

RATIONALIZATION OF PRODUCTIVITY OF INFORMATION TECHNOLOGY THROUGH BUSINESS VALUE

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PURPOSE

TO ascertain impact of IT in creation of employee value, customer value, shareholder value, and managerial value as a part of business value which in turn increases the overall productivity and profitability in organizations.

Design/Methodology/Approach: The primary data used in the following research have been collected from over 200 Indian organizations through Ministry of Statistics and Program Implementation. While the managerial and shareholder value data were calculated, the employee satisfaction and customer value data was originally collected as a part of surveying program by the Ministry with questionnaires having appropriate level of acceptance for empirical analysis. For the analysis, simple linear model is used based on the linear regression relation in each of the four hypotheses.

Linear regression is an approach to the linear model which aims in establishing relation between scalar dependent variable (namely Y) with an independent variable X. As only one independent variable is present, linear regression is being used instead of unified multiple regressions. Linear regression equation is given by $y = ax+c$ where y is the measured variable or regress, and c is numeric constant. For classification of data and tests of correlation, mean, mode, variance and standard deviation of the datasets has been found.

Findings: The present empirical analysis supports the previous researches and propositions that IT generates customer satisfaction as well as investment or shareholder value. However, it contradicts the productivity paradox which stated that employee satisfaction has decreased by significant levels after the implementation of IT.

Research Limitations/Implications: Thus, according to our empirical research and analysis, implementation of IT with an aim to attract investment and produce quality products while maintaining employee goodwill generates huge business value, and increases the productivity of the organization. Thus, business value should be considered as a crucial determinant of productivity through IT.

Practical Implications: The correct implementation and intelligent application of the available IT resources can surely revolutionize the technology based world in this globalization era. However, the key factors always need to be taken under consideration so that, the development takes place in the

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right direction. Business value generation with IT aims to achieve sustainable development of the organization along with its employees, shareholders and customers.

Originality/Value: The paper provides evidence of contribution of IT in generation of business value. The research has included key performance indicators such as employee value, customer value, shareholder value and managerial value as a part of business value for the purpose of determining whether or not they are influenced by IT. It also provides important insights to the decision makers to visualize IT in the appropriate dimensions of overall productivity.

Key Words: Information Technology, Business Value, Productivity, Customer Value, Employee Value.

Introduction

The business value of IT has been a topic of debate since many years and has perplexed researchers and managers ever since. As the digital era began and the IT came in the play, various organizations started investing in the field in order to make a breakthrough and revolutionize the industry through higher productivity. However, even after the undying efforts and heavy investments made, it has been noticed that the benefits haven't been materialized, and productivity of the organizations has fallen sharply, as stated in the 'productivity paradox' (Brynjolfsson, 1993). This paves way for reasonable doubts on the productivity estimations of implementation of IT. This research paper attempts to point to the right direction so that, the inconclusive debates and contradicting researches can be concluded.

In context to the current analysis and previous successful studies, there has been no definitive conclusion made with respect to the relationship between productivity of organization through business value using IT. The productivity of industry through business value and implementation of IT have been subjected to various researches and empirical studies but none has been successful in reaching a definite conclusion due to lack of latest compiled data or appropriate use of the selected regression model for the empirical analysis.

Business Value has been described as a 'vague term' which is not considered as an important factor for decision making by the policy makers of organizations. According to the management theory, all the values and factors which determine the future well-being and health of the organization have been broadly classified under the term 'business value'. Thus, business value does not remain limited to the economic value, investments and financial growth of the organization. Any factor that contributes to the well-being and development of the organization can be considered as a potential business value. In industry, business value expands to cover various sub factors such as, the customer value, shareholder value, partner value, employee knowledge, societal value, managerial value, and supplier value. (Devraj, & Kohli, 2001).

The most important business value sub factor is the customer value. Customer Value is most important aspect of consumption process. Customer Value for any organization is measured in terms of final utilities, end product specifications, quality and customer satisfaction (Parasuraman, & Grewal, 2000). For an organization in the industry to create successful customer value, the management needs to make sure that the end product is a high end quality product that provides ease of functioning as well as serves the purpose. Without appropriate customer value, an organization might not be able to proceed and gain profits or investments for future projects.

