Structural Equation Modeling (SEM)

This is an analytical approach where we study the linkages between unobserved variables or latent variables/ constructs and observed variables or manifest/indicator

**Figure 2.**




variables which constitute the unobserved variables. The unobserved variables are equivalent of factors in Factor analysis and each such variable may have multiple indicator variables. The model comprising the linkages between the unobserved variable and the indicator variables, which constitute it, is called the measurement model. The model comprising the linkages between different unobserved variables is called the structural model (Hair et al., 2007; Joreskog et al., 1993). In the simplistic example relating to customer satisfaction in banking industry we consider three unobserved latent variables, such as follows:

1. Availability of service
2. Professionalism
3. Overall satisfaction with service.

The manifest/indicator variables are:

### Availability of Service

The financial consultant was available to work with me at a good time

My appointment with the financial consultant was at a convenient time

### Professionalism

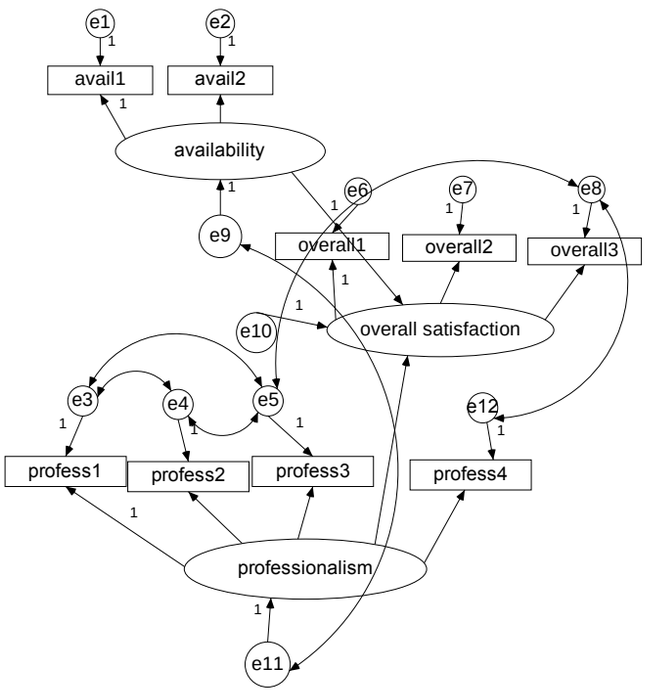
The teller talked to me in a pleasant way

The teller had a professional appearance

The teller carefully listened to what I had to say

The teller knew how to handle the transaction

**Figure 3.**




### Overall Satisfaction with Service

The quality of the way the teller treated me was high The way the teller treated me met with my expectation I am satisfied with the way teller treated me.

With the variables above, SEM provides an overall structural model where the significant linkages between the constructs are obtained. Of course the indicators of model fit and their significances are considered first. Thereafter the critical ratio associated with each proposed link is evaluated. For any link if critical ratio > 1.96, the link is considered significant. In the above model the link between availability of service and overall satisfaction emerged as not significant. But the link between professionalism of service and overall satisfaction came out to be significant, leading to the conclusion that it is professionalism of service which leads to overall customer satisfaction in banking industry.

## An Empirical Assessment of the Awareness to Relevance of Business Analytics in India Today

As mentioned earlier India has become one of the global hubs of Business Analytics. All the same, though there are many companies are applying and making effective use of Business Analytics approaches, there are still the greater percentage of companies who still need to get awareness as to what Business Analytics can do for them and how they could harness its potential to optimize their business decision making.

To arrive at an idea as to what is state of awareness to Business Analytics in Industry today an empirical study was conducted with a survey questionnaire as research instrument. The sampling frame constituted managers at different levels in Indian organizations. The survey questionnaire is given in the appendix. The survey questionnaire constituted the following entities.

### Demographic Section on:

a. Respondent: Age, Income level, Educational level, Occupation.
b. Company the respondent is affiliated to: Years of operation, size of the company in terms of number of employees, the industry the company is operating in, annual turnover, whether company has customers abroad.

### Awareness to the relevance of Business Analytics in Company Operations in India

Here the respondent was asked to rate his/her level of awareness on the following items under *six constructs* below on a 4 point Likert scale (not aware, little aware, aware, very aware.

