Value and supply chain in higher education: an interactive qualitative analysis of chain links

Cesar H. Ortega Jimenez (cortega@iies-unah.org)
Universidad Nacional Autonoma de Honduras

Julio Zavala Umanzor
Universidad Nacional Autonoma de Honduras

José Roberto Arrazola
Universidad Nacional Autonoma de Honduras

Abstract
This paper evaluates higher education supply and demand relationships by a value and supply chains model. Through three focus groups and a system for interactive qualitative analysis (SIQA), the proposed model was validated, noticing frictions due to missing linkages in practice, despite being a key issue for all informants.

Keywords: Value chain, Supply demand, Higher education

Introduction
Higher education (HE) in Honduras may be modeled using concepts of value and supply chains, in search of improvement in HE operations, in HE demanders’ satisfaction, in results of quality and outsourcing processes, etc. Furthermore, the study of both kinds of chains may be of predominant need because of many reasons, among them (Habib & Jungthirapanich, 2010): 1) current significance in services; 2) general tendency to globalization (especially supply and production); 3) competitive pressures and focus on innovation as part of global strategy; 4) tendency in management research (e.g. evolution in management models for initiatives that increase/improve HE services to society); and 5) for the demanders themselves in the chains and the complexity in the environment.

Many universities, especially at the international level, get to focus mainly in teaching/learning and researching models of value and/or supply chain, which may improve production, operations and business in general. However, very few of such universities (none in Honduras) do their own academic activities around the HE value and/or supply chain, regardless that such chains represent international concepts, with uninform dimensions at the global level that may be applied in HE (Habib & Jungthirapanich, 2008).

Thus, research must focus not only on demand (value chain), in order to achieve a forward integration (output of finished HE results), but also on elements belonging to supply (traditional perspective of HE logistics), which allows for a backward integration (supply chain), improving the entry process of HE inputs. Both views are needed so that
the HE operates as a unique value and supply system of production of services, with a balanced integration of the value and supply chain, with its input providers (supply side or input) and demanders/beneficiaries (demand side or output).

However, as in any service industry, HE not the exception, with a production and operations process, there is friction, seen as an opposition on the current supply flow. In a production and operations process, every link between any two connections would present friction, defined by a state of opposition between persons, material, ideas or interests.

Thus, friction may be zero if and only if such process is perfect or efficient. Furthermore, if there is friction then waste exists. On the other side, if the process is not effective then leaks may also happen.

On the other hand, an effective value chain must generate benefits, considering at least three focal points: 1) value chain process; 2) chain information flow; and 3) benefits granted to its demanders. Furthermore, an efficient supply chain should reduce its operating costs that include waste (Feller et al., 2006).

Although there are many ways to analyze production and operations processes, this paper chooses to tests if there are frictions in the higher education chain, by identifying bottlenecks. For this, there is need of a cross research of the HE process, by collecting and examining information from its key demanders about possible existing link frictions within the value and supply chain of higher education.

The structure of this paper thus continues with a review of conceptual framework. The methodology is next presented. Then, this paper presents results from a model of value and supply chains, setting out some conclusions and final considerations, pointing out a future research to follow up.

**Conceptual framework**

Considering production and operations management, two main HE services (i.e. teaching and research) may be best defined as part of a HE supply chain (HESC). On one side, there are direct and indirect services in order to process inputs such as secondary education (SE) graduates, HE graduate students, etc.). Direct services may include design and development, source and selection, academic and non-academic formation, practical and vocational formation, postgraduate formation, result assessment, development of continuing education (throughout life), workshops, training, instructions, etc. Indirect services may be campus improvement and maintenance, IT infrastructure, university dorm supply, access clearance to facilities and information (hard & soft), libraries, bookstores, security, cafeterias, sport facilities, etc. (Lau, 2007). In order to assure quality according to society demand for HE, a HESC would require customized processes for each student. Nevertheless, since every student is different and no higher education institution (HEI) could set up an individual process of HESC, in the critical design and development of every student, HE must assign an academic tutor who oversees the process of student development through the HESC (Habib & Junghirapanich, 2010).

