

Educational Supply Chain Management System: A Case Study in Indonesia

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Abstract— This study aims to explore the Educational Supply Chain Management System existing in the case faculty by using the sequential mixed methods (qualitative-quantitative). The use of mixed methods in this work not only captures the full picture of the comprehensive research results but also fills the gap in the existing literature. Purposive sampling method and simple random sampling method were used for selecting the participants. The target population involved academicians and management practitioners. The number of participants for qualitative was 48 and 50 respondents for the quantitative method. A semi-structured interview with at least 20 questions was used and 40 minutes was consumed on average per interview. Thematic analysis was employed for qualitative data analysis. Qualitative phase resulted in five primary activities involving input, operation, output, public relations, and services, and four supporting activities consisting of procurement, technology management, human resources, and infrastructure management (finance and student affairs). Based on these results, nine themes were developed to build quantitative instruments which included 38 Likert Scales questions. Pearson's R-Table method was used for instrument validity test and Cronbach Alpha Coefficient was applied to test instrument reliability. The data from the respondents were analyzed by Percentage Analysis method. Measurement level of all indicators achieved over 65% and thus, nine supply chain functions (qualitative results) have firmly identified by quantitative method as the existing functions. Therefore, this research gives the sufficient research findings of how the Educational Supply Chain works in the educational institution.

Keywords— *Educational Supply Chain, Mixed Methods*

1. Introduction

Every organization has Supply Chain Management System (SCMS) in their ways, which performs a set of activities, to produce a product or deliver the

service for the customers. Well-being Supply Chain (SC) can help every business sustain the competitive advantages [1]. It is a set of functions that involves input, operation, output, sales and marketing, service, procurement, technology management, human sources management, and infrastructure management [2]. Its goal is to integrate functions across and within the organization for giving customer value [3]. Although SC studies have commonly found in the business field in the earlier decades, many researchers from non-profit organizations have conducted researches about how it works in their relevant fields including humanitarian and education sectors [4]. It has received sufficient attention to governing the educational management system.

In the Education Supply Chain (ESC), most of the researchers defined "School" as "Service Provider", "Students and Research project" as "customers and raw materials", and "output" as "skillful graduates and research outcomes". Several studies on the ESC and Education Value Chain (EVC) could have been seen in the literature. Most of the studies conducted by prior researchers were exploratory types with a qualitative method and single case study. However, the number of SC studies in educational management was less than those of other social services and manufacturing industries [5]. [6] and [7] also pointed out that it was still scanty literature.

Existing literature has pointed out the lacking of the use of the mixed method in exploring Educational Supply Chain Management System (ESCMS) in the education industry. The use of mixed method research has several advantages. Mixed methods were especially useful in understanding conflicts between qualitative and quantitative findings. It could provide a voice to investigate participants and make sure that the results were grounded in the research subjects' experiences [8]. Such a study added breadth and depth to an integrative research group [9]. This study was, on the other hand, to

seek the existing ESCMS in the case faculty. The mixed method was, thus, used in this work, to present a full picture of ESCMS with fruitful and in-depth information.

Therefore, this study was aimed to fill the gap that was lacking in the use of the sequential mixed method in the exploration of ESCMS. The researcher chose the Engineering Faculty of a public university wherein this kind of research had never been conducted, as the discovery of the chain in a single case. Thus, this paper addresses the holistic ESCMS of the Engineering Faculty.

2. Literature Review

2.1 Controversy between Supply Chain and Value Chain

The concepts of Value Chain (VC) and SC seemed controversial among researchers. There was no any difference between the terms of “VC” and “SC” [10], [11], and [12]. The activities involved in VC could be called as SC activities. The terms “VC v.s. SC” could be used as synonym [13]. In addition, [14] stated SC was a subset of VC. SC was prerequisite of VC [15]. On the other hand, VC was from the customer side whereas SC was from the supplier sides [16]. Moreover, [16] considered that VC focused on value added by every member on the chain while SC emphasized on the process along with members.

Based on the existing literature, researcher perceives that “Adding Value” means a lot. A business can use its bargaining power to buy raw material, equipment, other commodity and so on. It doesn't mean that business uses cheap raw materials. It is choosing the suppliers among competitors who can provide the lowest price with required quality. Furthermore, “Adding Value” consists of controlling the waste of time and budget as less as possible along the chain. Thus, a business can produce the good quality products at low cost in a timely manner to meet the customer demands. As the result of that, VC emphasizes on “cost effectiveness”.