Shareholder value is calculated for public trading organizations as a part of capitalization. Distribution of profits increases the shareholder value while issuing of new stocks decreases it. The shareholder value as an aspect of business value depends on the customer value (Anderson, Fornell, & Mazvancheryl, 2004). As the organizations continue to make strategic implementation of technology and ensure quality while providing utility, the customer satisfaction increases, making way for the interest and reliability of the investors in the organization.

The value of business relationships helps in evaluation of partner value. Partner value is a driving factor in the productivity as production activities come to a halt when partner value diminishes. This factor is not always considered in all the organizations as it stands valid only when the organization is being co-owned by a group of individuals or an organization. Thus, even though it is a part of 'business value', the following research excludes the role of partner value generated by IT.

Managerial value determines the certainty of strategic decisions being made for implementation of IT for production activities and well-being of the organization (Barney, 1986). The management of the organization takes specific steps and decisions in the times of uncertainty in order to achieve best results for the organization. In IT domain, managerial value as an aspect of business value created is increased with successful strategic decisions for implementation of IT leading to higher productivity and profitability of the organization (Brynjolfsson, & Hitt, 2001)

The scope of business value no longer remains confined to the economic value and profitability but as they are crucial to the development and well-being of the organization, they can't be neglected. The extent to which the organization would make profits is a driving factor for investments made by both public and private investors, paving way for better and quicker production activities which finally leads to increased productivity (Mooney, Gurbaxani, & Kraemer, 1996). Thus, the possible economic value of the project and the managerial value created from the previous technology endeavors increase shareholder value and employee. But as it has already been concluded that economic value or investment value of the project creates business value and increases productivity (Bowman, & Hurry, 1993) in IT domain, the same has not been considered for the empirical analysis in this research paper.

Productivity of an organization using IT depends on various factors such as, the employee satisfaction, investment and financial aid, organizational factors, management factors, government policies, etc. (Emrouznejad, Parker, & Tavares, 2008). 'Business value' however, has not yet been confirmed as an organizational determinant of the productivity of the industry (Brynjolfsson, & Shinkyu, 1996).

Business value of IT in the modern era is not a definitive term itself and neither is its scope. The major contributor in the creation of business value through IT is the relationship of IT with the organizational structure, strategies and business processes. The alignment of IT with these factors at higher levels can be achieved with total integration of performance metrics, organizational design, business architecture, enterprise architecture, process design and management (Short, & Davenport, 1990). As there is a lot of debate on the exact scope and definition of the term, 'business value' is considered nothing more than a recurring term used by academicians, data analysts and aiding organizations. The role of business value in effective decision making for shaping the policies of industry in the current time is negligible because policy makers regard it as more of a distraction, than a permanent considerable determinant of organization's productivity.

This research paper therefore, aims to shed more light on the importance of business value generated by implementation of IT in increasing productivity of an organization.

Development of Hypothesis

Organizational performance depends on the expenditure done on successful operation and implementation of IT (Bartel, Ichniowski, & Shaw, 2005). Even though many researches confirmed the statement, none of them successfully concludes or points that IT creates business value which directly affects the productivity of the organization. As mentioned earlier, business value is no longer limited to the scope of economic value and profitability of the project or organization. This is the reason why other factors such as, the customer satisfaction, shareholder and investment value, organizational and business design as well as the employee satisfaction have been counted as relevant factors in the measurement of created business value. On the basis of the role of IT in creating these factors, suitable hypotheses

have been formed for tests. The mentioned factors of business value tend to effect the productivity of an organization and thus, they can be termed as suitable 'productivity determinants'.

