Available online at www.elixirpublishers.com (Elixir International Journal)

Management Arts

Elixir Mgmt. Arts 39 (2011) 4943-4947

ISSN: 2229-712X

Push vs. pull supply chain management system in education: a managerial perspective

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ARTICLE INFO

Article history:
Received: 28 July 2011;
Received in revised form:
22 September 2011;
Accepted: 29 September 2011;

Keywords
Education Management,
Quantum Paradigm,
Newtonian Thought,
Supply Chain Management,
Educational Policy.

ABSTRACT

This paper aims to study the effectiveness of the current education systems from the point of view of satisfying the industry demand for workforce. The current system is translated into the terminology of supply chain management (SCM), as it can be formulated as a 'push system' in SCM. As opposed to this education system which is highly centralized and lacks cooperation between the stakeholders, a new 'pull system' is proposed in this research. The proposed system incorporates high level of cooperation between the educational institutions and the stakeholders in the policy-making process. Shift from a push system to a pull system is considered along with a shift from the current paradigm of social sciences to the new paradigm, named as Quantum Paradigm. The concepts of SCM are evaluated through the window of quantum theory. The research also covers management issues for the educational leaders in practice.

Introduction

The educational system along with the management science has evolved during the course of the centuries and reached the current state which has its roots in the industrial era. The theories and the models developed in this era stem from a deterministic causality principal which constitutes the core of scientific method in the industrial era. The developments in the last decade however, have started to change the principles and foundations of the education system management altogether along with other fields of science as a result of a paradigmal change.

Different scientific-technological paradigms rule each era of the societies and civilizations. During this process; primitive technologies have determined and formed the primitive society, traditional technologies have led to the agricultural societies, and mechanic technologies have resulted in industrial societies. The goal of the science is to explain the process and interaction which can be regarded as 'technology' among the events of nature. These exploration and discoveries aim to provide the humanity with the control over the events surrounding him.

Technology is the organized thought in regards to the processes of the nature and life (Erkan, 2004). During the course of centuries, the scientific properties of technology have increased along with the complexity of it. The technology must be applicable to the nature and events; thus, it can be referred as 'applicable scientific knowledge'.

There exists a close relation between the scientific paradigm and technologic paradigm. The main paradigm of the industrial era is mechanic paradigm which stems from 'The Newtonian Thought'.

Traditional Approach

Newtonian Thought

Newtonian thought, the underpinning of civilization from the 18th century to the present, is rooted in physics and mathematics. The core of the paradigm, the laws of motion, suggests that the world is a well-behaved machine. These laws define the means by which motion changes, specifically the way in which those changes in motion are related to force and mass. The first law states that in order for motion of an object to change, a force must act upon it, a concept known as inertia. The second law defines the relationship between acceleration, force, and mass. The third law states that any time a force acts from one object to another, there is an equal force acting back on the original object.

Social sciences of the industrial age have especially relied on the balance of forces law of Newton. Thus, the main paradigm of the social sciences has become 'the balance', without the dimensions of time and place. In scientific researches of this paradigm, the logical interaction between the causes and effects are defined. The cause and effect relation of this type is deterministic in nature, and this interaction structure forms a close system.

Another paradigm has started to converge as the civilization is on the edge of a new era: information era (information age). The technology resulting in this conversion is the Quantum Technology, which constitutes the Quantum Paradigm.

This research studies the education network in a supply chain framework. The high schools acting as suppliers for the universities, supplying them with students and universities on the other side of the chain, supplying the end-users, namely the employers, with college graduates; constitutes a supply chain system. The next section offers a snapshot of the traditional education system from the SCM perspective.

