

Decision Analysis View of Higher Education Planning Activities of Admission and Recourses Allocation in Oman

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Abstract— Various activities of planning take place at most colleges and universities such as academic planning, enrollment planning, human resources planning, budget planning, facilities planning, campus master planning, and so on. The concern that this paper raises is on how effective is these planning activities. The paper provides managerial insights that may guide planner in two main activities: admission and recourses allocation. The insights were generated using two decision analytic models. The first model examines the Higher Education Admission Center in Oman which is responsible to enroll students to higher education institutions. However, the enrollment decision in which student enroll in which higher education institution needs is based on student competitive score. This score is calculated as weighted average of students marks in subjects. However, the models gives insights to students and parents on certain findings that can help them guide their effort. Also it gives insights to the Center on the weights associated with formula of this score. The second analytic model simulates about 200 thousands scenarios on academic resources (number of faculty) allocation given certain input factors such as faculty load, class size, number of courses per year, duration of the degree offered. The papers highlights certain findings such as: class size and faculty member load (number of course per year) have an exponential decreasing function in the number of academic staff. There are significant variation on the number of required academic staff for different scenarios which suggest that higher education institution planners should consider these variations. .

Keywords— *Decison Analysis, Higher Education Admission Center, Academic Resources Planning*

I. INTRODUCTION

Academic planning has a high degree of complexity . This complexity level is due to the number of inputs or variables such as admission procedure and criteria, degree offered, quality of education and research, class size...etc. We analyze key inputs in this paper and highlight the importance of considering their relationships. this interrelation between these inputs make the decision making process difficult. In general, these decisions related to the academic planning are driven mainly by budget. Budget driven based decisions sometimes can be irrational because decision makers may not consider "unknowingly" the relationship between academic variables like number of students admitted to faculty load and hence the student to faculty ratio. Some of these relations are not linear and may vary exponentially and as a result the education quality may be affected by such decisions. Moreover, uncertainties regarding job markets and degrees' demand add another difficulty level when planning in academic context. Therefore, these challenges motivate researches to design and develop decision support systems and tools in academic planning. These tools have different forms such as software developments , recommendations' report, and managerial insights. "Decision support systems are software based systems that supports business or organizational decision-making activities" Gorgan, V. (2015). Decision support system (DSS) have been applied efficiently in various fields. In health care sector: Aktaş et al. (2007) used DSS to assist health system managers toward improving the efficiency of the hospital system. Dios et al. (2015) utilized DSS for surgery scheduling. The purpose was to assign the dates and operating rooms for the patients that are waiting for surgery. In Logistics: Kengpol (2008) developed a DSS to assess investment in a logistics distribution network. This was done to maximize customer satisfaction and minimizing transportation cost. Fanti et al. (2014) presented an architecture of DSS that will help to make tactical decisions in logistics system. This decision system was designed to manage the flow of goods and the business transactions between a port and a dry port. In agriculture: Giusti and Marsili (2015) presented DSS for irrigation system based on a fuzzy inference system. This system was developed to enhance the performance of an existing web-based irrigation advisory system. In finance: Azadeh et al.(2012) utilized DSS for forecasting and optimization of complex personnel efficiency in a banking system. These were some of the papers that utilized DSS in various fields, however our main consideration about the utilization of DSS in higher education field. Most of the time the faculty members are busy with doing researches and providing lectures. Therefore, DSS helped in providing solutions for faculty members toward making complex and hard decisions. Deniz and Ersan (2002) demonstrated a DSS that included administrative and planning features. This was based upon students achievement levels. Mansmann and Scholl (2007) focused on solving the problem of offering reliable decision to balance the educational demand and supply in universities. The proposed model was as supply-demand relationship between teaching resources and students. Kardan and Sadeghi (2013) utilized DSS to determine the potential factors that

influence student behavior on course registration. They designed a model to imitate student course selection behavior. This model took into consideration student and instructor requirement as well as department regulations.

Many of these studies are case based researches because of context differences in the higher education systems. Therefore, it is essential to develop a more generic approach that considers different scenarios and give managerial insights which makes academic planning decision making process more effective. Moreover, assets or resources managements require clear analysis of the relationships between these various inputs. The paper discusses analyze two cases: one is specific case which is Higher Education Admission Center in Oman and the other one is more general approach when planning for new university. The aim to investigate the example of Higher Education Admission Center to highlight the importance of tiny detail which may be overlooked and has a significant consequences. The objective of the second analysis is to give decision makers a clear interrelationships between key variables by performing scenarios analysis which accounts for uncertainties.

