USING THE ACTIVITY-BASED COSTING APPROACH TO MEASURE THE COST OF QUALITY IN HIGHER EDUCATION: A FACULTY PERSPECTIVE

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ABSTRACT

Most critical activities in colleges and universities are driven by financial considerations. It is thus important that revenues are found to support these activities or ways identified to streamline costs. One way to cut cost is to improve the efficiency of schools to address the issue of poor quality. In this paper, the cost of poor quality in higher education is measured by using the activity-based costing approach. The activities measured in the cost of quality are viewed from the perspective of faculty members who are deeply involved in the critical activities of teaching and learning. Information on the cost of quality can help to assess whether an institution is going in the right direction. It can also help to identify changes and improvements that an institution can pursue to avoid staying on the wrong path for too long.

INTRODUCTION

Although teaching and learning are considered to be the most critical activities in colleges and universities, they are, to a large extent, driven by financial and budgetary considerations. To support these activities, anticipated revenue sources must be aligned with planned expenditures for "without good budgets, there are no schools" (Thompson and Wood, 2005, p. 136). Hence, it is often necessary to prioritize educational programs to match sources of funds with educational needs. If revenues are not enough, some programs may be scaled back or eliminated altogether. It is important, therefore, to find additional revenue to maintain these programs or to identify ways to reduce their costs. A major way to cut costs would be to improve the efficiency of schools by addressing the issue of poor quality.

The cost of quality or the cost of poor quality is one that is often difficult to measure in higher education. This can be partly attributed to the fact that "most accounting systems are not structured to capture important cost-of-quality information" (Evans and Lindsay, 2011, p. 390). Nevertheless, the college or university "should have a regular process in place to gather factual and quantifiable data about institutional quality" (Luxton, 2005, p. 11). The use of activity-based costing may help to overcome this challenge by making it easier to assign costs to their proper cost quality categories and subsequently facilitate continuous improvement activities in institutions of higher education.

QUALITY IN SERVICE ORGANIZATIONS

Service can be defined as "any primary or complementary activity that does not directly produce a physical product" (Collier, 1987; cited in Evans, 2011, p. 15). Quality in service may be defined as how well customers perceive their expectations have been met. "If quality is to be measured, a subjective assessment must be used to determine whether the experience was a pleasant or an unpleasant one" (Aikens, 2011, p. 452). Managing for quality in services is often challenging because their production typically requires a high degree of customization. No two services are exactly alike. Many service attributes are intangible; therefore, they cannot be stored, inventoried or inspected prior to delivery (Foster, 2010; Evans, 2011). Because of this intangibility, it is often difficult to obtain hard data relating to services. Production and consumption of services often occur simultaneously. This means that the service must be done right the first time. Customers tend to be more intimately involved in the production of services. Such customer contact increases the variability in the provision of the service which is more difficult to control. Each of such contact can be considered a moment of truth (Aikens, 2011).

The nature of services makes it challenging for service providers to fully understand and apply quality principles in their operations. However, a number of service quality dimensions have been developed to measure service quality performance. A number of these dimensions are listed below (Parasuraman, Zeithaml, and Berry, 1988; cited in Evans, 2011):

(a) Time – the amount of time a customer must wait.
(b) Timeliness – the service is performed as promised.
(c) Completeness - all items are included in the order.
(d) Courtesy - frontline employees greet each customer cheerfully.
(e) Consistency - services are delivered in the same fashion for every customer, and every time for the same customer.
(f) Accessibility and convenience - the service is easy to obtain.
(g) Accuracy - the service is performed right the first time.
(h) Responsiveness - service personnel react quickly and resolve unexpected problems.

Over the years, many colleges and universities have made substantial commitments to the total quality effort. However, the percentage of higher educational institutions engaged in long term efforts to measure and improve quality seemed to be relatively small (Evans and Lindsay, 2011). From 2001 to 2008, only three institutions have received the Baldrige Award: University of Wisconsin-Stout (2001), Kenneth W. Monfort College of Business (2004), and Richland College (2005). It could be that educators, political groups, and even the public have often been slow to address the problem of educational decline on a systematic basis. Also, academia has seen many management fads come and go that it is not surprising for faculty and staff to be skeptical of any new management approach that comes their way. One question that is often asked about quality implementation is whether it will pay financial benefits (Foster, 2010). Even for a non-profit organization, accounting is still the primary language of the financial function. One way to address quality concerns is to identify and measure the costs of quality.

THE COST OF QUALITY

The costs of quality, also known as the costs of poor quality, include "those costs associated with avoiding poor quality" and "those incurred as a result of poor quality" (Evans and Lindsay, p. 388). Dr. Genichi Taguchi refined the costs relating to quality as the losses incurred by individuals, organizations or societies as a result of poor quality (Foster, 2010). These losses can be measured not only in terms of rejection, scrap or rework but also in terms of pollution that is added to the environment, products that wear out too quickly, or other adverse effects that may occur. In services, the concept of ideal quality is influenced by customer perception and satisfaction. Service quality is measured in terms of loss to society if the service is not performed as expected (Foster, 2010).

> The cost of quality is determined by measuring results from existing poor or failed quality. For example, faulty product returns are measurable. Costs of inspection versus including quality into design can be measured. Company or user repair costs for labor and parts can be measured. Production line downtime can be measured. Customer losses due to poor service can be measured. Enrollment drops in a university can be measured. Investment in failure prevention can be costed. Results of Six Sigma programs can be compared with processes that have not adopted Six Sigma. Profits after ISO certification can be compared with those before certification. Costs of quality programs can be compared with revenues over time and with returns on investment prior to implementation of those quality programs. The costs of poor quality policymaking can be measured in terms of human suffering that it causes (Maguad and Krone, 2009, pp. 213-214).

QUALITY COST CLASSIFICATION IN MANUFACTURING AND SERVICES

The costs of quality in general can be broken down into four major components: prevention costs, appraisal or detection costs, internal failure costs, and external failure costs. Prevention costs are those costs associated with preventing defects and imperfections from occurring. They are considered as investments made to keep appraisal/detection and failure costs to a minimum, that is, to ultimately reduce the other two quality cost categories. Prevention costs are associated with such activities as quality training, quality planning, process engineering, supplier reviews, statistical process control, and corrective action.

Appraisal or detection costs are those associated with measuring quality directly. They are associated with efforts to ensure conformance to requirements through measurement and analysis of data to detect nonconformance. They pertain to the costs of lab testing, inspection, equipment test and materials, losses resulting from destructive tests, and costs associated with assessments like the ISO 9000:2000 or other awards.

Internal failure costs are those incurred as a result of unsatisfactory quality found before the product or service is delivered to the customer. Some examples include scrap and rework costs, costs of corrective action, downgrading costs, and process failures. External failure costs occur after poor-quality products or services reach the customer or stakeholder. Some examples include costs due to customer complaints and returns, product recall costs and warranty claims, product liability costs, lost customer goodwill, and lost sales. In service organizations, these

costs can take the form of interrupted service, delays in waiting to obtain service, excessive time in performing the service, errors made in billing, delivery or installation, or unnecessary service.

