Performance measurement in universities

--Managerial Perspective--

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17th January 2010

Enschede, The Netherlands

<u>Acknowledgement</u>

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Executive Summary

This paper is about a research on performance measurement in universities. The research is to figure out how the performance of universities can be measured from a managerial perspective. By far, few performance measurement frameworks originated from public sector have been developed for performance measurement in universities. Frameworks such as balanced scorecard in for-profit settings have been increasingly adapted to performance measurement in universities. Risks are concerned that they may incompletely grab the nature of university services. The paper aims to develop a framework for performance measurement in universities. Therefore, the main research question is:

"To what extent can a tailored performance measurement framework along the lines of BSC be developed for performance measurement in university settings?"

Universities are characterized by goal ambiguity (Barbara and Richard I, 1999, pp 25). Thus traditional performance measurement approach by goal rational model may not be able to serve performance measurement in universities. This paper argues that the performance of universities can be measured by the extent to which each of university functions is maintained toward the university goals. Based on this argument, it proposes a solution to performance measurement in universities by the distinction of academic performance and management performance. The distinction creates four sub-dimensions under the academic and management performance dimensions. The four sub-dimensions are education, research, finance and human resources. The four sub-dimensions construct a balanced concept for university managers in management control. Meanwhile, a complete performance measurement framework based on the notion of pyramid from Cross and Lynch (1992) is established by integration of the performance dimensions and performance indicators.

Performance measurement in universities has been focused on output and outcome measurement. However, outcome and output measures fail to catch the whole process of academic activities. This paper suggests that input and process measures be included in the performance measurement in addition to output and outcome measures. Most current performance indicators are quantitative. They are unable to measure some aspects such as customer satisfaction and employee satisfaction. Therefore, the use of qualitative indicators is proposed. Performance indicators under each sub-dimension are developed. Pros and cons of the indicators for university management are argued before interviews are going to be held in the University of Twente. The purpose of interviews is not only to know current performance indicators and performance measurement in the university but it is also to justify how valid and reliable the indicators in the paper can be put into actual applications in the university settings. In the end of this paper, potential problems and limitations from this research are discussed. The report ends with a conclusion for this research.

List of Abbreviations

BSC   -Balanced Scorecard
CUC   -Committee of University Chairs in United Kingdom
FTE   -Full-time equivalent
HBO   -Higher Professional Education in the Netherlands
HAVO   -Senior General Secondary Education in the Netherlands
IP   - Intellectual Property
KPI   -Key performance indicator
PM   -Performance measurement
UT   -University of Twente
VO   -University Education in the Netherlands
VWO   -University Preparatory Education

Part Ⅰ

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1. Introduction

1.1 Topic

This paper is written about a managerial perspective of performance measurement in universities in the Netherlands. The topic of performance measurement is popular in public sector. People are curious to know how the performance of universities can be measured comprehensively and effectively. By far, few frameworks from public sector have been developed for performance measurement in universities. This paper aims to devote to this field and tries to develop a tailored framework in university settings.

1.2 Background

Great pressure has been exerted on public organizations to increase the quality of services, efficiency and effectiveness in utilization of resource in new public management reform. As one kind of public organizations, universities have experienced great changes since then. Managerialism and entrepreneurialism concepts have been increasingly applied to university management. The ideology of university as a corporate actor has increasingly gained importance in systematic coordination in recent years (De Boer *et al.* 2007). Universities are responsible for themselves in resources seeking and market seeking. They need to be self-sufficiency and be accountable to the stakeholders. Increasing call for accountability to performance but with less financial supports from governments has caused university managers much burden in management control. University managers may need to seek external resources to meet the extra demands by academic activities. They may also need to ensure that the university resources are properly allocated. The managers need to undertake full responsibilities for their actions within the regulations to obtain value for money. Therefore, university managers may be relying more on performance measurement mechanisms to acquire the information in management control.

Performance measurement is defined as a process of quantifying the efficiency and effectiveness of actions (Neely *et al.* 1995). It is regarded as a pre-cautionary and diagnostic management control system to help managers to keep track of performance in organizational activities. The role of performance measurement is as if an information supplier, which can be regarded as a first step toward building an effective management control mechanism. University managers with information can facilitate the planning course of operation and pay attentions to aspects where improvements are needed. To capture valuable information in universities, performance indicators on multi-dimensions must be developed. This paper tends to provide some insights into the development of performance indicators and the build of a tailored multi-dimensional performance measurement framework from a managerial perspective in university settings. The paper

hopes to provide some contributions for university managers who are interested in performance measurement issues.

1.3 Objectives and research questions

The main objective of this paper is to look at a managerial perspective of performance measurement in universities and to develop a tailored framework in university settings. The paper will also study a popular balanced scorecard performance measurement approach. By studying its robust design, we hope to learn from it and adapt its balanced concept to the development of framework in this paper.

Based on these objectives, the main research question is formed as:

 "To what extent can a tailored performance measurement framework along the lines of BSC be developed for performance measurement in university settings?"

As a further step toward clarification of the main research question, sub-research questions are developed:

1. How can the performance of universities be captured using comprehensive dimensions?

2. In which way can a comprehensive performance measurement framework be set up for application along the lines of BSC in university settings?

3. Which performance indicators in the literatures (esp. PM in public organizations) along with own performance indicators could be used in the performance measurement in the University of Twente?

1.4 Structure

The paper is divided into four parts, here being the first part. In the first part of the paper, it will mainly be an introduction of research topic and methodology for this research. Research problems and research methods for answering to the research questions will be discussed.

In the second of part of this paper, it begins with a review of performance measurement and the evolvement from a single dimensional to multi-dimensional performance measurement framework. The balanced scorecard approach is discussed in terms of its pros and cons of application in higher education. Then the paper enters into the discussions of university characteristics and difficulties in performance measurement design. The discussions need to figure out a framework to capture the performance of

universities. After the framework, the paper will discuss each performance dimension and their importance to the performance areas. Performance indicators are the final and most important section in this part in which a portfolio of performance indicators in each dimension will be discussed.

In the third part of this paper, it will mainly be summaries of interviews in the University of Twente. A list of performance indicators will be evaluated by the selected people in the university.

In the final part of this paper, it will be discussions of potential performance measurement issues in the research. The paper ends with a conclusion of the whole research.

2. Methodology

2.1 Research outline

The paper is based on a research in University of Twente for the sake of in-depth comprehension into university affairs and environment. An overall methodology is a qualitative approach by reviewing existing literatures and an empirical study by conducting interviews in the University of Twente. By means of the interviews, performance indicators will be evaluated by university managers to see how valid they could be put into use. The endorsement of indicators by university managers plays a critical role to the success of this research. The interviews will shed light on what their concerns in terms of pro and cons of performance indicators. The desired outputs of this research include a list of performance indicators and a comprehensive performance measurement framework. The actual implementation of the framework is not discussed but potential issues associated with will be analyzed.

2.2 Problems statement

In past years, increasing interest in performance measurement in higher education was generated (Broadbent 2007, Ruben 1999) and various multi-dimensional frameworks such as balance scorecard and dashboard have been applied to higher education sector. By far, few frameworks from public sector have been developed for performance measurement in universities. Many performance measurement frameworks are originated from private sector in for-profit settings. Risks are concerned that they are unable to grab the nature of every public organization and they are unable to understand the complexities of university services.

A common character from the frameworks applied in higher education is that established dimensions are translated from clear organizational goals. Therefore, performance in the organizations can be measured by the extent to which these goals are achieved. The dimensions help capturing key performance areas that are critical to achieve the organizational goals. To universities with ambiguous goals, the measurement can not be applicable. University goals are often vague and broad e.g. contribution to regional development, social impact, world-class research and education etc. It is a rather difficult task to capture the performance areas related to the ambiguous goals. Besides, it is unclear to what extent the established dimensions from the frameworks can capture and understand the performance areas and goals in universities. Current performance measurement in universities focuses much on output and outcome measurements which are unable to grab the whole process of university academic activities from input, process to output till outcome. A call for input and process measurement is necessary to cover a broad perspective of university activities. Performance indicators are mostly quantitative, which they are unable to measure subjects that are not able to be quantified. The use of qualitative indicators may be necessary in measuring the non-quantifying objects.

2.3 Research design

The research is a combination of literature studies and an empirical research in University of Twente. It goes by answering three research questions.

With regard to the first research question of *"How can the performance of universities be captured using comprehensive dimensions",* we begin by reviewing existing performance measurement literatures and expect that they will provide some helpful insights into performance measurement in universities. A rational-goal model indicates that organizational performance can be measured by the extent to which organizational goals are achieved. Since the rational-goal model is only applicable for organizations with clear goals, universities with ambiguous goals may not be very appropriate for this approach. Then the research moves onto search for other literatures about performance measurement in public organizations. Past literatures demonstrate that organizations with ambiguous goals can be measured by other factors such as general condition of fiscal health, ability to acquire resources and ability to satisfy stakeholders etc (Sowa *et al.* 2004). The measurement is very similar to a general health check of human body to see how each of function of body is well maintained. Therefore, this paper argues that the performance of universities can be measured by the extent to which each of university functions is maintained toward the university goals. The performance can be mainly divided into academic and management performance. The academic performance dimension can be further divided into research and educational dimensions. Education and research are two traditional activities in most universities. The management performance dimension can be further divided into financial and human resource dimensions. Both of them are the enablers to the performance in university management.

With regard to the second research question "*In which way can a comprehensive PM framework be set up for application along the lines of BSC in university settings,* we begin by studying existing performance frameworks (BSC, performance pyramid, dashboard) to get to know how performance framework can be established and fit for university settings. An idea of pyramidal framework is triggered by Cross and Lynch (1992)'s notion on pyramid with cascading measures toward organization objectives. In Cross and Lynch's framework, performance dimensions at different organizational hierarchies are integrated into the framework.

Figure 1 Performance pyramid

(Source: www. Accaglobal .com)

The dimensions in the framework represent performance areas in different organizational layers. While in university settings, such cascading measures at different dimensions in a pyramid just fit the university hierarchies. At the top of pyramid, it could be the university vision as a whole in performance measurement with two main dimensions (academic and management). Four sub-dimensions (research, education, finance, human resource) are placed under the two main dimensions, meaning a clear division of hierarchy. At the bottom of pyramid, there are all kinds of indicators under the four sub-dimensions. The clear division of management and academic performance and their subsequent dimensions in the pyramid also show that university managers need to balance the performance measurement among them.   A further study of Cross and Lynch's pyramid discloses that they does not indicate the use of indicators. While in university settings, the use of indicators is necessary for different levels of managers. At higher level, managers may depend on key performance indicators with aggregated information on performance areas. To managers at lower level, they may need operational indicators with more specific information. Therefore, the final framework in the paper is a pyramidal framework that integrates performance indicators with performance dimensions.

In response to the third research question of *"Which performance indicators in the literatures (esp. PM in public organizations)along with own performance indicators could be used in the University of Twente?"* we begin by searching for existing performance indicators in literatures and developing own performance indicators. Existing performance indicators from the literatures and academic reports in higher education in United Kingdom and Australia provide some helpful instructions in how performance indicators can be developed. From these reports, some performance indicators will be collected and classified into the four sub-dimensions in this paper. The indicators will be discussed in

terms of validity and reliability in the measurement and pros and cons for management. The discussions lead to a few open and close questions for interviews in the empirical research. In order to see how valid the indicators can be put into actual use under each dimension, interviews were held to consult managers in the University of Twente. The interviews were made in the university because this research is a graduation assignment in the university. People in interviews are from different levels of positions in the management. They are Prof. dr. Loon, the dean of school of management and governance, Prof. dr. Krabbendam, the head of department of Operations, Organization and Human Resources and Dr. Stolk, the senior staff officer in Strategy & Communication. They were interviewed with open and close questions regarding the performance measurement and performance indicators in the university. The interview with Dr. Stolk has produced much helpful information regarding the evaluation of performance indicators in the university. The results are formulated into a final list of performance indicators based on the managerial evaluations.

2.4 Research Limitations

The potential research limitations in this paper come from two aspects. First, the build of performance measurement framework in the paper is based on the pyramid from Cross and Lynch (1992). Their pyramidal framework has not been empirically justified yet. Therefore, questions may be also raised about the validity of the framework in this paper with similar pyramidal structure. The second limitation may come from the design of research. The research starts from a managerial perspective of performance measurement in universities. Interviews were arranged in the University of Twente. It may cause discrepancies in the choices of performance indicators by managers in different universities. Universities are institutionally different. Therefore, the validity of performance indicators evaluated by the managers in the UT to be used in other universities might be compromised.

Part II

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3. Reviews of Performance measurement

To begin with the discussions of performance measurement, we need first to understand what organizational performance is. By far, there is no unanimous definition of organizational performance because organizations vary by industries with different situations. A description of organizational performance without considering actual organizational context might be faint. Efforts on clarifying organizational performance remain the most vague and loosely defined construct in the relative field of study (Rogers and Wright 1998). From the rational-goal model, organizational effectiveness or performance can be defined as the extent to which organizational goals are achieved (Price 1972). Thus, organizational performance can be measured by the extent to which the organizational goals are achieved. The system resource model defines organizational effectiveness through the survival of the organization by actively interacting with its environments to seek scare and valuable resources to ensure its functioning (Seashore and Yuchtman 1967). The survivability of an organization is a critical indicator of organizational performance. The ability to acquire valuable and scare resources is an important mean to an organization's survival. The models provide researchers with two theoretical approaches that can be helpful in configuration of organizational performance and in the design of performance measurement in the paper.

The brief reviews of performance measurement and organizational theories still do not solve the problem of what scholars might be looking at particularly in organizations. A widely accepted performance measurement definition by Neely *et al.* (1995) is the process of quantifying the efficiency and effectiveness of actions. The discussion of efficiency and effectiveness must relate to different contexts and measurement subjects such as inputs, outputs and outcomes (Carmona and Sieh, 2004, pp101). According to Carmona and Sieh's definition, efficiency generally described as the ratio of output to inputs relates to attributes such as the number of outputs etc. Effectiveness describes a relation between outcome effect and output. Neely (1998, p5) describe the effectiveness of organizational actions as to what extent customer's demands are met. The measurements on effectiveness and efficiency vary as organizational contexts and goals vary. If efficiency is only regarded as an output measurement at quality of products in a manufacturing company, then it might only need to measure the ratio of flawed products to total qualified ones. In reality, efficiency ought to be a result from multi-dimensional efforts in achieving organizational goals with least cost. In public organizations, the measurements on efficiency and effectiveness are even more complicated due to complexities between business features and non-business features, clear and ambiguous goals. The measurements are inclined to be multi-dimensional, which depends on how people interpret the "efficiencies" to a specific organization goal is. For example, if one of the goals of hospitals is to provide treatments and cares for patients who are suffering

from a variety of diseases and incidents, then the measurements on efficiency ought to cover aspects such as the number of patients cured in each category of illnesses, the average number of days a patient stay in hospital and the average amount of time each doctor spends on a patient etc. The measurements will require considerable numbers of multi-dimensional indicators in tracking every characteristic of hospital services. The measurements on effectiveness are also multi-dimensional, which they depend on how people interpret the "effectiveness" to a specific organizational goal is.

Thus, performance measurement on effectiveness and efficiency is not simply a fixed form of measurement on organizational past actions. Rather, it is a multi-dimensional concept that covers broad aspects in public organizations.

