

15. A Reference Model for Human Supply Chain Integration: an Interdisciplinary Approach

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The focus of this paper is to adopt an interdisciplinary approach of the education system's strategic planning process, by drawing insights and critically evaluating the possibility of applying a mechanistic view of the work force development inspired from the vast and numerous literature of supply chain management. The outcome of the study is a proposed high-level reference model for Human Supply Chain (HSC) integration.

1. INTRODUCTION

This paper is mostly a “thought provoking” paper and its main concept emerged as a result of discussions that have overwhelmed national media, about the increasing numbers of unemployment, especially in the “warmware” (skilled labour) area. The aim of this study is to adopt an interdisciplinary approach of the national education system's strategic planning by applying a mechanistic view of the workforce development processes. This effort relies on an attempt to stress similarities between the discrete planning phases of educational planning and the traditional supply chain steps (plan, source, make deliver, return) as described in the relative bibliography. In this way, the education process is decomposed and conceptualized as a mechanism for educating individuals and empowering them with skills and knowledge which meet the labour demand within an open market. Such notion would add to current occupational forecasting projections the functional aspects of streamlining processes and planning time and available resources.

In doing so, a study of the analogical reasoning methods was carried out, especially in the field of metaphorical viewing of social phenomena. It is true that while analogies can become excellent carriers of explanatory messages and provide useful tools for abstraction and inspiration, extreme caution should be taken when they become tools for analogical reasoning or assumptions. In addition, Morgan (1986) suggests that metaphors may end up becoming erroneous expressions of a false analogical thinking. Despite these impedimenta, it is our opinion that Supply Chain Management (SCM) methodologies, tools and techniques may provide education analysts and government services a source of valuable and creative ideas towards an effective process for education planning. This paper aims at bridging the raising demand for efficient education planning and the solid and well accepted fields of supply chain methodology, thus producing for education specialists and labour economists a positivist and normative approach on education planning.

To support this point of view, this study is proposing a high level reference model. The logic of the proposed model is based mostly on SCOR (Supply Chain Operation Reference Model) and is fathoming two levels of abstraction (strategy and tactical); the long term goal of these efforts is the elaboration of a full scale and operational model that will be able to support educational planning in such a way to streamline employees' sourcing with labour demand and increase the overall Human Supply Chain effectiveness and integration.

The paper is organized in four Sections including this introduction, which keeps the place of Section 1. Section 2 reviews the literature concerning Supply Chain Management and provides an analysis of the problem of Labour Market imbalances as well as a presentation of past and modern approaches addressing the problem. In Section 3, the core of our rationale is presented; Human Supply Chain is defined and the first two levels of the corresponding reference model are presented. Finally, in Section 4 the limitations of the research are recited followed by the prospects for further research efforts and model development.

2. LITERATURE

2.1 Supply Chain Management

The concept of Supply Chain Management has its origins to Forrester (Forrester, 1958; 1961; 1968), who identified the pattern of response to changes in demand in supply chain situations. A supply chain situation suggested the existence of a network of organizations connected to each other, through upstream and downstream linkages, carrying out in collaboration different processes and activities that produce value in the forms of products and services in the hands of the ultimate customer (Christofer, 1998). Croom *et al.* (2000) argue that an antecedent of Forrester's ideas can be found in the Total Cost approach to distribution and logistics (Heckert and Miner, 1940; Lewis, 1956). Both these approaches show that focusing on a single element in the chain can not assure the effectiveness of the whole system.

Hau *et al.* (1997), indicate the phenomenon of distortion in demand patterns created by the dynamic complexity present in transferring demand from end users along a chain of supply to manufacturers and material suppliers. It has been the identification of this kind of distortion and inefficiency along with the realisation of managers that actions taken by one member of the chain can influence the profitability of all the other chain members that have driven many organizations to managing their whole supply chain instead of short-sightedly focusing on their own organization (Lee *et al.*, 1997). Since then, SCM remains a topic of considerable interest among supply chain academicians and practitioners from both large and small companies as they strive for better quality and higher customer satisfaction (Larson and Halldorsson, 2002, Mentzer *et al.*, 2000; Chopra and Meindle, 2001).