Newtonian Aspects of Education System

The globalization trend of 20th century has already significantly changed the way of doing business in every corner of the planet. There is a fierce competition in every industry to maintain a share of the market in which many global competitors are competing for consumers. Consumer-oriented markets are enforcing the companies both in manufacturing and service business, to improve their productivity and cost efficiency while maintaining acceptable service levels. The

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manufacturing companies, however, have already adapted to these changes by utilizing supply chain management systems. Before using the SCM methodology and techniques it is necessary to define it (Simchi-Levi etal., 2000):

Supply Chain Management is the set of actions used to efficiently integrate the suppliers, producers, distributors, and end-users with the goal of minimizing the overall system cost while maintaining a certain service level.

The requirement of interdependency among the partners of supply chain enables significant cost reductions and lower lead times. The contradicting goals and methods applied by the companies in the chain, on the other hand, cause problems in reaching effective systems. It is apparent that a new paradigm is required to switch the mindset of practitioners as well as that of the scientists from a traditional level into the 'quantum' level.

In traditional approach associated with the industrial era, in which the universities (manufacturers) and industry (end-user) lack the desired level of cooperation, the universities recruit certain amount of students (products) from high schools and send them to the job market upon graduation. This kind of behavior resembles a push system of SCM. In this kind of supply chain the decisions regarding the production is based on long term forecasts. In order to satisfy the demand of end-users, the producer uses the historical order data. Thus, this type of systems cannot respond to the changes in the market fast enough (Sagbansua, 2006). In a new era associated with quantum technology, however, the importance of speed, responsiveness and flexibility is vital. The lack of responsiveness in a push system causes:

1. Not being able to satisfy the changing demand
2. Obsolescence of products in the supply chain
3. Low levels of customer service

The lack of information-sharing between the parties of chain causes mismatches in the market such as ending up with not enough number of qualified personnel for certain jobs, and congestion for other sets of jobs. It is not apparent how to determine the production capacities in these systems. Consequently, planning and production is more difficult due to the uncertainty; thus, resulting in unproductive use of the resources.

The research conducted by the Turkish Statistical Institute in the period of April, May, June 2009, aims to provide detailed and comparative information about the transition of the youth into to the workforce. The high density of young population and the high unemployment rate among young population makes this issue even more important for Turkey and for the countries with similar characteristics. The target group in this research is chosen to be 15-34 age groups. The people are asked whether they have ever worked in a job with duration of more than 3 months after leaving formal education for the last time.

1. The number of non-institutional population was 70,435 million in the second quarter of 2009 and the number of people between 15 and 34 years of age constitute 33,5% (22,627 million) of total non-institutional population.
2. In the period concerned; 23% of 15-34 population (5,428 million) are those who are attending to formal education.
3. Of total population graduated from the "teacher training and education science" field programs; 65,3% were employed, 11,5% were unemployed and 23,1% were not in labour force in the reference week.
4. Of total population graduated from the field of "business and administration" programs; 63% were employed, 15,6% were unemployed and 21,4% were not in labour force in the reference week.
5. Of total population graduated from the field of "health" programs; 87,9% were employed, 2,2% were unemployed and 10% were not in labour force in the reference week.

Not surprisingly, the research indicates that 35% of the students in "teacher training and education science" are not employed after graduation, and this number is 37% for the students in the field of "business and administration".

These figures which can be regarded as 'scrap' in the context of management and specifically supply chains, is not acceptable for any organization. In the information age and modern management science, in which cost figures and waste by all means are supposed to be minimized, apparently these figures are prove the inefficiency of the current education system.

According to Regina Ebner, the vice-president of the European Civil Society Platform on Lifelong Learning, it is time now to implement a more structured and regular dialogue between the institutions and civil society organizations. Furthermore, the efforts are being made in all the European countries to adapt the education and training systems to the knowledge-driven society and economy. The suggested education system through the quantum theory of information age is introduced in the following section.

Quantum Approach

Quantum Thought

The management field is in the process of reaching a new era, parallel to the restructuring of information age. Information technologies are the main enabler of this age. The structure, methods, and scientific explanations of the information society is based on Quantum Theory, otherwise called Quantum Paradigm. The technology, society, and the restructure of the management context consists of systems, structures, and processes that are quite different that those of the industrial society (Erkan, 2004).

