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Business Performance Management, Data Warehouse and Information System Flexibility for Business Process Improvement

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Abstract

Business performance management (EPM) is to help organization to achieve its strategic goals by efficient use of its resources. The competitive business environment is putting tremendous pressure on organizations to improve and outperform. The strategic flexibility allows the firm to meet the uncertainties around its environment. The enterprise performance measurement and management system allows to monitor and control the performance to achieve strategic objectives of the organization. Information system (IS) flexibility in terms of flexibility to use, flexibility to access and flexibility to change the system helps organization to effectively monitor the performance. The paper is based on empirical study in Indian upstream oil industry to identify the effect of strategic flexibility and IS flexibility on enterprise performance measurement and management. Effect of macro and micro variables of strategic flexibility and IS flexibility on effectiveness of EPM in measuring and managing enterprise performance improvement has been studied using univariate and bivariate analysis such as descriptive statistics, correlation, and regression. The dimensions of EPM effectiveness identified based on literature review are: strategic alignment, strategic monitoring, and perspectives such as financial, customer, internal business process, and learning and growth. Macro and micro independent and dependent variables are found to be strongly correlated. It has emerged from the study that strategic flexibility and IS flexibility are contributing to EPM effectiveness. At micro level, government policies and control, global opportunities, global competition, competitive strategy, market forces, computerization, EPM system functionality, flexibility to access system, flexibility to change system, and minimal investment for change are predictors of EPM effectiveness. The results are encouraging and the study may be extended to other sectors.

Keywords: *Data Warehouse, Information System Flexibility, Performance Measurement System, Performance Measures, Performance Improvement, Strategic Performance Management.*

Introduction

Enterprise Performance Management (**EPM**) is a set of processes that help enterprise to improve performance by efficient use of resources, system and infrastructure. It is, sometimes, also referred as performance management system (PMS). It describes all the processes, methodologies, metrics and systems needed to measure and manage performance of the organization. It is used as a strategic tool of learning, enabling to better understand what drives value creation in the enterprise. It helps organization to achieve their strategic goals. The objective of performance measurement has changed over the past few decades. Traditional performance

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measures based on financial performance or productivity are no longer appropriate in today's competitive global market. Alternative performance measurement systems have been developed incorporating variety of performance measures/key performance indicators (KPI) based on efficiency, effectiveness, productivity, quality, customer satisfaction, innovation, and employee satisfaction, etc., in addition to financial measures, to produce world-class enterprise performance. Alternative EPMS models such as economic value added (EVA), return on capital investment (ROI), activity based costing (ABC), total quality management (TQM), six sigma, etc., were proposed but they were having a particular perspective in focus and lacking in strategic perspective and comprehensiveness. Modern comprehensive EPM models such as Balanced Scorecard (Kaplan and Norton, 1992), EFQM Excellence Model (1991), and Performance Prism (Neely and Adams, 1998) have overcome the above shortcomings. The effectiveness of EPM have been studies in detail and found to be affected by various factors including flexibility.

Review of Literature

Business performance management is the process of assessing progress towards achieving predetermined goals. It help the firm to make efficient use of system and resources to improve business results. There are two concepts of organizational performance; efficiency (doing things right) and effectiveness (doing the right things). Measurement is an important aspect of performance, which is weakest area even today (Niven, 2002). Traditional systems concentrated more on financial or productivity aspects but latest generation of performance management systems are multi-dimensional in nature and mainly focussing of strategic perspective. The information generated by the system must be accurate, relevant, timely and easily accessible for the persons who need them (Neely, 1995, Bourne *et al*., 2003). They have set of performance measures or key performance indicators (KPIs) to quantify efficiency, productivity, quality, and effectiveness of actions undertaken by the enterprise so as to monitor, control, manage and perform the activities.

Kaplan and Norton (1992, 1996) proposed Balanced scorecard (BSC) to incorporate balanced set of leading and lagging, financial and non-financial performance measures/ indicators from four perspectives of financial, customer, internal business process, and learning and growth to drive performance improvement. Neely and Adams (1998) conceptualized a Performance Prism framework, which is a three-dimensional model having five facets for delivering stakeholders value namely Stakeholders satisfaction, Strategies, Processes, Capabilities, and Stakeholders contribution. Business Excellence Model, developed by The European Foundation for Quality Management (EFQM) (1991), is a self-assessment framework for measuring the strengths and areas for improvement of an organization which consist of nine criteria. Five enablers are leadership, people, policy and strategy, partnership and resources, and processes. The four results criteria are people, customer, society, and key performance indicators. Kaplan (2009) suggested 3-level risk management framework parallel to strategy scorecard.