3.1 From a single dimension to multi-dimensional PM approach

Early measurements of organizational performance in for-profit settings emphasized much on financial and accounting models. The models such as return on investment (ROA), sales growth and net profit margin were widely applied. They provided people with an easy measurement tool and a common ground where comparisons with other organizations can be made. Meantime, the only reliance on financial and accounting models in performance measurement has incurred many criticisms because of misleading signals for continuous improvements and inadaptable to today's environment (Kaplan and Norton 1992).

The shortcomings of only reliance on financial indicators might cause managers in organizations:

- myopia, which financial indicators may only emphasize on short-term organizational benefits and be regardless of long-term strategic planning, development and investment

- dysfunctional behavior, which managers focus on aspects that are easily measurable and achievable especially when such measures are linked to rewards (Metawie and Gilman ,2005)

- Inadequate attentions to other aspects where are strategically important to an organization e.g. people in human service organizations and labor intensive industries

The financial and accounting techniques provide very limited coverage on organizational performance and fail to grab more strategic areas such as learning and innovation in the organizations. Financial information only can hardly lead managers to steer an organization into right directions.

3.2 The Balanced Scorecard

As a response to the widely criticisms, multi-dimensional frameworks have been developed to cover broader organizational interests at both financial and non-financial areas. The balance scorecard (BSC) (Kaplan and Norton 1992), the performance pyramid (Cross and Lynch 1992), the results and determinants framework (Fitzgerald *et al.* 1991) and the performance prism (Neely *et al.* 2001) are examples of multi-dimensional frameworks, among which the BSC is mostly widely applied in public sector (Wisniewski and Dickson 2001, Auger and Roy, 2004 and Phillips 2004) and has been increasingly applied in higher education. (Chen *et al.* 2006 and Adriana *et al.*2008)

The BSC is a successful performance measurement framework based on the combination of four key performance dimensions in financial perspective, customer perspective, internal business processes perspective and learning and growth perspective. It provides the four dimensions concerning how well an organization is doing in a competitive environment with a "balanced" idea to capture organizational performance. The four dimensions are translated from the organization's visions and strategies. Thus they build a strategic management view concerning performance related aspects. The BSC is also a relatively loose framework that is open to interpretation (Neely, 2007 pp. 202). It can be applied to different organizational contexts with modifications. They are the two main advantages of BSC.

Figure.2 The balanced scorecard
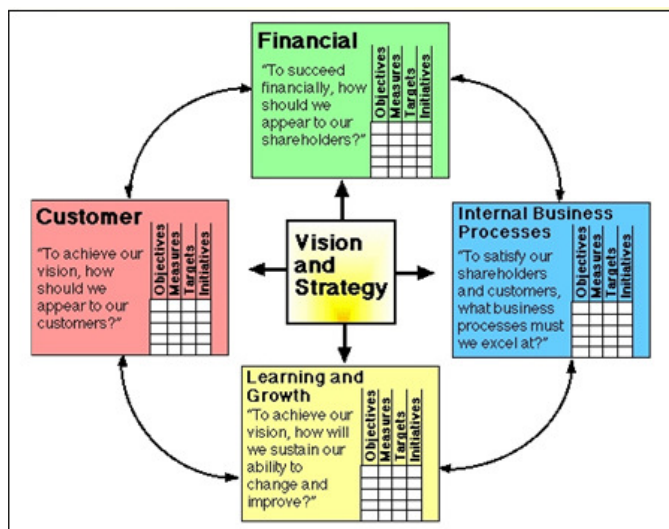
(Source: Balanced Scorecard Institute)

The four dimensions respond to the four important questions in organizational performance. (Kaplan and Norton 1992)

"To succeed financially, how should we appeal to our shareholders?"
"To achieve our vision, how will we sustain our ability to change and improve?"
"To satisfy our customers and shareholders, what business process must we excel at?"

"To achieve our vision, how should we appear to our customers?"

In public sector, concerns about disadvantages of BSC are also raised in recent years. It might cause difficulties in labeling a parameter as to a dimension or to another one with pre-codified framework in the BSC (Silvi *et al.* 2004). For example, it might be difficult to label educational indicators as either customer dimension or internal business process dimension in the BSC. The measurements in educational activities may contain both "how should we appear to our customers" and "what business process should we excel at". In other words, the measurements may contain what universities can offer to students and what kind of process of knowledge services the universities should excel at. The BSC also places much emphasis on the overall views of performance in organizations instead of operational views (Ghalayini *et al.* 1997). It focuses on the four strategic dimensions that are expected to capture the critical success factors of a given organization. It may make the BSC performance measurement only suitable for higher-level managers (e.g. chief executives).

As a business management tool developed in for-profit settings, the BSC may not be able to grab every nature of public service organizations and their performance areas. The design of BSC may be mainly for higher-level managers. Hereby, the application without modifications may cause difficulties in grabbing key performance dimensions in the organizations.

4. The complexity of university in terms of PM

Universities are in pursuit for knowledge creation and knowledge transmission. Performance measurement in universities has been focused on academic excellence. In past decade, the ideology of university as a corporate actor has increasingly gained importance in systematic coordination in recent years (De Boer *et al.* 2007). The change was accompanied by managerialism and entrepreneurialism concepts brought to higher education sector. A preliminary examination of performance measurement on efficiency and effectiveness leads to the questions of "What is the efficiency and effectiveness in a university?" and "How do we correctly label it and hence measure it".

4.1 University characters and constraints in performance measurement

Universities are characterized by goal diversity and ambiguity which are a common phenomenon in a wide range of universities. Readers seldom have a clear and direct impression of university statements in telling them what universities are actually aiming at. University goals are often complicated and broad e.g. contribution to regional development, social impact, world-class research etc. Much information is hidden and need digesting. Universities are not guided by principles of profit maximization solely as most organizations do in private sector. They may have no priorities in mind in terms of aggressive resources seeking, cost reduction and profit generation. Instead, universities may try to maintain a stable status of operating and by that they slowly achieve organizational objectives.   For example, in the mission statement of University of Twente, it states that

" The university needs to be responsive to the requirements of the knowledge society and also has a special responsibility to develop and implement a broad knowledge potential in science and technology…………the University of Twente also wants to stimulate economic and social development regionally: in Twente, the north-east of the Netherlands, and in the Gronau-Twente Euregio"

"Teaching is of the highest standard and the University is committed to: an educational programme that is in tune with the latest international research developments……The University of Twente conducts world class research……"

The goal ambiguity of universities suggests that performance measurement can not follow the rational-goal model which pre-determines that organizations with clear goals are priority in this model. Organizations with ambiguous goals can be measured by other factors such as general condition of fiscal health, ability to acquire resources and ability to satisfy stakeholders etc (Sowa *et al.* 2004). This approach is very similar to a general health check of human body to see whether the performance of each body function is well maintained. Thus, the performance of universities can be measured by the extent to which

each of university functions is maintained toward the university goals. Universities have two main function, academic function and management function. The overall performance ought to be a combined set of performance dimensions derived from the functions. Performance measurement on efficiency and effectiveness ought to be based on the measurement of performance in the functions in the university. For example, when it comes to efficiency and effectiveness in educational activities, performance in the university can be measured by the average amount of time for bachelors and masters to complete studies, the number of graduates and the number of diplomas etc. When it comes to the efficiency and effectiveness in research, performance in the university can be measured by the number of publications and the number of citations etc.

To better understand what exactly can be measured by performance indicators, a general model of input-process-output-outcome needs to be illustrated.

Fig.2 The input-process-output-outcome model

Inputs ➡ Process ➡ Outputs ➡ Outcomes

The arrows indicate the general direction of equation from inputs, process, and outputs till outcomes, which the four aspects are what performance measures arrive at. Tendency toward performance measurement reflects increasingly call for accountability in higher education (Ruben 1999). Two factors may influence on this trend. First, it is a general call for universities to increase the efficiency and effectiveness in management. Second, higher education is very costly. Financial constraint on investment in universities by the governments and emphasis on value for money suggest the funds be prudently and appropriately allocated. Any investment from the governments and individuals must have some kind of returns in contributions to the development of society, increase in educational output, employment etc. AUCC (1995) pointed out that the increasing demand for accountability has led to an interest in outcome measurement in performance measurement. Not only outcomes measurement, but also output measurement is what people may be interested in. Both of them focus on the valuable components in the equation.

However, output and outcome measurement fail to grab the whole comprehensive images of academic activities in universities. For example, the nature of educational activities determines that student's learning is an enduring process from input, process to output till outcome. By far, most people only see student's increase in knowledge, skills and capabilities as a result of educational activities. Little is known about the process of student learning and what universities have contributed to that process. In order to control the quality of education services, university managers ought to get to know what has happened in that process. Therefore, process measurement is becoming necessary to fill the gap and produce valuable information for the managers in the value-adding process. When emphases are on output and outcome measurement, input measurement still holds

its importance in performance measurement in universities. Heller (2001) stated in the forward of his book that a critical input (students) still plays a key role in educational outcomes of a university and some of the best outcomes are produced by a student's peers. Therefore, both input and process measurement are of equal importance with output and outcome measurement in performance measurement in universities. The input measures incoming resources such as students, infrastructures and instructors etc. The process measures how universities deal with these resources in educational process, courses programs and workload schedules etc. The output measures the achievements that result from the value-added activities and the outcome measures the effects of the achievements. All the measures together provide university managers with comprehensive information in university academic activities.

4.2 The distinction between academic and management function

In order to capture the performance of universities, dimensions need to be developed from the functions in the universities. It might be helpful and clear to distinguish between university academic function and management function related performance. The distinction is in line with the overall university academic and business-like structure. It creates two focal dimensions in capturing the performance of universities. Academic and management activities are closely linked with each other in university practices. Either of them could capture a complete and key factor of the performance of universities solely. For example, a university may have an excellent management system with excellent personnel but it does not necessarily result in excellent performance in the university. Academic performance is the core to a university's performance and management performance is the one that can enhance and serve academic performance. Both of them together, they construct a complete picture of performance in different functional roles in the university. Thus in the measurement of performance in universities, academic and management performance can be clearly distinguished from each other. The distinction provides managers with a tailored measurement approach to university settings.

The two focal dimensions can be further divided into sub-dimensions. Academic performance is traditionally composed of two kinds of activities, research and education. They are two kinds of university activities underpinning a society's development. Research and educational activities provide people with knowledge and trainings for jobs. They are sources of new theoretical and practical knowledge as well. Educational and research activities are the most common activities in wide categories of universities. Management performance has two components that are important to the performance in universities. It includes human resources (employee) and financial resources. Managers in universities must have financial resources to serve customers and hence performance in financial dimension determines how sustainable the managers are able to provide the services in long term. For example, investment in infrastructures, research equipments etc. Meanwhile, as human services provided by universities, staff especially academic staff

plays a crucial role in converting organizational inputs into outputs (Hasenfeld 1983).

4.3 Multi-dimensional PM framework

The framework is to be built on the distinction of university academic and management performance. Academic performance refers to a university's' core character in education and research. Management performance encompasses two important resources. Both of these resources are related to the capabilities in the university.

Cross and Lynch (1992) developed a performance pyramid model to measure organizational performance at different hierarchical levels. The notion of framework is built on cascading measures toward the organization objectives. It composes several layers in the pyramid where corporate vision is put on the top of pyramid together with two important market and finance dimensions. Underneath the market and finance dimensions, the dimensions of productivity, flexibility, customer satisfaction, waste, cycle time, delivery and quality are placed. The framework suggests that an organization's operation at different levels of structure have different focuses which can be monitored by performance indicators in the dimensions. The dimensions are supporting each other, which they eventually link the organizational objectives and strategies to actual operations.

Following the Cross and Lynch's notion of pyramid, we complete a similar pyramidal performance measurement framework to capture the performance of universities.

Figure 3, The PM framework for universities
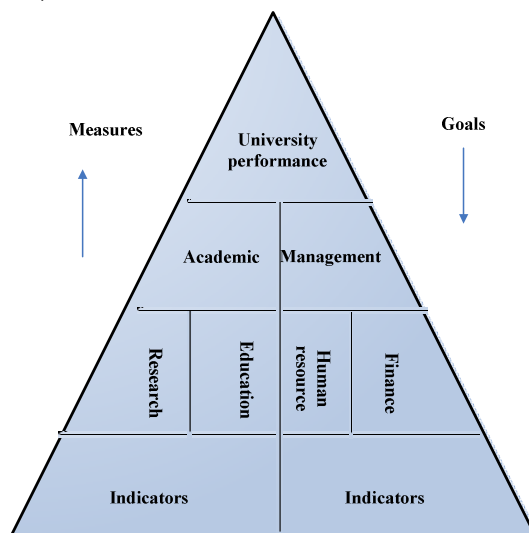
The pyramid is a product of systemic integration of the performance dimensions and indicators into a complete performance measurement framework. At the top of the pyramid, it is the university vision as a whole with two main performance dimensions

(academic and management) that are closely linked to the university goals. The two main dimensions are divided into four sub-dimensions (research, education, finance, human resource).   Therefore, it brings with a more strategic and balanced performance measurement to high-level managers with key performance indicators. At the middle and bottom of the pyramid, other indicators in four sub-dimensions construct an operational view of performance measurement in universities. Information from the indicators at each sub-dimension will be summarized and reviewed by high-level managers to form a main measurement on academic and management performance. Performance measurement follows a measure-up model in the framework.

4.4 Use of Key performance indicators

Key performance indicators (KPIs) are sets of measures on aspects that are most critical to current and future success of an organization (Parmenter, 2007, p3), where competitive advantages over competitors may be built.   They may bring to managers at several vantages points:

1. KPIs may provide a snapshot of an organization without wasting much time on volumes of information
2. The information is high-level and can be critical to decision making
3. KPIs can provide a set of competitive advantages in analysis where the results can be comparable to those in other organizations.

The use of KPIs is not an instant phenomenon but it has been a popular tool in performance measurement. The CUC report (2006) developed 10 high-level KPIs in the measurement of institutional performance from a perspective of governors in higher education, covering both financial and non-financial aspects. Here, the focus is on the development and selection of KPIs for academic and management dimensions. Although the use of KPIs has been a hot topic, little guidance or arguments on concrete selection of KPIs among other performance indicators have been developed. One of common criteria in selection may be critical and powerful to indicate the performance at their measurement. The selection procedures could be institutionally differentiated.   The selection processes are very likely to be the result of managerial subjective judgments and may be driven by external stakeholders in universities.

4.5 university academic performance

Academic performance is a primary indicator to most universities in performance measurement. It is an icon that people see whether good or bad a university is. As universities differ, emphases on academic performance differ from one discipline to another. For example, research universities may place more resources on research activities than educational activities. Thus, indicators in research dimension may take

more credits in the overall measurement of academic performance. The goals of a university affect what kind of academic activities in the measurement. They can further influence what kind of management activities should be done in accord with production process in academic activities. Academic activities traditionally include two components, research and education. The balance between research and education activities may be an important character in universities.

Criteria in academic performance disclose a university's expectations on academic activities. They provide managers with guidance to measure academic performance at different levels within the university. Criteria are mostly derived from university goals and mission statements, which they take on different characteristics at different hierarchies of university. At university level, criteria for academic performance are broad and show the university's general expectations in academic activities. At faculty, departmental and individual level, they become more specific and concrete to measure academic excellence. From broad to specific criteria, it leaves much flexibility to managers in interpretation and developing appropriate indicators that are in line with their situations.

To measure whether a university has excellent research performance, we may perhaps generally see whether it meets the following broad criteria.

