

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Performance measurement has generally been defined as the regular collection and reporting of information about the efficiency, quality, and effectiveness of decision units (Chansa-ngavej, 1997). The performance measurement is spread out in both manufacturing and service industries. The performance measurement has been applied in manufacturing industries to identify the benchmark partners that may be helpful in uncovering ways for achieving the selected performance standards. In recent years, service industries with profitable and non-profitable purposes have a critical role, especially in the educational service. Most universities provide students with knowledge and learning facilities. In the past, the universities were supported from the governmental budget (tax payment of public) with enough resources. Due to the state of globalisation, liberalisation, limited financial resources, and growing concern of the public for quality education, the universities have to recognise to their performance and marketing that they serve. As a result, the customers will also get the benefits from this situation such as more alternatives, reduced fee and tuition, high quality, and good service. Moreover, education is important for achieving the life goal in the future and the nature of university selection problems is a complex structure and environment including multiple criteria, which have both intangible and tangible criteria. The problems of university selection decision are interesting for studying a conceptual model in order to help applicants make an informed choice. Therefore, a conceptual model in university selection decision is proposed.

The performance measurement is one of the business tool groups that has been studied for a long time. According to rating and ranking systems in several countries such as USA, UK, Canada, Australia, and Hongkong, there are many organisations that establish universities ranking or rating. Moreover, the education performance measurement received attention from several groups: public or government, employers,

institutions, the potential students (Kotler and Fox, 1994). Sarrico et al. (1997) and Sarrico and Dyson (2000) addressed that the different stakeholders bring out the different objectives and criteria. Besides, Hayes et al. (1997) and Chansa-ngavej (1999) and Chansa-ngavej et al. (2001) took issues on the ranking and rating system concerning who is doing the assessment and what the purposes are.

This paper reviews the following issues: stakeholders classification for measuring university performance, development of criteria for the university selection decisions, weight assignment system, the performance measurement approaches which are the famous technique for quantify the value of performance, Analytic Hierarchy Process (AHP), and Analytic Network Process (ANP). These issues will be discussed in the next sections.

2.2 Stakeholders Classification

The primary objective of a university is to pursue and transmit knowledge. Specially, a university has a role to educate students to be useful to society, conduct advanced research to enhance the welfare of society, and host activities to bring social benefits to their local communities. One thing of interest to students, the government, and the public is the quality of each university. Much effort has been put into the study of this issue. Several scholars (e.g., Moed et al., 1985; Rasmussen, 1985; Wallmark et al., 1988) tried to give solid measurements of output from the category of research alone. Evaluation of social benefits, not for universities but for forestry research programs, has also been studied (Callahan, 1985). To evaluate the university as a whole, Higgins (1989) examined many aspects of performance measurements and indicates that performance measurements are necessary in assessing universities. Nevertheless, how to address the issue of who is doing the assessment, the perspectives of different stakeholders, and for what purpose to the universities measurements is not explicitly discussed.

Universities, as with any other organisations, serve a variety of stakeholders, defined as individuals or groups of individuals who have a stake or interest in the continued survival and high performance of the organisation. Kotler and Fox (1994)

identified the customers of the universities including employers, students, public at large or government, and academic staff. Some researchers classified the different stakeholders for the purpose of university performance measurement into three groups : (1) the government, wider society, implemented by the funding councils; (2) the potential students who are in the process of choosing a university; and (3) the institutions, constituted by departments with their staff and students (Sarrico et al., 1997; Sarrico and Dyson, 2000). Moreover, the different perspectives of stakeholders result from the existence of different missions and objectives within the sector, and lead to different purposes and criteria of performance measurement. Performance measurement is often used in a formative way. Institutions, for example, measure their performance to establish targets and to benchmark themselves against other performers in order to enhance their performance. It can also have a summative purpose of evaluation, when used for the allocation of funds depending on merit, or in the choice of a university by an applicant. To serve the different purposes for measuring performance, different criteria will be required. As an example of this diversity and considering student accommodation, students will be interested in good quality convenient accommodation at a reasonable price. Institutions will additionally be concerned about the level of income from university accommodation, whilst the funding councils will be concerned primarily with the overall cost effectiveness and efficiency of the institutions.