The new paradigm offers a sharply new way to think about problems that we comfort and opportunities that we may have (Zohar, 1998). It requires scientists and the whole society eventually, to look through different lenses to the surrounding reality. Quantum theory specifies a physical world where electrons routinely jump from one orbit to the other and they spontaneously disappear from one reality and appear in the other, they do not exist separate from observe, that is, their existence and situations depend upon observer (Dulupcu and Okcu, 2000).

The expansion from the Newtonian theory to the quantum, which includes time and place dimensions, requires evaluating the events with a system and process rationale. The complexity and multi-dimensions of these systems and processes have led to the new approaches in the context of quantum paradigm such as relativity and chaos theory:

Chaos theory and complexity theory, argue that relationships in complex systems, like organizations, are nonlinear (as opposed to the Newtonian theory), made up of interconnections and branching choices that produce unintended consequences and render the universe unpredictable (Tetenbaum, 1998).

A tendency to move towards the analysis of chaotic, multi-dimensional, and complex issues in the social events and processes of the nature, from the equilibrium point of mechanic

thought has emerged. The life has started be perceived in a new paradigm.

In quantum paradigm, the interaction of complex relations is approached as a whole. This theory questions the classical concepts of solid objects and of strictly deterministic laws of nature. It proves that energy is not transferred or transformed continuously but rather discontinuously in an indeterministic way. In quantum world, every attempt to observe changes the system and the object of observation (Peat, 1987). That is why quantum theories explains a universe not of certainty, but of indeterminism in which all we could ever know is the outcomes of our observations and not some fundamental truth or order (Overman, 1996).

The following table provides a comparison of Newtonian vs. Quantum Theory:

Quantum Aspects of Education System

The holistic characteristic of quantum approach requires the involvement of stakeholders, social partners and policy makers in the policy-making processes. It is essential that these parties sit at the same table to discuss issues. Stakeholders plea for more transparency and for a clear identification of decision makers at all levels. Stakeholder's consultation is key. Stakeholders acknowledged that progress is being made in involving civil society organizations but remains insufficient.

There is also a strong need for an expanded role for citizens' initiatives. On the other hand, social partners and civil society organizations need to cooperate further.

Education and training is not a product from a "school factory" but it is a process composed of a lot of different elements. Education and training policy has to be connected to other policies for instance labour markets. After all there is no use of pushing people in higher education if the students do not find enough employment opportunities. More attention should be given to the complementarity of education and training, employment and social policies. Policy makers must have a balanced vision of education and training. Lifelong learning has three main goals, learning for a profession, preparing for society and personal development. Policy makers have to prevent focusing too much on one of these elements. Policy makers must have a long-term vision of education and training. Policy makers should therefore concentrate on how learning takes best place and how people become lifelong learners.

The new approach suggested by this research in enabling above mentioned goals is a pull system in SCM context in which the production decisions are made based on the customer demand, rather than the forecasts. The employers determine the amount and type of university graduates they need and this information guides the universities in their decisions of how many students to educate in which field. In order to make this system work, fast and reliable flow of information among the parties involved must be in place. This approach will result in:

1. Reduced time of education and training (lead times of order)
2. Reduced variability as a result of reduced lead times
3. Reduced congestion levels (stock levels) as a result of variability

Thus, the universities will end up with less stock levels, more productive use of its resources, and lower costs throughout the system.

On the other hand it is difficult to use pull systems in situations where the lead times are too long to adapt to the demand information. In such cases, the initial levels of supply chain are designed as a push system, the later stages as a pull system. Mass production occurs in initial levels, while more custom tailored production is left for the later stages based on the customer demand. The line between these systems is called a push-pull boundary in a SCM context.

It is also essential to build a culture of quantum thought in the institutions.

As challenging as it is to build a new culture with a new philosophy that questions the way of thinking of people, it paves the way for a smooth orientation to a new model of education system. The culture can be approached in several dimensions: knowledge and information sharing, innovation and creativity, and diversity.