II. CASE 1: HIGHER EDUCATION ADMISSION CENTER IN OMAN

The following information about the center is directly extracted from the Ministry of Higher Education in Oman. "The Higher Education Admission Center (HEAC) is one of the Directorates of the Ministry of Higher Education. The Centre's main responsibilities include coordinating with Higher Education Institutions (HEIs) and the external scholarship department regarding the admission requirements of each HEI according to the different areas of discipline. HEAC receives, reviews, and registers all student applications through an electronic system that can be used online and/or with the support of an SMS service and smart phone applications. It regulates the admission of General Education Diploma and its equivalents graduates according to their preferences and grades in relation to the admission terms of the HEIs in question. Competitive Score: It is the criterion that defines a student's seat allocation based on (his/her) scored marks (grades) in the General Education Diploma exam or its equivalent before conducting the first electronic allocation. The competitive score may vary for the same student from one program to another based on his/her marks in the subjects required for the program (specialization). The arithmetic formula to calculate competitive score is as follows: Completion of the Registration Procedures: Referring to the period during which candidates who have received and accepted admission offers through the HEAC system will register and submit the required documents to the concerned. "

Competitive score

$$= (\text{total marks of subjects required for a specialization}) \times 60\% \text{ or } "0.6" \\ + (\text{total marks of subjects taken by the student}) \times 40\% \text{ or } 0.4$$

The center has achieved recognition locally and regionally as best practice for e-government. It is one of few entities that communicate remotely with students and parents. The weight for the total marks of subjects required for a specialization is considered large as 60%. The decision makers weight did not perform a careful analysis on the weighing scheme and how this may influence the students selections and admission. This paper gives a managerial insight on how the weight can give incorrect message to students and could result in "unfairness" thinking among them by showing different examples. It is worthwhile to mention that the current case in Oman is taking 10 subjects and there are about an average of five specialization subjects. Therefore, 60% weight goes to the five subjects and 40% goes to the total student average. Let's assume that the students is taking (n) subjects where he scores g in each subject. in which (x) are special courses and ($n-x$) non-special courses. Suppose that the student score g Thus, the competitive scores will be calculated as

$$\text{comptitive score} = w * \frac{1}{x} \sum_{i=1}^x g_i + (1 - w) * \frac{1}{n - x} \sum_{j=1}^{n-x} g_j$$

from which the special to non-special marks can be

$$\text{Special courses to non - spccial courses} = \frac{\left(\frac{w}{k} + \frac{(1 - w)}{n}\right)}{(1 - w)}$$

Currently, the students take 10 courses where five on the average are special courses (considered for specialization). If the weight is 60% then the special to non special courses is about 4:1 i.e. if the student lost one mark in a special course then s/he needs to have 4 points more in non-special in order to keep the same competitive score. The decision makers assume that 60% to 40% or 3:2 between the special and non-special courses but formula counts the special courses twice which leads to more weight given to special courses. The following figures 1 to 3 perform sensitivity analysis on the special to non-special marks. It is clear that the center can keep the competitive score equation but needs to change the weight to 20% that will lead to 3:2 ratio. Moreover, the students needs to give about 75% effort to the special course. Moreover, this may mislead the students who score high in non-special courses and yet have high total average. However, they may lose admission seats to those who score higher in special course but 4 times lower in non-special courses. Several examples where students has about

90s% in total average but could not be admitted due to lower competitive scores which makes the admission more vague. The claim that is applicable to all students but they don't keep in their mind that losing one mark in Math for example may need getting 4 marks more in Arabic for engineering specializations to keep the same competitive score .

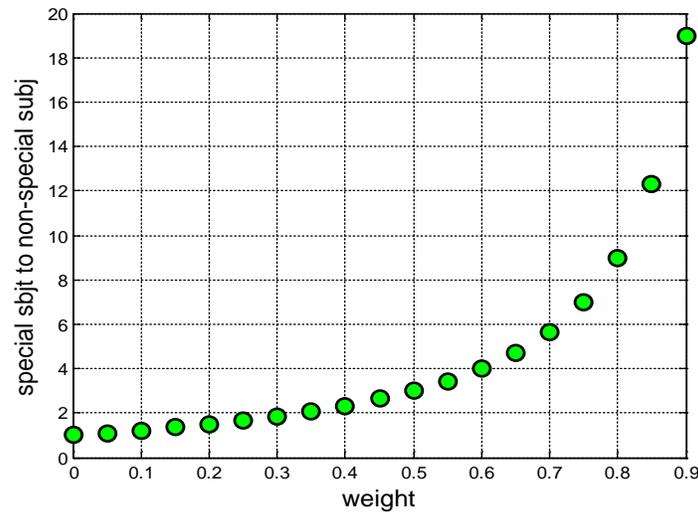


Figure 1: The actual weight between special subjects to non special ones as weight varies.