1. Excellent research personnel and recognized research groups or faculty
2. The amount of annual expenditures on researching activities
3. The number of doctorate granted
4. The amount of governmental and third party research funding granted
5. Excellence in research output and outcome

The University of Twente is an enterprising research university which focuses on technological development. It helps students, companies and governments to achieve competitive advantages through research and educational activities. The character of enterprising indicates a close link between university academic activities and market. It brings research activities with more features of commercialization in research products. Hence, in addition to the above general criteria for a university, the university should also bring in the criteria of enterprising in research performance measurement. For example, criteria such as excellence in commercialization of research outputs, annual increase in the number of entrepreneurs, spin-off companies etc.

Research activities are mostly carried out by academic staff and PhD students in universities. Some research programs may be project-based with definite time frame and are contracted with outside agents. Research performance is usually evaluated by peer review of outputs e.g. refereed journals. Indicators such as the number of refereed publications and the number of patents are used in measurement. Research performance can also be evaluated by external rankings and awards etc.

Criteria for educational performance focus much on characteristics in educational

activities. In the measurement of educational performance, we may perhaps see the following broad criteria

1. wide range of competitive degree programs
2. Excellent academic staff
3. diversity of intake of students from abroad and home, culture and religion
4. graduate's employability
5. High retention rate and graduation rate

Most educational activities are carried out at undergraduate and graduate stages in universities. Factors influencing a university's educational performance vary. The factors may include students, quality of teacher force and instruction facilities etc. Students can be regarded as a determining factor because their level of commitment to study may have decisive influence on cognitive increase. They directly involve in the production of educational activities as both customers and producers. Academic staff is another factor in educational performance. Staff experience, skills, commitment and motivation may influence how much knowledge is transferred to students in educational process. Input indicators in educational activities will include intake of students, degree programs, academic staff etc. Educational programs usually take years for student to complete. Process indicators in educational performance measurement will include student's study efficiency, drop-out rates and retention etc. Output indicators in educational performance measurement include the number of diplomas issued, the number of students graduated etc. The final outcomes of university educational activities are students with enough trainings and knowledge for employment in the society. Hence outcome indicators will focus on student's employment conditions and graduate's starting salaries etc.

4.6 university management performance

The framework also highlights the importance of management performance to the overall performance measurement in universities. Managers in higher education feel constant pressure toward effectiveness and efficiency in utilization of resources in management. Universities have human resources and financial resources that are critical and are strategically important to management performance.

4. 6.1 Human resources (employee)

The role of human resources has significantly changed from time to time. In early industrial era, people were only operationally or tactically important especially when products are physical things and routine services (McGregor 1988). Such tactical importance might be primarily due to early industrial organizational designs with emphases on efficiency in working places. Job responsibility and nature of tasks can largely define what kinds of people are necessary on the positions. At that time,

organizations with physical assemble lines and routine services tended to be standardized in production e.g. car manufacturing industry and retail services. In post-industrial era, the role of people has changed as a critical input into final products in organizations with "smart" and complex products (Brickner 1981).   The change has raised human resources (people) to strategic importance in management because people are no longer seen as a necessary but a decisive factor to the success of organizations. Universities are within this category of organizations that provide knowledge services and produce smart people. University staff, especially academic staff who directly involve in academic services, is the strategic and sometimes non-replaceable asset. Academic staff is the source of core capability in universities and their know-how has much influence on the overall level of service performance.

Academic activities influence human capital and associated policies and practices that are required to build in accord with certain level of academic performance. Both strength of human capital and effectiveness of HR policies and practices may be two important criteria in the measurement of human resource performance. To a research university such as University of Twente, having excellent research personnel is critical to build the stock of human capital that match its research needs.   The number of PhD students, professors and assistant professors in research activities are important elements in employee composition. Besides, the number of lecturers, supportive staff and other staff are also important stock of human capital to the university. University's human capital is influenced by factors such as age, experiences and outflow of people. With increasing average age of employees, universities may decrease in capabilities and level of outputs. To maintain a certain level of human capital, universities need investment in employee training, development and recruitment, where such means help building and acquiring the capacity embodied in people. Effectiveness of human resource policies and practices is another criterion in human resource performance measurement. It affects not only the building of human capital but also employee's job performance. Huselid (1995) argued that management practices such as the use of appraisal on performance on individual and group work performance, linkages with incentives and use of promotion opportunities will effectively encourage employee and raise their motivation. Thus, in measuring employee's job performance, indicators may include employee's satisfaction with the HR polices and practices.

4.6.2 Financial resource

Financial resources underpin an organization's capability in operations, decision making and organizational outputs. Morden (2007, pp, 33) regards the importance of financial resources as:

> *"The enterprise can only do what its available financial resources (and the quality of financial management) will permit it to do"*

Hereby, the amount of financial resources decides what an organization might be able to

achieve and what kind of people and asset are affordable. It is a crucial point in the realization of organizational capability and value creation as well. An example is about Formula 1, clubs having large quantities of financial resources can decide what kind of team members to acquire and what kind of technologies to use to improve speed and reliability of the formula cars. Though there might be no definite causal relationship between amounts of financial resources and organizational performance, it could become an important indicator in management performance.

The need on the amount of financial resources is different to academic activities in universities. For example, research activities that require large quantities of funds may beyond the cap of budgets that the universities can afford. Third-party funding and governmental funding have been becoming important extra sources of research funding to university budgets. Donations, government grants, subsidies, contracts and awards are typical means in the acquirement of financial resource. Besides tuition fees from students, universities can also acquire financial resources by means of providing consulting services, sales of intellectual property and even renting places and facilities to outside companies. Thus, the diversity of funding sources may be an important criterion in measuring financial performance in universities.

Financial performance in universities can be measured by whether universities are in financial health. Financial health may be a criterion in measuring how effectively universities have used financial resources to serve academic purposes. It is also a higher-level of key performance indicator in CUC report (2006). McKinney (2004, pp.2) views financial management as an indispensable role in achieving organizational objectives and it has two important implications, one of which is the means to obtain and allocate resources and another of which is to utilize methods and controls to achieve determined goals.

In summary, both human resource and financial resources are of importance to management in universities because they concern not only the capability of what universities can do but also who are going to serve the university's goals. Performance measurement in management will focus on these two kinds of critical resources where performance indicators in next section are developed.

4.7 Conclusion

The discussions by far have answered the two research question in the first part. The performance in universities can be measured by the extent to which each of university functions is maintained toward the university goals. Based on the argument, the performance in universities can be captured mainly by the management and academic dimensions. Academic performance is the core to the performance in universities and management performance is the enabler to the performance in universities. The main dimensions can be further into divided into the sub-dimensions of research, education,

finance and human resources, which the four construct a balanced concept to performance measurement in universities. With an idea of pyramidal framework from Cross and Lynch, we complete a similar pyramidal framework in the lines of BSC with the integration of the performance dimensions and performance indicators.   In the following section, we are going to focus on the development of portfolios of performance indicators in the dimensions of research, education, finance and human resources. We are also going to discuss the pros and cons of performance indicators for university management.

5. Performance indicators

A performance indicator is usually a statement that can be quantified on resources and achievements to the particular objectives of an enterprise (Higgins, 1989). It can also be defined as an item of information collected at regular intervals to track the performance of a system (Fitz-Gibbon, 1990, pp.1). Sizer (1979) suggested that performance indicators include the following characteristics: relevance, verifiability, freedom from bias, quantifiability, economic feasibility and institutional acceptability. While in Higgins' (1989) articles, he quoted the development of performance indicators from British Committee of Vice-Chancellors and Principals as "relate to objective, be specific, quantifiable, standardized, be simple as possible, be acceptable and creditable and be capable of acting as signposts to areas needing attention".

Relevance to goals is of priority in developing performance indicators in all kinds of businesses. It concerns whether performance measurement is right on what organizations aim to achieve. In most cases, university objectives are not explicit in written context where they can be easily distinguished. It is high possibility that many objectives are hidden in the mission statements. The clarification of mission statements must be taken consideration into the development of meaningful indicators. Acceptability suggests that performance indicators be accepted by people who are considered as users in order that fairness and relevance are not compromised. In other words, the indicators would fulfill the needs of management use. Quantifiability means that performance indicators must be quantifiable but cautions have to be taken when applied to non-quantifiable objects in developing meaningful indicators. Economic feasibility may have two kinds of implications. One is the development of indicators should be simple and easy to use, in a well structured form related to input, output and outcome model. The more complex of indicators hints that they are more expensive to collect (Propper and Wilson 2003). The other implication is that the overall benefits of developing performance indicators ought to outweigh the costs and associated harmful effects in the use of performance indicators. Metawie and Gilman (2005) documented problems such as employee dysfunctional behavior, principal-agent and gaming associated with the implementation of performance measurement in the UK public sector when performance measures are related to incentives and rewards. The development of performance indicators ought to be comprehensive from a user's perspective.

There is a great concern about the choices of indicators as well. Performance indicators are mostly quantitative and descriptive, relating to anything that can be quantified. Quantitative indicators may be not only inappropriate for items such as student's satisfaction and employee's satisfaction but also may provide little valuable information in these aspects for managers in improvement. Hence, more meaningful, qualitative and diagnostic performance indicators are required. Qualitative indicators are inclined to measure the effects of something. They may be very helpful in measuring how is working and what needs improving. Meanwhile, attentions need to be paid to the use of qualitative

indicators because qualitative indicators may contain people's opinions and are very likely subject to bias. Dowling and Richardson (1997, pp. 354) documented that the application of qualitative indicators in performance measurement caused frequent skepticism when measuring individual job performance of managers in health service. From a managerial perspective, the pre-settled vision has also implied two different uses for managerial controls. Managers need to know not only the overall views of performance but also need to know the operational views of performance in universities.

In summary, the development of performance indicators must follow the characteristics of relevance, economic feasibility and institutional acceptability etc. The development of indicator also needs to consider what kinds of performance indicators are most applicable to objects that are being measured. For example, qualitative indicators might be more helpful than quantitative indicators in measuring people's attitude and satisfaction etc. In a word, performance indicators ought to serve a useful mean to improve the quality of university activities with least cost.

5.1 Performance Indicators in the literatures

Several literatures and information sources are found exclusively useful for this study. They provide a few performance indicators which can be categorized into the dimensions in this study. The literatures and information source include CUC report (2006), Australian Government report in higher education (2005) and performance measurement in University of Edinburgh and performance measurement in University of Twente

The CUC report is about performance measurement in a university from a governor perspective. It focuses on ten high-level key performance indicators that are important to the performance in the university. The key performance indicators are institutional sustainability, academic profile and market position, student experiences, teaching and learning, research, Knowledge transfer and relationships, financial health, estates and infrastructure, staff and human resource development, governance, leadership and management and Institutional projects. From the high-level key performance indicators, a large number of key performance indicators are further developed. In doing so, the governors can get a comprehensive image of the performance in the university. As the report is for governors, the level of information from the indicator is considerable aggregated because of the use of key performance indicators.

The report by Australian government is a review of performance outcome indicators in higher education. In the report, it focuses on the robustness of performance outcome indicators in higher education. The indicators are progress rate, attrition/retention rates, graduate full-time employment, graduate full-time study, graduate salary, overall satisfaction, good teaching and general skills. The literature in University of Edinburgh is a balanced scorecard performance measurement approach which helps senior managers to achieve the goals in the university's strategic plan. The concrete goals in the strategic

plan provide a foundation for university managers to develop the performance indicators in the dimensions of organizational development perspective, financial perspective, stakeholder perspective and internal business perspective. Besides, by interviews within the University of Twente, the managers provide some helpful information regarding the current performance indicators in the University.

The performance indicators from the literatures, the website of University of Edinburgh and interviews in the Unviersity of Twente provide much information about the development of indicators in the four dimensions. Some of the indicators are categorized into the dimensions in this study.

5.2 Academic performance indicators

Academic performance can be seen as the core competencies of a university. All other university functions and facilities are built for this purpose. In this paper, the measurement of academic performance focuses on the educational performance and research performance. In the following sub-sections, academic performance indicators are discussed.

5.2.1 Research performance indicators

Research may be one of pillars that underpin a university's academic reputation. It is an important source of new knowledge as well. Academic research may often appear in a university's mission statement signaling what the university does. The development of research performance indicators will cover the whole research process. Input measurement includes indicators such as the number of researches from sponsors and researchers FTE etc. Output and outcome measurement frequently include indicators such as the number of publications, citations, the number of awards and memberships etc.

Table 1 Research performance indicators

Performance areas	Indicators	Measurement alternative	Pros and cons for management
Research input	researcher FTE	researcher FTE by PhD students, academic staff etc)	The FTEs provide university managers with a valid approach to measure employees with different level of involvement in research. University managers are able to know how many research employees or how many percentages of employees are completely committed to research activities. However, it is a question mark to what extent the FTEs provide a reliable measurement of actual input of time by researchers. To PhD students, overtime work is quite a normal phenomenon. The FTEs may only provide university manages with a measurement of researcher's involvement against standard amount of time in labor contacts.
	The number of researchers from sponsors	The number of researchers paid from external grants	The more number of researchers from external grants in cooperation, the more connections with external organizations a university could have in research networks. It also signals a university's research influence at its fields.
	The number of successful research granted applications (CUC report 2006)	The number of successful applications by National & international programs or by other sponsors	The indicator signals the research strength of a university in competing for research resources and their quality of research proposals. The indicator still needs manager's subjective judgments in the measurement of value in research programs because research programs differ. The indicator is also a measurement of performance in the university's systematic support and training for researchers to apply for research programs rather than the performance of "scatter-guns "by the large number of applications.
		€ amount of research grants	
	The number of Strategic partnerships(CUC report 2006)	The number of formal agreement the university has in research	The indicator counts the number of formal agreements a university is engaged in. The more number of formal agreements, the more strategic partnerships the university is engaged in, and the more diverse of sponsors could be.
Research output	The number of publications by research unit	ISI-refereed journals	The indicator by different measures has different issues of validity in measuring research performance. ISI-refereed journals, refereed conference paper, books and chapters are considered as higher validity in measuring research performance. The validity of non-ISI
		non-ISI refereed Journals	
		Journal articles (non-refereed)	

		Refereed top conference paper (i.e. Top 5)	refereed journals, non-refereed journals and other academic work in research performance measurement may be compromised. The indicator needs manager's subjective judgments on the quality of publications
		Books	
		Refereed book chapters	
		Other academic work	
	The number of doctorate conferred	The annual average number of doctorate conferred	The indicator is a very important disclosure of research outputs of a university. It provides university managers with the total number of conferred doctorate degrees in the university, which can be compared with the performance in other universities in the country.
	Exploitation of IP (CUC report 2006)	The number of Spin-off companies	The indicator of exploitation of IP measured by number of spin-off companies, patents and license agreements is an effective way to see how well a university has achieved in utilizing its research outputs in a commercial way. However, with regard to the actual value of exploitation of IP, it is the amount of economic benefits that matter to the university. The amount of information from the indicator by these measures is limited to university managers in this aspect.
		The number of License agreements	
		The number of Patents	
	The number of successful entrepreneurs (start-up companies)	Annual growth of successful entrepreneurs	The indicator quantifies the total number of students and university staff who become entrepreneurs but it may encounter difficulties in judging to what extent an entrepreneur can be seen as successful or not. Therefore, the usefulness to management might be limited.
Research outcome	Citation	Impact score	Citation is a widely recognized indicator in the measurement of research outcomes. Citation is also a very time-lagged indicator by different measures. It may take years until a publication of a given author is citied. Therefore, the validity of the indicator for management in the measurement of current research performance of a given research group might be compromised due to both time problems and outflow of researchers etc.
		H index	
	Membership of research council or editorship of journals	The number of board members in research council and editors in journals	The indicator may provide university managers with a clear image of research strength and research reputation in a university. However, the validity of memberships of research council and editorships of ISI journals to be used in current research performance

			measurement in the university could not be overestimated. There might be even no definite casual relationship between research performance and their positions in these organizations. Thus, the validity of membership for university managers in assessing research performance of a university is a question mark.
	Awards (CUC report 2006)	NWO Spinoza Prize or others (e.g. European Science Awards)	Awards are symbols of research strength of a researcher recognized by outsiders. It brings with high reputations. The indicator may not be practical on a regular basis and needs subjective judgments by university managers on different types of awards.
	Research ranking (Leiden ranking) or research assessment by peer reviews	Leiden ranking	The use of Leiden ranking is very simple for university managers with all the information provided from its website. Thus, the measurement can be done any time when managers feel the measurement is necessary. The indicator provides an external view of research performance measurement of a university based on the well-recognized research ranking.