The role of the manager in building and maintaining such a model includes, managing the transition, challenging the status quo, and creating a learning organization.

The basic properties of quantum education systems management (ESM) can be summarized as follow:

1. Quantum ESM relies less on precise planning. Precise planning may not be beneficial where too many minor variables can change, altering a precise plan (Stillwell, 1996). Instead it focuses on relations and mechanics of the network of variables.
2. Quantum ESM must be flexible and adaptive. The information technologies make it possible to track the changes around us simultaneously. It is extremely critical to maintain awareness of internal and external environment by taking advantage of the emerging quantum technology available.
3. Quantum ESM must be social-oriented. Quantum thought views the organizations as part of their environment. It is neither possible nor appropriate to analyze the organizations in isolation.
4. Quantum ESM emphasizes the relations between economic, social, political and cultural variables. In quantum thought, these systems are indivisible and dynamic. It is the relationships between things that count, not things themselves, because each thing drives its meaning from relationship it has with other things, that than from fundamental local properties it has (McDaniel ad Walls, 1997).
5. Quantum ESM focuses on learning rather than knowing. Since the variables and relations between them in the quantum world is ever-changing and the future is unknowable, building and maintaining learning organizations is more valuable.

A similar paradigm in education is proposed by the joint European Students' Union/ Education International project 'Time for a New Paradigm in Education: Student Centered Learning' (T4SCL). The project is based on the long-standing need to clarify and deepen the academic community and policy makers' understanding of the practical implications of the recent paradigm shift from teacher to student centered learning.

The call for the shift in philosophy is explained by the increasingly diverse profile of the learner, the demand for increased educational quality and the drive to increase equity in learning.

Major aims of the project can be summarized as follow:

- Increase awareness of the need to focus on learner-centered forms of learning.
- Identify and centralize previously existing research on the topic.
- Gauge the current outlook with regards to SCL among student and staff unions.
- Create a toolkit on the development of SCL aimed at both student and staff representatives.
- Discuss SCL with relevant stakeholders.

• Increase cooperation between students and staff aimed at working together for the advancement of learner-centered education.

Management Issues

The higher education environment is undergoing far-reaching change. Institutions are facing changes in the balance between state and market, global and local, public and private, mass education and individualization, competition and cooperation. To cope with these challenges, the new generation of educational institutions tend to set up an ongoing process of quality assurance, guidance, reflection, analysis and sharing of best practices among professionals in the field of education. Such a network is intended to enable the institutions to keep up with the latest innovation in education and in managing higher education institutions and enjoy even greater scope for information exchange, experience and professionalism using an interactive, dynamic approach.

The activities of the institutions focus on two main policy areas: the governance and management of the institution and its integration into the environment.

Strategic management which is defined as the allocation of resources to programmed activities calculated to achieve a set of goals underlines the institutions' overall strategy. In that sense, the strategic themes that are accepted by the institutions are:

1. To develop a strong 'student-centered' approach
2. To become more responsive to employers' needs
3. To serve students' special needs:

a. Minorities
b. Geographically remote areas
c. Academically poorly prepared

4. To improve retention and graduation rates

Ensuring That the Institution is Financially Monitored and Efficiently Managed

Managing human resources: today the demand for education is growing all the time, and this calls for a genuine human resource policy. But for reasons of tradition or special status, many institutions have little room for maneuver when it comes to personnel management. Attracting, retaining and motivating high-quality teaching-research status administrators become a challenge with a limited budget.

Budgeting is making decisions that distribute resources to enable operations. The budget is the device by which an organization carries out its plans and signals its priorities. It is the primary mechanism through which positive incentives for change can be created.

Linking planning and budgeting however is difficult because planning is typically conducted at the strategic level and budgeting is typically focused at the operational level. Thus, there is a need to develop and approach to strategic budgeting. Strategic decisions focus on the creation and maintenance of institution's capacity. Operational decisions focus on the utilization of that capacity in ways designed to accomplish specified purposes in Table 2.