As mentioned above, the different perspectives of stakeholders result from the existence of different missions and objectives within the sector, and lead to different purposes and criteria of performance measurement. Furthermore, different individuals will wish to apply their own values in selecting list of universities to apply to. This mentioned statement is critical to university performance measurement. This study focuses on performance measurement from the perspective of the potential student and the criteria influencing university selection is presented next.

2.3 Development of Criteria for University Selection Decision

This section involves criteria for decision making in university selection decision. The criteria are determined into two ways: 1) general criteria for university selection decision; and 2) proper criteria influencing university selection decisions depending on

the university program. However, derivation of suitable criteria should have a guidance for set of criteria. Therefore, the desirable characteristics of criteria are firstly reviewed and secondly, the previous and existing criteria influencing university selection decisions are addressed.

2.3.1 Desirable Characteristics of Criteria for University Selection Decision.

Guideline of selecting the criteria for university selection decision is reviewed as follows:

A) Keeney and Raiffa's Principle

Desirable characteristics for set of criteria suggested by Keeney and Raiffa (1976, referred by Goodwin and Wright, 2000) are concerned with:

1. Completeness. All the attributes which are important to the decision-maker have to be included.
2. Operationality. All the criteria are specific enough for the decision-maker to evaluate and compare them for the different alternatives.
3. Decomposability. The performance of an alternative on one criterion can be judged independently of its performance on other criteria.
4. Absence of redundancy. No criteria should represent the same thing
5. Minimum size. The set of criteria should contain as few numbers of criteria as possible.

B) Principle Set by Education Standards

This principle is created by the Office for the National Education Standards and Quality Assessment (ONESQA). A public organisation established from the proceeding of the new National Education Act (1999) in order to evaluate the external quality of higher educational level. The principle of ONESQA can be summarised as follows:

1. The criteria should identify the effectiveness of educational administration according in line with the principle and objectives of Thailand's National Education Act (1999)

2. The criteria should identify input/process/outcome of the educational administration relating to the mission and principle of undergraduate standard.
3. The number of criteria should not be large. Each criterion must be important, clear and acceptable to each institute.
4. The criteria should consider the type and diversity of institutes, which have different emphases on teaching and research, regional and national scope, vocational and comprehensive courses.
5. The criteria should be in line with the existing quality assurance process, components and criteria used for internal quality assessment of institute.
6. The criteria should help stimulate the continuous development of quality and the standard of the institute.
7. The criteria should enhance the educational standard for acceptance at international level

Conclusion

All desirable characteristics of criteria mentioned above are followed closely except the one on absence of redundancy, which is deemed restrictive. This is because following this characteristic strictly would construct the decision environment considered in this research, since interaction and dependencies between criteria are specifically allowed in the current decision environment as studied in this research.

2.3.2 Determination of Criteria

To develop a conceptual framework for performance measurement in university, it would be beneficial to investigate the ideas and approaches used in rating and ranking universities, giving quality awards, and strategic management. The performance quality criteria employed in such activities could be viewed as basic guidelines for determining performance indicators. Examples of criteria used in university rankings are (Hayes et al., 2000, and Chansa-ngavej, 1997):

U.S. News and World Report (U.S.A.)

Criteria and weights (%):

- Academic reputation (25%)
- Student selectivity (15%)
- Faculty resources (20%)
- Retention rate (20%)
- Financial resources (10%)
- Alumni donation (5%)
- Graduation rate (5%)

The Rise of American Research Universities (Graham and Diamond, 1997)

Criteria :

- Federal R&D Funding
- Publications
- Publications in Top-Science Journals
- Publications in Top-Social Science journals
- Arts and Humanities Awards

Research Assessment Exercise (RAE, U.K.)