It is typical to see external and internal failure cost ratios to be very high. Experts have estimated that about 60 to 90 percent of total quality costs come from internal and external failures (Evans and Lindsay, 2011). Traditionally, managers have responded to high failure costs by increasing inspection. However, such actions only increase appraisal/detection costs with little impact to overall quality or productivity. Actually, an increase in prevention usually results in larger savings in all other cost categories. For example, the cost of replacing a failed component in the field might be $1,000 but the cost of replacing it after assembly might only be $100. Still the cost of testing and replacing it during assembly might only be $10. And further still, the cost of changing the design to avoid the problem in the first place might only be $1. Clearly, it is evident that better prevention of quality reduces failure costs as fewer defective items are made and hopefully none of these falls into the hands of the customers. And since products are made correctly the first time, fewer appraisals or detection activities may eventually be required. Unfortunately many managers fail to understand and implement these ideas.

The cost of quality concept can be very meaningful to an organization because of the idea that failure costs can be reduced through marginal, discretionary investments in prevention and even appraisal/detection activities (Bottorff, 2004). Better prevention of poor quality clearly reduces internal failure costs and external failure costs. Moreover, fewer appraisals or detection activities are eventually required because products are made correctly the first time. The relationships among the four cost components pinpoint areas of high quality cost and turn attention toward the greatest improvement efforts. For most companies, management typically finds that the highest costs occur in the external failure category, followed by internal failure, appraisal, and prevention, in that order (Evans and Lindsay, 2011). Actually, the order should be reversed. The bulk of quality costs should be found in prevention, some in appraisal, perhaps a few in internal failure, and virtually none in external failure. It makes sense, thus, that a company embarking on a quality cost program should first try to reduce external failure costs to zero by investing in appraisal activities to identify the sources of failure and take corrective action. As the company improves its processes, both internal and external failure costs should decrease, and the amount of appraisal/detection can then be reduced with the emphasis gradually shifting to prevention activities. The key principle to understand the costs of poor quality is that when every activity in the organization is done right every time, these costs eventually disappear (Goetsch and Davis, 2010).

ACTIVITY BASED COSTING (ABC)

The traditional overhead allocation method such as departmental overhead rates averages department cost to products that are processed through the department. Further, each department may have unique activities that some products may be processed through and some not and by applying the same departmental rate to all product(s) that were processed through the department, the system assumes that those products were processed in all departmental activities when in actuality, they may not be so. Consequently, product(s) that does (do) not pass through all the activities in the department will be overcharged with departmental cost and, hence, overpriced. On the contrary, product(s) that pass through all the activities in the department will

be undercharged with departmental cost and, hence, underpriced. These errors may lead to loss in competitiveness and losses in revenue due to underpricing.

Activity based costing mitigates the problem of inaccurate cost accumulation by accumulating costs based on the activities that the cost object went through. The ABC method focuses on allocating overhead costs to activity cost pools using resource drivers and later allocating costs in the activity cost pools to products using activity cost drivers. The following figure depicts how resources are allocated to activity cost pools and eventually allocated to cost objects.
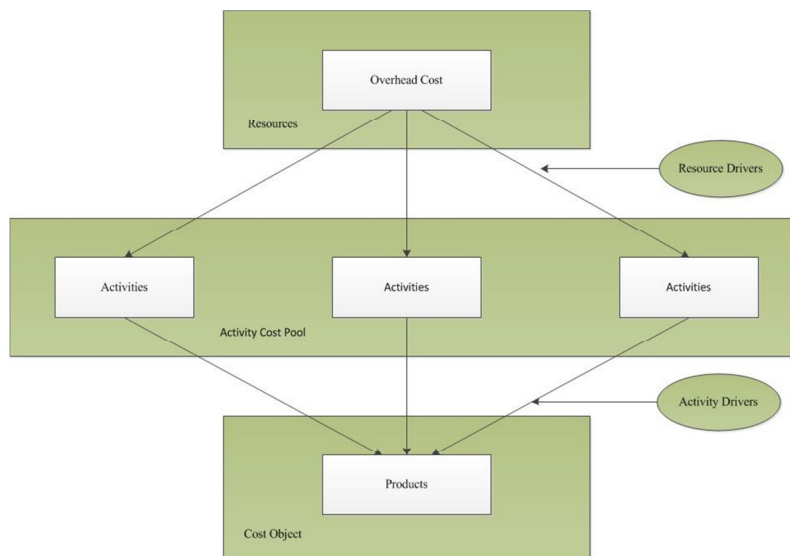

Figure 1, Resource Allocation to Products Using ABC

ABC is the more accurate cost allocation method compared to the traditional approach and, thus, is a better approach for managerial decisions such as pricing strategy, particularly, in heterogeneous product settings.

Gonzales-Gomez and Morini (2006) proposed an adaptation of ABC in the cost accumulation process of winemaking because of its perceived benefit of providing valuable cost information that can assist winery managers to achieve competitive advantage. The wine industry is becoming a highly competitive industry due to globalization and better informed and, thus, selective customers. The need for a more accurate cost accumulation system particularly regarding overheads is crucial for an accurate costing and eventually pricing decision because the production process in wine industry has evolved to the level where fixed and indirect costs are becoming more significant and where labor costs are becoming less important. The winery process varies depending on the input used and the type of product targeted. They conclude that the ABC system is the more appropriate system for costing in wine industry, compared to the traditional methods, because of its ability to adapt variations in the wine making process. It

provides a more detailed cost analysis, faster and more accurate cost information and, thus, *ceteris paribus*, better decision-making.

There are studies that also looked into the benefits of ABC application in the service sector. Vazakidis *et al* (2010) proposed the application of ABC in the public sector, particularly, to measure the cost of services performed by public office by showing the application of ABC in a Prefecture in Greek. Gujrat *et al* (2010) applied ABC costing in the cost accumulation per sample of various tests in the hematopathology laboratory while Shevasuthisilp and Punsathitwong (2009) demonstrated the application of ABC in an after press service company. Shevasuthisilp and Punsathitwong (2009) pointed out that their research subject had a significant overhead cost to total cost ratio of 36.65%. They also highlighted the inadequacy of traditional overhead cost allocation that was used by the subject firm that may lead to inaccurate pricing decision leading to losses. Upon comparing costing result under the ABC system and the traditional costing system, they found that 6 out of 56 items were underpriced which resulted in significant financial losses.