According to Volberda (1996), "Flexibility is the degree to which an organization has a variety of managerial capabilities and the speed at which they can be activated, to increase the control capacity of management and improve the controllability of the organization". Flexibility necessary to compensate for strategic changes that originate in indirect environment and reach via component of direct environment (Eppink,1978). It is the ability to precipitate intentional changes and adapt to environmental changes through continuous re-thinking of current strategies, asset deployment and investment strategies (Evans, 1991; Bahrami, 1992; Sanchez, 1995). Information system (IS) flexibility has several dimensions such as compatibility, functionality, data transparency, connectivity, technical and functional skill and technology management. It is positively correlated with mass customization, market position and innovativeness of the

organization (Byrd and Turner, (2001)).

An empirical study of 175 Canadian SME manufacturing companies related to supply chain showed a direct effect of strategy on flexibility and flexibility on performance (Kamel *et al.*, 2009). Healthcare PMS should have multi-perspectives such as efficiency, effectiveness and flexibility (Purbey *et al.*, 2007). Chenhall (1996) studied the performance of 37 manufacturing firms and found a positive association of high degree of manufacturing flexibility, performance measurement and organizational performance. Deloitte and Touche (2001) suggested three pronged strategy to be adopted viz. adoption of strategic flexibility to deal best with uncertainty; creation of strategically flexible organizations to deal with wide range of potential threats and opportunities using techniques such as scenarios, real options, financial options; and addressing uncertainty rather denying or resisting it. Sharma (2010) has studied the effect of various flexibilities on competitiveness, which enhances performance in mobile telecom companies in India. Strategic, financial, marketing, and operational flexibilities are best predictors of competitiveness and affect various perspectives of performance.

Due to uncertainty and competition, Chinese put greater emphasis on growth. Fleming *et al.* (2009) from an empirical study of 104 Chinese manufacturing firms, have established a linkage that those firms making greater use of BSC are performing at high levels. According to Thomas and William (2005), to effectively adopt and realize the benefit of performance management system, long-term planning, short-term planning and management reporting should be synchronized. Senior executives and business line managers should collaborate and communicate. Organizations adopted effective PMS, have flexibility devoting more time in proactive informed decision making and less time reacting.

Tapinos *et al.* (2005) provided empirical evidence on the impact of performance measurement and management on the strategic planning processes. Impacts are greater in large organizations and organization operating in rapidly changing environment. Bruno *et al.* (2005) in a case study in Brazilian company demonstrated how resources and competencies convert into performance. It was found that environmental factors related to demand had strongest performance determinant, employee satisfaction showed association with all BSC perspective but employee competency had no correlation with enterprise performance in the case study. Performance management is a process to ensure that resources including human resources are used in attaining the desired goal (Halachmi, 2005).

There research gap identified is to see the effect of Business Performance Management system design, use of Business Data Warehouse and Information System flexibility on enterprise performance improvement.

Research Objectives and Methodology

The objective of the research is to study the effect BPM, BW, IF on business performance improvement. A conceptual model has been developed based on literature review (Figure 1). This has been studied in two parts:

i) To empirically test the effect of BPM system design, Performance Analysis and Reporting, and Information system flexibility on business performance in Indian Oil industry.

ii) A case study of ONGC to see the use of BW for operational analytics in improving operational efficiency and productivity.