2.2 Relevant Research Findings

Academic inputs of ESC consisted of the students and research projects. They could also be regarded as customers [5], [6], [7] [17], [18], [19], [20], and [21]. Students took the role of customer-supplier duality because they invested their body, soul, time

and money for education in the university [5]. However, the student suppliers were the high schools and other universities. They did not mention about the students as suppliers. Suppliers of non-human entities include equipment suppliers, stationary suppliers, and research project funders [18].

The university was regarded as a service provider because it accepted new students from secondary school (student suppliers) and transformed these students into qualified graduates [22]. The four functions of university operation have been described as; student learning, teaching specialist, research and consultancy [23]. The functions such as procurement, technology management, human resources, infrastructure management, finance, outsourcing and insourcing, were also needed to facilitate the teaching-learning system [18].

In 2012, Integrated Tertiary Education Supply Chain Management (ITESCM) model, the first empirical study in ESC literature, revealed four main activities; education development, education assessment, research development, and research assessment [5]. The study showed the systematic investigation of input, process and output of the educational institution through the redesigned ITESCM model [30].

All researchers considered graduates and research outcomes as outputs. Besides, two types of beneficiaries were also divided into customers (students, parents, relatives, etc.) and the society. Society was regarded as final user [17] and [22].

In addition, output and feedback could be noted as linking factors because feedback from the end user was effective for the service provider [18]. Service quality could be modified or redesigned through the feedback. Regarding this, there must have government-business-university formal alliances to acquire the effective information about labor supply and demand [19].

SC is a set of activities from input process through operation to output process. Although the number of the ESC research is scanty, different researchers investigated their studies from the different perspectives. Some studies focused on value-adding to the academic process whereas others emphasized on management system process.

3. Methods

This exploratory research followed sequential mixed methods exploratory design developed by

Creswell in which qualitative interviews and quantitative Likert scales questionnaires were included [24]. As the exploratory type, the process for the qualitative method was preliminarily performed followed by the quantitative process. Based on the findings from both methods, the results were interpreted and reported.

This study accompanied with interpretivism epistemology because of dealing with the top management and faculty support of the university which were associated with the experiences, belief, and expectation of SC players (faculty staffs and educators). The data was first interpreted by the researcher. It was then interpreted by the stakeholders who were thesis supervisor, examiners, and some research subjects. Besides, the purpose of this interpretivism research was to deliver richer understandings and interpretations of the ESCMS context. Thereby, this study was in line with interpretivism epistemology [25].

The targeted population involved academicians and supporting staffs working in the case faculty. Purposive sampling method was used for selecting top-tier officials (Professor, Department heads and manager level personnel) due to the small population. Simple random sampling was utilized to choose junior lecturers and administration staffs because of the large population. Participants for qualitative and quantitative were different but they all possessed the same criteria [26]. The number of participants for qualitative was 48 and that for quantitative was 50. Thus, 98 academicians and management practitioners took part in the study.

A semi-structured interview type was applied for qualitative data collection. Twenty questions were asked to the interviewees and if required, follow up questions were also used based on the answer of the interviewee. The average interview duration took about 40 minutes per interviewee. To analyze the data collected, the researcher followed techniques of O'Connor & Gibson that consisted of six stages, namely organizing the data, findings and organizing the ideas and concepts, building the themes in the data, ensuring reliability and validity in the data Analysis, finding possible and plausible explanations of the findings and an overview of the final steps [27].

As this was an exploratory study that utilized a mixed-method, qualitative results played an important role to develop the instruments for quantitative data collection. In the quantitative phase, the researcher selected the most appropriate

themes, which best fitted the sample under the study, emerged in the qualitative results [24]. Based on the qualitative results, themes were selected to build quantitative data instruments. While selecting the themes, the researcher went back to research questions to ensure the themes for the quantitative method answer the research questions. Then, he also verified back to the referenced model, Porter's value chain model not to diverge from the concept of the supply chain.