Higher education institutions are also facing the challenge of staying competitive and will benefit from improving quality, improving efficiency, and eliminating activities that do not contribute to value or low-value adding activities (Krishnan, 2006). Managers of higher education institutions need costing information to be able to make sound managerial decisions that will enable them to improve quality, efficiency, and eliminate low or non-value adding activities. Krishnan (2006) showed that the application of ABC system can help higher education institutions to improve operation and better meet the needs of their customers. The study concluded that ABC provided for better cost management and enabled the calculation of true cost per student. As in the manufacturing setting, the application of ABC in higher education institutions also helped management to identify non-value added activities and improve efficiency.

Cox *et al* (2007) presented the use of ABC in higher education institutions. They identified four major activities that faculties were involved in: teaching, research, service and administration. It showed how ABC was used in allocating faculty salaries to these activities. Through surveys and possibly through interviews with department chairs, the full-time equivalent (FTE) spent by each faculty can be identified and, thus, a proper allocation of faculty salaries to each activity can be done. This study adopted the four activities used in Cox *et al* (2007) and the methodology employed in allocating faculty salaries to these activities. However, this study went further to show how ABC could be used to identify the cost of quality among these activities.

COST OF QUALITY IDENTIFICATION WITH ABC

Some of quality cost may be charged as overhead cost and, thus, becomes part of product cost. The cost of quality needs to be properly addressed and controlled if a firm wishes to thrive in a highly competitive environment. Competition in the education industry is also increasing where higher education institutions are trying to address the difficult task of attracting students by providing high quality education at an affordable cost. Ensuring a high quality education process not only facilitates the output of high quality graduates but also helps reduce overhead cost and, thus, offers a competitive education process.

Consistent with Cox *et al* (2007), in this paper, activities performed by faculties in institutions of higher education are categorized into teaching, research, service, and administration. Within each of these activities, ABC will be used to help quantify the cost of preventing failure, the cost of detecting failure and the cost of internal and external failures. By identifying these costs, management may be able to quantify the costs of quality and use them to assist in performing managerial functions such as planning and controlling.

It is in the interest of management to identify where the cost of quality is concentrated, whether it is in prevention, detection, internal failure, or external failure. A cost of quality that is mostly due to internal and external failures indicates that the pursuit of quality may have failed as evidenced by customer (e.g., students and parents) negative response. Ideally the bulk of quality cost should be in prevention. Identifying where quality cost is concentrated will help administration to evaluate the effectiveness of each faculty and identify ways to ensure effective failure prevention with the objective of minimizing if not eliminating internal and external failures.

Identifying specific activities that represent each category of cost of quality is as challenging as quantifying each activity in monetary terms. Activities that represent prevention and detection can be identified although these can be tedious. Moreover, identification of activities that represent internal or external failures can just be as difficult. Thus, it is proposed that events representing internal and external failure should be used as a proxy for failures.

Cot attributable to quality is determined by first determining the Full Time Equivalent (FTE) for teaching, research, service, and administration for each faculty. A survey along with an interview with department chair is necessary to determine the FTE of each faculty for the four activities. This interview could be done at the beginning of school year to determine the planned FTE to be spent on these activities and, thus, could be used as part of budgeting process while an interview at the end of the school year could be used to determine the actual FTE used in each activity. The planned and actual FTE spent on these activities can then be compared and used as part of variance analysis. For efficiency reasons, this survey can be done during the year-end evaluation with the department chair. Next, the FTE for prevention activities, detection activities, internal failure, and external failure for each activity a faculty is involved in (teaching, research, service, and administrative) needs to be estimated. To do this, it is necessary for each faculty to have a record of time actually spent on these activities. Figure 2 illustrates the logic of identifying the FTE associated with quality assurance activities in each of the four major faculty functions.

The total FTE for a faculty's teaching, research, service, and administration should always equal his/her full time hour. A faculty's total FTE in prevention, detection, internal failure, and external failure in teaching may not necessarily equal the faculty's FTE for teaching, because, only a portion of teaching time may be used for quality assurance activities. The same logic applies to prevention, appraisal, internal failure, and external failure in research, service, and administrative activities.
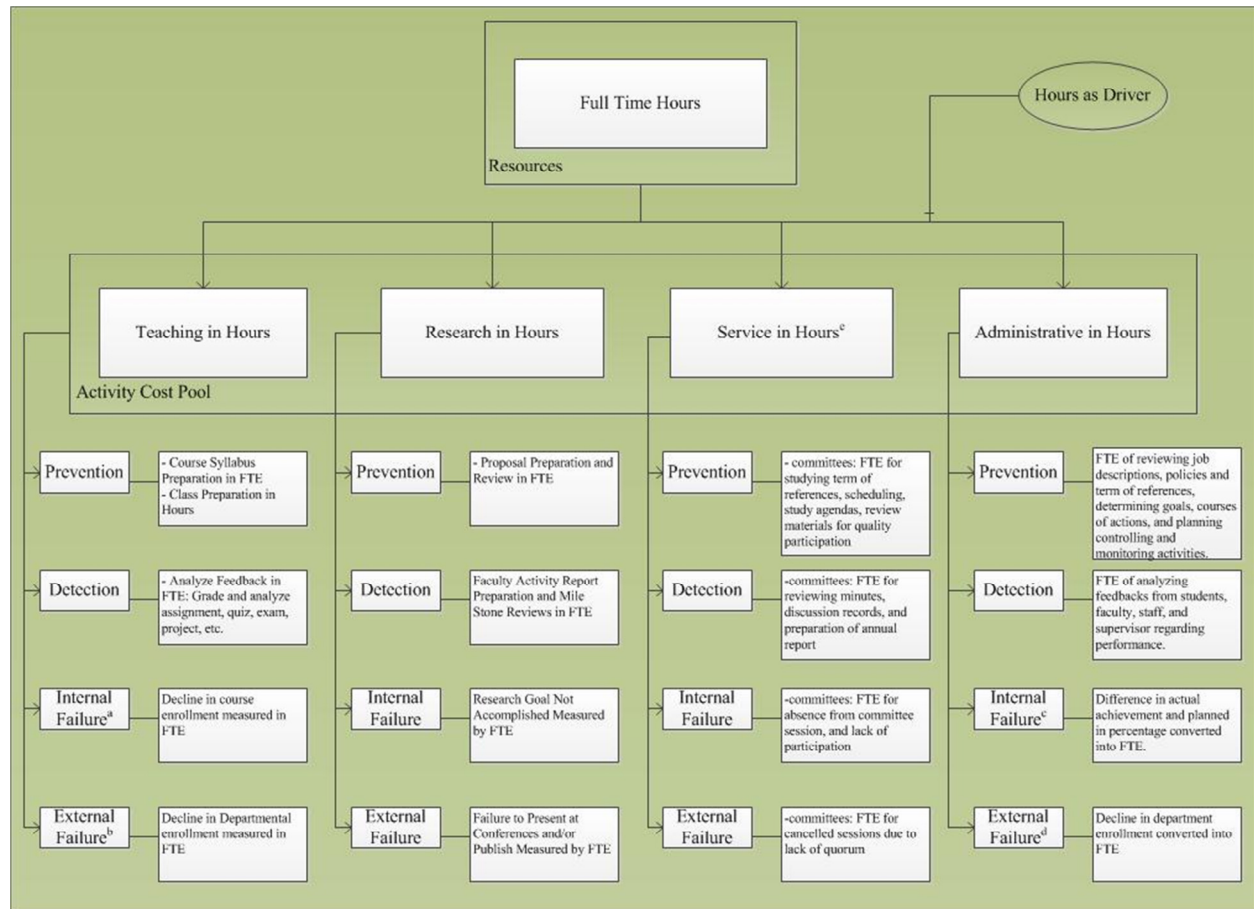
ac   The cost of internal failure could also be measured as loss in tuition

bd   The cost of external failure could also be measured as loss in tuition

e   Faculties could also be involved in other community services.