Opportunities for companies to use supply chain management principles to improve their competitive position are well documented in the literature (Davis 1993; Cooper and Ellram 1993; Gattorna, 1996). Successful implementation of supply chain management creates a number of benefits, these being cost deterioration (Mainardi *et al.* 1999; Cooper, R and Yoshikawa, T., 1994), technological innovation (Hult *et al.* 2000), increased profitability and productivity

(Gryna 2001), risk reduction (Chase *et al.* 2000), and improved organizational competitiveness (Fisher 1997; Christopher 2000). While supply chain management principles derive from a particular settings of problems and address a dialogue concerning these main issues, it may be argued that supply chain might offer an interesting paradigmatic view capable of providing new ideas for different fields of scientific thought.

2.2 Structural Unemployment and Labour Market Imbalances

There is a growing discussion about structural unemployment and the critical question of matching labour supply with labour demand. Inevitably, the complexity of social structuring and the transformation of social systems into dynamic entities (Castells, 2000) magnified the importance of accurate human development planning. Analysts often argue about the need for institutional adaptation and education reforms which must provide society with the appropriate labour supply. As Manacorda & Petrongolo (1999:182) suggest, "any increase in the relative demand for skilled labour would not cause major labour market problems if it were matched by a parallel adjustment of supply". Best (2001) also argues that the availability of the adequate skill base and the matching of supply and demand of technical skills become crucial factors for societal success and a critical question for innovation achievement.

Neo-classical models have ignored the importance of structural unemployment and the need for planning, arguing that labour markets are adjusting any imbalances in their own accord. But this is hardly the reality; inflexibilities and internal problems in structuring of education and training policies do exist. It has therefore been early stated that planning efforts must take place (Willems, 1996) in order to streamline education and labour market needs. In the past, the concept of manpower planning (Ahamad & Blaug, 1973), which consists of a solid methodological toolset for prediction and planning of labour demand, has been used. It was then occupational forecasting which boosted the efforts towards predicting and forecasting the jobs within the labour market in the long run (Johansen, 1960) and although occupational forecasting studies they require long effort and adequate funding, several surveys of that kind are still being published (Hughes, 1993; 1994).

It is arguable though, that connecting a forecasted labour demand with supply requires a great number of institutional arrangements and socio-economical reforms that must accompany a labour supply reform (*ibid*; Corrales, 1997; Whitley, 2001; Lloyd & Payne, 2003). It is also true that even in today's manpower forecasting efforts the study of the supply side of the labour market remains relatively under-explored (Willems, 1996:1). In other words, we need to integrate an effective prediction process with the adequate institutional measures and educational policy in order to come up with a realistic and effective plan of educational action.

In this paper we argue that the prevention or resolution of labour market imbalances may be resulted by integrating the educational and vocational training systems with the labour market, the same way that in the enterprise world, companies are integrating procurement, production and delivery systems for planning, interoperability and efficiency purposes. It is the aim of this study, to propose an alternative holistic view of the educational and labour market infrastructure and processes, taking advantage of the well proven methods picked

out of the enterprise reality, more specifically Supply Chain Management. Education specialists and governmental initiatives, we argue, may draw useful insights and ideas from a model-based view of education. The first step of these efforts will be presented in this paper in the form of a high level reference model, stating the analogy and creating the sub base for further research that will hopefully result into a fully operating human supply chain management model.