In the qualitative results, there were nine functions in the ESCMS of the case faculty. Based on these functions, themes were picked. However, some themes were eliminated due to several reasons such as not answering the research questions, a bias for participants, and unrelated to supply chain concept, for example, Human Resources (HR) management. The information about HR was hard to obtain from participants. On the other hand, the questionnaire used in the quantitative method was a closed-end type. If the biased question was included in the questionnaire form and it made the respondents confused to answer, the researcher could not get accurate data.

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum V_i}{V_t} \right)$$

Figure 1. Cronbach Alpha Coefficient Formula

Nine themes were selected to build quantitative instruments. Forty questions were primarily tested the instrument validation by using Pearson's R-Table method. Fifteen people took part in filling in the questionnaire form for the instrument validity test. They were chosen based on the same criteria as the actual research subjects. Two out of forty instruments were invalid and thus, these were eliminated from the questionnaire form. The remaining thirty-eight instruments were tested for instrument reliability by using Cronbach Alpha Coefficient Method, shown in Figure 1. A Minimum Cronbach's Alpha score of 0.7 was considered desirable [29]. Resulted in Cronbach Alpha score was 0.95, shown in Table 1. Thus, thirty-eight questions were reliable to use in data collection.

Table 1. Result of Instrument Reliability Testing

k	38
sum of item var	38.92
sum of total score	529.80
Cronbach alpha	0.95

To analyse the quantitative data, the Percentage Analysis method was used, shown in Figure 2. The data of respondents were statistically analysed in Microsoft Excel 2020 version. After completing the analysis, the results from both methods were interpreted for a research report.

$$\text{Percentage} = \frac{\text{No. of Respondents}}{\text{Total no. of Respondents}} \times 100$$

Figure 2. Percentage Analysis Formula

This study applied the five categories of measurement level of the respondents [27], shown in Table 2.

Table 2. Measurement Level of the Respondents

No.	Percentage	Category
1	90% - 100%	Very good
2	80% - 89%	Good
3	65% - 79%	Fair
4	55% - 64%	Bad
5	0% - 54%	Very bad

4. Research Results

4.1 Qualitative Results

The qualitative results showed nine activities in the ESCMS of the case faculty. They were five primary activities, namely input, operation, output, public relations, service, and four supporting functions, namely technology management, procurement, human resources management, and infrastructure management (finance and student affairs management).

4.1.1. Input

Input resources of the Faculty of Engineering (FE) were students, research projects, facility, equipment and funds. High schools, vocational schools and other universities supplied the students to the faculty. But because the schools and other universities belonged to the society involving parents, donor agencies, industries and businesses, the society could be considered as the sources of students and funding.

Input resources connected to the admission process. There were three types of new student admission methods for undergraduate programs: national selection (30%), joint exam selection (40%), and independent selection (30%). Joint selection was only embedded to postgraduate student selection. The national selection was an invitation selection for the outstanding students who graduated in the year concerned without any written exam. The joint selection was a college administration selection of public universities which was carried out in computer-based and paper-based tests. Independent selection was an exam held by the university itself. Furthermore, the university also had a sister high school that belongs to the university. The talented graduates from sister school were provided special offers to study in the Engineering faculty of the university.

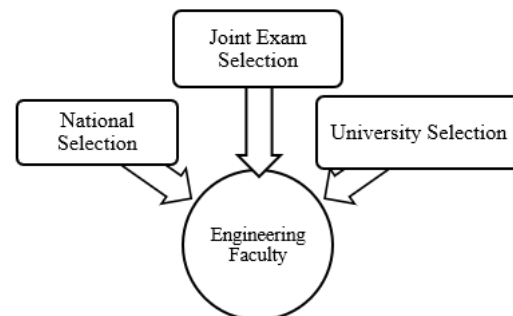


Figure 3. Student Admission Pathways for the Input Process

4.1.2 Operation

The main operational functions of the faculty consisted of teaching, researching and community services. To discharge these functions, there were two types of operator. Primary operators were academicians while secondary operators referred to supporting staffs. In the faculty, there were six departments; civil, mechanical, electrical, automotive, electronic, and mining. There were 20 study programs and types of programs involved

diploma, undergraduate, and post-graduate. Study programs were in-charged by both operation practitioners (academicians and management staffs).

