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Constraints in Organizational Learning, Cognitive Load and it's Effect on Employee Behavior[†]

Sidharta Chatterjee*

Abstract

Traditionally, learning organizations face certain constraints related to both exogenous and endogenous factors. In this paper, I model three well established constraints that employees face while being part of their organizations. These are in the tune of constraints on their natural behavior which is explicit, and two implicit constraints on their endeavor to acquire new knowledge and perform new actions. The implicit constraints which are elaborated, is related to their relative performance in acquiring new knowledge and by their consecutive actions based on the new knowledge gained. This paper, so forth, attempts to underline such limitations which the agents face under organizational culture and suggest possible strategic initiatives that would effectively counteract such binding limitations to stimulate positive performances from their end.

Keywords: Organizational learning, constraints, employee behavior, cognitive load, knowledge, organizational adaptation

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1. Introduction

Organizations as hub of all activities are bounded by different categories of constraints. These constraints arise out of the increasing complexity of the dynamic environment in which they operate due to the advances in technology and globalization. The ‘*constraint*’ factor as proposed by Goldratt (1984) states that organizational performance is often impaired by some form of *constraints* which evolve as bottlenecks on account of the complementarities of complexity of organizational tasks and routines that are gradually becoming more complex (Tucker et. al., 2003), as well, along with their diversity of culture as varied as they are. In response to such environmental complexities, and to cope with such dynamicity, organizations adopt innovative learning strategies with an aim to adapt (Carley, 2000) and empower their agents (employees) with cutting edge market information which facilitate them to compete with confidence in the global market place. According to K. Prasad (1998), organizations are complex adaptive systems (Bar-Yam, 1997) whose dynamicity reflects similar complexity of other complex systems.

Organizations involve human factors as being part of the complex dynamic environment in which they operate. As such, they learn to adapt to these ever-changing dynamicity by learning how to deal with those arising complexities

related to open and closed uncertainties, which is an important aspect of an adaptive, evolving agent. It is imperative to consider a firm as an active entity which deals with both *deterministic* situations and *probabilistic* circumstances; in other words, organizations are active decision-makers. To make a decision, one should know and be aware of about the contexts. Hence, organizations are active knowledge entities that they learn *how* and *when* to deal with complexities. Learning, hence, is now considered to be one of the most important aspects of organizational culture (Smith, 2001) as much as knowledge, considered as the most valuable asset of a 21st century institution (Drucker, 1999), and the ongoing technological advancement is reshaping it with much vibrancy. Corporate organizations (firms) are in a business of profit where their routines and tasks are getting complex by the day, and they are forced to adapt to this new dynamicity for long term growth and survival. This has no doubt, resulted in fierce competition amongst firms for resources and market information (Porter, (1980), Grant, (1991), Bridoux) and about the sources of such resources as a basis for resource-based view of firms (Amit & Schoemaker (1993)). One of the finest *sources* of such *resources* is the human resource itself. Since it is generally the human behavior and actions which affect organizational performance, managing human behavior is indeed a complex task due to the overwhelming complexity of human behavior itself coupled with environmental complementarities. In today's business

environment, success is not just hinged on the resources and talents one can access, but also, the way these resources and talents are managed (Cascio, 2006). Managing resources hence, is a business of making decisions, clearing bottlenecks and solving problems.

With rising complexities in the business environments and to deal with such uncertainties, organizations are both adopting as well advocating new systems of learning and management which are both innovative and flexible as well, easier to implement (ITeS-enabled learning platforms, open source learning systems and online information management(repositories) systems, to cite few examples). Learning helps organizations to develop their own knowledge-bank which they generally leverage in their routine activities. It is important for any *learning organization's* long term survival and growth (Senge, 1990). There are numerous channels by which organizations gain knowledge (Bhatt, 2000); primarily, in the form of human capital as *new knowledge* their employees bring in when they are inducted as a part of that organization. Firms also collect information from the market, from dealing with their clients and from the experience of doing their business. In effect, they are *perceptual agents* that they learn, and *unlearn*.

Whilst organizations learn as they carry out their routine activities, so do their active agents- the employees, who are agent representatives; the human factors

(Nickerson, 1992) of an organization. In this world of knowledge representative economy where organizations are adapting fast enough and where employees need to stay abreast in acquiring new information- which are, by means of, knowledge attainment, dissipation of the information acquired, managing and sharing of that knowledge (Barth, (2000), Frappaola, (1998)), all forming an integral part of organizational activity. Firms leverage such knowledge gained through numerous channels and apply those information into their business activities which becomes the fundamental aspect that often determine a firm's strategic performance. Hence, the importance of organizational learning (Smith, 2012) cannot be underemphasized, rather, the impact that learning have on organizations help firms to successfully implement new strategies, maintain competitive advantage over other firms as well, to enable them to develop structural insights whose action outcomes help organizations to adapt to an ever shifting economic environment.