On the other side, research, almost always expensive and long term, requires a customized, proactive and reactive HESC in order to satisfy the demand (e.g. users). Firstly, the HESC must manage the communication to professionals and facilities in a university to prevent duplicities when focus in on a basic research, which needs to develop observations from surveys with relevant data. Secondly, when there is need to
develop some system and/or technology for a certain industry, the HESC must look not only for suitable players (e.g. applied research professionals) for also for facilities, so that together it may be possible to carry out a more efficient and effective research (Habib & Jungthirapanich, 2010).

Along and parallel (opposite direction) to both previous HESCs (teaching and research), there is an integrated HE need of other customized, proactive and reactive process, in order to get feedback satisfaction levels from demanders and society for the perceived value from HE results of present services, in all possible geographical levels: local, regional, national and international. This process requires links to society demands within a HE value chain (HEVC) and may be considered either a third fundamental service, or an integral part to both teaching and research. The idea of this third service is that allows monitoring the added value by HE processes, from the initial condition of HE inputs until reception of HE results for HE demanders and society, assessing the quantity of HE added value. Hence, the HEVC must build a HE-society link that takes such feedback to improve the services of the two HESC (teaching and research) and relationship levels, correcting present situations or developing other alternatives, according to needs. On top of this, such link by HEVC must promote present services as part of both HESC, and the development of new services within the same both HESC, by means of a value flow from society to other players involved in HE (e.g. other demanders of HE results, HEIs, HE input providers, etc.).

However, in order to have a complete view, such flow must go beyond a unidirectional value flow by a HEVC (demand to supply), by integrating the supply flow from the other direction by a HESC (supply to demand), which results in a HE value and supply integrated system (HEVSIS), whose flow is therefore bidirectional. In such flow of a HEVSIS process, universities must work in designing curriculums in close collaboration with different entities such as high schools, technological institutes, present HE students, university faculty and other personnel, employers of their professionals, users of their research/projects, collaborators, etc., in order to assure need satisfaction of all participants in a HEVSIS (Heskett, 1964). Besides, the HEVSIS must have a vision guided by HE users (i.e. demand of HE results), which may produce a number of competitive advantages to the HE, by helping to improve productivity and user satisfaction, and to produce results of quality. Every day, it is being recognized, as part of a HE quality management, the potential benefits of associating final results to input providers (Habib & Jungthirapanich, 2010).

All of the above requires a systemic view of the conceptual framework of a HEVSIS, formulated multilevel and bidirectional. Being holistic, the system needs of all involved players in order to obtain the final results. Therefore, this paper sets out seven significant components for the HEVSIS proposed model: inputs, HE process (fundamental functions and supportive activities, three types of results (primary, secondary and tertiary) and a systematic society link to both, input and process. Such integrated model of the system must fulfill better the requirements of the two types of users (demand): 1) intermediate demanders (professionals, instructed graduates, and research results), and 2) final demanders (society, employers, sectors of projects of research, development and innovation (RD&I) executed/implemented).

The HE process (using its two kinds of fundamental functions as supplies) in Figure 1 represents the HE inputs (SE graduates as students and raw materials for
projects) and looks to transform them in the most efficient way into final primary results such as professionals and research/project results (Habib & Jungthirapanich, 2009). Some professionals may decide to work as HE teachers or administrative personnel (tertiary result to the process of fundamental functions and supportive activities)\(^1\). While, as secondary results, other professionals may seek postgraduates’ studies and some research results may be considered as inputs for new rounds of HE research\(^2\). These secondary results, at the same time as input providers, show clearly an output-input duality. This may represent an opportunity of input as part of the HE process, by having the chance of providing knowledge, abilities, practices, and experience in order to educate undergraduate students and to manage projects (e.g. postgraduate input from postgraduate to process undergraduate input). On top of this, this paper also seeks for a society link with HE results, process and input, which means searching for a better value perception and effectiveness of HE results, by the greatest added value in each part of the HE process. A good implementation of the three-decision levels (strategic, tactical and operational) that interrelates such system components is the key so that the three levels of HE results (primary, secondary, tertiary) fulfill the expectations of all players involved.