One of the participants expressed that the lecturer's main duty was to fulfil "Tri Dharma-Three Tasks" that included teaching, researching and community service. Some senior lecturers were also appointed to work for faculty management. For example, academic affairs management was appointed to Dean I. Faculty financial management was for Dean II, and management of student and alumni affairs was assigned to Dean III. Six senior lecturers were assigned as Heads of the academic departments.

Non-academic staffs, who were secondary operators, performed public relations, financial management, procurement, technology management, and student affairs management. Their main duties were for supporting the teaching and learning process and to make it happen smoothly. One interviewee explicitly stated that they did not directly involve in the teaching and learning process, but they took part in it indirectly to support the learning process from the perspective of management and administration.

4.1.3 Output

Faculty produced two types of output; human resources and non-human resources for community development from the perspective of engineering. The former referred to the graduates and the latter was mentioned as research outcomes. Some alumni returned to the faculty for further studies e.g. postgraduate studies. Some returned to the faculty for working as teaching staffs, laboratorians, administration staffs. In addition, research outcomes consisted of several assets such as product development, machines, IT-based learning module development, robot, coffee grilling machine, biscuit, noodle, etc. Most research results by academicians and students' innovations contributed teaching-learning and society development.

4.1.4 Public Relation Functions

Public relation activities were carried through society. Society could be divided into three parts; student society, workforce society, and common society. Student society referred to high schools, other colleges, and universities. Faculty

transformed students to be teachers at schools or qualified workers in industries. Workforce society belongs to the schools and industries. They were users of faculty's products (graduates). Common society referred to student parents, their relatives, and donor agencies. They encouraged would-be students to continue their studies in our faculty.

All kinds of society were invited to work together in the Engineering Faculty by holding seminars, workshops, campus visits, researches and community developments. Most research participants believed that the faculty could not stand alone. Great collaboration with society was taken into account as an essential tool. Even for developing the curriculum or providing the training, those must meet society's needs and wants. The three types of society can be seen in Figure 4.

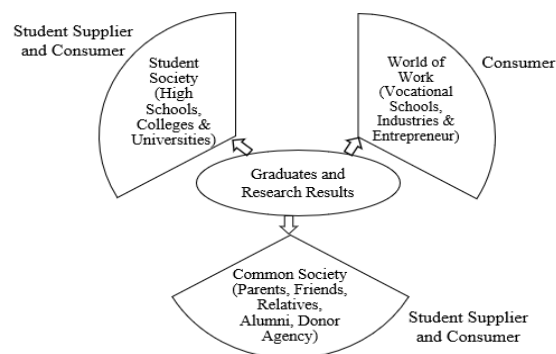


Figure 4. Three Types of Society

Faculty's extracurricular activities were executed as public relations functions such as collaboration with high schools, vocational schools, doing community services, and businesses collaboration. Public relation functions could be divided into two parts; ground activities and information access.

Ground activities were mainly led by the lecturers who conducted the community services. Some student projects also went toward community developments. Lecturers were forerunners and management staffs were supporting players to implement the projects. Regarding public information access, the university public relations division and faculty team cooperated. As a part of the public university, all of the information was announced on the university website, faculty website and social media in a timely manner.

There were several concerns for publicity such as media relations (websites, and social media), guest relations (conducting faculty tours), publications of the research articles and faculty information,

marketing publicity (announcing new products such as cutting machine, robots for COVID 19 patients, handwashing machine, etc.), business relations and alumni relations. Letting the society know the information of all of the activities in the faculty was a kind of sales and marketing strategy.

4.1.5 Services

In the education industry, the finished products (graduates) did not come back to the institute for repairing after completing their studies. Operators used the international standards to decide students' capacity and level e.g. grading 4.0 system. Thus, graduates were not needed to be repaired again after graduation. However, capacity building trainings and professional diploma courses were delivered to the alumni and society so that they could upgrade their abilities.

The language centre served four language programs; English, Indonesia, Arabic and Japanese. Furthermore, there were several scientific journals handled by Engineering Faculty. All of the scientists and researchers around the world could publish their respective research results in journals. Additionally, non-academic services were also provided such as mental counselling service, career counselling service, webmail service, clinic, campus internet access, off-campus internet access.

4.1.6 Technology Management

The working system of the faculty was based on IT (Information Technology). Although there were some parts followed by paper-based tasks, most of the functions were carried out by software and administrative portals. E-learning portals, websites, application and software were developed by the IT department to facilitate faculty activities, student admission, campus managerial affairs, teaching-learning activities.

