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A Generalized Model of Flexibility MeasurementUsing Business Environmental Factors and Flexibility Enablers

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Abstract

The ability to cope up with the uncertain environment is shaped by organizational flexibility. The flexible organizations sustain the competitive advantage over the period of time. The flexibility in different context essentially induces speed and agility in organizational processes. The flexibility evaluation mechanism will help organizations to measure and enhance the organizational flexibility. This study proposes generalized flexibility evaluation mechanism demonstrated by an example of workforce flexibility measurement by analyzing the impact of flexibility enablers and business environment. The workforce flexibility contributes significantly to versatility, responsiveness, and the ability of employees to move between jobs. The flexibility evaluation mechanismsavailable in the literature are industry, organization, and context-specific and not generic in nature and ignore the impact of the business environment.

Introduction

Flexibility enables the organizations to faster achieve the desired objectives and cope up with internal and external changes. The flexibility measurement techniques quantify the select flexibilities for making organizational strategies for competitive advantage. This paper identifies various types of flexibility measurement techniques available in literature and proposes a measurement framework which can be applied across industries by analyzing the impact of the interaction between flexibility enablers and business environment. The business environment is used in this paper as flexibility is the predictor of performance in a dynamic business environment (Anand and Ward 2004). Some of these methods examine the outcome of flexibility while other examines sources of flexibility for making an assessment of organizational flexibility. Following five categories of measurement techniques of flexibility are identified from the existing literature.

A) Broad Categorization of Flexibility

In this category, the organizational flexibility is put in different broad categories with a provision of gradation. Garavelli (2003) categorized supply chain flexibility in three categories i.e. no flexibility, limited flexibility and total flexibility. The flexibility aspects were mainly related to the performance of an organization. Verdu et al. (2009), proposed four types of managerial flexibility: internal and external, structural and strategic.

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B) Flexibility Measurement Using Mathematical Formula

In this case, various formulae are proposed for measurement of select flexibilities. The operational means are defined to understand the impact or outcome of flexibility. Beamon (1999) used output volumes, the percentage of the slack time, delivery time, number of different product types for measuring volume, delivery, and mix flexibilities. The capacity and load flexibility for manufacturing systems are measured by Teich& Claus (2017). However, mapping of the physical characteristic of the production system and quantification of manufacturing flexibility is difficult due to lack of methods for the synthesis of the functional parameters (Kahraman et al. 2004). Tsourveloudis (1998) used fuzzy logic to measure manufacturing flexibility. A rule-based flexibility evaluator has been demonstrated through prototype by Das and Caprihan (2008). Zhang et al. (2017) formulated measurement of process flexibility of product design by considering requirement variations. Tsai et al. (2017), used entropy-based and Taguchi quality loss for flexibility measurement.

C) Measurement Based Upon Sources and enablers of Flexibility

The enablers or sources of flexibility are examined for measuring flexibility. The example can be seen in work of Lin et al. (2006)[2] who proposed Fuzzy Agility Evaluation Method (FAEM) by examining business operation environments, agility drivers, and supply chain capabilities. Lee and Xia (2005) developed team flexibility measurement using capability and socio-technical perspective. Gligor et al. (2013) devised measures of supply chain agility based on swiftness, alertness, accessibility, and decisiveness. Kandemir and Acur (2012) used the resources, capabilities, and performance to frame strategic decision-making flexibility.

D) Index Based Weighted Measurement

The index based weighted flexibility measurement has used by many authors wherein Likert type scales were used. *Swafford et al. (2008)* measured each function of supply chain on this scale. Agility evaluation index isused by *Yang and Li (2002).*

E) Measurement of Flexibility through Assessment of Organizational Output

In this category the outcome due to organizational flexibility is examined. Thisincludes observation of visible characteristics of flexibility. *Lin et al(2006)*[1] have introduced fuzzy principles to evaluate the agility of an organization based upon performance and importance of agile capabilities. *Gong (2008)* suggested analytical models describing relationships between the degree of flexibility in a system and the system level performance. Ganguly et al. (2009) have proposed measurement of agility using market share, responsiveness and cost effectiveness. The study done by Sheffield et al. (2012) has identified the factors indicative of software development agility in the organization. Rastogi et al. (2016), indicated the flexibility as predictor of work family enrichment. The association between firm performance and HR flexibility is demonstrated by Sekhar et al. (2016).

It can be seen from literature review that flexibility measurement has taken progression from basic categorization of flexibility to fuzzy measurement of different types of flexibilities.