Criteria and weights (%) :

- Quality of published work (30-45 %)
- Evidence of esteem by external funders (20-35 %)
- Extent of postgraduate research activity (14-22 %)
- Evidence of vitality of the department and prospects for continuing development (14-22 %)

University League Tables (U.K.)

Criteria :

- Entry requirements
- Student accommodation
- Library expenditures
- Student-staff ratio
- First-class honours
- Teaching assessment
- International students
- Successful course completion
- Permanent employment
- Unemployment
- Research and further study

Good University Guides (Australia)

Criteria :

- Characteristics of the university
- Student composition
- Quality of teaching
- Career placement
- Access
- Entry toughness

Asiaweek's Rankings (Asia)

Criteria and weights (%)

- Student selectivity (25%)

- Faculty resources (25%)
- Academic reputation (20%)
- Research (20%)
- Financial resources (10%)

Malcolm Baldrige National Quality Award

The Education Criteria for Performance Excellence for Baldrige National Quality Program 2000 are:

<u>2000 Categories / Item</u>	<u>Point Values</u>
1. Leadership	125
1.1 Organisational Leadership	(85)
1.2 Public Responsibility and Citizenship	(40)
2. Strategic Planning	85
2.1 Strategy Development	(40)
2.2 Strategy deployment	(45)
3. Student and Stakeholder Focus	85
3.1 Knowledge of Student Needs and Expectations	(40)
3.2 Student and Stakeholder Satisfaction and Relationships	(45)
4. Information and Analysis	85
4.1 Measurement of Organisational Performance	(40)
4.2 Analysis of Organisational Performance	(45)
5. Faculty and Staff Focus	85
5.1 Work Systems	(35)
5.2 Faculty and Staff Education, Training and Development	(25)
5.3 Faculty and Staff Well-Being and Satisfaction	(25)

6. Educational and Support Process Management	85
6.1 Education Design and Delivery	(55)
6.2 Education Support Processes	(15)
6.3 Partnering Processes	(15)
7. Organisational Performance Results	450
7.1 Student Performance Results	(200)
7.2 Student and Stakeholder Focused Results	(70)
7.3 Budgetary and Financial Results	(40)
7.4 Faculty and Staff Results	(70)
7.5 Organisational Effectiveness Results	(70)
Total Point	<u>1000</u>

Not much research has dealt directly with the criteria for the university selection to assist the potential students choosing the most appropriate university, particularly at the undergraduate level. Chansa-ngavej et al. (2001) and National Opinion Research Centre (1997) reported the most interesting criteria influencing the university selection decision. They will be used as a basis for this research. Then, each criterion will be categorised into main components. These components and criteria can be shown in Table 2.1.