They were ones who handled all IT issues such as developing web domains, portal maintenance, and solving network problem, etc. As the special service, off-campus Wi-Fi access was also offered to the students for their learning anytime. All student could access Wi-Fi wherever they went outside the university as long as wifi@id access was being available around them.

IT was an essential tool not only for the internal working system but also for public information access. As a part of the public university, all of the data and activities done in the faculty were

informed to the society by the faculty. For publishing the information of activity reports, faculty used websites and social media platforms. Society was informed through these media.

4.1.7 Procurement

As the Faculty of Engineering, practical teaching was taken into account for the students. As the faculty provided the engineering programs, practical teaching was highly important for the teaching-learning process. To perform productive practice, the equipment and facility were basic needs. The faculty simulated the systematic procedure for supplying necessary equipment and facility.

4.1.8 Human Resources Management

As the case faculty was a part of a public university, faculty human resources management functions were mainly managed and controlled by collaboration with university leadership teams and the Ministry of Education and Culture, Indonesia. However, the faculty had two types of employees, namely government employee and non-government employee (staffs recruited by the university). For those who were non-government employee, the university had the authority to recruit new staffs.

4.1.9 Infrastructure Management

4.1.9.1 Financial Management

University funding was supported by the government, students and other donor agencies like IDB (Islamic Development Bank). Every monetary case was arranged by the supervision of the finance management division. University financial management team performed several affairs; financial and accounting affairs, personnel affairs, legal affairs, management affairs, household affairs, management of state property, and administrative affairs. Every academic faculty and management division needed to collaborate with them. Each department or management division prepared a budget proposal for the upcoming year in the current academic year.

Although the faculty was a part of public university, it created collaboration with various parties to increase income by providing the teacher training, submitting vocational grants, and executing insources such as scientific journals, student dormitory, language centre, swimming

pool, hotel, and leasing service for renting auditorium, multipurpose rooms, badminton hall, etc.

The financial management team also carried out outsourcing activities to save the waste of budget. Outsource functions were security service and cleaning service. The waste of budget was controlled by hiring the third-party business that met the criteria set by the finance team.

Furthermore, faculty unlike the management division had their own budget. The University finance team allocated the appropriate amount of budget to every faculty based on the number of students.

Dean II was responsible for budget allocation and every monetary case including procurement functions. Under the supervision of Dean II, there was financial management team in the faculty. This team directed and supervised all of the monetary issue proposed by all of the academic departments and management sections. Only the faculty finance team managed the financial case in all academic department and management section.

4.1.9.2 Student Affairs Management

In the faculty, there were departmental staffs on the ground and they were supervised by the faculty level student affairs practitioners who were directed by Dean I and Dean III. Management staffs worked on all administrative tasks such as teaching schedule, exam schedule, academic calendar, curriculum, academic portals and so on. They sometimes suggested the students to carry out their activities outside the teaching schedule. If the students performed the community services, they will get extra points on their academic record. Supporting staffs also helped solve students' problems by collaborating with lecturers.

On the other hand, university student affairs practitioners ensured the administration process to run smoothly. They worked in terms of student admission, calculating the capacity of the Engineering Faculty, estimating the number of students, and solving student struggles. They were the main players for all administrative tasks from the admission process through student's learning process until graduation. At first, they announce the admission information. Then they also conducted the three admission ways (National selection, joint exam selection, independent exam) collaborating with a relevant academic department. After the

selection process, eligible students were accepted and they were delivered to respective faculty to be informed so that the teaching-learning process could be carried out. If the students finished their study, students were transferred to their division from the faculty for graduation purpose.

4.2. Quantitative Results

This section describes the data description and the level of achievement of the respondents of nine aspects obtained from qualitative results, namely input, operation, output, public relations, services, IT development, procurement, financial management and student affairs. Statistical results were shown in Table 3.