![Figure 1. HE Value and Supply Integrated System (HEVSIS)](image)

Finally, the most important thing is to remember that the source of value is users (demanders), thus is necessary to consider demand flows (also known as demand chain), which goes from society to input provider, passing through results, HE process (supply), as seen in the red dotted lines (green ones of society links follow value flow). The Figure also shows what could be considered as possible flaws in the HE system represented by lines as provision and supplies in transitions (e.g. potential inputs that do not enter HE process, which may or may not enter eventually; HE students as supplies who have to work in or outside HE, and/or withdraw and may or may not reenter again; etc.).

Taking the demand flow from Figure 1, HEVSIS may be broken into three main parts: 1) demanders of HE results; 2) HE process with its internal supply and value chain (ISVC); and 3) HE input providers. The details of each one are explained in results.

Therefore, the following proposition and sub-propositions are set forth:

**P. There are frictions in the HEVSIS**

\(^1\) It may be possible a tertiary result with a research executed or implemented as part of the HE process.

\(^2\) It is valid to consider here the tertiary results that return again as HE input.
Pa. There is waste in the system for not being efficient.

Pb. There are leaks from students and research leaving and/or not entering the system.

**Research setting**

The empirical evidence used to test the propositions was taken from three focus groups (Hamui-Sutton & Varela Ruiz, 2013). Surveyed institutions were considered as part of any of the four links in the proposed higher education value and supply integrated system (HEVSIS). Following the flow of the supply chain (from supply to demand), the first link (1) is the HE input provider, represented by people from the following organizations: National Secondary Education Secretary, Treasure Secretary, Science and Technology Secretary, National Vocational Training Center, education quality supervisors, private research organizations, scholarship foundations, secondary students’ family associations. The second link (2) has the HE supplier, represented for private and public HE institutions (HEI) with high number of students. The third link (3) represents the intermediate demander in the HEVSIS, i.e. first HE beneficiary or user of HE results: National intellectual property Office, professional associations, higher education family associations, scholarship foundations, private and public research centers. The last link (4) is the last/final demander and includes the labor market, entrepreneurship groups and organizations: National Labor Secretary, banking and entrepreneurship associations, production and service sectors (selected by productions rate).

The three main functions were conceptualized and defined as multidimensional constructs. Each dimension represents one facet of these broad constructs and all pertinent dimensions together define a main HE function as a whole (Figure 2).

![Figure 2. HE constructs: teaching, research and demand links](image)

Three duel focus group sessions were used to collect the information. This kind of focus group is a technique to capture qualitative information, requiring two moderators, who present a sequence of conflicting proposals about the relations of the informants. Each moderator takes a different perspective and seeks to defend the position of his assigned link; likewise, he tries to blame the next link assigned to his fellow moderator, in order to create controversy and discord among the participants, enriching the study with belligerent and defensive arguments, in relation to the proposal/perspective. Thus, groups of representatives between adjacent links (1-2, 2-3, 3-4) are confronted in the flow of the HE supply chain (supply to demand). The purpose of this was to identify frictions and divergence between them, assessing their relationships and categorize them, by analyzing the comments that were collected.

There are three sub-stages part of such qualitative research methodology:

1. Identification of the current higher education process, as well as an introduction to the subject to try to include topics that generate discussion about relationships between
two bordering links.

2. Confrontation, centered on the higher education, between the key players in one link against the players of the neighboring link in the higher education chain. This sub stage was used to identify differences and incompatibilities between them and to analyze how linking is done (e.g. backward, bidirectional, or forward). This is done by several questions challenging current operations management of both links, thus evaluating the efficiency (supply) and effectiveness (value).

3. Knowledge gathering on common ground on the operations management, in order to model or parameterize input flows from the analysis of both links, taking convergence points for elements that both agree upon, as potential optimal points for the value chain and supply chains. The disagreement points generate frictions. If both links have implemented the same or similar process for the same operation, it means waste.