In order that the budget responds to the responsibilities of institutional leaders and link to the strategic plan, it is suggested that:

1. The budget be given a structure that explicitly reflects the areas of responsibility of strategic level decision-makers that it contains the following components:

a. Base/Continuation-the Status Quo adjusted for price changes
b. Strategic initiatives
c. Contingency
d. Asset Maintenance
e. Asset creation/deletion-Intentional changes in the asset structure

2. The budget process requires guidelines to be established around each component prior to initiating unit level budget-building.

Sharing and Disseminating Information and Experience

Joint events such as seminars, conferences and workshops provide the personnel of the institutions with access to a genuine network of professionals in the field of education. This gives them the opportunity to share and compare the management policies and practices of a variety of institutions in an international setting using an interactive approach. Disseminating examples of successful innovation and developing a knowledge base are ways of building the capacity and tools required for institutional management.

Managing and Supporting Research

Research is caught between the demands and needs of civil society, universities, business, industry and government. So finding a balance to ensure that the necessary funding, training and administrative support is available for research to function properly becomes an important issue.

Developing New Tools

The development of information and communication technologies offers new potential for dispensing and acquiring knowledge. Yet the infrastructure and human capital required to realize this potential are complex and often expensive which makes it a challenge to be met. The most realistic approach to e-learning, taking into account the risks weighing on institutions in this field is also being searched for this matter.

Monitoring Internationalization in Higher Education

Internationalization affects the wider environment of higher education. In this sense, the implications for the institution and the demands in terms of skills and provision of educational and training services become important issues.

The regions are vital players in promoting sustainable economic development and social cohesion. Optimizing the links between the institution and the regions so as to fostering their mutual support and development gains extra importance as well for this matter.

Conclusion and Future Research

The solution suggested by the current research is to switch from the traditional push system to the pull system where there is high level of cooperation among the universities and the employers in the form on information sharing. This system will ensure more accurate knowledge in regards to the demand of employers for specific types and amounts of graduates. Since the universities will increase their ability of planning according to the market demand and responding to the changes in the market, it will lead to better use of resources and increase the productivity on the university side. A better match between the needs of employers and the supply of universities will also avoid the congestion in certain fields while ensuring enough sufficient supply of qualified students in others. Since the duration of education (approximately 4 years) is much longer than the traditional production times in supply chains, mechanics of utilizing a pull system is not straightforward. It also may not be possible to apply pull system throughout the chain. A delayed differentiation is suggested for such a case. The initial stages of the supply chain, which operates as a push system, and offers a standardized education. The differentiation is applied at the push-pull boundary based on the market demand. Thus, the

combination strategy seizes the advantages of both systems; taking advantage of the economies of scale by standardized, mass production until the differentiation point, and customizing the production based on the market demand on the other hand, enjoying the benefits of the pull system.

The further research will be conducted to formulate the theory of quantum paradigm in supply chain management context. SCM with ever-improving nature, overlap with a good deal of concepts of the new paradigm. To engineer an easy and flawless utilization of SCM in service businesses as well as manufacturing firms, the mindset of managers must be well-prepared to the new way of doing business, parallel to the transition to the information age resulting from a paradigmal change in place.

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Table 1. Comparison of Concepts of Newtonian vs. Quantum Theory

Newton Theory	Quantum Theory
Determinacy	Indeterminism
Linearity	Non-linearity
Simplicity	Complexity
Independence	Interaction
Causality	Uncertainty
Predictability	Interrelatedness
Consistency	In-definetiveness
Objectivity	Lack of objectivity

Table 2. Costs/Revenues

Costs	Revenues
Assets	Tuition
Personnel	Appropriations
Facilities	Government Grants
Equipment	Private Gifts
Collections	Endowment
Students	Sales and Services
Finances	Other
Program	
Consumables	Reserves
Services	
Supplies	
Utilities	
Contingency	
New initiatives	