3. UTILISING THE ANALOGIES: THE HUMAN SUPPLY CHAIN REFERENCE MODEL

The sciences do not develop in complete isolation. On the contrary there is influence between the disciplines (Thoben, 1982). One way of achieving such as an interdisciplinary approach is through identifying analogies. This metaphorical way of thinking is a natural cognitive process primarily met in Aristotelian thinking. Recent literature provides us with many examples of utilising analogical reasoning techniques and metaphorical viewing in training and learning (Gregan Paxton & John, 1997), in manufacturing (Mill & Sherlock, 2000), for the theorizing of the firm and the organization (Penrose, 1952; Alchian, 1953; Keely, 1980; Morgan 1986; Oswick et. Al, 2002), for sociology and economics, a scientific field extensively viewed under a mechanistic and organistic view (Thoben, 1982). Successful analogical reasoning is possible when it assimilates a process of transferring an explanatory structure from the source domain to the target domain (Tsoukas, 1993:337; Oswick et. Al, 2002). In other words, we suggest that an analogy provides a solid methodological ground for research when it is the result of an effort to ‘compare’ instead of ‘assimilate’ two different systems (Morgan, 1986).

This is exactly the aim of this paper, to use analogical thinking and transfer principles and perspectives of Supply Chain Management into the problematic areas of labour economics and structural unemployment. In this paper it is suggested that the power of the SCM concepts may be found in their simplicity; an abstract view of a supply chain may be adopted, providing useful thinking for educational planning.

The Supply Chain Operations Reference Model (SCOR) is a tool for representing, analyzing and configuring supply chains. It was developed by the Supply Chain Council (SCC) and the consulting firm Pittiglio Rabin Todd & McGrath (PRTM), as well as over 65 major companies (Supply Chain Council, 2002a). Unlike optimising models, no mathematical formal description of a supply chain or heuristic methods for solving a problem are given. Instead, terminology and processes are standardized, enabling a general description of the supply chain under study. In this case, SCOR will be used as the basis for establishing a first abstract view of what we call the Human Supply Chain Reference model.

The first step, towards the elaboration of the primary two upper levels of the Human Supply Chain Reference Model (HSCRM) was the determination of the Supply Chain itself, the actors and the alternative pathways a human can follow in transforming himself from an unskilled worker to a ready to occupy a job position employee. A schematic time-oriented representation of the Human Supply Chain is shown in Figure 1.

The next step in the proposed approach was the application of analogical thinking in order to establish the necessary semantic bridges into initiating an

interacting connection between the two different scientific research fields, these being Supply Chain Management and Educational & Occupational Planning.

Enterprise Integration (EI) has grown in the past ten years at a pace where there is an obvious need for a more frequent forum where these strategic discussions can be continued bringing together leading thinkers of industry, defence and research.

As soon as the analogies were created, the actual core processes could be identified along with the actors that initiate and utilize them. This is shown in Figure 2, in the form of a UML (Unified Modelling Language) Business Use Case Diagram.