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Chansa-ngavej et al., 2001	National Opinion Research Centre, 1997
Value Added <ul style="list-style-type: none"> • Academic • Intellectual • Mind 	Admissions <ul style="list-style-type: none"> • Requirements for Admission (in terms of academic preparation and test scores) • Ease of Applying (application form, required essays, interview, campus visit, distance, fees) • Likelihood of being Admitted; Admission Selectivity • Percent of those Admitted who actually Enroll (Yield Rate) • Relative Standing among Fellow Students (if admitted; likely performance and graduation)
Curricular <ul style="list-style-type: none"> • Diversity • Flexibility • Update 	Financial Requirements <ul style="list-style-type: none"> • Tuition and Fees, net of Financial Aid • Financial Aid Options, including Grants, Loans, Employment, College Work Study
Faculty Staff <ul style="list-style-type: none"> • Relationship with student • Teaching and Learning • Academic Position and Qualification • Outcome and Product 	Academic Experiences <ul style="list-style-type: none"> • Academic Reputation and Quality of the Faculty • Access to Faculty inside and outside the Classroom • Student:Faculty Ratio • Curriculum (nature of, requirements, difficulty, flexibility) • Types of Instruction (large vs. small classes; lectures vs. discussions; independent research) • Evaluations of Work<Grades, Written Evaluations • Set of Degree Programs of Interest Offered • Use of Teaching Assistants • Rigor • Opportunities for Study Abroad • Graduation Requirements • College Calendar<Semester, Quarter, 414, etc.
Location <ul style="list-style-type: none"> • Atmosphere and First Impression • Safety • Ease of Travel 	Academic Resources <ul style="list-style-type: none"> • Expenditures per Student • Quality of Libraries, Laboratories and Computing Resources • The over Physical Plant
Facility <ul style="list-style-type: none"> • Class Room, Lab. Room and Various Instruments • Computer Quality and Internet Network • Library Quality • Other Facilities • Number of Computers and Book related • Expenditure for facilities 	Social Experiences <ul style="list-style-type: none"> • Diversity of the student body<by Race/Ethnicity, Gender, Politics, Values, Geographical Origin, and Socioeconomic Level • Traditional (i.e., 1824 year old) versus non-traditional Student Emphasis with regard to Age distribution of the Student Body, part-time Enrolment Options, Evening Courses • Proportion of Students involved in or Opportunities for Volunteer or Community Activities Clubs, Fraternities/Sororities, Parties • Recreational/Intramural and Sports Facilities and Opportunities (as a participant, as a spectator) • Intercollegiate Athletics • Expenditures per student on Non-Academic Programs • Dormitory/Housing Options and related Academic/Social Programs • Food Service Quality and Options • Crime rate

Table 2.1 The interesting Criteria for University Selection in Undergraduate Level

Chansa-ngavej et al., 2001	National Opinion Research Centre, 1997
Expense for study <ul style="list-style-type: none"> • Tuition and Fee • Living Cost 	College Outcomes <ul style="list-style-type: none"> • Retention and Graduation Rates • Prestige/Status (Social and Academic) of the Institution and its Graduates • Advantages in getting a job (Type, Selection and Expected Income Level) • Advantages in gaining Admission to Graduate/Professional Programs • Intellectual, Social, and Psychological Development • Opportunities/Programs and Connections for Alumni
	Other Considerations <ul style="list-style-type: none"> • College versus University; Undergraduate vs. Graduate Emphasis • Size of university • Residential versus Commuter Nature • The Attractiveness of the Campus Environment • Distance from Home • Particular Alumni Affiliations of Parents/Siblings (apart from ease of admission aspect) • Setting (Urban, Rural, Suburban) • Climate, Region • Particular Requirements with regard to Automobiles, Attendance at Religious Activities, Constraints on Personal Behaviour • Special/Personal Interest (Religious base, Accommodations for the Disabled) • Health Services, Career Services, and other Resources

Table 2.1 (Con.) The interesting Criteria for University Selection in Undergraduate Level

2.4 Weight Assignment of Ranking University Performance

This section presents the methods of weight assignment in university performance measurement (ranking or rating university). There are two systems generally for determining priority in ranking or rating university: 1) single value system, and 2) multiple value system. The next section is presented in more details.

2.4.1 The Single Value System

The single value system is the method of assigning the weights in well-known ranking agencies such as the U.S. News & World Report, Good University Guide (GUG), Times Higher Education, Maclean's magazine, and Asiaweek. The purposes of the ranking agencies are mainly to give a balanced view of a university and provide

information to help applicants make an informed choice. The data related to given performance indicators and each university are usually given a score in the range of 1-100 on each indicator. The scores are then added together to form an aggregate score, which is then used to form the rankings. The disadvantage of the single-value system is that it represents only one aggregate view on universities and does not allow for different viewpoints and backgrounds of various individuals. As such it represents only the viewpoints of the best applicant, for example, when in fact all applicants have different backgrounds and requirements.

2.4.2 The Multiple Value System

Various applicants will be reflected in their different attitudes. Different individuals will wish to apply their own values in selecting the list of universities to apply to, rather than simply accept the top ranking universities from the first supplied by ranking agencies approach allowing a diversity of values and weights is Multiple Criteria Decision Making (MCDM).