Methodology

The Flowing stream strategy by Sushil (2012, 2013)has been used in this paper for providing theoretical support to flexibility measurement method used in this paper. This frameworkcompares characteristic of flowing stream with organizational growth. This framework is used for identifying different types of forces acting on organization.In framework of “Flowing Stream Strategy” the major forces that pull the organization towards its continuity are: core ideology, customer base, infrastructure, technology, core competence, brand, supply chain and distribution network, culture and performance. The major forces that push the organization towards change are: globalization,

new opportunities, competition, changing customer needs, new technology, e-business, mergers and acquisitions, government policies and legislation and environmental concerns. For the purpose of study of organization, the combinations of continuity and change forces are mapped on a continuity-change assessment matrix. The result of assessment is further used for measuring flexibility.The flowing stream strategy operates under seven guiding principles. These principleslay emphasis on strategic changes by leveraging the benefits of the continuity in a dynamic manner. The underline methodology behind framework and its principle gives enablementof flexibility. Toachieve next level of performance, organization requires creative discontent with the present situation and desired change is enabled by flexibility. The organizations have to show flexibility to incorporate opposite options. During organizational growth the energy is drained and it needs to be continuously vitalized. The organization encounters a number of hurdles on the way and finds its way by circumventing these hurdles by using suitable flexibility. The usage of four key strategic channels divert, shift, partition and integrate requires flexibility by organization.The proposed measurement framework of flexibility requires identification of various forces acting on organization which is identified as flexibility enablers. The visual depiction is made in Figure 1 for impact of business environment, flexibility enablers on organization. The entire process of flexibility evaluation using example of workforce flexibility has been described in four steps.

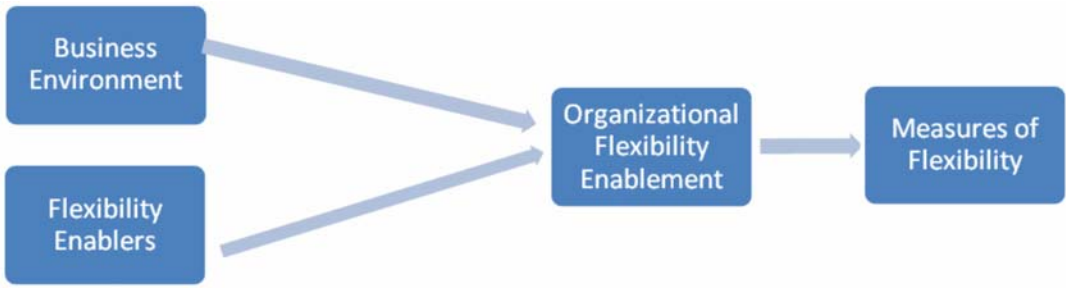

Figure 1: Interaction among business environment and flexibility enablers

Step-1.Identification of Business Environmental Factors Impacting Flexibility

Twenty business environmental factors impacting flexibility are identified using framework of Flowing Stream Strategy(Sushil2012, 2013). These are major continuity and change forces acting on organization for inducing flexibility.

I. Impact of Globalization
II. New opportunities
III. E – Business
IV. Competitors
V. Mergers and Acquisitions
VI. Government policies and legislation
VII. New technology (Software/ Hardware)
VIII. New technology (Method)
IX. Environmental concerns

X. Economies of scale

XI. Growth of niche market

XII. Increasing rate of change in product models

XIII. Increasing pressure on cost

XIV. Product lifetime shrinkage

XV. Rapidly changing market

XVI. Increasing pressure on cost

XVII. Quicker delivery time

XVIII. Quick time to market

XIX. Increasing quality expectation

XX. Increasing pressure of global market

Step-2. Identification of Enablers of Flexibility within Organization

Within given business environment, there are enablers present in the organization which induces the flexibility. The workforce flexibility in information technology (IT) industries plays major instrument of growth. Workforce flexibility and corresponding enablers are utilized from study done by *Yusuf et al (1999)* as agile capabilities. Ten such enablers to induceflexibility are listed below.

I. Integration

II. Competence

III. Team building

IV. Technology

V. Quality

VI. Change

VII. Partnership

VIII. Market

IX. Education and skill upgrade

X. Welfare

Step-3. Computing intensity of continuity and change forces

The questionnaire is prepared to make an assessment of environment (external and internal), continuity and change forces acting on an organization. The key concerns of assessing continuity and change forces for designing the questionnaire are listed below.