Table 3. Overall level of respondent achievement

Indicator	Result (%)	Category
Input	77.69	Fair
Operation	86.6	Good
Output	78	Fair
Public relations	85	Good
Services	83.2	Good
Finance management	81.52	Good
Technology management	80	Good
Procurement	77.6	Fair
Student affairs	80.27	Good

This study used Roysse et al., (2010)'s measurement level (Table 2). In generally, the result for each indicator (Table 3) was above 65% that was the least percentage showing the "fair" category. The result of "Input" was 77.69% with "Fair" category. The percentage of indicator "Operation" was the highest one in all results, 86.6% with the "Good" category whereas indicator "Procurement" obtained 77.6% with the "Fair" category. "Public relations" indicator was 85% following by "Service" (83.2%), "Finance" (81.52), "Technology management" (80%), "Output" (78%) and "Input" (77.69%). In summary, every existing SC functions gained in qualitative findings could be authenticated by quantitative method. The holistic view of the statistical diagram was shown in Figure 5.

5. Conclusion

This exploratory study revealed the existence of ESCMS by utilizing the mixed methods

(qualitative-quantitative). Based on the results from both methods, this research has exposed five primary activities; input, operation, output, public relations, and services, and four supporting activities; technology management, procurement, human resources, and infrastructure management (finance management and student affairs). The results of the former qualitative phase that involved 48 participants have been authenticated by the later quantitative phase in which 50 respondents participated. Therefore, this work provides the important research findings for ESC field. Figure 6 is configured based on results.

There were three levels of management; university level, faculty level, and department level. Departmental teams directly collaborated with faculty teams whereas they indirectly dealt with university-level teams. Faculty teams settled between the university level and department level. In the university level, all nine activities were being executed whereas only four activities (student affairs, finance, public relations and procurement) were being existed in the faculty level. However, the remaining five functions were still being performed from the university level through faculty by collaborating, cooperating and coordinating. The main goal was to execute the study programs

(department level) smoothly towards generating the qualified graduate and research outcomes.

It has sufficiently been evident that ESCMS is a crucial system for educational institution. If the faculty is regarded as a sustainable project, ESCMS can be defined as a process system. Without the effective process system, a project cannot achieve its objectives. Only if the desired expectations can be delivered to fulfil the needs and wants of the customer and consumers, the organization will longer exist in the education market, especially in the three types of society. Therefore, the researcher believes that this study's findings will contribute to the educational management field.

5.1 Limitations of the Study

This study has several limitations. This is a single case study that emphasizes the supply chain activities within and across the research site. This study might be weak for generalizability due to a single case approach. As this is an exploratory study, there is no evaluation of the results. Consequently, evaluation researches are also needed based on the findings of this study. Besides, this study did not measure the performance effectiveness of each component along the chain.