Method of analysis: system for qualitative analysis (SIQA)
Qualitative research has increased in the last decade, predominantly in social sciences; proof of this is the increasing number of high impact scientific journals publishing qualitative research and the introduction of qualitative research courses as part of many research post-degree programs (García, 2012). This rise of the qualitative paradigm has generated a development of supporting software for researchers, both to gather a greater quantity and variety of data and the analysis thereof.

On the other hand, although the adoption of new information and communication technology of (NICT) in scientific research has followed a smaller trend, especially in social sciences, its widespread application in the near future, although ambitious, may be feasible, since the use of technology in research has been driving scientific changes and NICTs have been consolidated into tools supporting different disciplines (Meyer et al., 2008). In this sense, Colas (2012) states that NICTS are contributing to an accelerated transformation of the scientific culture, generating a visible impact in qualitative research.

Despite the existence of a great variety of software for management and analysis of qualitative data, there was not a program on the market that fulfilled all the requirements for the HEVSIS, so it was necessary to develop an ad-hoc system for interactive qualitative analysis (SIQA), created at the Institute of Social and Economic Research (IIES), due to the need to get perceptions from experts of the four links in the higher education chains in relation to different aspects framed in HEVSIS, and thus be able to identify and analyze the relationships, common points and frictions that exist at all levels of the Honduran higher education system.

This software of collecting and analyzing qualitative data, currently being patented and programmed in Java with the NetBeans IDE 7.2 compiler, possesses a multiuser platform with different access’s levels and configurations, three management and data analysis modules, a statistical module and the flexibility to operate under any wired or wireless computer network (Figure 3). The modules, part of it, are explained next.

Sign Up / Log in: In this module each user is identified by an alphanumeric login and password. There are also professional and personal user information and access levels.
Storage: It stores all information for each session and each user locally (on the computer that is installed). Then, all computers database can be synchronized via a server.
Login: It loads from the local database the last stored session of a user. If new user, it
loads a preset session by the administrator.

**Graphic module:** It allows creations and editions of entity-relationship diagrams through a user-friendly interface with a large repository of shapes, connectors and full range of colors in the RGB system.

**Analysis module:** It allows editing, group and commenting implicit/explicit relationships created in the graphic module.

**Metaplan module:** It is a virtualization of the metaplan technique, which captures users’ perception and weighting (good, neutral, bad) on different aspects of one or more objective questions defined by the administrator.

**Statistical module:** It allows the administrator to filter and generate a summary of all comments and perceptions entered by users on a network.

**Discussion of results, conclusions and future research**

The three focus group sessions were designed to capture particularities of the system and frictions that limit an effective linkage between HE input providers, universities, society and the job and research market. In this way, institutions’ experts from the quadruple helix (university, government, business and society) were convened in order to have a view of the system from all perspectives.

In the sessions, a set of entity-relationship diagrams were constructed and validated, as seen below, showing the internal structure of the links of HEVSIS, as well as a display of the main relationships and processes in which the actors from the HE chains interact. Table 1(a) shows the *input-provider link*, which shows higher education provisions, both in teaching and research, as well as the leaks in the system by non-formal education and non-academic consulting. It also shows, direct and indirect relationships between secondary education students and social sectors of the economy (private, public, public-private, and nonprofit sectors), as well as the relations seen between regulators of the secondary education system. Table 1(b) shows the processes involved in the *HE supplier link* (offerer). It also displays the organizational structure of a HEI, its adding value processes to students and research projects, toward their output as professionals and research results. Table 1(c) shows intermediate demander (customer), such as professionals, student’s families, professional associations, donors, etc. It shows teaching and research supply chain, and their interrelationship to entrepreneurship, research and employment. Besides, donors may participate in vocational education and training, and cooperate by investing/financing research projects impacting society through publications.
Table 1. HEVSIS frictions: a view of waste and leaks from SIQA

The sessions provided in depth information about the structure and the effective and efficient levels of each link inner process. There were several key issues covered in three main clusters: teaching/learning, research and HE links to society demand.