- Overall level of understanding of the goals within the organization.
- Benchmarks for the planned progress
- Additional enterprise-wide support needs for change
- Best practices from other organizations.
- Planned actions

- Challenges to employees understanding
- Current dynamics of the market place and its impact
- Mechanism to capture signals from customers in advance
- Ways to better understand customer needs
- Key processes being worked on and their selection criteria
- Values enhancement from the customer's perspective
- Leveraging the strengths of enterprise
- Economies of scale are being realized
- Relative intensity of continuity and change forces

Step-4. Measurement of Select Flexibility

A matrix is prepared to show the strength of interaction between forces i.e. business environment and applicable flexibility enablers in an organization. The relevant flexibility is derived from these assessments.

Overview of Case Organization

The company A has started from scratch when the information technology hardly existed in India. Currently, it has employee strength of more than 1 lack. It put enlightened approach to employee development and provides people whatever they need to succeed, be it a virtual assistant or talent transformation sabbaticals, expert guidance or fast track growth, inner peace or democratic empowerment. It's range of offerings span product engineering, technology and application services, BPO, infrastructure services, hardware, systems integration, and distribution of technology and telecom products. The organizational is constantly trying to be the most preferred and significant software and engineering led global IT services provider in chosen markets. The organization promotes entrepreneurial behavior. This enables to handle rapid changes in the environments and technologies.

Results and Discussion

The operationalization of method for measuring workforce flexibility has been demonstrated for case organization in this section. The rationale for the impact of enabler on the environment is explained below for work force flexibility. If the environment impacts the enabler, then value "1" is assigned to the matrix cell given in Table 2.

I. Impact of Globalization: It is forcing organizations to adopt for workforce flexibility. The workforce flexibility is enabled by current practices in the organization like the concurrent execution of activities, multi-venturing capabilities, individuals working in cross-functional and team across company borders, decentralized decision making, technology awareness programs, strategic relationship with customers and suppliers, new product introduction etc. The impact of globalization touches all enablers; therefore, all the enablers participate in workforce flexibility. Hence enablers like integration, competence, team building, technology, quality, change, partnership, market, education, and workforce skill upgrade are given value "1" in matrix cells given in Table 2.

II. New opportunities: Adoption of new practices and scenarios for new opportunity are enabled by existing skill set. The workforce flexibility is enabled by enterprise integration, information accessible to employees, business practice difficult to copy, the team across company borders, customer satisfaction, response to market changes and supported by other enablers and accordingly marked in Table 2.

III. E-Business: The business environment impacting organization enablers are business practice difficult to copy, cross-functional teams, technology awareness, products with substantial value addition, first-time-right design, response to market changes. The corresponding heads under enabler are integration, competence, team building, technology, quality, partnership, market, and education; these are marked as "1" in Table 2.

IV. Competitors: Stiff competition forces redeployment of resources at the certain point of time and workforce flexibility is enabled. All the enablers participate in this case.

V. Mergers and Acquisitions: Environment and enablers are multi-venturing capabilities, the culture of change etc. The enabler's heads are integration, competence, team building, technology, quality, change, partnership, market, education, welfare and workforce skill upgrade. All these enablers participate in workforce flexibility.

VI. Government policies and legislation: The applicable environment and enablers are enterprise integration, information and welfare measures along with all other enablers. Hence enablers like integration, competence, team building, technology, quality, partnership, market, education welfare and workforce skill upgrade are given 1 in matrix cells.

VII. New technology (Software/ Hardware): It is creating major impact and organization enablers for enabling workforce flexibility are multi-venturing capabilities, technology awareness, skill and knowledge enhancing technologies, short development cycle time, the culture of change, learning organization, multi-skilled and flexible people. Hence enablers like integration, competence, team building, technology, quality, change, partnership, market, education, and workforce skill upgrade are given 1 in matrix cell given in Table 2.

VIII. New technology (Method): It is more related to process and has the similar impact as tools as described in above section of new technology.

IX. Environmental concerns: It induces a major change in organizational business and policies. Hence enablers like integration, competence, team building, technology, quality, change, partnership, market, education, and workforce skill upgrade are given 1 in matrix cells in Table 2.

X. Economies of scale: The applicable enablers, in this case, are the concurrent execution of activities, multi-venturing capabilities, quality over product life, products with substantial value addition, strategic relationship with customers, close relationship with suppliers, new product introduction, customer satisfaction, response to market changes. Corresponding enablers are integration, competence, team building, technology, quality, change, partnership, market, education and workforce skill upgrade which are given 1 in matrix cells.

XI. The growth of niche market: The business practice difficult to copy, empowered individuals working in teams, technology awareness, products with substantial value addition are contributors in this process. The enablers like integration, competence, team building, technology, quality, change, partnership, market, education, welfare and workforce skill upgrade participate for workforce flexibility and given 1 in matrix cells.