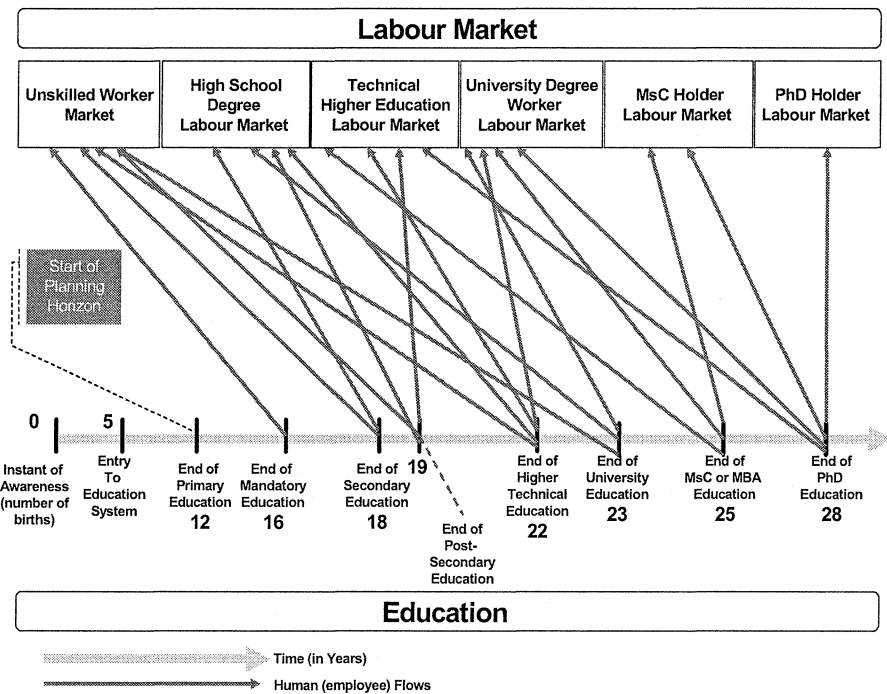


Figure 1: A Time Oriented Representation of the Human Supply Chain

The final step of the proposed approach was the application of the utilized analogies and the elaboration of the first two levels of the Human Supply Chain Reference model. According to the Supply Chain Council (2001, 2002b) Level 1 consists of five elementary distinct management processes which in our case have the following characteristics that are described below:

- Plan- Its scope includes the following planning activities:
- Developing and calculating all the necessary projections after processing the available data and estimations.
- Balancing resources with requirements and establish/communicate plans for the whole supply chain,
- Transition management, planning configuration, institutional arrangements and regulatory framework requirements and compliance.

- Align the supply chain unit plan with the financial plan.
- Source: Its scope includes the following sourcing activities:
 - Educational system infrastructure management and development
 - Graduating policies assessment and update.
 - Demographic policy management.
 - Admission and quotas framework.
- Make: Its scope includes the following activities:
 - Educational institution establishment and function management.
 - Syllabus management.
 - Academia and labour market relationship management.
 - Education staff procurement.
- Deliver: Its scope includes the following job market activities
 - Job market functionality improvement.
 - National and private career services development.
 - Labour equality and justice framework establishment.
- Return:
 - Continuing education programmes development including alternative education training schemes.
 - Vocational training and skills development programmes establishment.
 - Executive postgraduate schemes development.

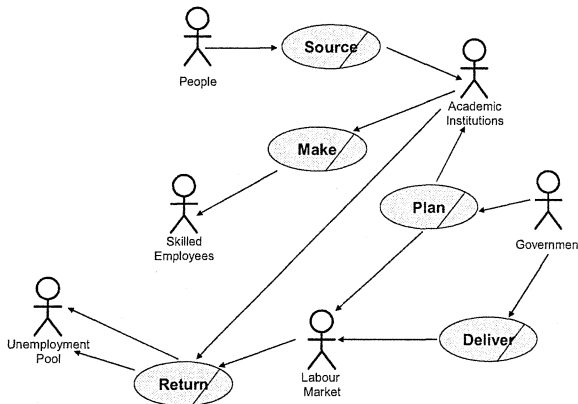


Figure 2: Human Supply Chain UML Business Use Case Diagram

The five distinct management processes described above are further decomposed into 30 process categories. At this level, typical redundancies of established business, such as overlapping planning processes and duplicate or unneeded sourcing activities can be identified. Each process category belongs to one of the types: planning, executing and enabling.

More specifically:

Planning (decomposition of Level 1 Plan process): Process categories of this type support the allocation of resources (educational or other) to the expected demand. They incorporate balancing of supply and demand in an adequate planning horizon. These processes are executed in a periodical manner and they directly

influence the supply chain's flexibility in rearranging it self when demand changes. For example a new emerging technology that is going to dominate the business environment will subsequently create a demand for employees capable of using this new technology. Planning is responsible for reallocating existing (e.g. change of the current syllabus of related courses to include this new technology) or establishing new resources (constitute new educational establishments or initiate training programs) in order to reschedule the human supply chain, thus enabling it to provide the labour market with the employees that will match in the best possible way the specific market needs at the time created.