Customer Value: Customer Value is an important determinant in policy shaping and decision making process of Industry (Gale, & Wood, 1994). The final value or utility, the organizations are providing to customers through IT serves as a major factor in getting future business opportunities (Smith, & Colgate, 2007). Thus, regardless of the scale of consumer organization (individual or business), customer satisfaction and the final quality of the product dominate the profitability of an organization using IT (Slater, & Narver, 2000). Considering standardization and customization of the products to suit the needs of the customers, organizations may strive to improve their customer value in order to get more business from their established consumer base. IT assists in better client handling and finishing for high end-quality (Mahmood, Burn, Gemoets, & Jacquez, 2000). As customer satisfaction comes from IT implementation, it results in productivity and profitability. Hence, we hypothesize- *'IT has a positive effect on creating Customer Value.'*

Employee Value: Employees have been regarded as the greatest assets to an organization, especially in the industry where machines have to be guided by individuals with sound technical knowledge, and projects need to be managed by competent managers (Hitt, & Brynjolfsson, 1996). Thus, the knowledge of an employee about the project plays a crucial role as the reporting communication of the project remains transparent and quick. Also, it has been observed in previous studies that the employee productivity of an organization decreases in case of no satisfaction. However, this comes in contradiction of the stated productivity paradox according to which the productivity with implementation of IT has fallen and has not increased (Brynjolfsson, 1993). This paves way for another hypothesis- *'IT has a positive effect on creating Employee Value.'*

Shareholder Value: For investments in industry, the previous profitability of the organization is studied by both the private investment parties and the public consumers. If the organization using IT has been successfully launching products in the market and has received acclamations through quality and customer value and satisfaction, the dividends augment the value of the shares as the profit is distributed among the share-holders (Melville, Kraemer, & Gurbaxani, 2004). However, if the organization lacks the resources and does not possess adequate capital to start the project, the business value tends to fall and the productivity of the organization using IT decreases drastically as the production activities cease. This compels the organization to issue new stocks in the market, which decreases the shareholder value. As the investments as well as the available capital from IT implementation dominate the production activities in the industry, hypothecation of the following is done - *'IT has a positive effect on creating Shareholder Value.'*

Managerial Value: The organization structure of any organization is of the utmost importance for better functioning and report communication for verifications (Allen, 1986). It is the duty as well as the responsibility of the managerial level employees to make sure that the people are given first priority over any other aspect. The upper level management is solely responsible for the policy making as well as the business design and plans which result in higher productivity (Karimi, Somers, & Gupta, 2001). Thus, not only do they have to manage the project, but they also need to pay special attention towards the management of resources. The level of implementation of IT as well as the block of capital; all depends on the decision of the management. For effective and efficient run in the production sector, the managerial value of the project or the organization should be high. This paves for another hypothesis that *'IT has a positive effect on creating Managerial Value.'*

Methodology

For investigation of business value and the relationship it has with the level of implementation of IT, the approaches mentioned in the above section are applied to given data set. With the investigation, the

approaches and sub factors of business value can be examined and interrelation be established. This strategy of investigation will focus on the relation between IT and business value factors which determine productivity.

The primary data used in the following research has been collected from over 200 Indian organizations through Ministry of Statistics and Program Implementation. While the managerial and shareholder value data were calculated, the employee satisfaction and customer value data was originally collected as a part of surveying program by the Ministry with questionnaires having appropriate level of acceptance for empirical analysis. The primary data used in the research has been compiled and shown in the appendix (Table No. 1, 2, 3, 4 and 5). For the analysis, simple linear model is used based on the linear regression relation in each of the four hypotheses.

Table No. 1: Implementation Extent of IT

IT Implementation Extent			
S. No.	Year	Organization Quarter	IT Implementation extent
1.	2007	1	48.87
2.	2007	2	41.34
3.	2007	3	42.45
4.	2007	4	45.52
5.	2008	1	51.35
6.	2008	2	52.57
7.	2008	3	41.21
8.	2008	4	41.77
9.	2009	1	42.47
10.	2009	2	46.89
11.	2009	3	47.53
12.	2009	4	41.32
13.	2010	1	40.41
14.	2010	2	43.94
15.	2010	3	45.31
16.	2010	4	46.1
	Average=		44.94063

Table No. 2: Customer Value

Customer Value Index		
S. No.	Year	Index
1.	2007	94.3
2.	2008	97.6
3.	2009	95.2
4.	2010	96.1
	Average=	95.8