The question is not *why* organizations must learn, but *how* they should learn and apply the knowledge gained. Learning helps organizations to successfully restructure their problems and guide them strategically which is an outcome of learning-induced organizational adaptation (Chatterjee, 2010). It has become a well established theory that learning improves future performance of organizations. However, learning organizations as well as their employees (agents), generally, face certain *constraints* related to both learning and applying new knowledge thus

gained. A definite presumption might be, it is these “*constraints*” related to learning that often evolve as *cognitive load*, a concept based on Cognitive Load Theory (CLT) first proposed by Miller, (1956), and then, by Sweller, (1988), Ayres, (2006), and Miller, (2006) which states that our working memory is limited with respect to the amount of information which we can process, and which induce *stress* on both the agents and on the learning (instructional) organizational system. This is what that I attempt to underline in this paper with a simple model of constraint. In such endeavor, this research attempts to integrate Goldratt’s (1998) *Theory of Constraint* with Sweller’s (1988) *Cognitive Load Theory* to comprehend *what* constraint is and *how* it might be related to cognitive load, besides, recommending a simple strategic model framework to deal with cognitive load associated with endogenous constraints in learning organizations.

Hence, the present research is organized into following sections; Section I deals with a short introductory note containing the aims and objectives of this research. Section II outlines the philosophy of the concept of *constraint*; Section III describes the ‘*constraint*’ model and assumptions based on organizational learning representations which guide behavior of firms. Section IV presents with a discussion linking above findings to inferences drawn, and finally, a concluding section with future research implications.

2. The Concept of Constraint: Complementarities and Bottleneck

In effect, the philosophy of the concept of “constraint” was introduced in organizational studies by Eli Goldratt (1984) in his book “*The Goal*”. According to his theory, organizational performance is modulated by several categories of constraints. These constraints appear as bottlenecks which prevent organizations to fully maximize their performances related to their goals. These constraints are in the tune of both exogenous (external) in nature and endogenous (internal) in origin. Endogenous constraints can appear as people, skills, operational, technical (equipment) or a combination of some of the above, whilst, exogenous constraints may appear as information, supplies, macroeconomic factors, government policies or exchange rates.

However, there is one particular endogenous constraint related to people and skills which we may call job-related leaning-constraint which may pose as a bottleneck toward maximizing employee performance. It has been observed that constraints in learning are more apparent in bottom-lines of an organization where agents often struggle to acquire new knowledge and skills relevant to their organization’s objectives. Whereas constraints are much less pronounced or detectable at the mid-managerial and managerial level, they are far less apparent at the corporate/executive levels. Since the executives set organization’s goals, they

are often better 'informed' than bottom-lines. But this is often not so the case since Robinson and Schroeder (2004) consider that managers are often supercilious and they require inputs from their subordinates. They have a view based on empirical evidence that ideas are free and managers should engage their employees toward knowledge and idea generation since they usually deal with aggregate information(Hayek, 1945) while their subordinate employees' deals better with contextual knowledge.

Managers generally pass down corporate goals and objectives from the executives/CEO to their direct subordinates in reverse hierarchy down to the lowest secretarial level, where it can be said that knowledge that benefits organizations at large do benefit their employees to some great extent, and vice-versa. Managers also guide new entrants on how to learn and apply relevant information to meet corporate objectives. Yet still, in many organizations, it is often the bottom-line where information is not shared or generated uniformly, neither are there enough opportunities to incentivize learning-based application of the knowledge acquired for individual growth and development. They are often left to stagnate in mind and in intellectuality, and this is a major concern with a learning organization which lack vision and proper mentorship. This nature of cognitive stagnation in people and practice is the current topic of this research, wherein, I have attempted to highlight the factors and variables involved which

pose as an important *endogenous constraint*- the constraints of learning and training related to human resource development.

Virtually every type of organization whether in the business of research and development, manufacturing, information technology, retailing, biotechnology or marketing research, must learn to sustain their competitive advantage and face competition from new entrants, who evolve with better knowledge since, new entrants often benefit from a information base dissimilar than that of incumbents (Zack, 1999). Learning increases the capacity to absorb further information and turn them into productive knowledge. It enables organizations with effective decision-making; to manage uncertainty, since; an informed organization is better positioned to deal with the complexities of its business environment. Organizations in the business of turning knowledge into assets comprehend the relative importance of learning which empowers its workforce with relevant knowledge required to sustain their competitive advantage.