**Table 2.**

| *construct* | *mean* | *standard deviation* | *t-value* | *significance* |
|---|---|---|---|---|
| product attribute | 2.922414 | 0.534954305 | 4.252266 | Significant |
| market segmentation | 2.836957 | 0.685104072 | 2.358746 | Significant |
| customer satisfaction | 2.862069 | 0.538348749 | 3.621818 | Significant |
| market performance | 2.57931 | 0.593644501 | 0.719453 | not significant |
| finance application | 2.258621 | 0.714901213 | -1.81825 | not significant |
| HR application | 2.293103 | 0.691365644 | -1.61155 | not significant |
| keen to incorporate | 2.586207 | 0.609727186 | 0.761387 | not significant |

## Company Product and Attributes

The items considered were:

a. Awareness that Business Analytics can identify attributes which are considered significantly important by the target market.

b. Awareness that Business Analytics can identify attributes which are considered significantly satisfactory by the target market.

c. Awareness that Business Analytics can help entrepreneurs to predict the market acceptability and performance of the product/service they are offering.

d. Awareness that Business Analytics can identify attributes which lead to willingness to buy.

## Customer Satisfaction

- Awareness that Business Analytics can identify factors leading to customer satisfaction in a company
- Awareness that Business Analytics can improve customer satisfaction in a company
- Awareness that Business Analytics can develop indicators for benchmarking customer satisfaction factors within the industry vertical

**Table 3.**

ANOVA

| | | *Sum of Squares* | *df* | *Mean Square* | *F* | *Sig.* |
|---|---|---|---|---|---|---|
| Product | | | | | | |
| Attributes | Between Groups | 2.001 | 3 | .667 | 2.774 | .062 |
| | Within Groups | 6.012 | 25 | .240 | | |
| | Total | 8.013 | 28 | | | |
| Market Seg. | Between Groups | 4.174 | 3 | 1.391 | 4.297 | .018 |
| | Within Groups | 6.152 | 19 | .324 | | |
| | Total | 10.326 | 22 | | | |
| Customer | Between Groups | 1.909 | 3 | .636 | 2.563 | .077 |
| | Within Groups | 6.206 | 25 | .248 | | |
| | Total | 8.115 | 28 | | | |
| Market | | | | | | |
| Performance | Between Groups | 4.072 | 3 | 1.357 | 5.854 | .004 |
| | Within Groups | 5.796 | 25 | .232 | | |
| | Total | 9.868 | 28 | | | |
| Finance | Between Groups | 3.154 | 3 | 1.051 | 2.356 | .096 |
| | Within Groups | 11.156 | 25 | .446 | | |
| | Total | 14.310 | 28 | | | |
| HR | Between Groups | 6.049 | 3 | 2.016 | 6.872 | .002 |
| | Within Groups | 7.335 | 25 | .293 | | |
| | Total | 13.384 | 28 | | | |

### Market Performance

- Awareness that Business Analytics can help predict the probability of purchase
- Awareness that Business Analytics can help predict the future market share of an existing product or a new product
- Awareness that Business Analytics can help predict the market performance of a new product
- Awareness that Business Analytics can develop a strategic perceptual map of different brands operating in the market
- Awareness that Business Analytics can assess competition and compare existing competitors operating in the market.

### Market Segmentation

- Awareness that Business Analytics can identify preferred customers in a company
- Awareness that Business Analytics can identify most likely buyers ( MLB) in a company
- Awareness that Business Analytics can identify most valuable customers in a company
- Awareness that Business Analytics can help direct marketing or promotional campaign in identifying a primary target market to as to enhance the response rate.

### Finance Application

- Awareness that Business Analytics can help to determine probability of delinquency in banking, loan and other financial institutions.
- Awareness that Business Analytics can help to determine probability of fraud in credit card industry
- Awareness that Business Analytics can help to develop credit scores in banking, credit card and loan extension industry
- Awareness that Business Analytics can help improve the profitability of companies

### H.R. Applications

- Awareness that Business Analytics can help identify the profile of employees who might tend to leave
- Awareness that Business Analytics can develop loyalty scores for employees in organizations
- Awareness that Business Analytics can help decrease attrition of good employees in organizations.
- Awareness that Business Analytics can determine factors leading to employee dissatisfaction in organizations.