Firstly on teaching, the focus group members affirm that there are big deficiencies in public education in all levels: primary, secondary and tertiary. This worsens by strikes, mismanagement, and lack of standardization, measurement and quality supervision, producing frictions in the teaching-learning process. Thus, informants assented public school, especially secondary, should be concerned with raising the academic level, since most HE freshmen are not properly prepared. As far as teacher training, there is often didactic deficiency in the higher education process by professors, not because of lack of knowledge but lack of transfer capability to the student. This view was shared by all the participants, so they recommend periodic teacher training, especially in pedagogy and
technology use, due to the increase in virtual classrooms and video conferencing training. As of skills/competence, the need to prepare HE professionals, with a set of knowledge and competence, is key to perform well in the labor market. In addition, professionals often have communication problems limiting effective knowledge transmission, probably due to insufficient students training in interpersonal relationships. Also, HEI should encourage other skills and competences such as team work skills, use of technological tools, second language proficiency (especially English), basic mathematics knowledge, and, as second line of skills and competences, basic knowledge on economics, research methodologies, entrepreneurship, analytical skills and ethics. Finally, on financing and desertion, informants agreed that low socioeconomic status of students, in secondary or tertiary level, forces them to renounce (or partially) their studies in order to get half or full time jobs. This has an impact on their academic performance, setting a stage for student desertion. Other dropout factors on both secondary and tertiary levels, are the low perception on education importance, lack of motivation, lack of attitudinal guidance, and mostly by widespread disenchantment about labor supply. Education investment (student) is high and job opportunities are few, leading to underemployment, i.e. labor market does not pay the knowledge acquired in higher education.

Secondly on research, informants agreed that teaching-research linkage is not balanced since HEIs have been devoted mostly to professional training, and usually in college degrees there is close to none research. Hence, it is necessary to implement research programs for students in current areas with social relevance. HE should make students spend more time doing research, since the vast majority of professional graduates suffer from this competence. As concerns research dissemination, resources for research in Honduras are scarce and projects are carried out without an adequate diffusion, so results may not only outweigh the investment, but also they may not have much impact on society. In this sense, it may be necessary a central institution for all public and private research being conducted in the country. Finally, there is a high demand for social projects, whose funding may not always be there due to lack of support provided for research. Thus, it a priority to identify projects and areas of research that are oriented to the objectives of society needs and invest in them.

Thirdly on HE links to society demands, the existence of requirement imbalance in the way HEIs provide their service, so it is necessary to define a HE regulation with minimum standards in both content and teaching evaluation, constantly monitoring their compliance. This should be a priority, since there are HEIs offering low standard services due to lack of demanding requirements. As of design of HE planning, although HE perception was positive since professionals training is acceptable, knowledge transfer is often more theoretical and students do not usually acquire needed skills to effectively implement such knowledge. Thus, programs need to be updated with practical studies. Also, the National HE Board must build strategic alliances with other national and international agencies to promote HE development. Board’s planning is scarce and follows old bad practices that do not generate new ideas and thus a monitoring system aimed at performance management should be established. As far as professional practice and internships, HE should encourage more volunteering and internships, as well as to increase professional practice period, since students may experience real market labor, letting them strengthen their skills acquired during higher education. Finally, the general perception was that there no HE-labor market linkage, and thus there must be
government-business-university formal alliances to obtain effective information about labor supply and demand and to establish agreements on young graduate market insertion.

Lastly, these results show significant support on the propositions and sub-propositions.

Conclusions and future directions
Hence, this paper shows the importance of the integration among all links in the HEVSIS, which impacts by adding value to the HE processes to both supplies (i.e. teaching and research) but also the productivity of both, thus continually improving a bidirectional HE-society demand flow. Therefore, it is important that all actors involved worked out to solve frictions, leaks and wastes due to problems in linkages between them. This approach will be used as a cornerstone for future quantitative research on frictions or disconnections in all parts of the HE chains, which may result in problems such an HE supply and demand unbalance. Such quantitative research is currently designed on an ongoing project that allows for an efficient and effective interrelationship among HE input providers, HE suppliers, and HE demanders, guided by demand (value supplied to demanders) from a model of value and supply system with total integration (a HE integrated not only forward by demand, but also backward by supply).

Lastly, in this research almost every module of SIQA was involved in the analysis, and the obtained results proved SIQA versatility.

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