However, since knowledge has become an integral component of business activities, whether that is in retailing or market research, understanding consumer behavior, consumption patterns and customer preferences all require analysis of information gathered by every member of the organization's workforce. Yet often, many organizations ignore the fact that there remains some inequality in

knowledge sharing and information dissipation across the organization-wide platform. This inequality stems from the constraints in learning and designing effective organizational learning systems solutions that would benefit its workforce and unleash their covered potentialities. Moreover, the stress related to constraints should be acknowledged and dealt accordingly. Herein, I attempt to model in such objective paradigm the constraints associated with learning systems and knowledge acquisition processes in organizations and suggest few strategies that would facilitate its (knowledge) organization-wide application. This paper hence aims at modeling such constraints those organizations face and provide a structural framework to deal strategically with such constraints in learning systems whereby, knowledge becomes a strategic asset of the organization.

3. The Model

The model that is presented herein is based on the assumptions of organizational learning model that propose certain conditions which guide organizational behavior much similar to normative modeling of theoretical assumptions when those conditions are met. It is assumed that when information has been gained by the agents it would reflect with actions on the organization's behavior. The designed constraints on learning and agent behavior are based on the following assumptions which propose two theories; the first assumption is how learning will

improve future performance given the parameters of performance classified as past, present and future performance of the agents as, P_{t-1} , P_t , and P_{t+1} respectively. The variables are parameterized as given conditions as; where P denotes performance $P_{t-1} > 0$, $P_{t-1} < 0$ and $P_{t-1} = 0$ respectively. Given that k which denote knowledge gained where k can have three conditions; $k=0$, $k>0$, $k=P_i = 1, 2$ and $a=0$ or $a>0$ respectively for agent actions. The first equation that can be derived to represent behavioral changes in agents with respect to learning and knowledge acquired may be written as,

$$\Delta P_{t+1} = [(P_{t-1} - P_t) + l(k + a) + B_h]/C_e - C_i \quad \text{eq. (1)}$$

Where, l denote learning, B_h denote agent behavior and a for agent actions. The variable C_n is modeled as constraint of difference between exogenous (external) constraints and endogenous (internal) constraints, where $C_n = C_e - C_i$. C_n can have three values, either $C_n = 1$, or $C_n \cong 0$, or $C_n = 0, 1$ wherein if $P_{t-1} = -1, 0, 1$ and $C_n > 0$, and $P_t = -1, 0, 1$ while $C_n \cong 0$ or, $C_n = 1$, then we can assume several values that can be assigned to actions 'a';

$$a = 0 \quad \text{when } l \geq 0$$

$$a > 0 \quad \text{when } l = 0$$

$$a < 1 \quad \text{when } l = 1$$

$$a=1$$

$$a < 0 \text{ and } a < -1.$$

Given the parameters above, it may well be computed when we assign some values to the above variables and find out whether knowledge has been gained, or what knowledge was acquired by the agents that would tend to reflect with actions on employee behavior. Now, by assigning values to the above equation no. 1, we will be able to derive the nature of outcome that would mirror performance, so, I call this equation *constraint-based performance measure* of employee behavior. Reciprocally, Cascio (2006) in his work mentions about the impact of employee behaviors on the economic, operating and financial performances of firms. Now, substituting values above, we may derive;

$$\Delta P_{t+1} = \int_b^a 1 dx * ((P_{t-1} - P_t) + l(k + a) + B_h) / C_e - C_i \quad \text{eq. (2)}$$

$$\Delta P_{t+1} = \int_b^a 1 dx * \frac{((-1 - 1) + 1(1 + 1) + B_h)}{1}$$

$$P_t = - \frac{(-B_h)(a-b)+1}{\Delta} \quad \text{eq. (3)}$$

$$P_t = - \frac{-B_h + 1}{\Delta}$$

where, it signify that there has been non-positive change (for Δ) in behavior and no change in overall performance if the constraint is a positive integer, and wherein, when the employees undertook non-negative actions, the performance did not change. The functional variables as limits a, b denotes the bounded constraints derived as the difference of $(a-b)$ when solved for performance P_t , where we derive non-positive change in agent behavior.

Now solving for B_h , we derive;

$$B_h = \Delta P_t + 1 \quad \text{eq. (4)}$$

This relation signifies that the real change in agent performance is directly related to the agent behavior that tends to be positive only when the constraints $C_n=(a-b)$ are impassive.

Definition 1 *Knowledge gained by the agents will reflect with actions on their behavior where $(k \rightarrow \forall a \in B_h)$ that is, for all agent actions the knowledge of which originate as well reflect from and into agent behavior.*

This definition leads us to following two assumptions;

Assumption 1 *Learning 'l' will depend on both (how) knowledge(k) is acquired and actions(a) performed with constraints(C_n) binding to both*

organizational learning and employee behavior that would overall determine organizational performance.