5.2.1.1 Research input indicators

➢ **Researcher FTE**

The FTE is a popular measure of the involvement level of researchers in research activities. It is measured by the amount of time an employee is involving in research projects. FTE of 1 generally equals to a full-time employee's level of involvement in research activities, for example, 40 hours a week etc. FTE of o.5 is half of the amount of time the employee with 1 FTE. Therefore, by counting employees with different scores in FTE, university managers are able to know how many employees are completely committed to the research activities or how much percentage of employees is with different FTE scores. Most research activities are carried out by PhD students and academic staff in universities. The FTE provides the managers with a valid approach to measure employees with different level of involvement in research. However, the results from FTE are calculated from the standard amount of time laid down in contracts. It is unclear to what extent the FTEs provide a reliable measurement on actual input of time by researchers. To PhD students, overtime work is quite a normal phenomenon. Therefore, the FTE may only provide university manages with a measurement of researcher's involvement against standard amount of time in labor contacts.

➢ **The number of researches from sponsors**

With increasing external funding from outside organizations, universities may employ researchers from sponsors to co-participate in research programs as parts of agreement. The indicator can be measured by the number of people paid from external grants. The more researchers from external grants in cooperation, the more connections with external organizations a university could have in research networks. It also signals the university's research influence at its fields.

➢ **Successful research granted applications**

The indicator measures the total number of granted applications for wide ranges of research programs. A similar indicator can be the ratio of successful research grant applications in the CUC report (2006). The indicators signal the general research strength of a university in competing for research resources and the quality of research proposals. Research programs can be divided into a few levels of international, national and other institutional. Successful research grant applications by international and national level sponsors can be considered as high achievements for a research scholar. International and national level research programs from research councils and international institutions may require an applicant with higher academic achievements in certain fields. Not all applicants may meet eligibility criteria to the category of research programs. Besides, an applicant may face fierce competition by other scholars from different universities at home or abroad. Thus, it can be considered as a valid indicator in research performance measurement.

The number of successful research grant applications can also be measured by other research programs in non-governmental institutions. The research programs may open to large group of applicants with less strict requirements attached than programs from research councils. Thus in the measurement of research performance, they may not be as valid as research granted applications from high level research programs. In addition, factors influencing the success of application can not be ignored. The factors may include the scientific topics addressed in applications, popularity of research topics related to university researching fields and research budgets etc. The reliability of indicator for university managers in the measurement of research performance should not be over-estimated. The indicator may also subject to broad economic influence in the measurement. In years with good economic condition, the number of successful applications may increase significantly when compared with years in bad economic conditions. To university managers, the indicator is also a measurement of university's systematic supports and trainings for researchers to apply for research programs rather than the performance of scatter-guns by the large number of applications.

Besides, the number of successful applications can also be measured by monetary terms e.g. euro. It provides managers in universities with an annual sum of research granted funds which can be compared with the amount of funds granted in pervious years. Again, because of broad economic influence and size of research budgets from the applications, the reliability of the measurement might be compromised. In extreme case, one successful application can generate great proportion of research funds to total research granted funds.

➢ **The number of strategic partnerships**

The strategic partnership is a formal agreement between a university and external organizations, which the parties share the information, know-how and support common objectives. It is also an important source of research funds and sponsors as well. Partners in the agreement could cover all business areas, from venture capitalists to governments, from technological companies to universities. The strategic partnership establishes a channel that common interests can be pursued for benefits in areas of interests by involved parties. With increasing strategic partnerships, the university can eventually form a knowledge transfer networks. Thus, it is an important input indicator to the university in the CUC report (2006). The more strategic partnerships the university is engaged in, the more diverse of sponsors could be. The indicator can be measured by the number of strategic partners that the university has formal agreements with. It is a valid and direct measure on quantity of partnerships that the university has. However, it may not be very reliable in measuring quality of strategic partnership which affects the actual amount of value might be created in cooperation. The indicator provides a quantitative measurement on the university's engagement in connections with external organizations.

5.2.1.2 Research output indicators

➢ **The number of publications**

In output measurement, the use of indicators such as the number of publications is a frequent quantifying measure on research outputs. The indicator is simple in use but the information from it is limited because little is known about the quality of these publications and how profound of the publications can produce is unknown. Thus, a problem here is how to judge the quality of publications, in other words, how prestigious journals and conferences where paper gets published can be seen as a good indicator of excellent research performance. The publications can be measured by refereed journals, non-refereed journals, conference, books and chapters of books etc. Refereed journals can also be divided into ISI refereed journals and non-ISI refereed journals. ISI journals are the most frequent used academic journals categories in worldwide. ISI journals provide a relative high valid and reliable measurement on the quality of publications. ISI refereed journals, books and refereed chapters in books published by world top publishers can generally be considered as good quality. The publications are carefully examined by publishers in content for a long period of time and they mainly serve academic purposes. To non-ISI refereed journals, non-refereed journals and other non-refereed publications by some not well-known publishers, it is unclear whether the publications can be regarded as good quality or not. The publishers may lack of mechanisms in prudently assessing the quality of publications or they assess publications by low level of criteria.

To conference publications, university managers face the same problem in validity and reliability issues. Conference publications can be categorized into refereed paper and non-refereed paper by different levels of conferences. For example, ISSCC (*International Solid State Circuits Conference)* is the best in electronic engineering. Paper there tend to be considered as top quality ones in the field because they have been reviewed by experts before publication. However, researchers can also submit their papers to some small conferences such as *IEEE International Midwest* Symposium on Circuits and Systems. To non-top conferences, it is unknown whether paper get published there is good or not. The validity of the papers in non-top conferences in measuring research performance might be compromised by low level of acceptance criteria. To non-refereed paper, the validity of measurement in research performance is low. Therefore, the indicator of the number of publications still needs subjective judgments by university managers on whether the publications are considered as good research performance or not. The indicator lacks the reliability in the measurement on quality of publications. The indicator may unexpectedly lead research personnel to chase for quantity instead of quality of publications if ISI refereed journals and top conferences are not emphasized.

➢ **The number of doctorate conferred**

The number of doctorate conferred is an output indicator in research performance measurement. It counts the total number of doctorates conferred to PhD students annually.

PhD students constitute a research university's main research groups. When they graduate, they also become the university's research outputs as well. Thus, it is a relative valid and reliable measurement in research performance. It provides managers with a total amount of doctorate degrees in the university, which can be compared with the performance in other universities in the country.

- **Exploitation of Intellectual Property (IP)**

Exploitation of IP is an output indicator for a university to measure how effectively she has used IP for economic benefits. In the CUC report (2006), the indicator is put under the dimension of knowledge transfer and relations. The indicator can be measured by the number of spin-off companies, license agreements and patents etc. The number of university spin-off companies measures how well the university has transformed intellectual property, technologies into new products with commercial value into market places. A spin-off company usually starts life within the university and later progresses to be an independent business organization on its own endeavor. The higher number of spin-off companies, the higher performance the university will be in exploitation of intellectual property. Thus, exploitation of IP by the number of spin-off companies is a valid measure. Because of close relations with the university at initial stages of development, spin-off companies can be seen as reliable measure in the measurement of a university's IP exploitation.

The number of license agreements signed measures a university's commercial effort in utilizing its intellectual property in exchange for economic interests. Thus, it is a valid measure of the university's effort in exploitation of IP. However, the number of licenses the university can successfully issue is affected by external demands and criteria in the agreements. If there is no demand by customers or both sides can not reach the agreement, there will probably no license agreements by the university. No license issued does not necessary mean poor exploitation of IP in the university. Thus, the reliability of this measure in measuring exploitation of IP should not be overestimated. The number of patents granted is another measure in exploitation of IP. A university can secure its research achievements by applying for patents from governmental institutions. Patents are sources of competitive advantages as well. The patents could be seen as a first step for commercial exploitation of IP. However, with regard to the value in the patents, it is the outputs of the patents that matter rather than the sheer number of patents. A university with hundreds of patents that are never to be commercialized will not produce the same amount of economic benefits as another university with only a few successfully commercialized patents does in exploitation of IP. Thus, it could not be a very valid measure in the measurement. The indicator of exploitation of IP measured by the number of spin-off companies, patents and license agreements is a way to see how well the university has made effort in utilizing its research outputs in a commercial way. However, with regard to actual value of exploitation of IP, it is the amount of economic benefits that matter to the university. The information from the indicator is limited in this aspect.

➢ **The number of successful entrepreneurs**

The number of successful entrepreneurs may also be one of output indicators in research. It quantifies the total number of students and university staff who become entrepreneurs with research background in the university. An entrepreneur can be seen as a person with passions and ambitions to be an enterprise with bears of risks and benefits. It is also a passion to create value with knowledge, skills and techniques learned from research activities in the university. Thus, it is an important process of transferring research outputs into real business applications. An alternative measure is the growth rate of entrepreneurs, which it counts the incremental percentage of people who become entrepreneurs. However, to become an entrepreneur is a matter; to become an entrepreneur who succeeds is another matter. It takes time to justify. Beside, it is unclear the extent to which criteria can be used to evaluate a successful entrepreneur or not. The validity of indicator used in research performance measurement may not be overestimated.

5.2.1.3 Research outcome indicators

➢ **Citation**

Citation is a widely applied indicator on quality of publications. It counts the frequency of quotations from a specific source appeared in other authors' publications. It provides a helpful method for people to scientifically measure the quality of publications. Citation by impact score is a widely applied tool in ISI publications. It measures the average number of frequencies of published papers are citied usually two years after publication. However, it also subjects to deficiencies in the reliability of scientific counting. Lehmann and co-authors (Lehmann *et al.* 2008) argued that because of the asymptotic power-law distribution of citations in all kinds of websites, the average number of citations under a given author may be unreliable due to fluctuations of sample means in selection. It also suffers criticisms because of limited use only in ISI publications and self-citations. Furthermore, the impact score to a given author may be manipulated by the increasing number of review papers which may boost the impact score. Thus, it may have validity and reliability issues in research performance measurement.

An alternative approach in measuring citations is the h index. The h index can be applied to wide ranges of objects including individuals, departments, faculties and universities. Hirsch (2005) explains that "*a scientist has index h if h of his or her Np papers have at least h citations each and the other (Np-h) papers have ≤h citations each*". The advantage of h index for management is a measurement on both quantity and quality of publications. The disadvantage of h index is still largely dependent on manager's intuitive judgments on citation data. The index is not amenable to quantitative investigation in the measurement of scientific research performance of people especially when such citation data are used in evaluation of promotion and appointment (Lehmann et.al 2008). For example, if an author has 12 papers with each at least 12 citation, then the index is 12. When compared

with another author has with 16 papers within which 12 has been citied at least 12 times each and the rest is less than 12 times citations, the result of h index is still 12.

Another disadvantage in the measurement might be lack of time based concern. The h index depends on the accumulation of an author's publications and citations over time (Hirsch, 2005). The longer an author works the larger h index he or she may have accumulated. While in research performance measurement on a regular basis, a problem arise at whether very past performance records should still be used in current performance measurement. The H-index may purposely boost performance with very historically data in updated measurement of research outcomes. Besides, the h-index focuses on papers with most cited records that may give rise to biased comparisons among institutions. Sypsa and Hatzakis (2009) concerned that "An institution with a moderate-size production will not reach the h-index of a very large institution even if the quality of its publications are of similar or even better quality simply because its total production may be even less than h."

For university management, citation provides managers with a widely recognized tool in the measurement of research publications. However, citation is a very time-lagged indicator as discussed by different measures above. It may take years until a publication of a given author is citied. Therefore, the validity of the indicator for management in research performance measurement of a given research group might be compromised due to flow of researchers and accumulation of citations.

➢ **Membership of research council and editorship of ISI journals**

The indictor counts the number of people with membership in research councils and editorship of journals. It may signal a general research reputation and research strength of a university. Thus, it might be a helpful indictor for university management. Research councils may include both national and international research councils. ISI journals are the most frequently used and highly recognized journals in academic world. To become a member of research councils or an editor in ISI journals may be a great honor to a researcher in the field.   The indicator can be measured by the number of editors in ISI journals and the number of board members in research councils. They provide a measurement by counting the total number of people with titles in these organizations. However, the validity of memberships in research councils and editorships of ISI journals in current research performance measurement of the university may not be overestimated. Most likely, it is because of the researcher's past research performance that leads them to the positions in the prestigious organizations. There might be even no definite casual relation between research performance and their positions in these organizations.   Thus, the validity of membership for university managers in research performance measurement of a university is a question mark.

➢ **Awards**

Award is an outcome indicator in research performance measurement, which is also used in the CUC report (2006). The indicator counts the total number of awards people received from outside research organizations. For example, the NWO Spinoza prize, also called "Dutch Nobel Prize", is a national-wide award to researchers for great contributions in research activities. One of winners in 2009 is Prof. Albert van den Berg at the University of Twente. The NWO Spinoza prize is a well-recognized award in the country with high reputations. Thus, it can be considered as a valid and reliable indicator in research performance measurement. Besides, in journals and conferences, researchers can also be awarded by "best paper" to their publications in their research fields. Because of various types of awards, the validity of the measurement to university managers might be compromised. High-level awards are recognized by most people and they bring with high reputations to researchers. The indicator depends on manager's subjective judgment on the value of types of awards. The reliability of awards in measuring research performance is a problem for different types of awards.   The indicator of awards is simple to use but it might be not practical on a regular basis. The chances of actual use of the indicator might not be very often because awards are rare to happen.

➢ **Research ranking**

Ranking can be an indirect measure on research performance in universities. It measures the ordinal numbers of each research subject by different criteria. One of well-known research rankings is from University of Leiden, commonly known as Leiden Ranking. The ranking can be done by selection of different fields, scopes and period of time on the basis of composed indicators in research. Thus, it provides a relative valid and reliable measurement to measure the university's research performance. The use of Leiden ranking is very simple for university managers with all the information provided from its website. Thus, the measurement can be done any time the managers feel the measurement is necessary. An alternative approach is research assessment by peers' reviews. Research performance in universities can be rated by experts outside the universities. Their ratings can also provide a relative objective measurement for universities.

5.2.3 Educational performance indicators

Educational performance may be another pillar that underpins a university's academic reputation. It is a traditional and standard dimension in performance measurement in universities. Educational performance indicators will cover the whole educational process from input, process and output till outcome.