Figure 2, Allocation of Faculty Hours into Activities and their Sub-activities

COST OF QUALITY FOR TEACHING ACTIVITIES USING ABC

Teaching is considered to be one of the most critical activities in a college or university. To facilitate this activity, however, requires a substantial amount of financial resources. Thus, it is often necessary to prioritize educational programs to meet educational needs. It is also important to improve the efficiency of teaching by measuring its cost of quality.

Prevention and Detection Cost

To ensure a quality teaching process, faculties engage in activities that are tailored to prevent failure such as time spent on course design, on class preparation, etc. The list of activities could be expanded as necessary. Faculty needs to estimate the time required designing a course and preparing for classes at the beginning of the school year. It is also necessary for the faculty to record the actual time spent on designing a course and preparing for classes. Activities intended

to detect failure may include grading of assignments, quizzes, examinations, projects, etc. Analysis of grades may provide feedback regarding the quality of the education process. It is necessary for the faculty to estimate the time that may be required to perform these activities in the course of the semester and to record time actually spent on these activities.

Internal Failure Cost

We define internal failure as the failure of an individual faculty in delivering high quality education process. An internal failure is, therefore, a consequence and, thus, an event representing a consequence of failure to deliver high quality education process. We propose to use the decline in course enrollment as a proxy for internal failure because failure in delivering high quality process may eventually be apparent in the decline of student enrollment in the course. The challenge is to isolate the decline in course enrollment that is due to failure of quality from the seasonal and market trend. We propose the use of a statistical approach in estimating course enrollment. Negative deviation from the estimated course enrollment adjusted for tolerable deviations is assumed to be the consequence of internal failure.

The next challenge is to express the decline in student enrollment for a course that is due to internal failure into monetary terms. This can be done in two ways: The first alternative is to determine internal failure cost by estimating the FTE per student for the faculty teaching the course and multiplying it by the salary rate per hour for the faculty. The second alternative is to consider the loss in tuition because of the decline in student enrollment an internal failure cost.

Several information is necessary in the first alternative. First, the faculty's monthly teaching hours need to be determined (by survey or interview). Second, the total number of students enrolled in the faculty's course in the fall and spring semesters needs to be identified. Third, the FTE per student for the faculty need to be calculated. The FTE per student will be different in the two semesters. In the case that different numbers of students are enrolled in the courses taught by the faculty, an average should be computed. The FTE for internal failure may be obtained by multiplying the FTE per student with the number of decline in enrollment that is due to internal failure. To calculate the cost of internal failure, the FTE for internal failure will then be multiplied by the faculty's salary rate per hour.

Illustration of Internal Failure Cost – Method A

The following hypothetical data for Professor A is used to illustrate the estimation of internal failure cost. The first set of data that is necessary is the FTE of Faculty A for each of the four major functions performed.

Functions	Weekly Hours	Monthly
Service	2	8
Research	10	40
Teaching	28	112
Administration	0	0
Total	40	160

The next set of data needed is the total number of students enrolled in the faculty's course in all semesters taught. For illustration purposes, we assume Faculty A teaches in the fall and spring semesters.

Courses	Semester	Enrollment
A	Fall	22
B	Fall	15
C	Fall	15
D	Spring	14
E	Spring	7
F	Spring	7

There were 52 students and 28 students enrolled in the courses taught by Faculty A in the fall and spring semesters respectively. The average teaching hour per student of Faculty A is 2.15 (112/52) in the fall and 4 (112/28) in the spring semester. The teaching hours per student for Faculty A is the average of fall and springs semester, 3.08 ([2.15+4]/2).

Assuming that after comparing actual enrollment with estimates, it was found that because of internal failure in quality there is a decline in enrollment for each courses taught by Faculty A (Table A, Column C). Assume that Faculty A's salary per hour is 26.44 calculated from $55,000 annual salary divided by 2,080 annual hours (40 hours/week X 52 weeks).

Table A is a worksheet that illustrates the estimation of internal failure cost attributed to Faculty A on a monthly basis.

Table A: Cost of Internal Failure Attributable to Faculty A

Column A	Column B	Column C	Column D	Column E	Column F	Column G
Courses	FTE per Students	Decline in Students	Decline in Students Due to Teaching	FTE of Student Decline	Faculty Hourly Rate	Cost of Internal Failure per Month
A	3.08	5.00	3.5	10.78	26.44	285.05
B	3.08	3.00	2.1	6.47	26.44	171.03
C	3.08	0.00	0	0.00	26.44	0.00
D	3.08	2.00	1.4	4.31	26.44	114.02
E	3.08	1.00	0.7	2.16	26.44	57.01
F	3.08	1.00	0.7	2.16	26.44	57.01
						684.12

Column B is the average monthly teaching hours per student (FTE per student) which is calculated as the average of monthly teaching hours/student in the fall and spring semesters ([2.15+4]/2). Column C is the decline in students due to internal failure. Column D is the decline in student enrollment attributable to teaching activities, Column E is Faculty A FTE of student decline (column B multiplied by column D). Column F is the hourly salary rate for Faculty A while Column G is the cost of internal failure per month (Column E multiplied by Column F).

Under this approach, the total cost of internal failure is equal to faculty compensation that is paid out and found to be ineffective.

Illustration of Internal Failure Cost – Method B

The second approach is to treat loss of income from decline in student enrollment as cost of internal failure associated with Faculty A's quality failure. Table B presents the calculation of internal failure cost assuming 3 credits per course and tuition fees of $800/credits.