MCDM for a single decision-maker (DM) or group of decision-makers, is a process of selecting activities or courses of action amongst alternatives, activities or courses of action so that it will produce “optimal” results under some criteria of “optimisation”. “Optimal” implies “satisfying”. There are two categories of MCDM- Multiple Objective Decision-Making (MODM) and Multiple Attribute Decision-Making (MADM). MODM is a problem of design and mathematical techniques of optimisation are used, usually used for large (infinite) set of alternatives. For example, the MODM technique consists of Linear/Non-Linear/Integer (mathematical) Programming including Data Envelopment Analysis (DEA). However, according to MADM, a problem of choice and classical mathematical programming tools are seldom used. Nevertheless, selecting an alternative from among a small explicit list of alternatives is used more often. In other words, the technique of MADM consists of preferment or weight, Analytic Hierarchy Process (AHP) including Analytic Network Process (ANP), Multi-Attribute Utility or value theory, Electre and Promethee. Moreover, if the values of the criteria are assumed to be known with certainty, the MCDM problem is called deterministic, otherwise it is a non-deterministic or stochastic. For the classification and techniques for MCDM

problem including the major methods of transforming qualitative variables into quantitative relationship, see Kengpol (2000).

During the 1980s, application of MCDM was shifted from MOCM to MADM since the condition and nature of problems changed. In other words, solving well-structured problems under hypothetical and unrealistic assumptions was replaced/substituted with capturing the DM actual decision behaviour (Atthirawong, 2002).

The next section will present the basic concept of AHP and its limitations. Then ANP will be described in the following section.

Analytic Hierarchy Process

AHP is one of the most popular multi – attribute decision models. It works by breaking down a decision problem into sub-problems and then finds the solutions by aggregating the solutions of all the all sub-problems. Both quantitative data and qualitative judgments of the decision maker (s) are easily incorporated in AHP models. Prioritised ranking or weighting of each decision alternative is the outcome from AHP.

Limitation of AHP and the Development of Analytic Network Process

Many decisions cannot be hierarchically structured because they involve the interactions and dependencies in higher and lower level elements (Saaty 2001). From the limitation of AHP, there is a need to develop the decision process that is closer to the reality of human decisions. Saaty (2001) developed ANP which allows alternatives to be connected in a network system enabling the modeling of dependence and feedback within and between cluster/elements.

A brief description and a simple explanation of the limitations of ANP may be found in Kengpol (2000).

Early applications of the Analytic Network Process are described in Saaty (2001).

Some fundamental ideas in support of the ANP are:

- 1) The ANP is built on AHP
- 2) The ANP goes beyond the AHP by including dependence and has the AHP as a special case.
- 3) The ANP is concerned about a set of elements (inner dependence) and among different sets of elements (outer dependence)
- 4) The looser network structure of the ANP enables the representation of any decision problem without concern for what comes first and what comes next.
- 5) Not just elements in the ANP priorities but also groups or clusters are often necessary in the real world.

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Kengpol (2000) suggested the steps for problem solving of ANP as follows:

- The control hierarchy is determined.
- The clusters, elements and their relationships are decided.
- Pairwise comparisons of every cluster and element relationship are performed.
- Supermatrix is constructed and limiting priorities of each result is determined.
- The weights and final priority of each alternative are synthesised.

The explanation of each step including the illustrative example of ANP can be found in the work of Kengpol (2000). Moreover, a number of published papers concerning the applications of ANP in various fields are reviewed as follows:

In the manufacturing area system, ANP was applied to make a decision in product replacement (Azhar and Leung, 1993), to evaluate agile business process (Meade and Rogers, 1997), to conduct a structured Business Process Re-engineering (Ashayeri et al., 1998), and to choose various organisational alternatives on major environmentally conscious business practices (Sarkis, 1998). For logistics and supply chain, application of ANP to evaluate the optimum logistics system is presented in the paper of Meade and Sarkis (1998) and the supply chain problem can investigate from the paper of Agarwal and Shankar (2002). Moreover, some researchers used ANP for project selection, which can be viewed from the paper of Meade and Sarkis (1999) and Lee and Kim (2000).