Table No. 3 Employee Value

Employee Value Index		
S. No.	Year	Index
1.	2007	94.8
2.	2008	97.61
3.	2009	98.24
4.	2010	95.6
	Average =	96.5625

Table No. 4: Shareholder Value

Shareholder Value Investments in INR (Billions)		
S. No.	Year	Index
1.	2007	86.89
2.	2008	87.4
3.	2009	89.13
4.	2010	93.55
		89.2425

Table No. 5: Managerial Value

Managerial Value		
S. No.	Year	Index
1.	2007	82.59
2.	2008	85.73
3.	2009	88.47
4.	2010	90.3
		86.7725

Linear regression is an approach to the linear model which aims in establishing relation between scalar dependent variable (namely Y) with an independent variable X. As only one independent variable is present, linear regression is being used instead of unified multiple regressions. Linear regression equation is given by $y = ax+c$ where y is the measured variable or regress, and c is numeric constant.

For classification of data and tests of correlation, mean, mode, variance and standard deviation of the datasets is found.

Average = Sum of Observations/Total number of Observations

The following method was used in Microsoft Excel = Average (number) to calculate the averages of each of the datasets. After this, the standard error, median, mode and the standard deviation along with the variance is calculated from the statistical formulae.

Next using SPSS Analysis, we have calculated Descriptive Statistics of each dataset, as recorded in the Appendix.

Correlation tests were done to check the dependency of two variables. Sample correlation covariance is denoted as -

$$r = \frac{\text{Cov}(x,y)}{\sqrt{s_x^2 * s_y^2}}$$

where Cov (x,y) is the covariance, given by the formula

$$\text{Cov}(x, y) = \frac{\Sigma(X - \bar{X})(Y - \bar{Y})}{n - 1}$$

The value of the test lies between -1 and 1. If the value is highly positive, the dependency is present whereas negative value of the correlation coefficient denotes that no dependency is present between the two variables.

After the calculation of these values, the t-tests were performed for each of the four null hypotheses to check their validity.

$$t = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

The value μ_0 is the mean of the population, \bar{x} is the sample mean whereas s is standard deviation and n is sample size. After calculation of t value, corresponding p-value can be found from the t-distribution table of values. If p-value is less than chosen threshold according to level of significance (0.05 in our analysis), then the suggested null hypothesis is rejected else accepted.

The Results have been discussed in the following section.

Results and Discussions

From the evaluated datasets, following results are recorded and discussed-

- **Standard Deviation:** Volatility of the extent of implementation of IT is low with customer value as well as shareholder value. The low standard deviation indicates that the data points tend to be very close to the mean; high standard deviation indicates that the data points are spread out over a large range of values.
- **Sample Variance:** The data points for implementation of IT, customer satisfaction and employee satisfaction have small variation, indicating that the data points are close to mean and each other. Whereas, the variation of data points with high variation are very much spread out from its mean and from each other.

These form the secondary data and have been shown in the Tables No. 6 and 7.

Table No. 6

IT Implementation Extent		Customer Value		Employee Value	
Mean	44.94	Mean	95.8	Mean	96.5625
Standard Error	0.90	Standard Error	0.4	Standard Error	0.37
Median	39.23	Median	80.4	Median	79.54
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	1.70	Standard Deviation	3.19	Standard Deviation	2.9781
Sample Variance	5.2	Sample Variance	7.9553	Sample Variance	7.8382

Table No. 7

IT Implementation Extent		Shareholder Value (Economic investment in Billion)		Managerial Value (Organizational Value from Design)	
Mean	44.94	Mean	89.2	Mean	86.7725
Standard Error	0.90	Standard Error	0.3842	Standard Error	0.3779
Median	41.23	Median	88.9264	Median	84.0342
Mode	#N/A	Mode	#N/A	Mode	#N/A
Standard Deviation	1.70	Standard Deviation	2.76	Standard Deviation	3.0462
Sample Variance	5.2	Sample Variance	7.9553	Sample Variance	7.8969