Table B: Internal Failure Cost as Loss of Income

Column A	Column B	Column C	Column D	Column E	Column F	Column G
Courses	Decline in Students	Decline in Students Due to Teaching	Credit per Course	Loss of Credits Attributable to Teaching	Tuition per Credit	Cost of Internal Failure
A	5	3.5	3	10.5	800	8400
B	3	2.1	3	6.3	800	5040
C	0	0	3	0	800	0
D	2	1.4	3	4.2	800	3360
E	1	0.7	3	2.1	800	1680
F	1	0.7	3	2.1	800	1680
TOTAL					4800	20160

Loss of credits (Column E) is calculated by multiplying column C with column D and represents the total credit hours that the department loses due to the decline in student enrollment. The cost of internal failure per semester (Column G) is calculated as the loss of credits multiplied by tuition per credit. Courses A, B, and C are taught in the fall semester and courses C, D, and E are taught in the spring semester, hence, to derive the monthly figure, the cost of internal quality for each course have to be divided by 6t. Under this approach, the total loss of income from decline in student enrollment that is due to Faculty A's inability to ensure quality in teaching is assumed to be the cost of internal failure.

External Failure Cost

We define external failure as consequence of quality failure that has found its way beyond courses taught by a faculty. In this case, the decline in departmental enrollment may be an event representing external failure. Statistical estimation techniques that are based on historical department enrollment may be used to estimate normal enrollment adjusted for estimation error. Any negative deviation in department actual enrollment from the estimate is assumed to be due to external failure.

Two approaches could be used to estimate external failure cost. The first approach calculates external failure cost as the dollar value of FTE of decline in department enrollment for each faculty (see Method C below). The second approach calculates external failure cost as the loss of income from decline in departmental enrollment (see Method D below).

The following information is necessary in the first approach: first, the FTE for service, research, teaching, and administrative activities of each faculty in the department; second, each faculty's

salary rate per hour; third, the estimated teaching hour per student per month for each faculty in the department; fourth, decline in the department's student enrollment due to external failure. This approach involves the following steps: first step, calculate the proportion of each faculty's teaching hour (FTE) per student per month from the total teaching hours (total FTE) per students per month in the department; second step, determine the decline in department's enrollment attributable to each faculty; third step, convert the decline in department enrollment attributable to each faculty into FTE by multiplying the decline in enrollment attributable to faculties by their respective teaching hour (FTE) per student per month; fourth step, calculate cost of external failure by multiplying the FTE of decline in enrolment by faculty salary rate per hour.

The second approach requires information regarding credit hours per student per semester and tuition per credit hours on top of the information set required in the first approach. This approach involves the following steps: first, calculate the proportion of each faculty's teaching hour (FTE) per student per month from total teaching hours (total FTE) per students per month in the department; second, determine the decline in department's enrollment attributable to each faculty; third, determine the credit hour lost due to decline in department enrollment by multiplying credit hours per student with the number of decline in student enrollment due to external failure; fourth, determine the credit hour lost due to decline in enrollment attributable to each faculty; fifth, determine the annual loss of income due to loss in credit hours attributable to each faculty; sixth, determine the monthly loss of income due to loss in credit hours attributable to each faculty. The monthly loss of income due to loss in credit hours attributable to each faculty is considered the monthly cost of external failure.

Illustration of External Failure Cost – Method C

For illustration purposes, we assume that there are three faculties in the department, faculty A, B, and C. The FTE for service, research, teaching, and administrative for each faculty is as follows:

Functions	Monthly Hours		
	A	B	C
Service	8	6	10
Research	40	40	38
Teaching	112	114	112
Administration	0	0	0
Total	160	160	160

Salary per hour for each faculty is calculated as the annual salary divided by total hours worked by each faculty (2,080 hours). For illustration purposes, we will assume Faculties A, B, and C are paid $55,000, $70,000, and $80,000 per annum, respectively. Their salary per hour is $26.44, $33.65, and $38.46 for each faculty, respectively.

The next information required is the average faculty teaching hour (FTE) per student per month that is calculated in a similar fashion for all three faculties, A, B, and C. For illustration purposes, the average faculty teaching hour per student for each faculty is 3.08, 4, and 2.9 for Faculties A,

B, and C respectively. Table C is a worksheet illustrating the calculation of external failure cost using the first approach.

Table C: Calculation of External Failure Cost per Month

COLUMN A	COLUMN B	COLUMN C	COLUMN D	COLUMN E	COLUMN F	COLUMN G
FACULTY	AVG TEACHING HOURS/STUDENT/ MONTH	FACULTY PROPORTION OF DECLINE IN	DECLINE IN DEPT ENROLLMENT ATTRI. TO FACULTY	DECLINE IN ENROL. IN FTE	FACULTY SALARY RATE	COST OF EXTERNAL FAILURE
A	3.08	0.31	3.09	9.51	26.44	251.34
B	4	0.40	4.01	16.03	33.65	539.54
C	2.9	0.29	2.91	8.43	38.46	324.11
	9.98					1115.00

Each faculty's proportion of decline in enrollment due to external failure (Column C) is calculated by dividing a faculty's average teaching hour (FTE) student per month (e.g., 3.08 for Faculty A in Column B) by the total teaching hour (FTE) per student per month (total of Column B). For illustration purposes, we assume that after comparison between actual and estimated enrollment, the decline in enrollment that is due to failure to uphold quality is 10 students. The decline in department enrollment that is attributable to each faculty (Column D) is calculated by multiplying Column C by 10 students. The next step is to calculate the decline in department enrollment in FTE (Column E). It is calculated by multiplying Column B by Column D. Finally, the cost of external failure can be estimated by multiplying Column E by Column F.

Illustration of External Failure Cost – Method D

This method calculates external failure cost as the loss of income from decline in departmental enrollment (Method D). The same set of information for Method C applies to Method D. Table D presents the worksheet of external failure cost calculation.

Table D: Calculation of External Failure Cost per Month as Loss of Income

COLUMN A	COLUMN B	COLUMN C	COLUMN D	COLUMN E	COLUMN F	COLUMN G
FACULTY	DECLINE IN DEPT ENROLLMENT ATTRI. TO FACULTY	CREDIT HOUR LOST/STUDENT DUE TO DECLINE IN ENROLLMENT	CREDIT HOUR LOST/STUDENT ATTRIBUTABLE TO FACULTIES	TUITION/ CREDIT	ANNUAL COST OF EXTERNAL FAILURE	COST OF EXTERNAL FAILURE/ MONTH
A	3.09	16	49.38	800	39503.01	3291.92
B	4.01	16	64.13	800	51302.61	4275.22
C	2.91	16	46.49	800	37194.39	3099.53
	10.00		160.00		128000	10666.67

The decline in departmental enrollment that is attributable to each faculty is found in Column B (See Table C, Column D) while credit hours lost per student attributable to faculties is presented

in Column D, which is derived by multiplying column B by column C. The annual cost of external failure is presented in column F and is derived by multiplying column D by the tuition/credit hours (column E). The monthly cost of external failure for each faculty is presented in column G and is calculated by dividing the annual cost of external failure (column F) by 12.