Given by equation nos. 1, I derive a formal equation of the effect of learning on employee behavior related to performance;

$$l = \frac{l(k+a)+B_h}{C_n} P \quad \text{eq. (5)}$$

$$l = \frac{B_h P}{(-P)(a+k) + C_n}$$

Or,

$$l = \frac{B_h P}{C_n - P(k+a)}$$

$$l = \frac{B_h P}{C_n - P(k - a)}$$

Lemma 1 *Performance-based knowledge acquisition and actions wherein learning as a direct explicit outcome of employee behavior modified or affected by constraints placed on both knowledge acquisition, performance and actions which present as cognitive load(l_c) on the system.*

While for,

$$l_c(C_n - Pk - Pa) = PB_h \quad \text{eq. (6)}$$

$$l_c = \frac{B_h P}{(-a)P - kP + C_n}$$

We derive the same outcome as equation nos.5. One may also find that the constraints are binding though implicitly to knowledge acquisition, agent actions and performance, and induce cognitive load as l_c on learning l . Now when we solve for performance ‘ P ’, we find it is in direct relation to constraints on learning, whereby, both agent actions and knowledge can affect constraints given by;

$$P = \frac{C_n l}{l(a+k)+B_h} \quad \text{eq. (7)}$$

We can deduce a general definition from the above modeling in that; continued, guided agent intervention and innovative instructional designs can obliterate the cognitive load (Cooper, 1998) on learning l . The path to cognitive enhancement will only be possible when such constraints are taken care of and the resultant cognitive load is minimized (Rouet, 2009) since, learning is based on agent actions and how knowledge is acquired which invariably affect agent behaviors.

Definition 2 *Constraints are binding on employee behavior explicitly, but implicitly on the employees’ performances in acquiring new knowledge and performing new actions.*

Proof. See equation no. 3.

4. Discussion

The above model provides a general inference about human effort; that is, human capacity is finite and in order to maximize human effort, there should be efficient resource strategy models to streamline performance and manage constraints. Employees use up physical and mental energy into producing, maintaining or converting economic resources into useful commodities (Sahlins, (1974), Chatterjee, (2010)). The magnitude of effort and the momentum of exertion that they put in impact the outcome of performances under organizational settings. The above model also describes how agents' performances are impaired under constraints and how their behavior is modified or affected by complementarities. Definition 2 states that constraints are binding on the employees' performances implicitly toward their goal in attaining new knowledge and practice.

It shall however be remembered that employees bring in new knowledge when they are inducted as well, they learn from their routine activities, through in-house training programs and from other R&D related activities that create new knowledge for a knowledge-based organization. In other words, they adapt to an ever demanding professional silhouette where their productivity is measured in terms of the ratio of progress to effort (Berry, 1989), or using other professional assessment systems (PAS). Knowledge originates from specific agent actions

which reflect in their behavior and actions but there often appear constraints which act as bottlenecks toward knowledge generation and learning. Here, according to *lemma 1* above, constraints can be binding on knowledge acquisition (learning), performance and agent actions. When these constraints become large enough, they act as '*cognitive load*' and invite stress on the part of the agents. Managing these issues require *three* strategic modules; (i) minimize constraints, (ii) lessen or reduce the cognitive load, and (iii) reduce stress. When the binding constraints are minimized or removed, cognitive load declines which enables learning and better absorption of knowledge (Tsai, 2001). The decline in cognitive load (Mayer and Moreno, 2003) reduces the "stress" associated with job-related tasks which help improve agent performances and brings in neuroeconomic efficiency in organizational practice.

5. Conclusion

It is now a well acknowledged fact that learning is an important aspect or organizational culture. In a knowledge-base economy, where information acquisition is important, it is equally important that the knowledge gained should be managed as well. Yet, there are certain complementarities associated with learning under organizational culture those which appear as bottlenecks. The real cause of such bottlenecks is some kind of constraints-or barriers toward efficient

employee learning, since, agents need to keep themselves ahead of their competitors with state-of-art current information about the market and their job-related tasks. Inefficient learning environment hamper knowledge absorption and hinders growth. Such inefficiencies might result from unplanned human resource development programs aimed to empower the agents with the right kind of information they would require in their job. But the real causes could lie somewhere else, as constraints on learning that hinder knowledge growth, and thus, overall cognitive development of the agents. Constraints can become big enough to present as cognitive load on the agents, thus, compromising with their performances. This paper in part, attempts to model such job-related constraints on learning and proposes three well-established constraints that employees (as agents) face while being part of their organization, and in lieu of this, recommends some simple strategies to overcome such constraints. One important finding of this research is that, the model successfully establishes the relationship between constraints and agent behaviors, and the impact of such on their performance. Further research on this frontier can be as interesting as on the nature of such constraints and remedial measures that would likely follow.

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