Executing (decomposition of Level 1 Make process): These are processes that are triggered by planned or current demand. Process categories of the type executing, directly influence the time interval between incoming orders and delivery. They depict the core processes of a supply chain, which are responsible for the implementation of the orders and the resource and time constraints that rule them, as dispatched by the planning processes, in the strategy level. The process types source, make and deliver are divided with respect to the seven different human categories (see Figure 3) corresponding to the level of their education.

Enabling (decomposition of Level 1 Source, Deliver and Return process): This type of processes support the later two process types. They prepare, preserve and control the flow of information and the relations between the other two types of processes.

In the next Section, a set of limitations and constraints of this study will be presented along with the further research efforts to overcome them.

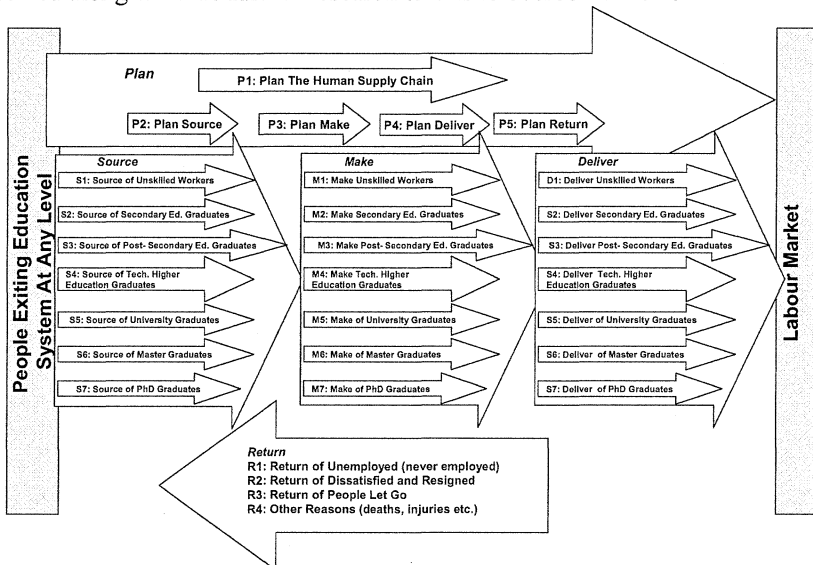


Figure 3: The Human Supply Chain Reference Model – Level 2

4. LIMITATIONS AND PROSPECTS FOR FURTHER RESEARCH

Supply Chain management is a flushing field of exploration for both researchers and practitioners. Major international consulting firms, academic institutions and enterprise R&D departments are developing large practices in the supply chain field, and the number of related research papers is growing rapidly. Despite these facts, there are no efforts spotted in the international bibliography that try to connect supply chain disciplines with human chains and educational planning.

It should be stated at this point, that research proposed in this paper is limited by certain constraints which are resulted by the social nature of the problems itself. It could be suggested that the model under consideration requires a high level of abstraction from the complexity of reality; such complexity is magnified by the fact that materials flowing within the systemic boundaries refer to people who maintain their own beliefs, expectations and decisions. In addition to that, education choices are not only a question of personal choice or institutional strategy but also a social process often presented as a 'social right' (Corrales, 1999: 78).

Nevertheless, we argue that a supply chain perspective on human resources planning within a social system may provide policy makers the missing link between forecasted jobs and the decisions related to the structuring of education, thus improving the overall human supply chain efficiency. In doing so, several research efforts should take place in the future, as described below:

- The further decomposition of the process categories identified in the second level of abstraction of the reference model (see Figure 3), into fourth level process elements.
- Finalising the Human Supply Chain Typology in terms of functional and structural attributes in order to help the identification of the type of decision problems and guidance of the selection of standard or specialized modules, models and algorithms for decision support.
- Issuing a set of detailed metrics and best practices for each one of these process elements, establishing a performance and benchmarking measurement system.
- Outlining a procedure for the application of the elaborated reference model.

In parallel with these activities it is the aim of the authors to disseminate the human supply chain concept and the holistic approach introduced in this article, an effort initiated with this paper. Further prospects of collaboration within the context of a research project in national or European level will be thoroughly examined.

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