XII. Increasing rate of change in product models: The relevant enablers are continuous improvement, customer-driven innovations, response to market changes. The relevant enablers participating in inducing workforce flexibility and given value 1 in the matrix cells given in Table 2.

XIII. Increasing pressure on cost: The corresponding enablers are first-time-right design, short development cycle time supported by all other flexibility enablers. Their equivalents are

given value "1" in matrix cells in Table 2.

XIV. Product lifetime shrinkage: The major enablers are concurrent execution of activities, enterprise integration, information, multi-venturing capabilities, empowered individuals, technology awareness, leadership in the use of current technology, skill and knowledge enhancing technologies, products with substantial value addition , first time right design ,short development cycle time, strategic relationship with customers, customer-driven innovations, customer satisfaction, response to market changes, learning organization, multi-skilled and flexible people. Therefore, all the enablers participate in workforce flexibility and value 1 assigned is assigned to the matrix cells.

XV. Rapidly changing market: A product portfolio variability driven by customer requirement is the business environment and relevant enablers are the culture of change and continuous training and development. All other enablers are effective for inducing workforce flexibility in this case.

XVI. Increasing pressure on cost: Customer expectation for a value of money is the driver for adoption of improved processes. The relevant enablers are concurrent execution of activities, enterprise integration information, multi-venturing capabilities, empowered individuals, technology awareness, leadership in the use of current technology, skill and knowledge enhancing technologies, products with substantial value addition , first time right design ,short development cycle time, strategic relationship with customers, customer-driven innovations, customer satisfaction, response to market changes, learning organization, multi-skilled and flexible people are participating to achieve objectives. All enablers participate in workforce flexibility and assigned value 1 in the matrix except for exceptional decision to compromise on welfare objectives.

XVII. Quicker delivery time: The faster delivery time is a major focus of IT organizations. The variability in technology domains and experience of individual induces multiple skill set in an employee. The risk-taking initiative impacts development schedule which is mitigated with help engineers of different technology domain. The relevant enablers for workforce flexibility, in this case, are organizational training and exposure along with other support mechanisms and other relevant enablers given in Table 2.

XVIII. Quick time to market: All types of enablers are required for timely delivery of products. The workforce flexibility is enabled by leveraging the short development cycle of products.

XIX. Increasing quality expectation: High-quality product delivery requires IT organization to have individuals trained in other areas which are required for integration of products for complete solutions. It involves all enablers support and hence value '1' is assigned to matrix cells.

XX. Increasing pressure of global market: It is a major force acting on organizations to adopt for workforce flexibility due to faster expansion and collaborative work practices. Enablers like integration, competence, team building, technology, quality, change, partnership, market, education and workforce skill upgrade are required in this case for workforce flexibility. The relevant enablers are marked as "1" in Table 2.

Computation of Intensity of Enablers throughContinuity and Change Assessment

The study is carried out to find out various change and continuity factors impacting the organization at this point in time along with the intensity of each factor. All survey items measuring the continuity and change factors given in Table 2 are measured using a 5-point Likert scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4= agree, 5 = strongly agree).

The higher scores indicate higher levels of each factor. Thirty respondents from case organization "A" working in team leadership and managerial position have completed the questionnaire. The summary of observations is presented in Table 1.

Table 1: Summary of intensity of continuity and change forces

S.No	Continuity and change forces	Average value of factors	Standard Deviation	Average intensity of continuity forces
Continuity Forces Assessment				
1.	Huge customer base	4.45	0.15	4.02
2.	Well entrenched infrastructure	4.41	0.21	
3.	Core competence	3.95	0.21	
4.	Technology	3.36	0.43	
5.	Global supply chain and	2.88	0.34	
6.	Internal Factors	4.80	0.16	
7.	Existing culture	3.42	0.18	
8.	Performance	4.89	0.17	
Change Forces Assessment				
1.	Globalization	3.63	0.29	3.74
2.	New opportunities	3.52	2.1	
3.	Competition	3.86	0.32	
4.	Customer Needs	3.74	0.17	
5.	New Technology	4.02	0.21	
6.	E – Business	3.58	0.19	
7.	Mergers and Acquisitions	3.28	0.34	
8.	Government policies	4.03	0.13	
9.	Internal Factors	4.04	0.25	

The survey has shown the case organization "A" is operating under moderately high change forces and high continuity category. The technology-driven and regulatory driven forces, customer forces are impacting high.