In addition to awareness the respondent was also asked to give his/her rating on a 4-point scale on how keen/eager is the respondent that his/her company should incorporate Business Analytics in the operations (not keen, little keen, keen, very keen).

The items included were:

- Keen to Incorporate Business Analytics in company operations
- Keen to arrange in-house training on Business Analytics to develop skills on Business Analytics
- Keen to invite industry experts to come and give seminars On Business Analytics in the company
- Keen to set up Business Analytics committees to propagate Business Analytics culture in the company.

## Results From Empirical Analysis

### Awareness to Relevance of Business Analytics

Based on the responses obtained from the survey the mean scores and the associated standard deviations were computed. Also the mean scores etc. were calculated for the constructs as awareness to relevance of Business Analytics to help in Company Product and attributes, customer satisfaction, market segmentation, market performance, HR applications, finance applications and keenness to Incorporate Business Analytics in company operations.

The following table gives the mean scores and associated t-values for the constructs:

For identifying which possible awareness constructs would lead managers to incorporate Business Analytics in their company operations a one-way ANOVA, Analysis of Variance was applied. The grouping variable, willing 4, was created as a 4-point discrete variable, emerging from

**Figure 4.**

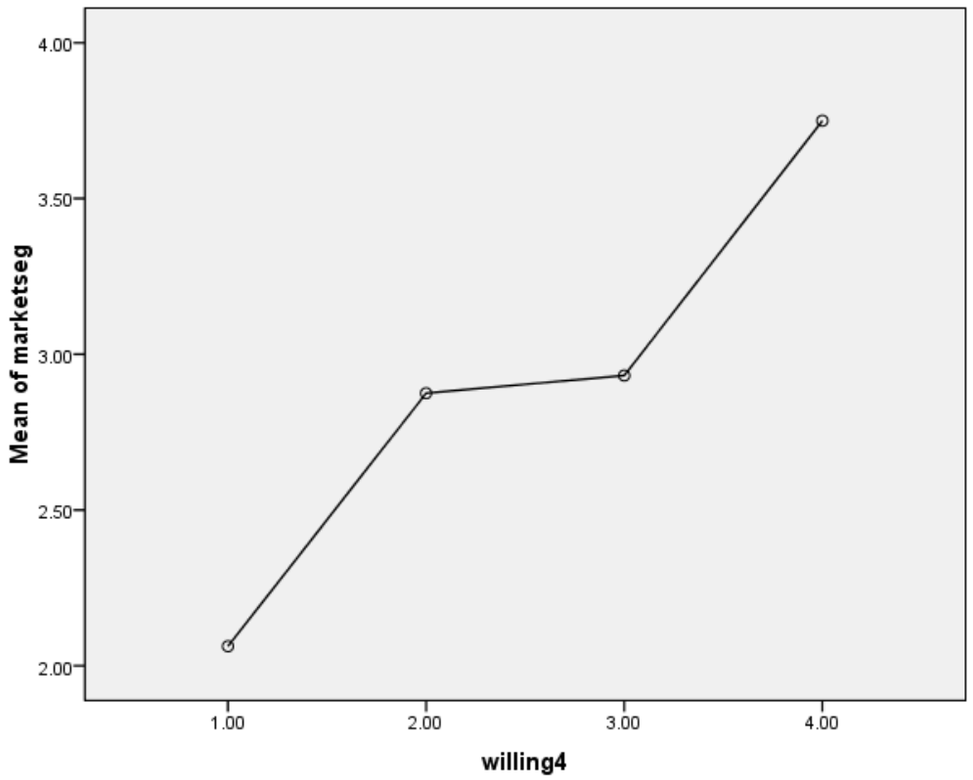



**Figure 5.**

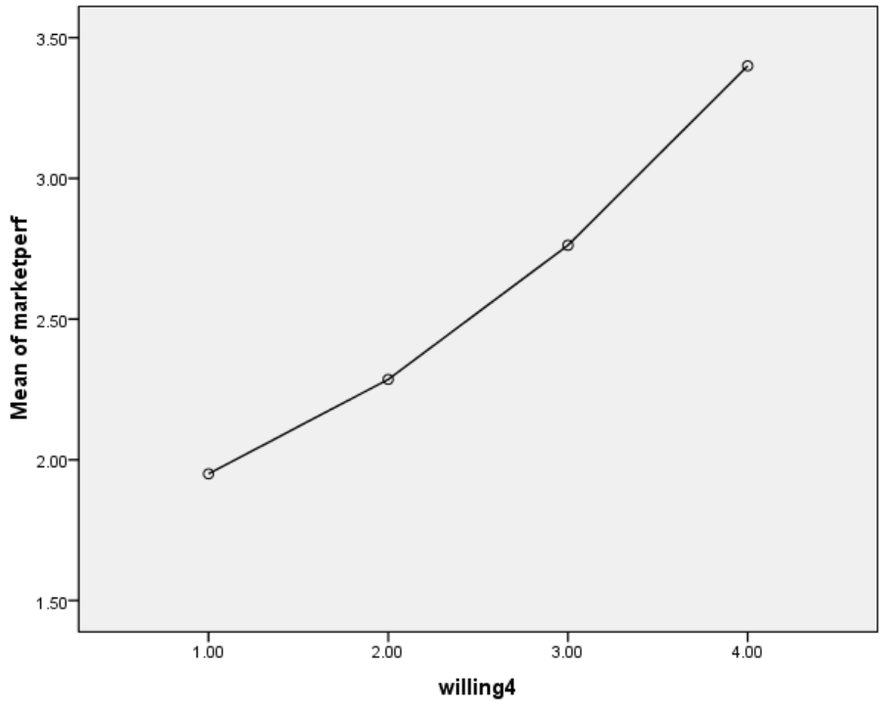
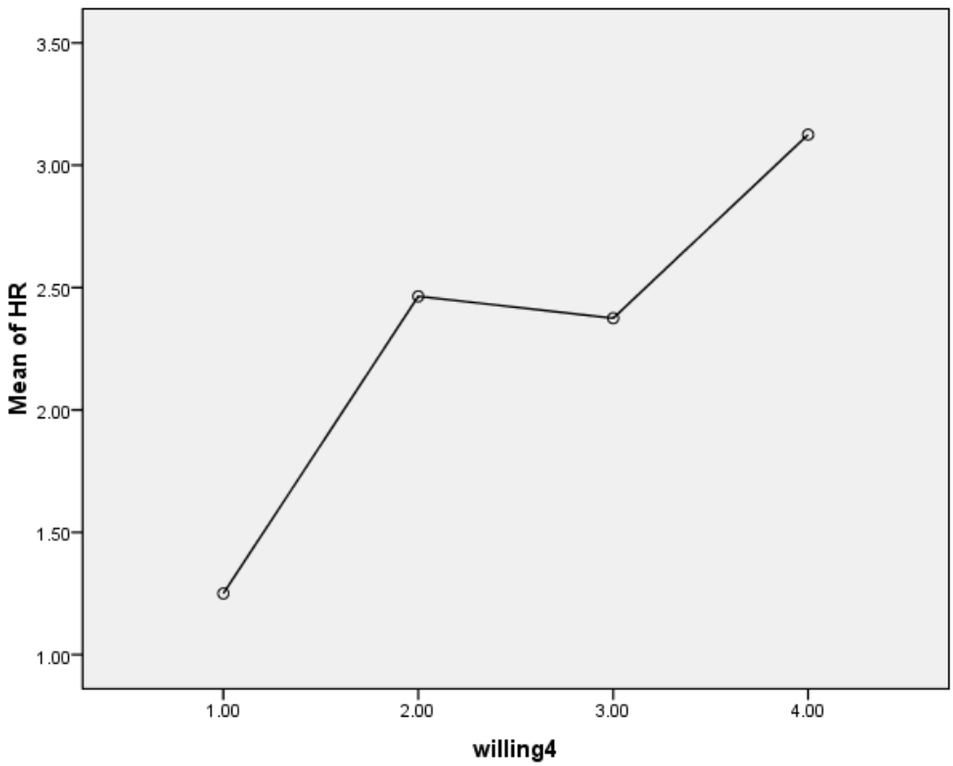


**Figure 6.**




the construct, keenness to incorporate Business Analytics by Indian managers.

The following table provides the F-values and their significance:

The construct awareness to market segmentation, market performance and HR applications emerge significant at 5 % level of significance whereas product attributes, customer satisfaction and finance applications are significant only at 10 % level of significance.