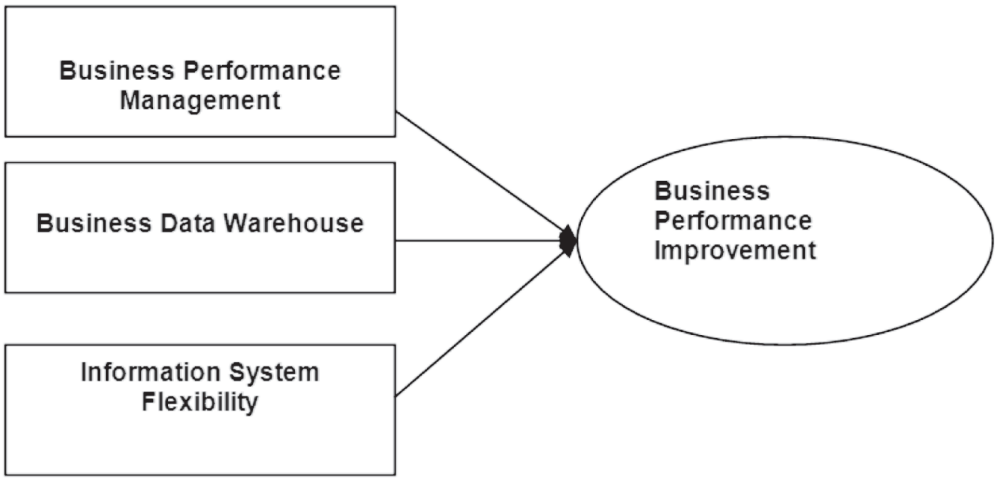

Figure 1: Conceptual Model for Business Process Improvement

Empirical Testing Effect of BPM and ISF on Enterprise Performance in Indian Oil Industry

In this study, effects of business performance management and information system flexibility on business performance has been studied. For the purpose following hypotheses have been formulated:

H1: Business Performance Management system design affects the Business Performance.

H2: Performance Feedback affects the Business Performance.

H3: Information System Flexibility affects the Business Performance.

Variables related to BPM and ISF has been identified which affects business performance improvement along four dimensions/ perspectives. Empirical study based on questionnaire based survey method has been carried out to establish the relationship between BPM, ISF and Business Performance. Questionnaire with 6-point likert scale (1 for strongly disagree to 6 for strongly agree) has been designed to test the impact of BPM system design, performance analysis and reporting, and IS flexibility on business performance along four dimensions/ perspectives of financial, customer, internal business process, and learning and growth. The questionnaire after pilot test and validated for consistency and reliability, was mailed/emailed to 500 executives in 15 upstream oil and gas companies in India, 139 responses from 10 companies (six government owned and four private owned) were received.

Exploratory factor analysis using principal component extraction with varimax rotation to test construct validity of variables has been carried out. Factors with loading 0.7 has been retained and shown in Table 1. It is seen that 3 macro and 5 micro variables are retained after factor analysis. Univariate and multivariate analysis were carried out using SPSS package showing the descriptive statistics of independent and dependent micro variables in Tables 2 and 3.

Table 1: Factor Analysis (PCA with Varimax Rotation) of Independent

Variables N=139 *(6-Point Likert's scale)*

Macro Variables	Factors	Factor Name	Eigen Value	Per cent of Variance	Cum Per cent
Business Performance Management System Design (BSD)	BSD1	Selection of Dimension and Measures of BPM	10.610	70.73	70.73
	BSD2	Customised BPM System	0.808	5.39	76.12
Performance Feedback (BPF)	PAF1	Performance Analysis and Feedback	3.965	79.30	79.30
Information System Flexibility (ISF)	ISF1	Flexibility in BPM System Functionalities	4.608	65.83	65.83
	ISF2	Information Technology Flexibility	0.823	11.75	77.58

Table 2: Descriptive Statistics for Independent Micro Variables

N=139 *(6-Point Likert's scale)*

S. No	Independent Variables/ Factors	Description	Mean	Std. Dev.
		Business Performance Management System Design		
1	**BSD1**	Selection of Dimension and Measures of BPM	3.85	1.03
2	**BSD2**	Customised BPM System	3.42	1.40
		Performance Feedback		
3	**PAF1**	Performance Analysis and Feedback	3.85	1.18
		Information System Flexibility		
4	**ISF1**	Flexibility in BPM System Functionalities	4.27	0.97
5	**ISF2**	Information Technology Flexibility	4.26	1.05

Table 3: Descriptive Statistics of Dependent Micro Variables

N=139 (6-Point Likert's scale)

S. No	Dependent Micro Variables	Description	Mean	Std. Dev.
1	**FIN**	Financial Perspective	4.26	1.13
2	**CUS**	Customer Perspective	4.19	1.33
3	**BPR**	Internal Business Process Perspective	3.98	0.96
4	**LGR**	Learning and Growth Perspective	4.07	0.89

From the Tables 2 and 3, it can be seen that almost all the five independent and four dependent micro variables of business performance are having mean score around 4.0 and standard deviation around 1.0. It gives confidence in mean values as indicative data and follows normal distribution.