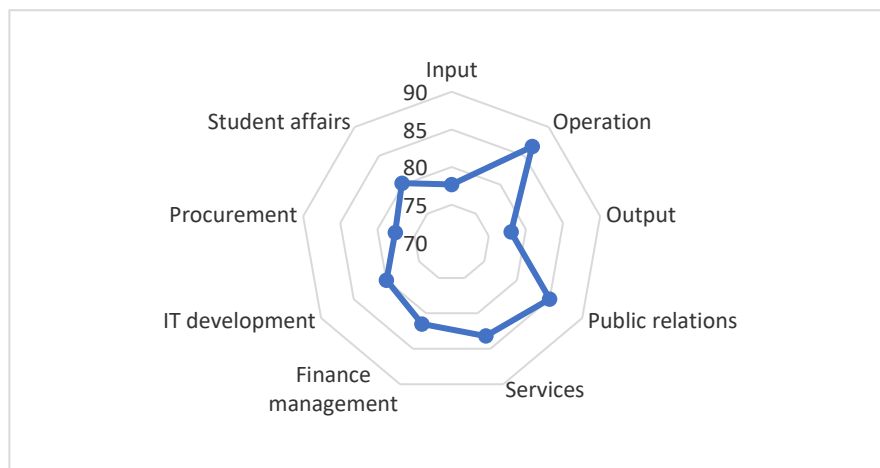


Figure 5. Statistical Result of Education Supply Chain Management System

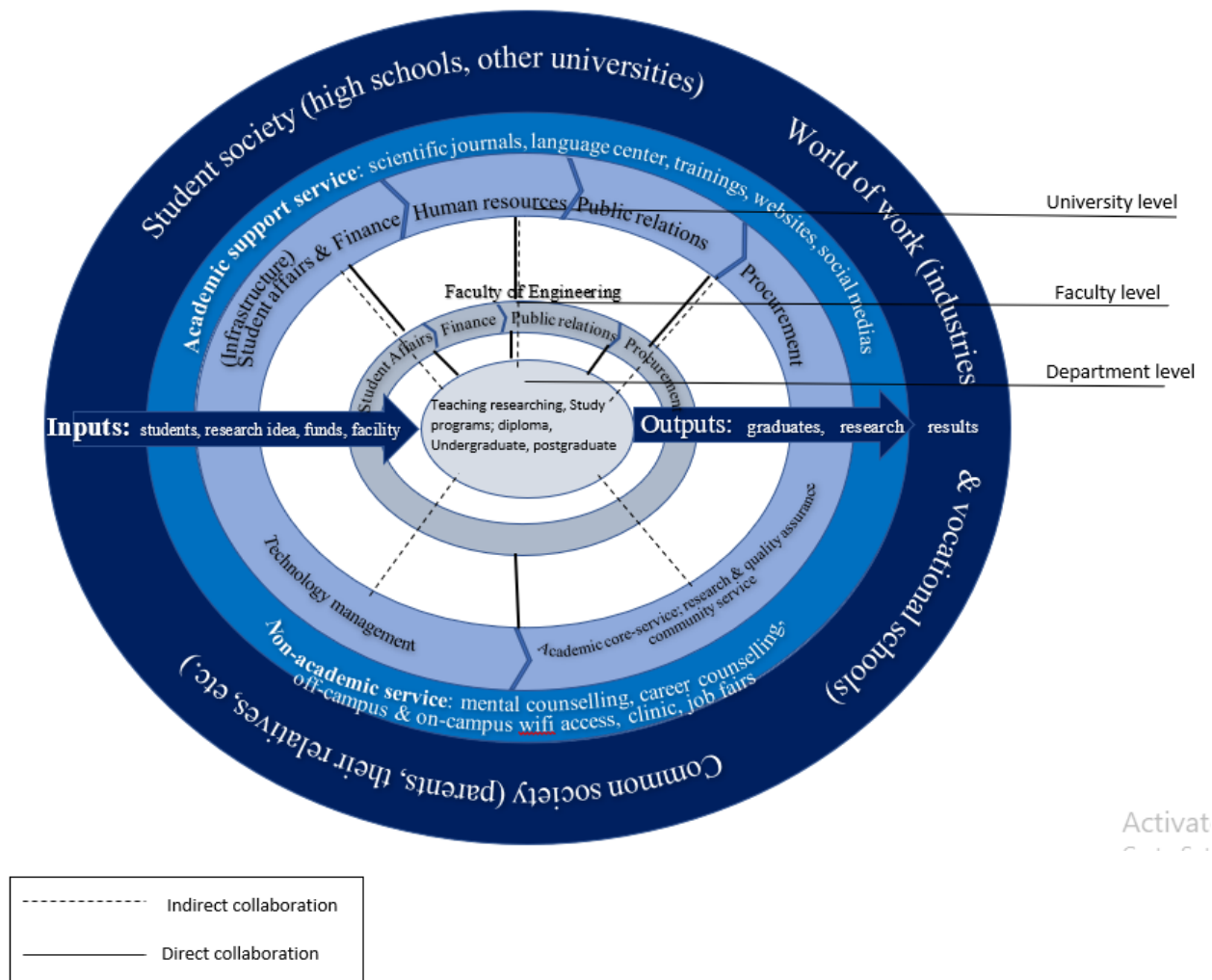


Figure 6. Holistic View of Educational Supply Chain Management System of the Engineering Faculty, Universitas Negeri Padang

5.2 Recommendations for Future Research

SCM has a broad array of network such as agility, transparency, distribution, relations between industry and suppliers etc. Although some concepts are not fit for the education field, some concepts can still be used to find out the solution in the education field such as education value chain system from kindergarten to senior high school, curriculum development value creation, impact of agility on ESC, and so on.

The constitution of research design was also an important matter. While most studies were exploratory types, there was not much more evaluation research. Most of the studies were completed by single case study and thus, lack of multiple case studies was happening at the same time. Many researchers applied the qualitative

method rather than the quantitative one. Even the use of mixed-method was very scanty literature. Consequently, evaluation studies and multiple case studies should be implemented as further studies. The quantitative and mixed-method should also be employed occasionally based on the research designs.

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