Computation of Workforce Flexibility

The final matrix of enablers and environment are given in Table 2 for measurement of workforce flexibility in the case organization "A". The sum of all enablers in the cell is multiplied by the weight of factors obtained in continuity and change assessment which are listed in the first row of Table 2. The total sum of all enablers is obtained w.r.t maximum score of 1000. The is normalized to the scale of 1. For all enablers and environmental forces whose weighted score is required for measurement of flexibility, the nearest value from continuity and change forces assessment from Table 1 is used if it is not directly available from the questionnaire.

Table 2: Assessment of Workforce Flexibility

Environment of Workforce Flexibility(Industry influence)																					
Weighs of Environmental factors (Organizational influence)		3.63	3.52	3.86	3.74	3.58	3.28	4.03	4.02	4.02	4.03	3.63	3.52	3.74	4.04	3.52	4.04	4.04	4.04	4.04	3.63
Enablers of Workforce flexibility		Impact of Globalization	New opportunities	Competitors	Customer Needs	E – Business	Mergers and Acquisitions activities	Government policies and legislation	New technology (software)	New technology (methods)	Environmental concerns.	Economies of scale	Growth of niche market.	Increasing rate of change in product models.	Product lifetime shrinkage	Rapidly changing market	Quicker delivery time	Increasing pressure on cost	Quick time to market	Increasing quality expectation	Increasing pressure of global market competition
	Integration	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Competence	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Team building	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Technology	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Quality	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Change	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
	Partnership	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Market	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Education and Workforce skill upgrade	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Welfare	1	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	0	1	1	1
	SUM of all enablers	10	10	10	10	8	10	9	9	9	10	9	10	10	10	10	10	9	10	10	10
	Sum of all enablers with weightage	36.3	35.2	38.6	37.4	28.6	32.8	36.3	36.2	36.2	40.3	32.7	35.2	37.4	40.4	35.2	40.4	36.4	40.4	40.4	36.3
	Workforce Flexibility weight on scale of 1000	732.6																			
	Workforce Flexibility weight on scale of 1	.7326																			

The Workforce flexibility for case organization is .7326 on a scale of 1 which is on the higher side. The organization is desired by to be competitive. All enablers are interacting with most of the environment factors within the regulatory framework to achieve the desired flexibility.

Conclusion and Future Work

This framework assumes that flexibility in an organization is enabled by the external environment. The framework "Flowing Stream Strategy" captures internal and external change forces needed for flexibility and growth of an organization. To face the changing circumstances while maintaining benefits of existing continuity forces, the flexibility is needed (Adaptation Flexibility, Organizational Flexibility, and Responsive to Target Market Flexibility) in the organization. The intensity of external forces impacts the degree of flexibility. The different combination of continuity (High and low impact forces) and change forces (High and low impact forces) gives the different types of flexibility enablement (Strategic Flexibility, Structural Flexibility, Total System Flexibility, Delivery and Delivery Time Flexibility, Distribution Flexibility, New Product Flexibility, Operation Flexibility, Operational Flexibility, Response Flexibility, State Flexibility, System Flexibility, Adaption flexibility etc.). It also shows interdependence among various flexibilities. It can be seen that various types of flexibilities are required to handle a combination of environmental forces and

organizational factors (Kara et al. 2002). The turbulent business environment has a role in shaping the organizational flexibility (Camps et al. 2016).

The twenty environmental factors described in previous paragraphs are analyzed for impact on Workforce flexibility and corresponding values are indicated between (0-1) based on the relevance of enabler. In the ideal case of all enablers are present for all types of flexibilities gives 100% flexible organization w.r.t workforce. The workforce flexibility on a scale of 1 is 0.7326. The indicators for which data is not directly available, the data of closest indicators are used from continuity and change assessment. The various continuity forces in organization show the higher values of 4.02 due customers, infrastructure, and performance related issues. Lower standard deviations are observed for all related indicators. The overall intensity of continuity factors is on higher side due to policy-driven governance and infrastructure availability.

The purpose of this study was to examine interactions among environment and organizational enablers to measure flexibility. This mechanism of measuring given a type of flexibility is important because it is generic in nature and can be applied to all types of flexibility in the other organizations. The framework is generic and can be applied to other types of industries with slight modifications and incorporating factors relevant to the industry but measurement technique will remain same. The factors impacting organizational flexibility have been identified by Jain and Raj (2013). The methodology can be applied to any organization for which continuity and change assessment is available. A number of organizational surveys is needed to fully explore the given methodology. Organization enablers and industry influence factors are kept at ten and twenty at present which can be extended. In the present survey, some of the factors are not directly measured but their equivalent values are taken on assumption that if these values are measured their values will be closer to assumed values. In the matrix cells decision is taken to include and exclude a given parameter by giving binary (0,1) values. The intermediate levels are also required to make this flexibility measurement framework more effective.

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