COST OF QUALITY FOR RESEARCH ACTIVITIES USING ABC

Another responsibility of academe is to enhance knowledge through research activities. Research activities facilitate discovery of new knowledge, theories, and applicability of theories. They also help improve the quality of faculties by increasing depth and breadth of their knowledge that is hoped to improve teaching. At the institutional level, effective research activities may attract funding from public as well as private sectors and improve institutional reputation through representations in conference proceedings and publications. Overall, the positive attributes of research activities should also help higher education institutions to be more competitive.

One of the objectives of an institution of higher education in regards to research is to ensure high quality research activities which may be evident through refereed journal publications. Higher education institutions need to be aware of these costs so that it can be planned and controlled effectively. As in teaching activities, there are two major sources of quality costs in research, the cost of preventing and detecting quality failure and the cost arising from quality failure, both internally and externally.

Prevention and Detection Cost

Publication is generally an indication of quality research and should ideally be the goal of all research activities. A research project may take place but without the dissemination of the result through a proper venue such as a publication, the objective of a research is not fully met, which is the advancement and dissemination of knowledge. Hence, management and faculties engaging in research activities need to design activities that prevent and detect failures as early as possible before they turn out to be internal and/or external failures.

Adequate proposal preparation, including identification of resources such as data, time, literature, manpower, funding, etc., is an important part of a research project. An adequately prepared and reviewed research proposal is one of the key activities to prevent failure of research quality. The list of prevention activities may be expanded as necessary. To enable sound budgeting of quality cost, faculties need to estimate hours they plan to spend on proposal preparation. Faculties need to log hours spent on proposal preparation and review to enable measurement and reporting of prevention cost and the analysis of variation of actual from budgeted cost.

In an imperfect world prevention activities may not always prevent quality failure and, thus, an early detection of quality failure in research progress is necessary. Mile-stone reviews and annual faculty activity reports are arguably one of the key detection activities. For budgeting purposes, the hours planned to be spent on preparation of faculty activity reports and reviews of research project milestones need to be documented, while, measurement and reporting of detection costs requires faculties to keep log of hours spent on faculty activity report preparation and reviews of research milestone.

The process of allocating time spent by faculties on preventive and detective activities will determine the FTE for both activities. The FTE will then be multiplied by salary rate per hour of each faculty and, thus, the prevention and detection costs associated with each faculty's research activities can be estimated.

Internal Failure Cost

We define internal quality failure as failure of faculties to meet research project milestones or research project goals. The challenge is to convert failure to meet milestones or goals into FTE. Calculation of internal failure cost becomes easier when the FTE of failure to meet milestones or research goals are estimated. One way of converting internal failure is by determining the percentage of milestone achievement. An achievement below 100% indicates internal failure, thus, a failure will be indicated by a negative value. The difference between actual achievement and goals in percentage multiplied by the total hours used by the faculty for research activities during the year indicates the FTE of internal failure. FTE of internal failure multiplied by salary rate per hour of the faculty is the internal failure cost.

External Failure Cost

The ultimate proof of quality in research activity is publication of the research work, thus, we define external failure as the failure to publish the result of research activities. A research project may take multiple years to accomplish and get published, thus, only in the year of publication target will there be a measurement for external failure. For example, Faculty A determined a target publication on the 3rd year of research work. On the first 2 years, there is no external failure, however, on the 3rd year, external failure may occur if the target publication is not achieved. A notice of acceptance for publication is an acceptable proof of publication. In the case that further work is required in the notice of acceptance, the cost of additional work is categorized as internal failure.

Failure to publish indicates the failure of the entire research work and, thus, we propose that the entire research hour spent by the faculty be deemed external failure cost. This can be calculated as the entire research hour spent throughout the research project multiplied by salary rate/hour. In the case that the research work gets published later than anticipated because of additional research work required, the additional resources spent are considered internal failure and external failure will not be measured until the new estimated publication year.

In the case that the research work is also funded by a grant, the allocation of funds into prevention and detection depends on the actual use of the fund in those activities, thus, a proper budgeting and recording of funds secured from a grant in the research project is necessary. Internal failure cost is the cost of faculty FTE internal failure plus the allocation of grant fund as internal failure. The grant fund that is allocated to internal failure can be determined as the percentage of internal failure (*see internal failure section*) multiplied by funds from research grant that is spent on the related year. In the case of external failure, both the entire research hour spent by the faculty on the failed research project and the entire grant fund spent on the research project are considered an external failure cost.

Illustration of Internal Failure Cost for Research Activities

The following table is prepared for one year internal failure and is based on the following assumptions for Faculty A: no grant as funding for the research project; achieved only 95% of his/her goal for year 1; hours allocated for research project is 40 hour per month, and; the salary rate per hour is $26.44.

Table E: Internal Failure Cost for Research Activities of Faculty A on Year 1

COLUMN A	COLUMN B	COLUMN C	COLUMN D	COLUMN E	COLUMN F	COLUMN G
Actual Achievement of Goals/Mile-stones in %	Failure in %	Hours Spent on Project for the Year	Failure in FTE for the Year	Salary Rate per Hour	Annual Internal Failure Cost	Monthly Internal Failure Cost
95.00%	-5.00%	480.00	24.00	26.44	634.62	52.88

Column B is internal failure in percentage; it is the difference between actual achievement and perfect achievement of 100%. Thus, a negative sign in column B indicates failure. The faculty will need to determine the failure in percentage together with the head of department. Column C is the time spent by the faculty on the research project for the entire year and assumes 40 hour per month on the research project. Column D is internal failure in FTE which is calculated by multiplying the absolute value of the percentage in column B with column C. The annual internal failure cost, Column F, is calculated by multiplying column D with column E. The monthly internal failure cost, Column G, is calculated by dividing column F by 12.

Illustration of External Failure Cost for Research Activities

The illustration of external failure cost for research activities is prepared assuming a 3-year research project by Faculty A. The same information applies as in the illustration for internal failure. It is assumed that Faculty A plans to publish on the 3rd year of the project, however, he or she failed to publish.

Table F: External Failure Cost for Research Activities of Faculty A

COLUMN A	COLUMN B	COLUMN C	COLUMN D	COLUMN E	COLUMN F	COLUMN G
Year	Failure in %	Hours Spent on Entire Project *	Failure in FTE for the Entire Project	Salary Rate per Hour	Annual External Failure	Monthly External Failure
1	0.00%	480.00	0.00	26.44	0.00	0.00
2	0.00%	960.00	0.00	26.44	0.00	0.00
3	100.00%	1,440.00	1,440.00	26.44	38,076.92	3,173.08

*at 40 hours/month - Accumulation of hours spent on project

Assumption: Estimated Publication on the 3rd Year

        Fail to Publish

External failure is only measured on the year of estimated publication and, failure to publish is a 100% failure. The entire hours spent by Faculty A (Column D is calculated by multiplying column B with column C) on the research project is an external cost and is multiplied by salary

rate per hour to estimate the annual external failure cost, Column F. Monthly external failure cost is the annual external failure cost divided by 12.