Table 2, Educational performance indicators

Performance areas	Indicators	Measurement alternatives	Pros and Cons for management
Input	Market share of 1st year bachelors		The indicator measures the demographic characters of intake of students by classifying them into different groups.
	Intake of 1st year bachelor students		
	Intake # of International and EU bachelor students	The number of enrolments (university of twente)	Strictly speaking, the indicators lack of validity in the assessment of educational performance because no definite casual relationship with university educational performance. It is unclear whether educational
	Total intake # of masters		
	Intake # of international and EU master students		performance precedes the number of enrollments or vise versa.
	The number of degree programs(BA/MA)	student per degree programs	The indicator provides university managers with guidelines in appropriate investment of resources in degree programs
		The number of honor degrees	
	Staff FTE	Academic staff FTE	The FTE may provide managers with a relative valid and reliable approach to measure university staff with different levels of involvement in educational activities.
	Student/ academic staff	Ratio of the number of full-time Student/ academic staff	The student/ staff ratio indicates a general strength of teaching force to students in education. Though the indicator provides a ratio of the number of required academic staff to students in universities, managers may not immediately take actions to improve the ratio due to factors such as financial constraints and recruitment timing if academic staff is in shortage. Thus, the usefulness to university managers may be discounted.
Process	Retention (Australian Government report in higher education 2005)	Retention rate (1st year to 2nd year)	It is a measure to see how many percentages of students has progressed after first year's study or how attractive a university to students could be. Student's retention rate is not only affected by the university's educational performance perceived by students in the first year's study, but also are affected by the student's behaviors and other academic mechanisms (screen

			policies by hogeschool) by principals. The reliability of the indicator in measuring educational performance is limited to university managers.
	Drop-out	Drop-out rate (BA/MA)	The indicator provides university managers with percentages of students who drop out due to various reasons. Though the number of drop-out students may not directly relate to educational performance of a university, it might be an important indicator to see how the university has made effort in keeping their students on campus.
	Contact hours	Average contact hours per week for bachelor and master students	Information from the indicator can provide managers with clear understandings of what universities have contributed to the process of education. The indicator might be used as a mechanism to increase the study performance of students but the actual efficiency of how students has utilized the contact hours are unknown to the managers.
	General student satisfaction (CUC report 2006 and Australian Government report in higher education 2005)	Student evaluation by Internal survey	It is a valid and economic method in measuring the satisfaction level of students by surveys. Because of qualitative indicators, the data from the indicators may only be referential.
	Study efficiency (Australian Government report in higher education 2005)	avg. time to complete for bachelors, research and non-research masters	It provides a helpful tool for university managers to know what the average amount of time each category of students are needed to complete their studies but the reliability of the measure in efficiency of studies may not be overestimated due to factors such as students work before getting diplomas.
Output &Outcome	Graduation (CUC report 2006, Australian Government report in higher education 2005)	Graduation rate The number of diplomas issued	It is a direct measure on outputs of university's educational activities. It is an effective measurement on how many percentage students have managed to graduate as a result of university educational services. Universities may even purposely loosen graduation criteria for sheer increase in the number of graduates if too many emphases are put on the indicator.

	Graduation satisfaction (Australian Government report in higher education 2005)	Student graduation evaluation by survey	It provides valuable feedbacks for university managers in the evaluation of university services where further improvement may be made. However, data from student's evaluations may only be referential because student's evaluation may lead to bias by subjective judgments.
	Employment (CUC report 2006)	Employment rate	It shows the competitiveness of graduates from universities in labor markets as part results of university education and training. It is an important outcome indicator of educational activities but it is affected by factors such as self-employment and continuing studies. Thus, the reliability of the indicator might be compromised in measuring educational performance in universities. It is beyond what university managers can control.
		Average starting salaries	
		Employer feedback	

5.2.3.1 Input indicators

➢ **Intake of graduates and undergraduates**

Past indicators on input measurement by student's entry qualifications and initial abilities have been unsatisfactory (Higgins 1989). These indicators only measure what students bring into universities and they may not have direct links to the subsequent performance of students. Current indicators on input measurement have been focused on measuring the number of intake of students. The number of enrollments for undergraduates and graduates or market shares of students are used as input indicators in the University of Twente. However, the linkage between educational performance and the number of enrollments is unclear in whether educational performance precedes the number of enrolments or vise versa. Strictly speaking, the indicators lack validities in the measurement of educational performance. Besides, the indicators may also have reliability problems because students' preference to some universities may directly influence the number of enrollments in other universities in the country. The indicators of intake of students can be separated into intake of bachelors and masters. Intake of students in bachelor programs includes indicators such as the number of intake of 1st year students, the number of intake of international students in bachelor programs and the number of intake of EU students in bachelor programs. Intake of students in master programs includes indicators such as the total number of intake of internal master students, the number of intake of international masters and the number of intake of EU master students. The indicators aim at measuring the demographic characters and socio-economic backgrounds of students by classifying them into different groups. All the indicators can be measured by the number of enrolments in universities. The measurement can be compared with the actual number of intake of students against university targets. Thus, it is a valid and reliable approach to measure intake of graduates and undergraduates. The indicators provide university managers with a clear image of coming student's characteristics.

➢ **The number of BA/MA degree programs**

The indicator measures the total number of degrees in bachelor and master programs that students can choose from. It emphasizes on the variety of degree programs to meets diverse needs of students. An alternative measure may be students per degree programs. The measurement can provide university managers with effective and reliable guidelines in appropriate investment of resources in degree programs. Another alternative measure may be the number of honor degrees. It measures the number of competitive honor degree programs the university has to attract talent students. The honor degrees are great acknowledgement of success to students with higher study results. It is more difficult for students to achieve than normal degrees in bachelor and master level. Thus, the honor degrees may mean higher level of educational performance for the university. The measure provides the managers with a clear image of how competitive their degree programs are.

➢ **Staff FTE**

The FTE may be a measure of staff's involvement level in educational activities as well. It is measured by the amount of time an employee is involving in educational activities. It is similar to the researcher's FTE discussed in the research dimension. By counting staff with different scores, university managers may be able to know how many percentages of academic staff are fully committed to educational activities or how many percentages of academic staff are with different scores of FTE in educational activities. The FTE may provide the managers with a valid and reliable measurement approach to distinguish staff from different levels of involvement in educational activities.

➢ **Student/ academic staff ratio**

The student/ staff ratio indicates a general strength of teaching force to students in education, which is also used in the University of Twente. The indicator can be measured by the ratio of number of full-time students to academic staff. The measurement may provide university managers with a ratio of how many academic staff is needed for the number of full-time students on campus. Though the indicator provides a ratio of the number of required academic staff to students, managers may not immediately take actions to improve the ratio due to financial constraints and recruitment timing etc. Thus, the usefulness of this indicator for university managers may be discounted.

5.2.3.2 Process indicators

Renaud and Murray (2007) justified the use of higher-order questions in assignments as a process indicator in educational performance measurement and argued that the use of higher-order questions will improve student's critical thinking skills. Pascarella and Terenzini (2005) presented that previous process indicators such as size of libraries and facilities can not be seen as valid measures because they unlikely have a strong connection with student outcomes. Their argument is further explained by Renaud and Murray (2007) that pervious indicators on size of libraries and facilities are selected on the basis of expediency and presumed relations with student outcomes. The indicators are far removed from what are actual happening in classrooms. In this paper, the emphasis of process indicators is on students because it believes students are the master of themselves and they directly involve in the production of educational service. Their satisfaction, complaints and overall opinions might directly affect their perceptions on the quality of educational activities, which ought to be severed as more reliable process indicators than the higher-order questions. Ruben (1999) noted that in many universities, little attention has been paid to measuring expectations and satisfaction of students and even less to the people working there.

> **Student satisfaction**

Student's satisfaction toward educational activities is an important indicator in measuring educational performance in universities. As both customers and producers, student's experiences and opinions can produce valuable information on the quality of educational activities. The indicator is used both in CUC report (2006) and Australian Government report in higher education (2005). It measures the student's satisfaction level in the educational process. It is a relative broad concept in measuring student's satisfaction toward variety of objects. Similar indicators are proportions of students satisfied with overall facilities, proportions of students satisfied with teaching method, course programs, and information services and so on. The measurements can be done by student's evaluations by internal surveys to cover a wide range of student populations. It is a valid and economic method in measuring the satisfaction level of students. Though it is an easy way in the measurement, cautions should be raised by the reliability of data from the surveys. Data collected in the surveys may subject to all kinds of biases because of subjective judgments by students. The perceptions by students on educational activities are influenced by emotions, expectations and motivations overtime. Thus, the results from the indicators can only be referential in educational performance measurement.

> **Study efficiency**

The indicator measures student's efficiency of studies in universities. It can be measured by the average amount of time students need to complete their study in bachelors, research masters and non-research masters programs. A similar indicator is progress rate from Australian Government report in higher education (2005). It provides a basis on which student's efficiency of studies can be compared with the required amount of time. For example, the bachelor programs are 3-year study programs in the University of Twente. The longer the students need to complete beyond the required amount of time, the low efficiency of their studies could be. Thus, the measurement could be a valid approach in measuring study efficiency of students. However, in some cases, students may choose to work ahead of having their diplomas. The reliability of the measurement in efficiency of studies may not be overestimated. For university management, it provides a helpful tool to get to know what the average amount of time each category of students are needed to complete their studies.

> **Retention rate**

The indicator measures the percentages of students who remain in study from first year to second year in the same institution. It is a measure to see how many percentages of students have progressed after first year's study or how attractive a university to students could be. It is also used in the Australian government in higher education (2005). Student's retention rate is not only affected by educational performance perceived by students in the first year's study, but also is affected by student's behaviors and other academic mechanisms by principals. The retention rate might be especially useful for

Hogeschools whose policy of minimum 48 credits will screen a lot of students out after first year's study. The indicator can be used as a quality control mechanism in educational process especially in Hogeschools. To universities in the Netherlands, effects from the indicator in application might not be obvious. In rare situation, the retention rate may drop significantly without such a screening policy.

➢ **Drop-out rate**

The indictor measures the percentages of students who have dropped out during their studies for various reasons. It is an opposite indicator to the retention rate. It is calculated by the number of drop-out students divided by the annual number of enrollments. The indicator can be measured in bachelor and master levels. Though the number of drop-out students may not directly relate to the educational performance of a university, it might be an important indicator to see how the university has made efforts in keeping their students on campus. The measurement by different degree programs provides a detailed assessment on the drop-out rate in the university.

➢ **Average contact hours**

The indicator is measured by the average amount of time per week that academic staff set aside for bachelor and master students to discuss problems in study. During the scheduled contact hours, students can directly go to teachers' offices to discuss any study problems face to face. Thus, the measurement by average contact hour per week may produce clear information of what the university has contributed to students during the process of education. The average contact hours might be used as a mechanism in universities to increase the study performance of students but the actual efficiency of how students has utilized contact hours are unknown to university managers. The effect of indicator for management use is limited.

5.2.3.3 Outcome indicator

Output and outcome indicators are prevailing in all kinds of performance measurement reports (CUC report 2006, Australian Government 2005, etc). Most widely used indicators in these reports cover graduation and employment.

➢ **Graduation**

Graduation is a direct output of educational activities in universities. The Indicator can be measured by graduation rate in percentage of students who complete their studies on time. It is an effective measure to calculate how many percentage students have managed to graduate as a result of educational services in universities. Similar measures are the number of diplomas and the number of students graduated yearly. Results from the measures may fluctuate year by year due to the size of student population, delays in

studies and continuing studies etc. Therefore, the reliability of the measurement might be compromised. Universities may even purposely loosen graduation criteria for sheer increase in the number of graduates if too much emphasis is put on the indicator.

> **Graduation satisfaction**

Graduation satisfaction is an outcome indicator which measures the general satisfaction among alumni to universities. It produces an overview of graduation satisfaction usually months after students who graduate. The indicator can cover a broad range of topics including skills and knowledge, preparation for jobs and their opinions of educational programs in universities etc. The measurement can be done by asking students to register in alumni websites or using surveys. Thus, the measurement can provide valuable feedbacks for university managers in evaluation of university services from student's perspectives. Because of subjective judgments by students, the results from the surveys may only be referential.

> **Employment**

Employment rate measures the percentages of graduated students who are employed full time after graduation to the total number of graduates. It shows the competitiveness of graduates from universities in labor market as part results of educations and training. However, results from the indicator only represent a narrow picture of graduate's employment's situation. Student's employment is affected by factors such as self-employment and continuing studies. Thus the reliability of employment rate as an indicator in educational performance measurement should not be overestimated. One alterative measurement of employment is the average level of starting salaries that students are able to get from their first jobs after graduation. Due to broad economic influences on employment, the reliability of the measurement should not be over-estimated. However, the measurement can generate much information about starting salaries by students with different degree programs in labor markets. Student's employment situation can also be measured by employer's feedbacks about student's working capabilities. The feedbacks may provide some helpful information about employer's general satisfaction toward students on the job but the reliability of information in measuring employment situation might be compromised by size of surveys and employer's subjective adjustments etc.

5.3 Management Performance indicators

When universities develop policies and take actions toward achieving organizational goals in management, they may thirst for information that could both predict future directions and justify their past actions. In universities, the task might be complicated and difficult. Managers may face constant less input of resources but increasing demands for outputs with desired outcomes. Managers needs to be cautious of every move in developing, planning and execution of university policies and tasks. Performance indicators can provide university managers with early warnings if things go wrong and directions where actions can be taken.

5.3.1 Financial performance

Research activities in universities require considerable capital investment. Abundance of funds may play a critical role in research outputs and hence the level of research performance in the universities. Thus, the amount of financial resources is critical to the university's academic performance. Besides, effective financial management of resources is also important to the financial performance of universities. Financial performance indicators will focus on these two aspects in the universities.