The next test involves the correlation test in the linear model for regression. The correlation test results are discussed below-

- Correlation between IT implementation and Customer Value:** The variables IT implementation level and customer value are positively correlated having a degree of correlation around 0.889 indicating a high degree of correlation. Therefore, a 1% change in customer value results in 88.9% change in level of implementation of IT. Implying every customer that the organization manages to satisfy increases the use of its IT resources and its implementation by 88.9% for the future projects and endeavours.

$$-1 \leq 0.889 (R) \leq 1$$

- Correlation between IT implementation and Employee Value:** The variables IT implementation level and employee value are positively correlated having a degree of correlation around 0.83 indicating a high degree of correlation. Therefore a 1% change in employee value results in 83% change in level of implementation of IT. Implying one employee needs 83 IT resources of the organizations to work for him/her.

$$-1 \leq 0.830 (R) \leq 1$$

- Correlation between IT implementation and Shareholder Value:** The variables IT implementation level and shareholder value are positively correlated having a degree of correlation around 0.801 indicating a high degree of correlation. Therefore, a 1% change in shareholder value results in 80.1% change in level of implementation of IT. Implying organization invests in 80 IT resources to gain one new shareholder for the organization.

$$-1 \leq 0.801 (R) \leq 1$$

- Correlation between IT implementation and Managerial Value:** The variables IT implementation level and managerial value are positively correlated having a degree of correlation around 0.872 indicating a high degree of correlation. Therefore, a 1% change in managerial value results in 87.20% change in level of implementation of IT. Implying one effective decision or strategy executed by the management of the organization increases the implementation of IT by 87.2%.

$$-1 \leq 0.872(R) \leq 1$$

T-Test Validity of Hypothesis

Next, the t tests are done to check the validity of the hypotheses suggested in the beginning.

The significance of the regression model is checked to determine whether or not the null hypothesis is accepted.

- The calculated t value comes out to be greater than 1.1 for the first hypothesis. The p value corresponding to this t value is 0.237 which is greater than 0.05. Thus, the first hypothesis is not rejected.
- In the second hypothesis t test, the t value is 1.15 which gives a corresponding p value of 0.238. As this p value is greater than 0.05, we accept the second hypothesis.
- The third hypothesis test gives a t value of 1.2 in the t test which puts the corresponding p value to be equal to 0.24. Being greater than 0.05, we do not reject the third hypothesis as well.
- The fourth hypothesis gives a t value greater than 1.1 with a corresponding p value greater than 0.235. As it is again greater than 0.05, the fourth hypothesis is also accepted.

Conclusion

The tests with the linear regression model clearly indicate that the implementation of IT creates business value for an organization. It was seen that the present empirical analysis supports the previous researches and propositions that IT generates customer satisfaction as well as investment or shareholder value (Ray, Muhanna, & Barney, 2005). However, it contradicts the productivity paradox which stated that employee satisfaction has decreased by significant levels after the implementation of IT (Brynjolfsson, 1993). Suitable managerial value is also created with IT confirming the outcomes of a previous research (Bharadwaj, 2000).

Recommendations

Thus, according to our empirical research and analysis, implementation of IT with an aim to attract investment and produce quality products while maintaining employee goodwill generates huge business value, and increases the productivity of the organization. The correct implementation and intelligent application of the available IT resources can surely revolutionize the technology based world in this globalization era (Black, & Lynch, 2001). However, the key factors always need to be taken under consideration so that the development takes place in the right direction. Business value generation with IT aims to achieve sustainable development of the organization along with its employees, shareholders and customers. Thus, business value should be considered as a crucial determinant of productivity through IT.

Future Scope of Study

The researchers intend to stretch this research study on a bigger data set incorporating a bigger number of organizations. There is also a possibility of segregating the organizations on the basis of their ownership structures (public, private & government), and a comparative analysis be performed with respect to business value generation as a result of implementation of IT. The researchers may also undertake a comparative research based on geographic demography as well to compare the extent of business value generation between Indian and Multi-National Corporations (MNCs) as a result of implementation of IT.

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