Moreover, the ration between special to non special courses increases linearly as the number of total subjects while having five special courses. Moreover, some majors or specializations require less or more special courses. Clearly, there is exponential relation between the number of courses and the actual weights. For example for major that requires only three special courses the ratio is about 6:1 which is more than five special courses. Students should keep in mind that there competitive score becomes more critical in specializations that require less special courses. The effort of the student must be about 83% more to special courses.

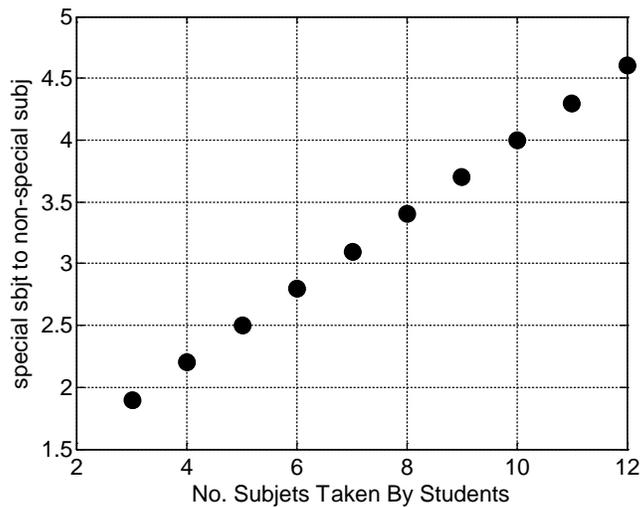


Figure 2: The actual weight special subjects to non special ones for 60% weight as total subjects vary.

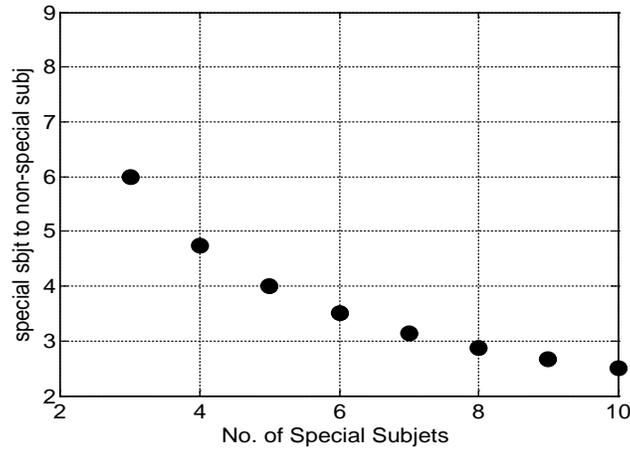


Figure 3: The actual weight between special subjects to non special ones for 60% weight

To conclude, the competitive courses may mislead students where they generally distribute their effort evenly between courses to gain as high total average as possible. Parents as well understand the implication of total average which somehow place their kids in ranking bases. To minimize the this, it is recommended that the center use 20% instead of 60% because this will keep the presumed ratio of 3:2 or 60:40%.

III. CASE2: RESOURCES PLANNING FOR A NEW UNIVERSITY

The aim of this case is to give a managerial insights on the interactions between the key inputs of academic planning. The following figures 4 and 5 illustrates the scenario analysis where different variables inputs such as number of courses, or program duration. The total number of scenarios analyzed are 109,200 scenarios. Where the number of staff required and the student to faculty ratio are computed for each scenario. It was noted that some of these factors are linearly related to the number of academic staff required. They are: number of courses per year, program duration, number of students admitted per year. However, an exponential relationship exist with the other factors: faculty load (number of courses per year) and class size. One challenge for proper planning is the output variations. As figure 5 indicates that the variation in the number of academic staff required is significant for some scenarios. Therefore, decision makers may need to consider these scanners variability.