Table 3 Financial performance indicators

Performance areas	Indicators	Measurement alternatives	Pros and Cons for management
Financial resources	Amount of research income (CUC report 2006)	Annual granted research funds and contracted funds	The indicator discloses a symbol of financial strength in providing resources for research activities. It is also a capability of acquiring resources by commercialization of research outputs. However, a research project with large amount of research funds granted may take years for a research group to complete before any new funds that might be contracted. Therefore, university managers may need to pay attentions to the influence of large research programs that affect the subsequent capabilities in contracting new research funds. The reliability of indicator in financial performance measurement might be compromised.
		Annual research income from commercialization (patents, license agreement, spinout companies etc)	
	Research indirect cost recovery (University of Edinburgh)	Indirect cost/ contracted income	The higher indirect cost recovery, the less cost a university needs to bear. It is a helpful indicator to measure financial performance in terms of acquirement of financial resource. The reliability of the measure may be affected by the maximum amount of funds the sponsors can supply with. The indicator can provide university managers with a basic percentage from historical data to see how much funds are required to contract.
	Share in third-party and share in governmental funding to university income	% third party funding	It signals a kind of capability and competitiveness for universities to acquire diverse sources of financial resources. It is also an ambition for universities to be self-sufficient. By means of the indicators, managers can directly know their weights to the total amount of funding. The higher the percentage of third-party and government funding, the higher financial performance the universities could be.
		% governmental funding	
	Income from tuition fees and other	Fees from national bachelors	The measures provide university managers with a classified source of income from different groups of students and other university services.
		Fees from international and EU bachelors	

	services	Fees from national masters	
		Fees from international and EU masters	
		Income from other services	
Financial position	Operating cost recovery	Operating cost/revenue	The indicators provide university managers with simplified explanations of financial statements, a basis of comparison with past records and helpful tools for planning and forecast. Too much emphasis on short-term financial indicators may cause the managers myopia and sacrifice long term development opportunities for short-term benefits.
	Surplus/deficit as % of income	Annual surplus/deficit as % of income from accounts	
	Current ratio	Current asset/current liability from accounts	
	Debt ratio	Total liabilities/ total assets	
	Days expenditure available (CUC report 2006)	days' expenditures as percentage of available cash from accounts	
	Administrative cost per FTE student (Cave et al. 1996)	Ratio of central administrative cost per FTE students	The indicators provide a clear assessment on each category of costs and expenditures that a university has incurred per student. It also illuminates university managers with directions in cost reduction. High administrative costs may often become a main financial problem in universities. If cost in maintenance is too high for certain aging facilities, the managers need to come up with long term investment plans for new facilities.
	Utilities, maintenance cost per FTE student (Cave et al. 1996)	Ratio of expenditure in utilities, maintenance and repair cost per FTE student	
	Annual amount of investment in infrastructures	annual expenditures on facilities, library, and sports facilities etc.	The indicator provides a clear assessment of long-term investments in universities.
	Manager's satisfaction with financial strategies	Manager evaluations	The indicator provides a tool for university managers to evaluate the effectiveness of financial strategies toward current and future uncertainties The evaluations may include manager's critical reflections of financial

			strategies and thereby it leads to a chance of revising current financial strategies. However, because of manager's subjective judgments, the measurement may encounter reliability issues. The indicator should be of cautiousness in the measurement.

5.3.1.1 Financial resources

➢ **Amount of research income**

The indicator counts total the amount of income related to research activities in universities, which is also used in CUC report (2006).   It can be measured by the amount of research granted funds and research incomes. The amount of research granted funds counts the total amount of funds from research applications and sponsors. It discloses a symbol of research strength in financial point of view. The amount of research income from commercial activities counts the total income from trade of patents and license agreements etc. There are two sources of income for research activities. The indicator hints an important financial capability of universities in acquiring resources for research activities. However, a research project with large amounts of research funding granted may take years for a research group to complete before any new funds that might be contracted. Therefore, university managers may need to pay attentions to the influence of large research programs that affect the subsequent capabilities in contracting research funds. The reliability of indicator in measuring financial performance in universities might be compromised.

➢ **Research indirect cost recovery**

One notable indicator related to contracting research funds is research indirect cost recovery contribution as percentages of total research income. The indicator has been used in the performance measurement in University of Edinburgh. The indicator measures the amount of contributions paid for research indirect cost recovery to the total research income contracted. The research grants and research contracted funds usually account for a certain percentage of research full direct cost. The remaining cost must be covered by universities. The indicator is especially useful in contracting research funds for university managers. The higher the indirect cost recovery, the less cost the universities needs to bear. It is a valid indicator to measure financial performance in terms of acquirement of financial resource. The reliability of this measure may be affected by the maximum amount of funds the sponsors can supply with. The indicator can provide the managers with a basic percentage from historical data to check how many new funds are required to contract.

➢ **Share in third-party funding and share in governmental funding**

Diversity of funding sources may be becoming an important criterion in financial performance measurement in universities. It signals a kind of capability and competitiveness of universities in acquiring diverse sources of financial resources. It is also an ambition for universities to be self-sufficient and secure in funds sourcing. The indicator of third-party funding measures the percentages of funding to universities from competitive funding sources. Third-party funding may include funds from private companies, research councils and donors etc. The indicator of share in governmental

funding measures the percentage of funds directly from the governments. The higher the percentage of third-party and governmental funding, the higher financial performance the universities could be. As a financial indicator, the results from the indicator may fluctuate by the amount of funds the sponsors can supply with.

➢ **Income from tuition fees and other services**

Tuition fees are one of the main sources of financial resources to universities. It can be measured by the amount of tuition fees in categories of national bachelors, international and European bachelors, national masters, international and European Masters and other university services etc. Income from other university services may include income from renting facilities, income from retail services within university etc. The measurement provides university managers with classified sources of income from different groups of students and other university services. Therefore, the managers are able to know what the exact amount of income from these specific sources is.

5.3.1.2 Financial position

Financial position or financial condition may be an overall indicator in financial performance measurement. It contains both short-term and long-term financial position. Short-term financial position primarily concerns financial condition of an organization within one year. Accounting ratios and financial results are main tools in the measurement. Long term financial position is about strategic and long-term financial status of an organization for more than one year. Effective financial strategies are vital to lead managers to achieve long-term financial health in the organization. University managers may look at these indicators as a preliminary diagnosis of whether a university is able to be financially sustainable toward its objectives.

Short-term financial position

The kinds of financial results and accounting ratios to be used as financial indicators are institutionally defined. They depend on university environments and managerial choices. The CUC report (2006) and University of Edinburgh provide some financial indicators that include operating cost recovery, surplus/deficit as % of income and current ratio. Besides, ratios such as administrative cost per FTE student, utilities and maintenance cost per FTE student and other expenditures per FTE student are also used in the measurement of cost varieties in universities. (Cave *et al.* 1996)

➢ **Operating cost recovery**

Operating costs are expenses that are related to university's operating activities. They include all kinds of variable operating costs such as maintenance cost and repairing cost.

Operating costs usually vary with the level of university outputs. To offset the recovery of operating cost from associated benefits in use, the operating costs are recovered from university's revenue. The indicator is measured by the ratio of operating costs to total university revenues. It is an indicator to measure how much revenue is needed for matching the incurred operating cost in the university operating.

➢ **Surplus/deficit as % of income**

The indicator measures a percentage of surplus or deficit in proportion to total university income. The surplus or deficit is the difference between university income and university expenditures. When measured by percentage of income, it indicates the percentage of surplus can be left for next year's operating or the amount of deficit must be covered by next year's revenue. It is very helpful for university managers to use the indicator as a control mechanism in budget planning.

➢ **Current ratio**

The indicator measures the financial strength of universities to see how much current liabilities are covered by current assets. Because universities barely have any inventories, most current assets are quick assets that are easily convertible into cash.   The larger the ratio, the great financial strength of the universities is.

➢ **Debt ratio**

The indicator indicates a percentage of university assets are provided by debts. It is measured by the ratio of total liabilities to total university assets. The larger the ratio, the higher amount of assets is financed by liabilities in the university. A high debt ratio might cause university managers loose control on expenses and discourage lenders from loans in the future.

All these short-term financial indicators are frequently used in the measurements in universities. They provide helpful tools for university managers to measure financial positions in universities. The reliability of the measurements by financial indicators depends on the accuracy of information published in financial statements and reports in universities. The indicators also provide the managers with simplified explanations of financial statements, a basis of comparison with past records and helpful tools in planning and forecast. One potential disadvantage on financial indicators is that too much emphasis on financial indicators may cause the managers myopia and may sacrifice long term development opportunities for short-term benefits.

Long-term financial position

Long term financial position is about strategic and long-term financial status of an

organization for more than one year. Like other non-profit organizations in public sector, universities may need financial strategies to guide managers in appropriate financial management with lower risks. University's long term financial position may be measured by the effectiveness of financial strategies in severing financial management. The measurement is an ongoing and empirical process to see whether financial strategies have provided constructive contributions to university financial management. Another alternative measurement is by the amount of investment in infrastructures. The infrastructures provide the basic needs for universities to achieve long term development. The investments will also affect the long-term financial position in the universities.

➢ **Manager's satisfaction toward financial strategies**

It is an approach by measuring manager's satisfaction toward current financial strategies. The purpose of this indicator is to see whether a university has proven strategies that could effectively lead managerial behaviors to meet current and future challenges. Manager's opinions can serve as valid measures in the measurement of effectiveness of financial strategies. The indicator can be measured by manager's evaluations on the current financial strategies. The evaluations may include manager's critical reflections of financial strategies and thereby it may leads to a chance of revising current financial strategies. However, because of manager's subjective judgments, the measurement may encounter reliability issues. The measurement should be of cautiousness.

➢ **Annual amount of investment in infrastructures**

The indicator measures the total expenditures on infrastructures in universities. The infrastructures provide the basic needs for universities to achieve long term development. It will also affect the long term financial positions in the universities. In CUC report (2006), a similar indicator is total cost of remedial investment on estates and infrastructure.

5.3.2 Human Resource (employee)

The relation between human resource management and organizational performance has well been examined in human resource literatures (Huselid, 1995, Rogers and Wright 1998). However, the systematic performance measurement on human resource might be very rare at this moment. Wright and McMahan (1992) defined strategic human resource to organizational performance as planned human resource deployment and activities that enable organizations to achieve goals. As universities do not have clear goals, it is difficult to measure the extent to which the goals are achieved by means of human resource management. Performance measurement on human resource might be more appropriate to measuring human capital and effectiveness of policies and practices in universities. They are two important criteria in evaluation of human resource performance.

Table 4 Human Resource Indicators

Performance areas	Indicators	Measurement alternatives	Pros and Cons for management
Human Capital	Success rate in recruitment	% of full time recruitment	It provides university managers with a signal in whether more resources are needed in this area to increase the success rate to recruit more amount of human capital
	Staff skills and staff diversity (CUC report 2006)	% of English speaking employees	The indicator of staff skills and staff diversity is a measurement of staff force in universities but it may have difficulties in how actual these skills can be measured objectively. For example, it might be not practical to ask all employees to take part in an English test to justify their English-speaking capacity.
		The number of PhD students	
		The number of Professors	
		The number of assistant professors with or without PhD	
		The number of lecturers	
		The number of supportive staff	
		Academic /non-academic staff ratio	
	Employee's age distribution (CUC report 2006)	% of employee in age span e.g. 30-40 or over 60	It provides university managers with an image of growth patterns in the age distribution among university employees. Once the average age of employees is becoming old and is at the cost of university outputs, recruitments for new employees may get important in manager's agendas. One potential pitfall is unclear what the average age is ideal to university staff with optimal level of experiences and outputs. Thus, the validity of this indicator to university managers is compromised.
Effectiveness of HR policies and practices on Job performance	Expenditures on training and development (CUC report 2006)	Annual expenditure on training and development	Expenditures on training and development have large influence on organizational productivity. However, it may take overtime before any significant job performance might be seen from employees as a result of training and

			development programs. The effect of the indicator to university managers in measuring job performance might not be obvious
	Employee motivation or satisfaction (CUC report 2006)	% of employee satisfied with welfare, promotion and pension	Employee motivation is an important factor in job performance but results from the indicator may only be referential because of subjective judgments by employees. For university managers, it is an easy and quick method for detecting employee's satisfaction toward relevant policies and practices.
		Employee turnover and sick leave	

5.3.2.1 Human capital

The importance of human capital to universities builds on whether the universities can provide with qualitative and competitive academic personnel to meet the needs of academic activities. Human capital can be seen as the stocks of skills and knowledge that are capable of producing value. These skills and knowledge are embodied in people.

➢ **Percentage of Success in recruitment**

Recruitment is important for universities to store and maintain a certain level human capital for university services. It caters for the needs of universities to fulfill its available job positions. Recruitments can be divided into full-time and part-time recruitments. Fulltime recruitments to the universities mean more than souring for candidates to do the jobs. It means a strong fit between job positions with required knowledge, skills and experience. Thus, the indicator might be more appropriate and valid here for the universities to measure the performance in human capital. The indicator measures the successful rate in the total fulltime recruitments. The results from the indicator may fluctuate because of the number of available job positions. Thus, the reliability of the measurement in recruitment ought not to be overestimated. It provides university managers with a signal of whether more resources are needed in this area to increase the success rate.

➢ **Staff skills and staff diversity**

Staff skills are broad and can be measured by variety of skills related to staff capabilities. The indicator is also used in CUC report (2006). One of methods in the measurement is by staff's language skills. As universities with large number of international students on campus, communication in English is becoming important to university staff in services. For example, percentage of staff who can speak English with min. 5.5 in IELTS (an English proficiency test) might be a valid and reliable measure in this respect but it might not be very practical in application. It needs all staff to take part in the English test, which might be very costly. Staff diversity is also an important indicator in staff composition in universities. It can be measured by counting the number of PhD students, professors and assistant professors, the number of academic staff, supportive staff, lecturers and ratio of academic staff to non-academic staff etc. As knowledge and skills are embodied in people, the indicator also provides university managers with a clear image of academic capabilities in terms of human capital stored in university staff. The measurement is a quick snapshot of how diverse of university staff could be. The indicator of staff skills and staff diversity is a helpful measurement of staff composition and staff capabilities in universities but it may also encounter difficulties in how actual these skills can be measured objectively.

➢ **Employee's age distribution**

Employee's age distribution measures the average age among different groups of

academic and non-academic employees. On one hand, the increasing average age of employees may decrease in university capabilities and outputs. On the other hand, it also signals the increasing experiences among university employees. The validity of this indicator in human capital may not be overestimated. It is unclear what level of average age is ideal to employees with optimal level of experiences and outputs. The employee's age distribution can be measured by percentages of employees in different age spans in the division of gender, e.g. % of male employee in age 30-40 and % of employee over age 50 or 60. It provides university managers with an image of growth patterns in age distribution among university employees. The measurement is a valid and reliable presentation of university employee's age distribution. Once the managers think the average age of employees is becoming old and is at the cost of university outputs, recruitments for new employees may get important in their agendas.

5.3.2.2 HR policies and practices

The effectiveness of human resource policies and practices may be measured by how these policies and practices have helped in increasing employee's job performance in addition to human capital. The importance of job performance related to organizational performance in service industry is widely documented in human resource literatures. Schneider and Bowen (1993) attributed this important connection to the uniqueness of service industry that features a flimsy and permeable boundary between organizations and their customers. Thorsten (2004) argued that customers often depend on the behaviors of service employees in judging the quality of service. Hence service employee's level of customer orientation becomes a key driver for customer satisfaction. Service employee's level of customer orientation can also be regarded as a leverage of service organization's economic success (Bitner et.al, 1990). Therefore, the effectiveness of human resource policies and practices play a critical role in universities. The level of individual job performance might decide what amounts of value can be created in organizational service.

Universities have both academic employees and non-academic employees. A common problem is that people's job performance can not be directly measured. For example, how can you measure an academic employee who is sitting 10 hours a day in his office as good or bad performance? University managers can not directly measure the performance of the employee unless his paper is published by a well-known journal at some day. There is a long lagging time between inputs of time and efforts into making the paper and the outcome of the paper. People are not machines which their job performance can be directly seen.

Before the development of performance indicators, we must first get to know what job performance is and what constitutes and affects the performance of employees in universities. A well known model derived from Harold Kelley's theory of causal schemata in relationship between performance, ability and effort information (motivation) offers a

great help in explanation.   Job performance can be configured into:

$$Performance = ability * motivation$$

Campbell *et al.* (1993) defined a more complicated definition of job performance as individual behavior variables that compose knowledge, skills, abilities and motivations toward organizational goals. The definition highlights the importance of employee abilities, skills, knowledge and motivations in job performance toward organizational goals. While in Kelley's model, the ability is a bigger word that contains knowledge, skills and nature-born abilities. The development of performance indicators will focus on these aspects that potentially affect employee's ability and motivation in human resource management.