Results and Discussion

Bivariate and multivariate analysis has been carried out to test the hypotheses and validate proposed EPMS model as given in Figure 1.

Correlation Analysis

To measure the relationship between independent and dependent micro variables, Pearson's correlation analysis has been carried out (Table 4) and they are exhibiting strong correlations.

Table 4: Correlation Analysis between Independent and Dependent Micro Variables

	BSD1	BSD2	PAF1	ISF1	ISF2	FIN	CUS	BPR	LGR
BSD1	1	.438	.826	.755	.438	.649	.510	.675	.673
BSD2	.438	1	.308	.350	.339	.239	.323	.346	.248
PAF1	.826	.308	1	.724	.409	.601	.426	.690	.644
ISF1	.755	.350	.724	1	.657	.680	.554	.735	.735
ISF2	.438	.339	.409	.657	1	.379	.355	.448	.435
FIN	.649	.239	.601	.680	.379	1	.664	.724	.669
CUS	.510	.323	.426	.554	.355	.664	1	.568	.513
BPR	.675	.346	.690	.735	.448	.724	.568	1	.751
LGR	.673	.248	.644	.735	.435	.669	.513	.751	1

Note: All Correlations are significant at the 0.01 level (2-tailed).

Regression Analysis

Regression analysis has been carried out for dependent macro and micro variable of business performance and the results are shown in Tables 5 and 6 respectively.

Table 5: Regression Summary at Macro Level

Dependent Macro Variables	R^2	SE	Independent Macro Variables (Predictors)	B	SE
PERF	0.736	0.47			
			BSD	0.282	0.075
			ISF	0.398	0.064

Table 6: Regression Summary at Micro Level

Dependent Micro Variables	R^2	SE	F	Independent Micro Variables (Predictors)	B	T	Sig. of T
FIN	0.505	.800	69.39				
				ISF1	0.515	4.792	0.000
				BSD1	0.348	3.433	0.001
CUS	0.327	1.102	32.98				
				ISF1	0.543	3.669	0.000
				BSD1	0.276	1.978	0.050
BPR	0.592	0.618	98.69				
				ISF1	0.490	6.218	0.000
				PAF1	0.271	4.182	0.000
LGR	0.573	0.587	91.34				
				ISF1	0.487	6.180	0.000
				BSD1	0.239	3.210	0.002

At macro level, the values of R^2 is 0.736 i.e. 73.6 per cent variation in Business Performance is explained by independent variables business performance management system design and IS flexibility (Table 5). From regression analysis at micro level (Table 6), coefficient of determination (R^2) is above 0.50 except in case of customer perspective i.e. more than 5o per cent of variation in micro variables of business performance is explained by the independent micro variables. All the independent variables are significant in the models at confidence level of 99 per cent as the result of t-test for the model indicate significance of $T < 0.01$. The major predictors of business performance at micro level are flexibility in business performance management system functionalities, selection of dimensions and performance measures, and performance analysis and feedback for taking corrective action by the management to improve the performance of the organisation.

Interpretation and Conclusion

Business performance is affected how it is measured and what is measured. Based on empirical study in Indian upstream oil companies, the major macro factors affecting business performance are business performance management system design and information system flexibility incorporated into system. At micro level, selection of dimension and performance measures, flexibility in business performance management system functionalities, and performance analysis and feedback are contributing to business performance improvements along four dimensions of performance measurement namely financial, customer, internal business process, and learning and growth.

Case Study of ONGC

Case study of ONGC to see the effect of BPM and BW on Performance improvement has been carried out. The use of Balanced Scorecard implementation for measuring and monitoring performance at corporate as well as business unit level has shown significant improvement over a period. Similarly business dataware house implementation i.e. web-based SAP BI 7.1 implemented for measuring operational performance on daily basis has provided significant insight to operational managers to monitor and control activities on daily basis leading to operational efficiency and productivity. At employee level, key performance indicators have been used to assess employee performance for giving performance related pay (incentives) and for promotion purposes.

Limitations of the Study and Suggestions for Further Works

The empirical study covered senior and middle managers of Indian upstream oil companies. The case study of ONGC to see the effect of BSC, BW, ISF has been based on interviews with key executives. A more elaborate study to cover at corporate, tactical and operational managers would enhance the utility of this research.

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