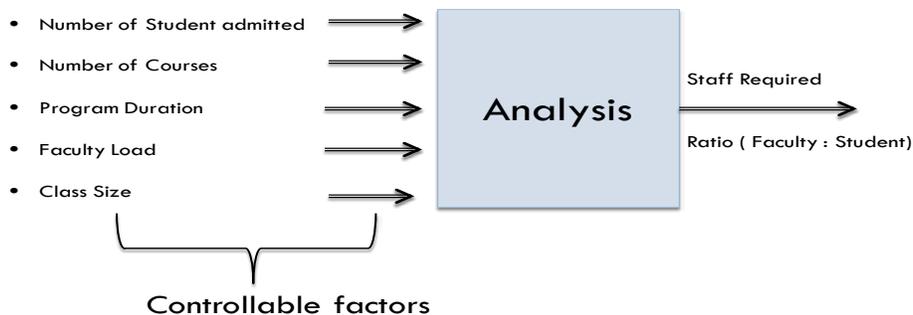


Figure 4 Analyze different planning scenarios

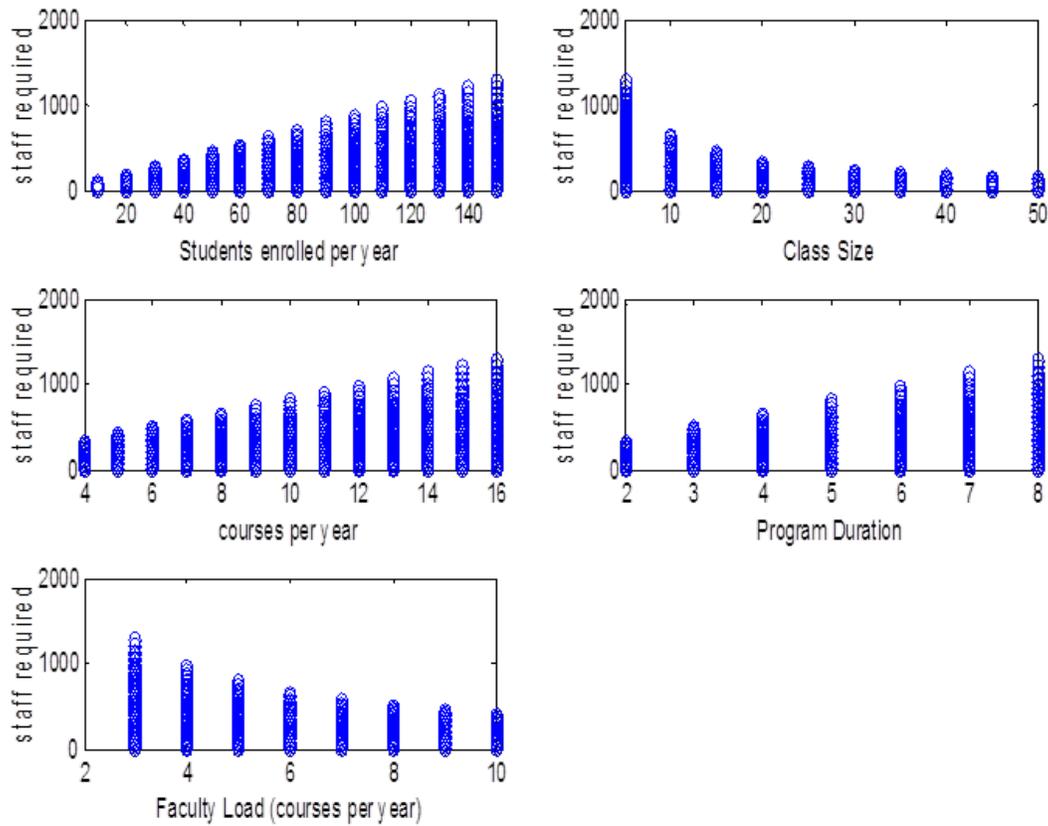


Figure 5: 109,200 scenarios are analyzed as shown in the simulation model.

IV. CONCLUSION

The complexity level in the academic resources planning has motivated researchers to design a decision support systems. These systems have different forms such as software's, scenarios studies, or recommendations' report. The paper has investigated two cases of academic resources planning. Case 1 studies the higher education admission center in Oman and Case 2 analyzes Resources Planning for New University using scenarios analysis. In case 1, the paper shows that the competitive score which is used to admit students may be misleading. The competitive score gives about 4:1 weight between the specialization course vs. non-speciation courses. This weight is not what is intended initially for which is 3:2 weight. In case 2, the paper presented 109,200 scenarios which differs in the input factors. These factors are: the number of students admitted each year, class size, program duration, and faculty load. The scenarios show that these factors have different mathematical relationships with the number of academic staff required. Therefore, they should be treated differently and the versions in the output suggests difficulty in planning when theses input vary.

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BIOGRAPHY

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