This result leads to the conclusion that:

a. Awareness to the Possibility of Business Analytics applications in Market segmentation, market performance and HR applications would significantly lead managers to incorporate Business Analytics in their company operations.

b. Awareness to the Possibility of Business Analytics application in identification of product attributes, customer satisfaction and finance applications do not lead managers to incorporate Business Analytics in their company operations yet.

The following means plots graphically demonstrate some of the results as obtained in ANOVA.

## Conclusions

In conclusion to the empirical research one observes that:

1. Out of the six awareness constructs demonstrating awareness to possibility of Business Analytics applications, there is significant awareness already for identification of product attributes, market segmentation issues and customer satisfaction. This conclusion emerged from significance testing.
2. Out of the six constructs, it emerges that the three constructs such as awareness to the possibility of Business Analytics applications in (a) market segmentation, (b) market performance, and (c) HR applications would significantly (2% level of significance) lead managers to incorporate Business Analytics in their company operations.
3. Awareness to the Possibility of Business Analytics application in (d) identification of product attributes, (e) customer satisfaction, and (f) finance applica-

tions do not lead managers to incorporate Business Analytics in their company operations yet.

## RECOMMENDATIONS EMERGING OUT OF EMPIRICAL ANALYSIS

Given the immense possibilities of using Business Analytics applications to enhance managerial decision making in Indian organizations, the empirical research leads one to conclude that awareness to such possible applications does indeed lead managers to incorporate Business Analytics in their respective company operations. Thus for ensuring greater effectiveness in managerial decision making:

(a) Business Schools should try and promote inclusion of Business Analytics in their curriculum which would enhance awareness.

(b) In addition to that, seminars may be organized by Business Analytics experts to promote awareness amongst industry professionals as well as individuals.

(c) Finally, academic journals and industry magazines should encourage authors to write research papers and articles on Business Analytics, both from theoretical as well as application perspectives to educate industry and managers regarding how Business Analytics can help companies achieve greater efficiency, cost effectiveness competitiveness, and improved profitability and productivity.

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## THE SURVEY QUESTIONNAIRE

### Demographic Section on:

a. Respondent: age, income level, educational level, occupation.

b. Company the respondent is affiliated to: years of operation, size of the company in terms of number of employees, the industry the company is operating in, annual turnover, whether company has customers abroad,

Awareness to the Relevance of Business Analytics in Company Operations in India

Here the respondent was asked to rate his/her level of awareness on the following items under *six constructs* below on a 4-point Likert scale:

NA = not aware

LA = little aware

A = aware

VA = very aware

### Company Product and Attributes

Question: How aware are you that Business Analytics can

- Identify attributes which are considered significantly important by the target market
- Identify attributes which are considered significantly satisfactory by the target market
- Help entrepreneurs to predict the market acceptability and performance of the product/service they are offering.
- Identify product attributes which would lead to willingness to buy

Customer satisfaction

- Identify factors leading to customer satisfaction in a company
- Improve customer satisfaction in a company
- Develop indicators for benchmarking customer satisfaction factors within the industry vertical

Market performance

- Can help predict the probability of purchase
- Can help predict the future market share of an existing product or a new product
- Can help predict the market performance of a new product
- Develop a strategic perceptual map of different brands operating in the market
- Can assess competition and compare existing competitors operating in the market

Market Segmentation.

- Identify preferred customers in a company
- Identify most likely buyers (MLB) in a company
- Identify most valuable customers in a company
- Help direct marketing or promotional campaign in identifying a primary target market so as to enhance the response rate.

Finance Application

- Can help to determine probability of delinquency in banking, loan, and other financial institutions.
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H.R. Applications

- Can help identify the profile of employees who might tend to leave
- Develop loyalty scores for employees in organizations
- Help decrease attrition of good employees in organizations.
- Determine factors leading to employee dissatisfaction in organizations.

In addition to awareness the respondent was also asked to give his/her rating on a 4-point scale on how keen/eager the respondent is that his/her company should incorporate Business Analytics in the operations.

NK = not keen

LK = little keen

K = keen

VK = very keen

**Incorporate Business Analytics**

Here the question asked was:

How keen are that your company should

- Incorporate Business Analytics in company operations
- Arrange in-house training on Business Analytics to develop skills on Business Analytics
- Invite industry experts to come and give seminars On Business Analytics in the company
- Set up Business Analytics committees to propagate Business Analytics culture in the company.