In the case that faculties revised the estimated publication year to the following year, then, the additional research cost, for example, research hours, is considered to be internal failure cost. The external cost will only then be measured on the revised year of publication.

COST OF QUALITY FOR SERVICE ACTIVITIES USING ABC

Aside from teaching and research activities, faculties are also required to provide services, either to the community or to the university. Services to community can be manifested in the form of voluntary works for non-profit organizations that provided benefits to the community while services to the university may be in the form of committee memberships. Faculties have the responsibility to ensure quality services are provided in all organizations they are involved in and in committees that they serve.

As in teaching and research, there are costs associated with quality of services provided: costs associated with ensuring quality (prevention and detection), and costs associated with failure of quality (internal failure costs and external failure costs). Management needs to be able to quantify the cost of quality in service activities to enable proper measurement and the reporting of cost of quality. The following paragraphs propose approaches that may be used to quantify the cost of ensuring quality and the cost of quality failure in service activities.

Prevention and Detection

Activities to prevent failure of service to community and committee memberships may differ from one faculty to another depending on each situation. The example that is provided in this paper provides a general idea of how prevention activities may be quantified into a dollar amount to enable measurement and reporting.

Faculties may be appointed or requested to sit as committee members to enable enough representation across the university in providing insights and adequate deliberations on important issues. To ensure the proper functioning of committee according to its term of reference, committee members should spend adequate time studying the term of reference for the committee at the beginning of appointment, spend time to design proper scheduling, spend adequate time studying the agenda on hand, and review related materials to ensure quality participation in committee sessions. It is necessary for faculties to record the time spent on such activities. Such recording will enable the measurement of FTE spent and, consequently, the measurement of costs associated with preventing failure in delivering quality service as committee members.

Failure to provide quality service as committee member should be detected as early as possible to prevent further costly failure. This can be done by reviewing committee minutes and records of discussion which will enable faculties to identify his/her level of participation in committee deliberations. Lack of participation does not always indicate lack of quality; however, adequate preparation is likely to result in participation. Another way to detect failure to provide quality service is through the preparation of annual report that outlines the activities of faculties in three

areas: teaching, research, and service, throughout the year. Preparation of annual report for service activities should involve self-assessment of attendance and level of participation. The time spent on reviewing committee minutes and records of discussion and the time spent on preparation of annual report for service activities are the FTE associated with detecting failure of quality in services as committee members. The cost of such activities can be calculated by multiplying the FTE with salary rate per hour of the faculty.

Faculties may also decide to serve the wider community by being a member of an organization that serves the public. As part of preventing failure to provide quality service to these organizations, faculties need to review their responsibilities and the expectations of these organizations. Also faculties need to make efforts to prepare an itinerary that includes schedules of involvement in these services. The time spent on these efforts need to be logged to enable measurement and reporting of the costs associated with it. Multiplying hours spent on these activities by salary rate per hour will estimate the cost associated with prevention activities.

Preparation of annual reports, particularly regarding service activities to the public, involves analyzing whether the faculty is able to provide services to the community as planned. The time spent in preparation of this report represents the FTE spent by faculty in detecting failure to provide quality services to the community. Multiplying this by salary rate per hour for the faculty will result in an estimate of the cost of detecting failure for services to the community.

Internal Failure

In the case of services as member of a committee, internal failure for service activities is defined as absence from committee sessions and lack of participation. The FTE for absence from committee sessions can be estimated by multiplying the number of absences by the length of committee session per meeting. The cost of internal failure in services as committee member can be estimated by multiplying the hours of absence from committee sessions by salary rate per hour of the faculty.

Converting the level of participation into FTE is challenging. The level of participation can be determined either through self-assessment or by the committee chair-person. Level of faculty participation as member of committees has rarely been an object of assessment, however, it may be necessary for such assessment to take place if we are to measure the quality of service rendered as committee member. The difference between the level of participation and 100% represents failure if it is negative. It can then be multiplied with the total hours allocated by the faculty to service as a committee member to derive the FTE for internal failure. The FTE for internal failure is then multiplied by the salary rate per hour of the faculty to come up with an estimate of the cost of internal failure.

Internal failure of quality for services rendered to community is defined as absences from scheduled sessions or meetings. The cost of absences from scheduled sessions can be estimated by multiplying the frequency of absences to number of hours scheduled to be spent per session and multiplying it by salary rate per hour.

External Failure

We define external failure for committee membership as cancellation of scheduled sessions due to lack of attendance (quorum). Other evidence of failure may be the failure to produce, however, it is difficult and probably not efficient enough to quantify. The frequency of cancelled scheduled session that is due to lack of quorum is multiplied by the length of meeting per session to estimate the FTE external failure. The FTE is then multiplied by the salary rate per hour to estimate the cost of quality arising from external failure.

The external failure for community service may be challenging to measure. A self-assessment where percentage of accomplishment is determined may be used as the basis to calculate FTE of external failure for community service. The percentage of completion can be estimated by self-assessment or by a supervisor where the service is being rendered. It may be necessary to have assessments in place to measure service activities. The difference between the percentage of accomplishment and 100% represents failure if it is negative. This failure in percentage can be multiplied by hours planned to be used by faculty for such services. The FTE for services to the public can be then multiplied by the salary rate per hour for the faculty.

COST OF QUALITY FOR ADMINISTRATIVE ACTIVITIES USING ABC

Faculties may be given administrative assignment on top of teaching, research, and service functions. Faculties that are trusted with administrative position should take all efforts necessary to ensure quality of administrative work. The type of preventive activities varies in practice from one position to another; however, the principle is the same. Both activities to prevent and detect failure in quality and the time spent on these activities needs to be logged to enable the estimation of cost of quality.

Prevention and Detection

Faculties involved in administrative function need to review and understand their job descriptions, study policies and term of references related to their job, spend time at the beginning of school year to determine goals, plan courses of actions that can best meet set goals, and plan controlling and monitoring activities to ensure goals will be achieved. These activities should help the performance of faculties with administrative positions and, thus, prevent failure in delivering quality services. Hours that are spent on these activities need to be logged and multiplied by the salary rate per hour for the faculty, thus, the estimated cost of preventing quality failure.

Preventive actions may not always be effective, hence, activities designed to detect for any lack in quality must be in place to avoid it turning into quality failures, both internal and external, which may be costly. Analysis of feedbacks from students, faculty, staff, and supervisor regarding performance of administrative function is an important element in detecting lack in quality. Analysis of feedback include efforts to weed out illegitimate complaints and focus on legitimate claims. Regardless of whether a claim is legitimate or not, spending time analyzing feedbacks will help faculty to find ways of avoiding such claims or complaints in the future. These feedbacks can take many different forms at different intervals. It is up to the faculty to design a feedback system that fits the objective. It may be in the form of departmental meetings, or suggestion forms, bi-annual surveys, or interviews with faculties. Regardless of the activities,

it is important for faculties with administrative positions to log hours spent on analyzing such activities and hours spent on analyzing feedbacks received in those activities. The hours spent represents the FTE for detecting lack of quality, hence, multiplying this FTE with the salary rate per hour will estimate the cost of detecting lack of quality.