➤ **Expenditures on training and development**

Ability can be generally defined as someone's capability of doing something, which is similar to the concept of human capital discussed above. One important indicator related to ability is employ's training and development. It can be measured by annual expenditures on employee's training and career development in universities. The indicator is also used in CUC report (2006). The expenditures on job training, career development and opportunities can have a directly impact on employee's job performance. Bartel (1994) argue that the relationship between training and labor productivity exists not only at individual level but also at organizational level. However, the effect of training and development to employee's job performance should not be overestimated.   It is only one of the factors that may affect on employee's job performance. Besides, it may take overtime before any significant job performance might be seen from employees as a result of training and development programs.

➤ **Employee motivation**

Motivation is another factor that may has a great influence on employee's job performance. Brewer and Selden (2000) identified several kinds of motivations associated with employee's job performance in government agencies, including structure of task/work, task motivation, public service motivation and individual motivation. The motivations can be grouped into intrinsic and extrinsic motivations. Motivation factors vary, which may include all sorts of briefs, values, needs and wants. Without motivation, employee's job performance might be comprised and may not last longer, no matter how hard employees are forced to work and how talent, experienced and skillful the employees are.

Employee's extrinsic motivation can be measured by their level of satisfaction toward university human resource policies and practices. The use of survey is a qualitative method for detecting employee's satisfaction toward the policies and practices such as welfare, promotion and pension etc. The policies and practices may construct the main source of extrinsic motivation factors. The use of survey by employee evaluations is a

useful mechanism to know what employee's general opinions in these aspects. For university management, the data from the indicator may only be referential because of subjective judgments by employees. Besides, employee's motivation may also be measured by employee's turnover and sick leave. Employees with less motivation may negatively quit the job or be sick leave. Their behaviors will result in a higher turnover and sick leave rate. The employee's turnover and sick leave provides a helpful mean for university managers to measure employee's motivation by their associated behaviors. However, it might be not very reliable.   Even if employees with low motivation, they may still go to work on time by the enforcement of rigid labor contracts. The measurement also needs considerable efforts in collecting data every day and thus it may cause extra workloads for employees.

5.4 Conclusion

In this section, we have presented the performance indicators that can be useful for each dimension. The performance indicators are discussed in terms of pros and cons for university management. They have partly answered the third research question. In the following section, we are going to summarize the interviews in the University of Twente. The interviews will shed lights on the usefulness of the performance indicators in university settings.

Part Ⅲ

6. Managerial evaluation of performance indicators

In Part Ⅱ, performance indicators in each dimension have been discussed in terms of pros and cons for university management. In this part, the performance indicators will be evaluated by university managers to see whether they are appropriate to managerial use in a university setting. The evaluations are done by the interviews in the University of Twente. In the following sections, the results will be summarized from the evaluations. A complete summary of managerial comments is presented in Appendix 2.

6.1 Managerial evaluation of research indicators

Table 5 Summary of research performance indicators evaluated by UT managers

	Evaluation by Managers in UT		
	Current use	**KPI**	**Future use**
Research dimension			
1. Researchers FTE	✓		
2. The number of researchers from sponsors			
3. The number of successful research granted applications			
a) The number of successful application by programs			
b) € amount of research grants	✓		
4. The number of Strategic partnerships			
5. The number of publications by research unit	✓	✓	
(ISI, non-ISI journals, conference, books, chapters and others)			
6. The number of doctorate conferred	✓	✓	
7. Exploitation of IP			
a) The number of spin-off companies	✓		
b) The umber of license agreements			✓
c) The number of patents or output of patents	✓		
8. The number of successful entrepreneurs			
9. Citation			
a) Impact score	✓		
b) H index			
11. Membership of research council or editorship of journals			✓
12. Awards			
a) NWO Spinoza Prize	✓		
b) Simon Stevin Prize	✓		
13. Research ranking			

a) Leiden Ranking		✓	
b) Jiaotong Ranking		✓	

The interviews conclude eleven indicators that are helpful in the performance measurement in the university. The number of research publications and the number of doctorates conferred are considered as key performance indicators because they are closely related to the amount of research funds the university can acquire from the government. The non-acceptable performance indicators include the number of researchers from sponsors and the number of successful entrepreneurs.

➢ FTE is a frequent tool in measuring researchers' level of involvement in research activities.   The managers will count the number of FTE researchers by PhD students and academic staff. Academic staff is further divided into tenured academic staff and non-tenured academic staff. A tenured staff is the one who has a formal contract with the university in research. UT Managers do not pay attention to the details in the researcher's number of FTEs because there is no such a reliable mechanism that can count the actual researchers' amount of time in research activities in the university. Often, the managers in the university will count the FTEs of each researcher by estimation.

➢ In research application, managers in the university care about the amount of research funds researchers can get. According to the manager's opinion, Dutch university research funds come from three streams: government non-competitive, government competitive and private. Governmental competitive and private are the streams that researchers need to compete with others in application for research programs. It may be hard to measure the research performance based on the level of programs from government competitive and private sources.

➢ The indicators of the number of license agreements and membership of research council or editorship of journals are still in discussion at university level. The university needs to define the kinds of license agreement that can be valid for the measurement of research performance. Some license agreements such as memorandum of understanding may not have the binding power of contracts. The indicator of memberships of council or editorship of journals has been accepted by the managers but it has not been accepted by the university. Because in some disciplines (e.g. Law), the researchers do not write journal papers. Therefore, the validity of the indicator in the measurement may be limited. Both the indicators might be used in the future in the university.

➢ The number of strategic partnerships, average time to doctorate and the number of successful entrepreneurs are not considered as useful indicators. According to the manager's opinions, the indicator of strategic partnership and the number of successful entrepreneurs are not measurable. It is hard to define what kind of

strategic partnerships are important to the university. It is also hard to define the categories of entrepreneurs. For example, students may work as taxi drivers in their studies. They can also be seen as entrepreneurs. Thus, the reliability of the indicator is discounted. Besides, the managers generally do not pay attention to details in how much time PhD students may need to achieve their diplomas.

➢ In citation, UT managers tend to use impact score as the only measure in citation. Though the impact score may have some reliability issues in the measurement of citation, the managers still consider it as the relative best and most convenient approach. The impact score is a widely accepted measure in other universities as well, which makes the comparisons of the performance in citation easy.

➢ In award, UT managers are inclined to use NWO Spinoza Prize and Simon Stevin Prize as measures. In research rankings, the managers use leiden and jiaotong rankings.

6.2 Managerial evaluations of educational performance indicators

Table 6, Summary of educational performance indicators evaluated by UT managers

	Evaluation by Managers in UT		
	Current use	**KPI**	**Future use**
Educational dimension			
1. The number of enrolments	✓	✓	
a) Market share of 1st year bachelor			
b) Intake # of 1st year bachelor students			
c) Intake # of international and EU bachelors			
d) Intake # of masters			
e) Intake # of international and EU masters			
2. The number of degree programs (BA/MA)			
a) student per degree programs			
b) The number of honor degrees			
3. Staff FTE			
4. Student/ academic staff ratio	✓		
5. Retention	✓		
6. Drop-out	✓		
7. Contact hours			
8. General student satisfaction	✓		
9. Proportion of students satisfied with facilities	✓		
10. Proportion of students satisfied with teaching method etc.	✓		
11. Study efficiency	✓	✓	
12. Graduation	✓	✓	
a) Graduation rate			
b) The number of diplomas			
13. Graduation satisfaction	✓		
14. Employment			
a) Employment rate	✓		
b) Average starting salaries	✓		
c) Employer feedback			

In educational dimension, the interviews conclude twelve indicators that are helpful in the performance measurement in the university. The number of enrollments, study efficiency and graduation are considered as key performance indicators in educational performance measurement at the university level. The non-acceptable indicators include number of degree programs and staff FTE.

➤ The number of enrolments is regarded as a KPI by managers in the university. In terms of market share of 1st year bachelors, the managers tend to look at the market

share of bachelors at program level. UT managers are also interested in student's pervious education background e.g. HAVO or VWO. For master programs, the managers measure master students by internal, national masters (HBO, WO) and international masters.

➢ The number of degree programs is not considered as a very helpful educational performance indicator because they may be closely related to university intentions in the mission statement and the amount of resource available.

➢ The usefulness of Staff FTEs is very limited because university academic staff does not tell their managers how much time they spend on educational activities or how much time they spend on research. Therefore, managers may usually get the results of staff FTE by estimation. There is no such a reliable mechanism that can count the actual staff' amount of time in academic activities in the university.

➢ Managers do use student/ academic staff ratio but they do not pay much attention to the result from the indicator in the university. The indicator only provides managers with a general idea of comparison between the number of students and academic staff.

➢ Contact hours are not considered as a valid indicator because there is not just one educational model. Every program has its own curriculum and the building blocks of curriculum are different. The indicator is not very measurable.

➢ The indicators of student satisfactions are becoming important in universities. In the University of Twente, student satisfaction is measured both by new students in first year and students in last years. Though the reliability of measurement may be compromised by student's subjective judgments, the managers believe that the measurement can still produce valuable information especially when questionnaires are handed out to large amount of the student population on campus.

➢ Graduation satisfaction and employment are two important indicators in educational outcome. The measurement is done by Dutch Higher Education Monitor System "WO" which contains questionnaires about employment and average starting salaries to national higher education students. The indicators provide managers with valuable information of student's after-university life but employer feedback is not practical due to the difficulties in information collection.

6.3 Managerial evaluations of financial performance indicators

Table 7 Summary of financial performance indicators evaluated by UT managers

	Evaluation by Managers in UT		
	Current use	KPI	Future use
Financial dimension			
1. Amount of research income	√	√	
a) Annual granted research funds			
b) Annual research income from commercialization			
2. Research indirect cost recovery			
3. Share in third-party & share in governmental funding	√		
4. Income from tuition fees and other service	√		
5. Operating cost recovery			
6. Surplus/deficit as % of income	√	√	
7. Current ratio	√	√	
8. Debt ratio	√	√	
9. Day's expenditure available			
10. Administrative cost per FTE student			
11. Utilities, maintenance cost per FTE student			
12. Annual amount of investment in infrastructures			
13. Manager's satisfaction with financial strategies			√

In financial dimension, the interviews conclude six performance indicators that are useful in the financial performance measurement in the university. From the indicators, the amount of research income, surplus/ deficit as % of income, current ratio and debt ratio are considered as key performance indicators in financial performance measurement at university level. Except for the indicator of the amount of research income, the remaining three KPIs will be reported to the Minster of Education. The non-acceptable indicators include research indirect cost recovery, day's expenditure available, administrative cost/utilities, maintenance cost per FTE student, annual amount of investment in infrastructure and manager's satisfaction with financial strategies.

➢ To research indirect cost recovery, the managers do not see it as a useful indicator because the amount of research funds the university can get might be beyond the managerial control. Thus, in calculating of research indirect cost recovery, the reliability of the indicator in the measurement might be compromised.

➢ To income from tuition fees and other services, the managers need only to count the number of students in calculating the total amount of tuition fees. Tuition fees from

national bachelor students are fixed

- With regard to indicators of No.5, 9, 10, 11.12 in table 7, UT managers do not consider them as useful indicators in financial performance measurement. They are not the aspects that the university managers are interested in. In university departments, the managers tend to use profit and loss account as the measure in financial performance measurement.

- With regard to the indicator of manager's satisfaction with financial strategies, it might be a helpful financial indicator in the future. In the manager's opinions, current financial management is relatively old-fashioned in the university. The way to evaluate the effectiveness of financial strategies is based on the evaluation of university financial performance which requires the change in governmental mechanisms. It might be taken place but the progress of governmental procedure is slow right now.

6.4 Managerial evaluations of human resource indicators

Table 8 Summary of HR performance indicators evaluated by UT managers

	Evaluation by Managers in UT		
	Current use	KPI	Future use
Human Resource dimension			
1. Success rate in recruitment			
2. Staff skills and staff diversity	√		
a) % of English-speaking employees			
b) The number of PhD students			
c) The number of professors (Prof.)			
d) The number of assistant professors (UHD)			
e) The number of lecturers (UD)			
f) The number of supportive staff			
g) ratio of academic staff/non-academic staff		√	
3. Employee's age distribution	√		
4. Expenditures on training and development			
5. Employee motivation or satisfaction	√		
a) % of employees satisfied with welfare etc.			
b) Employee turnover and sick leave			

In human resource dimension, the interviews conclude four indicators that are useful in the performance measurement in the university. Among the four indicators, the ratio of academic and non-academic staff is regarded as a key performance indicator in human resource. The non-acceptable indicators include success rate in recruitment and expenditures on training and development

➢ With regard to the indicator of success rate in recruitment, managers do not see it as an important indicator in human resource. Recruitments do not take place every year. Thus, the reliability of the indicator in the measurement of human resources might be compromised.

➢ With regard to the indicator of staff skills and staff diversity, English tests are conducted every year as a measure of employee's proficiency of English language in the university. The tests can either be TOFEL or IELTS. Besides, the managers regard the ratio of academic and non-academic staff as a key performance indicator in human resource.

➢ Managers in the university do not measure the expenditures on training and development separately. The indicator is measured by average expenditure per FTE the university has spent on salaries, desks and computers etc.

➢ Employee's satisfaction in the university is measured by an external institution every two or three years. The measurement provides an external evaluation mechanism for the university managers in the measurement of employee satisfaction.

6.5 Conclusion

From this section, we summarize a list of performance indicators that can be used in university settings. The evaluations by the managers in the University of Twente have made the usefulness of performance indicators in the four dimensions clear. However, questions may be raised by the extent to which the performance indicators in the study can be used for other universities and the extent to which the framework can be used in university settings. From the evaluations, most performance indicators are relevant but some are not. In the following section, we are going to discuss the relevant questions.

Part Ⅳ

7. Discussion

In the following section, several questions might be raised after the research.

1. How robust can the performance dimensions and the framework from this research be used in universities?

In this research, we endeavor to find a solution to performance measurement in universities. Universities are characterized by gal ambiguity and goal diversity. Therefore, it is difficult to capture performance dimensions from the ambiguous goals. This paper argues that the performance of universities can be measured by the extent to which each of university functions is maintained toward the university goals. Based on this argument, the academic dimension and management dimension are developed to capture the performance. The two dimensions can be further divided into four sub-dimensions. They are research, education, finance and human resources. The development of the main and sub-dimensions may not be exhausted to universities. For example, in University of Twente, valorization is an increasingly important dimension to the performance in the university. The development of the dimensions in the framework may not be the ultimate solution to capture all performance areas but it hopes to find key and common grounds that may be interested by managers in most universities. The performance framework developed is the integration of both performance dimensions and indicators. The four dimensions represent a balanced concept to university managers in performance measurement. As mentioned that the development of the dimensions in the framework are not exclusive, the framework may also be modified to incorporate more dimensions that managers are interested in universities.

2. Are the performance indicators evaluated by managers in UT suitable for other universities in the country?

In developing performance indicators for each dimension, we endeavor to cover the key performance areas in university activities. Besides, we have also studied other performance measurement literatures to see how performance indicators are developed in universities in United kingdoms and Australia. The list of developed performance indicators might not be 100% exclusive for each dimension but we have tried to develop indicators as many as we can from a managerial perspective in university management. The evaluation of performance indicators is done by the managers in the University of twente, which is to justify the validity of indicators from real managerial perspectives in university management. Because of subjective judgments, it may cause discrepancies in the choice of performance indicators by managers in different universities. It is also one of the limitations in this research. Therefore, it may also happen that the indicators in the

paper will not be endorsed by people in other universities. The use of performance indicators might be institutionally defined in universities. It might be very likely be a result of managerial discretions based on the analysis of environments and technologies used in universities.