Furthermore, applications of ANP are broadly used in the field of energy planning such as the Analytic Network Process in Energy Policy Making (Hamalainen and Seppalainen 1986). In another field, sport, ANP was incorporated with Quality Function Deployment (QFD) for prioritising and designing rule changes for the game of soccer (Partovi, 2001). Moreover, ANP was also used to design the program structure in terms of total length of the program and the length of time units (Fox et al., 1996).

2.5 Conclusion

This chapter reviewed the research literature on the different aspects of evaluating university performance which are concerned about stakeholders classification for measuring university performance, development of criteria for the university selection decisions, weight assignment system, the performance measurement approaches, namely the well-known techniques for quantifying the value of performance, Analytic Hierarchy Process (AHP), and Analytic Network Process (ANP). Different criteria will be required for different purposes for measuring performance. The criteria for university selection decisions may be divided into general criteria for university selection decisions and specific criteria influencing decisions on university programs.

Keeney and Raiffa's Principle (Goodwin and Wright, 2000) and the standards and indicators used by the Office for the National Education Standards and Quality Assessment (ONESQA) are applied as a guideline for selecting the criteria for university selection decision. Keeney and Raiffa suggested the desirable characteristics for a set of criteria, namely completeness, operationality, decomposability, absence of redundancy, and minimum size. On the other hand, the National Education Standards and Quality Assessment standards and indicators are used to evaluate the external quality of higher educational level. They deal with the criteria that should identify the effectiveness as well as input/process/outcome of educational administration. In addition, the criteria may be used to enhance the educational standard for acceptance at international level.

The criteria used in the rating and ranking of universities, and a quality awards, are listed and used as a conceptual framework for performance measurement in university selection in this research.

Two systems for determining priority in ranking or rating university performance measurement: the single value system and multiple value system are mentioned. The former gives a balanced view of a university and provide information to help applicants make an informed choice. In the value system, the scores of individual performance indicators are added together to form an aggregate score, which is then used to form the rankings.

AHP Analytic Hierarchy Process (AHP) is one of the most popular multi-attribute decision model. The AHP breaks down a decision problem and then aggregates the solutions of all sub-problems into a conclusion. Decision making is facilitated by organising perceptions, feelings, and judgements into a framework that exhibits the forces that influence a decision. However, AHP has its limitations since making a decision cannot always be hierarchically structured because there are interactions and dependencies in higher/lower level elements (Saaty 2001). Consequently, the decision making process should be developed that is more similar to that of the human decision making process by capturing the complex problem in a fairly simple form. Therefore, ANP is developed by connecting all criteria and alternatives in a network system that allows various dependencies since the preference on the alternatives themselves may also influences the importance of criteria and via versa.

The Analytic Network Process (ANP) is used to derive composite priority ratio scales from individual ratio scales that represent relative measurements of the influence of elements that interact with respect to the three control criteria. The supermatrix of ANP elements are matrices of column priorities themselves so when the ANP captures the outcome of dependence and feedback within and between clusters of elements.

The ANP consists of two parts: (1) a control hierarchy or network of criteria and sub-criteria usually consisting of benefits, costs, and risks as the three main control, and (2) a network of influences among the elements and clusters. The limitations of ANP are

a control hierarchy or control system of benefits, costs, opportunities, and risks each represented in the controlling system.

ANP is applied in the field of energy planning and sport, incorporated with Quality Function Deployment (QFD) for prioritising and designing rule changes for the game of soccer, and used to design the program structure in terms of total length of the program and the length of time units.

The problems of university selection decision are interesting to study a conceptual model in order to help applicants making an informed choice, therefore, a conceptual model in university selection decision is proposed. However, there are various agents used the single value system to weigh the priority of ranking university performance which may have the drawback of ranking, in terms of prestige (only one of the many perspectives on universities). Furthermore, the evaluation of university performance wants criteria representing of measure and the method is suitable.



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