Internal Failure

Activities designed to prevent and detect lack of quality in administrative function may not be effective enough, hence, the existence of internal and external quality failures. Such failure in quality may prove to be costly and, thus, it is in the interest of management to be able to quantify the cost of failures. In this sub-section, one way of quantifying internal cost into dollar amounts will be discussed.

Internal failure in administrative function may be defined as failure to meet goals set at the beginning of school year; hence, an assessment may be necessary to determine the percentage of achievement. An actual achievement in percentage that is less than one hundred percent represents internal failure. Multiplying internal failure in percentage by total faculty hours allocated for administrative function represents the FTE for internal failure. The internal failure cost is then derived by multiplying FTE for internal failure by salary rate per hour.

External Failure

Various administrative efforts are tailored to achieve many goals and objectives which at the end of the day are hoped to improve department enrollment numbers. The bottom line is that efforts to improve and maintain quality in teaching, research, and services through quality administrative efforts are tailored to attract and maintain more students enrolled in the department. This is particularly true in a highly competitive setting that higher education institutions face today. Hence, we define external failure of quality arising from administrative function as decline in student enrollment that is in excess of normal fluctuation.

Statistical techniques that utilize adequate historical data can be used to estimate departmental enrollment adjusting for any tolerable deviations. Negative difference between actual department's enrollment and estimated department's enrollment indicates external failure in quality. The estimation of cost of external failure in administrative function can be done using two approaches: Method E, FTE of decline in student enrollment that is due to lack of quality in administrative function; and Method F, loss of income from decline in student enrollment that is due to decline in student enrollment that is due to lack of quality in administrative function

Method E involves the following steps. First, the decline in student enrollment that is due to lack of quality in administrative function needs to be converted into FTE of decline in student enrollment. This is done by estimating the FTE per enrolled student and multiplying it by the number of decline in student enrollment that arises from external failure in quality of administrative functions. Next, the cost for external failure in quality of administrative function can be estimated by multiplying the FTE for decline in student enrollment by salary rate per hour for the faculty doing the administrative function.

Method F involves the following steps. First, determine the proportion of administrative hours relative to total hours. Second, determine the decline in departmental enrollment (external

failure) that is attributable to administrative functions by multiplying the proportion of administrative hours to the decline in departmental enrollment (external failure.) that is attributable to administrative function. Third, determine the total credit hours lost from decline in departmental enrollment (external quality) attributable to administrative function. Finally, multiply the total credit hours lost due to departmental enrollment (external quality) by tuition per credit hour to estimate the cost of external quality.

Illustration for Internal Failure Cost of Administrative Function

This illustration is based on the assumption that the department consists of three faculties A, B, and C, with faculty B holding the head of department position. Let us assume that after assessment of performance and upon approval from immediate supervisor, the performance of the department head is determined to be 93%, hence, 7% internal failure. Table G presents the worksheet that estimates the internal failure cost from administrative function.

Table G: Internal Failure Cost for Administrative Activities for Faculty B

Column A	Column B	Column C	Column D	Column E	Column F
Actual Achivement of Goals/Mile-stones in %	Failure in %	Annual Administrative Hours	Failure in FTE for the Year	Salary Rate per Hour	Annual Internal Failure Cost
93.00%	-7.00%	960.00	67.20	33.65	2,261.28

Column D in Table G is the FTE of failure to achieve goals which is estimated by multiplying failure in percentage to annual administrative hours (Column B x Column C). The annual internal failure cost (column F) is estimated by multiplying FTE of failure to achieve goals (internal failure) to salary rate per hour for faculty B. The monthly internal failure cost can be determined by dividing column F by 12 months.

 Illustration for External Failure Cost of Administrative Function

Method E – FTE for Loss of Student Due to Lack of Quality

The FTE per student for administrative function is calculated by dividing the annual administrative hours by prior year enrollment. Column E is the FTE of decline in department enrollment which is calculated by multiplying decline in department enrollment due to quality failure by FTE per student for administrative function (Column C x column D). The annual external failure cost is estimated by multiplying the FTE of decline in departmental enrollment to salary rate per hour (Column E x Column F). The salary rate per hour is the total annual pay for Faculty B divide by total annual hours of Faculty B ($70,000/2,080).

Table H: External Failure Cost for Research Administrative for Faculty B – Method E

Column A	Column B	Column C	Column D	Column E	Column F	Column G
Prior Year Enrollment	Annual Administrative Hours	Administrative Hour per Student	Decline in Department Enrollment Due to Quality Failure	FTE of Decline in Department Enrollment Due to Quality Failure	Salary Rate per Hour	Annual External Failure Cost
300.00	960.00	3.20	10.00	32.00	33.65	12,921.60

The monthly external failure cost can be estimated by dividing column G by 12 months.

Method F – Loss of Income

To illustrate the estimation of external failure cost for administrative function, the following assumptions for Faculty B are made: the decline in departmental enrollment due to failure in quality for the year is 10 students, the normal credit hour per student per semester is 16 credits, tuition per credit hour is $800, and the proportion of administrative hours relative to total working hours of Faculty B is 0.50 (80/160). Based on these data, the external failure cost from administrative function is estimated.

Table H: External Failure Cost for Research Administrative for Faculty B – Method F

Column A	Column B	Column C	Column D	Column E	Column F	Column G
Decline in Department Enrollment Due to Quality Failure	Proportion of Administrative Hours Over Total Hours	Decline in Dept. Enrollment Attributable to Admnistrative Function	Full time Credit/Student	Total Credit Hour Lost Due to Decline in Dept. Enrollment	Tuition per Credit Hour	Annual External Failure Cost
10.00	0.50	5.00	16	80.00	800.00	64,000.00

Column G of Table H presents the estimated annual quality cost arising from quality failure in administrative function. The monthly cost can be estimated by dividing it with 12 months.

CONCLUSION

The paper shows that the cost of quality in higher education - prevention, detection/appraisal, internal failure and external failure - can be estimated using the activity-based costing model. It is hoped that by translating the magnitude of quality problems into monetary terms, administrators can evaluate the relative importance of these problems and identify opportunities for cost reduction. The information would also be useful in evaluating the institution's success in achieving its quality objectives. It must be noted that a successful quality initiative will not guarantee institutional success. However, it can be argued that poor quality can eventually drive an institution to failure. Information on the cost of quality can help to assess whether an institution is going in the right direction. It can also help to identify changes and improvements that an institution can pursue before staying on the wrong path for too long.

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