3. What particular findings might be raised from the research?

There are some indicators from the literatures that have not been chosen in the evaluations by the managers in UT. For example, the indicator of research indirect cost recovery has been used in the University of Edinburgh. It is an important indicator in the measurement of financial performance in the university. The indicator measures the percentage of indirect cost that can be recovered from the grants and contracts in research activities. The higher the ratio, the less cost the university need to bear in associated research activities. One possible explanation might come from the reliability of the indicator in the measurement of financial performance. When the university in contracting research funds and applying for research applications, the amount of research finding granted might be beyond the control of the university. The required amount of funding may exceed the maximum amount of funds the sponsors can supply with. Therefore, the reliability of the indicator in financial performance measurement in university might be compromised. Another possible explanation might be that the managers in the University of Twente have not realized the indicator because of different environments in comparison to those of the University of Edinburgh.

Another indicator worth mentioning is the staff FTE. The use of FTE is a popular tool in the measurement of employee's involvement in activities. From the interviews, we know that the managers in UT will not count the details of staff FTE because the staff usually does not tell their managers how much time they spend on educational activities or how much time they spend on research activities. Therefore, the managers tend to estimate the staff's involvement in percentages. The difficulties in counting concrete academic staff FTE might come from the different kinds of staff on job positions in the university. The university has full–time tenured academic staff positions, full-time non-tenured academic staff positions, part-time academic positions (less than one year) etc. The mix of staff on different positions may make the university difficulties on the establishment of FTE standards. For example, the full–time tenured academic staff may have FTE of 1. A part-time staff may have less than FTE of 1 but it is unknown whether the FTE of part-time staff can be 0.5 or 0.7 or something else. Therefore, the university may need to set up a few guidelines or standards in order to measure the concrete FTEs of staff.

8. Conclusion

In this section, we are going to conclude the whole research by answering to the research questions in the first part.

The main objective of this research is to look at a managerial perspective of performance measurement and try to develop a tailored framework in university settings. Based on this objective, we developed the main research question as:

"**To what extent can a tailored performance measurement framework along the lines of BSC be developed for performance measurement in university settings?**"

In order to answer the main research question, we will answer the sub-research questions first.

Sub-research Q 1) **how can the performance of universities be captured using comprehensive dimensions?**

Universities are characterized by goal ambiguity and goal diversity. Thus performance measurement in universities is not an easy task. The difficulties arrive at how the performance can be captured into appropriate dimensions. This paper argues that universities with ambiguous goals can be measured by the extent to which each of university functions is maintained toward the university goals. Based on this argument, the performance can be mainly captured into academic dimension and management dimension. The academic performance is the core and the management performance is the enabler to the performance in universities. The two main dimensions can be further divided into four sub-dimensions. They are research, education, finance and human resources, which the research and educational performance is the core and the financial and human resource performance is the enablers. Research and educational activities are most common activities in wide categories of universities. Financial and human resources are very important to university management. The development of sub-dimensions may not be for capturing all the performance areas but it hopes to find key and common grounds in most universities.

Sub-research Q 2) **in which way can a comprehensive PM framework be set up for application along the lines of BSC in university settings?**

From the balanced scorecard, we are able to know that the performance of an organization can be captured into the dimensions of financial, learning and growth, customer and internal business. The customer and internal business process perspectives are the actual performance areas in the organization. The financial and learning and growth perspectives are the enablers to the organizational performance. As

the BSC is originated from the for-profit settings, the application without modifications may cause difficulties in universities.

Based on the notion of pyramid from Cross and Lynch (1992), we complete a similar pyramidal performance measurement framework with the balanced scorecard concept (See Figure 3). The pyramid is a work of systemic integration of performance dimensions and indicators into a complete performance measurement framework. At the top of the framework, it is the university vision with two main performance dimensions (academic and management). Academic performance is the core and management performance is the enabler to the performance in universities. The two main dimensions are divided into four sub-dimensions (research, education, finance, human resource). The four dimensions construct a balanced scorecard concept in the framework. Therefore, it brings with a more strategic performance measurement to managers with key performance indicators. At the middle and bottom of the pyramid, other indicators in four sub-dimensions construct an operational view of performance measurement for managers in universities. Information from the indicators at each sub-dimension will be summarized and reviewed by high-level university managers to form a main measurement on academic and management performance in universities. Performance measurement follows a measure-up model in the framework.

Sub-research question 3) *which performance indicators in the literatures (esp. PM in public organizations) along with own performance indicators could be used in university settings?*

In this research, we developed a portfolio of performance indicators that could be used by university managers in each dimension (Table 1, Table 2, Table 3 and Table 4). These indicators are discussed in terms of pros and cons for management. From the interviews in the University of Twente, the performance indicators are evaluated and selected. The interview with Dr. Stolk especially generated much helpful information about the selection of performance indicators. Both in Part Ⅲ and appendix, the results from the evaluations are presented. Most performance indicators are relevant to the university but some are not. One possible explanation is the use of performance indicators might be institutionally defined in universities. It might be very likely be a result of managerial discretions based on the analysis of environments and technologies used in universities. It also might be the development of performance indicators in the paper is not good enough.

The main research question,) "*To what extent can a tailored performance measurement framework along the lines of BSC be developed for performance measurement in university settings?*"

In this paper, a pyramidal performance measurement framework based on the notion of Cross and lynch can be developed to match the university structures in performance

measurement. The pyramid is a work of systemic integration of performance dimensions and indicators into a complete performance measurement framework. Within the framework, the balanced scorecard concept can be applied to the four performance dimensions to capture the key performance areas in universities. By means of integrating the balanced scorecard concept into the pyramidal framework, we develop a tailored performance measurement framework that could be used in university settings.

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Appendices

Appendix 1 Performance indicators evaluated by UT managers

Table 9 Research performance indicators evaluated by Managers in UT

	Indicators	Measurement alternatives	Managerial evaluations
Research input	researchers FTE	PhD students, Academic staff (tenured / not tenured)	FTE is a widely used measure on employee's involvement in activities. In the university, managers count the number of FTEs of research academic staff by tenured and non-tenured staff in research performance measurement. Tenured staff is employees having formal contracts with the university.
	The number of researchers from sponsors	The number of researchers paid from private grants	Dutch university research funds come from three streams: government non-competitive, government competitive and private. Governmental competitive and private are the streams that researchers need to compete with others in application for research programs. The number of researchers from sponsors should be measured by the number of researchers from private grants.
	The number of successful research granted applications	The number of successful applications by National & international programs or by other sponsors	
		€ amount of research grants (government non-competitive, government competitive and private grants)	
	The number of Strategic partnerships	The number of formal agreements the university has in research	It is hard to define what kind of strategic partnerships are important to the university. Therefore, in university manager's opinions, the indicator of strategic partnership is not measurable.
Research output	The number of publications by research unit	ISI-refereed journals	It is a key performance indicator in research. A similar measure in the university is the number of publications per FTE staff. Higher level university managers will not pay attention to the level of conference. They only pay attention to refereed or non-refereed conference paper. Low level managers may pay attentions to the different level of conferences.
		Non-ISI refereed Journals	
		Journal articles (non-refereed)	
		Refereed conference paper	
		Books	
		Refereed book chapters	
		Other academic work	
	The number doctorates conferred	The annual number of doctorates conferred	It is a key performance indicator used in the university. The number of doctorates conferred is also closely related to the

			amount of research funding that the university is able to acquire from the governments.
	Exploitation of IP	The number of Spin-off companies	The university counts number of spin-off companies and output of patents in measuring research performance. The use of number of license agreements is still in discussion in the university.
		The number of License agreements	
		The number of Patents	
	The number of successful entrepreneurs (start-up companies)	Annual growth of successful entrepreneurs	It is not very useful to university managers because it is hard to define the categories of entrepreneurs. For example, students may work as taxi drivers in their studies. They can also be seen as entrepreneurs.
Research outcome	Citation	Impact score	The managers tend to choose impact score as the only measure in citation because they consider it as the best and most convenient approach among others. It is also very comparable when other universities use the same measure in citation.
		H index	
	Membership of research council or editorship of journals	The number of board members in research council and editors in journals	The managers do count the number of membership of research council and editors in journals in research performance measurement but the indicator has not been officially accepted at the university level as a mean to compare the performance between universities. Some disciplines such as Law, researchers do not write journals and conference paper. Therefore, editorships of journals are not applicable for law disciplines. The validity of the indicator is limited.
	Awards	NWO Spinoza Prize or others (e.g. European Science Awards)	The indicator is used in performance measurement in the university. In addition to Spinoza prize, the university also emphasizes on Simon Stevin Prize in the country.
	Research ranking (Leiden ranking)	Leiden ranking	In addition to Leiden ranking, Jiaotong Ranking is another measure that university managers use. It provides an external view of university research performance.

Table 10 Educational performance indicators evaluated by managers in UT

Performance areas	Indicators	Measurement alternatives	Managerial evaluations
Input	Market share of 1st year bachelor	The number of enrolments	The number of enrollments is regarded as a KPI by managers in the university. In terms of market share of 1st year bachelor, the managers tend to look at market share of bachelors at program level. University managers are also interested in student's pervious education background. E.g. HAVO or VWO. For master programs, university managers measure masters by internal, national masters (HBO, WO) and international masters.
	Intake # of 1st year bachelor students		
	Intake # of International and EU bachelor students		
	Total intake # of masters		
	Intake # of international and EU master students		
	The number of degree programs(BA/MA)	student per degree programs	The university managers do not see the number of degree programs as a useful educational performance indicator because degree programs are closely related to university intentions and the amount of resource available.
		The number of honor degrees	
	Staff FTE	Academic staff FTE	The usefulness of this indicator is very limited because university academic staff does not tell their managers how much time they spend on educational activities or how much time they spend on research. Therefore, managers may usually get the result of staff FTE by estimation
	Student/ academic staff	Ratio of the number of full-time Student/ academic staff	Managers do use this indicator but they do pay much attention to the results from the indicator. It only provides the managers with a general idea of comparison of the number of students and academic staff.
Process	Retention	Retention rate (1st year to 2nd year)	The managers see both indicators as important indicators in measuring student's study process in the university.
	Drop-out	Drop-out rate (BA/MA)	
	Contact hours	Average contact hours per week for bachelor and	Managers do not see contact hours as a valid indicator because there is

		master students	not only one model of education. Every program has its own curriculum and the building blocks of curriculum are different. The indicator is not very measurable.
	General student satisfaction	Student evaluation by Internal survey	They are important indicators in measuring student's opinions toward the university. It is measured both by fresh students in first year and students in last years. Though the reliability of the measurement by survey may be compromised by student's subjective judgments, the measurement can still tell something valuable information especially when questionnaires are handed out to the large number of student population
	proportion of students satisfied with overall facilities (classrooms, libraries etc)	Student evaluation by Internal survey	
	proportion of student satisfied with teaching method, course programs, and information services etc.	Student evaluation by Internal survey	
	Study efficiency	avg. time to complete for bachelors, research and non-research masters	The indictor can also be called as study speed in the university. It is a key performance indicator in educational performance measurement. In the university, an alterative measure is the number of European credits per average student by different programs.
Output &Outcome	Graduation	Graduation rate	Graduation indicator is regarded as a KPI in educational performance measurement. It helps university managers to measure the level of university outputs.
		The number of diplomas issued (BA, MA)	
	Graduation satisfaction	Student graduation evaluation by survey	They are two important outcome indicators. The measurement is done by Dutch Higher Education Monitor System "WO" which contains questionnaires about employment and average starting salaries to national higher education students. The indicators provide the managers with valuable information of student's after-university life but the measurement of employer feedback is not practical due to difficulties in information collection.
	Employment	Employment rate	
		Average starting salaries	
		Employer feedback	

Table 11 Financial performance indicators evaluated by managers in UT

Performance areas	Indicators	Measurement alternatives	Managerial evaluations
Financial resources	Amount of research income	Annual granted research funds and contracted funds	University research income is a key performance indicator in financial performance measurement. Annual grant researcher funds counts the total amount of research funds from government (competitive and non-competitive) and private sponsors.
		Annual research income from commercialization (patents, license agreement, spin-off companies etc)	
	Research indirect cost recovery	Indirect cost/ contracted income	It is not a very valid indicator because the amount of research funding the university can get might be beyond university control.
	Share in third-party and governmental funding to university income	% third party funding	The indicator is also used in the university but the managers will separate governmental funding into competitive and non-competitive funding.
		% governmental funding	
	Income from tuition fees and other service	Fees from national bachelors	Fees from national bachelor students are fixed. Therefore, university managers will only count the number of national students in calculating the total amount of tuition fees from them.
		Fees from international and EU bachelors	
		Fees from national masters	
		Fees from international and EU masters	
		Income from other services	
Financial position	Operating cost recovery	Operating cost/revenue	Managers do not see it as a useful indicator in the performance measurement of universities
	Surplus/deficit as % of income	Annual surplus/deficit as % of income from accounts	These three performance indicators can be regarded as key performance indicators. They are calculated at university level and University managers will report the results to Minster of Education.
	current ratio	Current asset/current liability from accounts	
	Debt ratio	Total liabilities/ total assets	
	Days expenditure available	days' expenditures as percentage of available cash from accounts	Managers do not see them as useful indicators in university settings. There are not the aspects university managers are interested in.
	Administrative cost per FTE student	Ratio of central administrative cost per FTE students	
	Utilities, maintenance cost	Ratio of expenditure in utilities, maintenance and repair cost	

	per FTE student	per FTE student	
	Expenditure on computer service, library and sports facilities per FTE student	Ratio of expenditure on computer service, library, and sports facilities per FTE student	
	Manager's satisfaction with financial strategies	Manager evaluation by self-assessment	With regard to the indicator of manager's satisfaction with financial strategies, managers might see this as a helpful financial indicator in the future but current financial management is relatively old-fashioned in the university. The way to evaluate effectiveness of financial strategies is abased on the evaluation of university financial performance which requires the change in current governmental mechanism. It might be taken place in the future in manager's opinions but the progress of governmental procedure is slow.

Table 12 Human resources indicator evaluated by UT managers

Performance areas	Indicators	Measurement alternatives	Managerial evaluations
Human Capital	Success rate in recruitment	% of full time recruitment	The Managers do not see it as an important indicator in human resource. Recruitments do not take place every year.
	Staff skills and staff diversity	% of English speaking employees	Employee's English-speaking capability is measured by English tests such as TOFEL and IELTS in the university. The managers see the ratio of academic staff to non-academic staff (supportive staff) as a key performance indicator in human resource.
		The number of PhD students	
		The number of Professors,	
		The number of assistant professors with or without PhD	
		The number of lecturers	
		The number of supportive staff	
	Employee's age distribution	% of employee in age span e.g. 30-40 or over 60	The indicator is used in annual social report in the university as a measure of employee's age distribution
HR policies and practices on Job performance	Expenditures on training and development	Annual expenditure on training and development	Managers in the university do not measure expenditures on training and development separately. They are measured by average expenditure per FTE the university has spent on salaries, desks, computers etc.
	Employee motivation or satisfaction	% of employee satisfied with welfare, promotion and pension	Employee's satisfaction is evaluated at every two or three years by an external institution.
		Employee turnover and sick leave	