

Quality cost in tertiary education: Making internal failure cost visible

DG Gouws
Department of
Financial Management
University of Pretoria

HP Wolmarans
Department of
Financial Management
University of Pretoria

Abstract

Student failure in tertiary education costs taxpayers and donors large sums each year. The cost of quality can be substantial, but it can also be a source of significant savings. This study attempts to provide a framework in terms of which these costs can be quantified through the application of the principles of quality costing in tertiary education. An emphasis on quality increases profitability by increasing student throughput and by decreasing the cost of the provision of services. Significant savings are possible if the educational system could achieve greater success by focusing on adding value to those students that are more likely to succeed. If quality costing is made visible in the South African tertiary education system, it could have a profound impact on the products (students) that are delivered to society.

Key words

Quality costing

Student failure

Internal failure costs

Decreasing costs

Tertiary education

1 Introduction

University failures cost the South African taxpayer a staggering R1, 3 billion per year (Mamaila 2001). This is the amount of government subsidy reported to be wasted by a failure rate of approximately 20% of enrolled students or roughly 125 000 students that fail each year in some or all of the courses for which they enrol at South African tertiary education institutions. In terms of some estimates, between 35% and 40% of students that enrol at the various tertiary

institutions in the country drop out before completing their studies. This percentage compares unfavourably with an internationally acceptable rate of about 10%. Research also indicates that the further the student advances in the study process, the greater the value that is lost if he or she drops out (Van der Merwe and Gouws 2001). An example of this relationship is that a third-year BCom student that fails the final semester and then drops out, represents much more value lost than a first-year student that drops out in the first semester.

There are similarities between a student that has to repeat a course or drops out and a commercial product that is returned by a customer. In the latter case, the product has to be totally reprocessed or replaced before it satisfies the quality specifications of the customer. The principles of quality cost control can be applied to a rejected product to determine the actual cost to the system of the various quality control events at which some semi-completed products are taken out of the system because they do not fulfil the quality specifications. Naturally, this action increases the fixed-cost component that has to be borne by each completed product. As tertiary education institutions implement quality improvement programmes, a need arises to monitor and report on the progress of these programmes. Management needs to know what quality costs are and how they change over time. The question that arises is whether the principles of quality cost control can be applied in a tertiary education environment. However, it has been said that: 'What can be measured, can be managed' (Goldratt 1990:81).

Until quality measures are translated into financial terms, the impact of quality on a company's financial performance cannot be determined (Ansari, Bell, Klammer and Lawrence 1997a:23). Without quality cost information, tertiary education institutions are unable to evaluate the wide-ranging effect of quality.

2 Statement of the problem

Quality costs have received little attention in tertiary education institutions. Because opportunity costs are not usually recognised in accounting records, certain quality costs remain hidden. These hidden quality costs can be significant and should be estimated. Most of the hidden costs are in the internal and external failure categories. Hidden quality costs are opportunity costs that result from poor total quality management (TQM) principles. Traditional management and cost systems do not identify or measure quality costs separately. Instead, quality costs are either ignored or subsumed within the costs recorded in many different parts of a university.

It is generally recognised that tertiary education institutions have a high failure rate, i.e. not all students that initially register for a three-year degree course graduate after exactly three years. Some students only graduate after four or five years, some take even longer, while others drop out and leave the tertiary education system without obtaining a degree or a diploma. The principles of

quality cost and quality management can be applied to this process to identify both the real costs and the opportunity costs of lost output.

A student initially applies for admission to a degree course, succeeds in the selection process and enrolls for the first year of study. When he or she has successfully completed the first-year of study, he or she enrolls for the second year and completes the required courses. When the requirements for the second year have been fulfilled, the third year of study follows and the student obtains a degree and successfully exits the system. The student is then ready to be an economically active member of society, accept an available job and earn a salary.

There are, however, a number of assessment opportunities along the way, any of which may cause the student to take longer than the minimum time to complete the degree course. The students may even drop out of the system. Both these possibilities would bring about increased costs to the system, which means that the unit cost of each graduating student (a “completed product”) would increase.

This study does not focus on the traditional accounting concept of analysing costs for reporting or activity-based purposes. In contrast, it investigates how the principles of quality cost management can be applied to a tertiary education environment. Can the principles of quality cost management be used to, firstly, identify relevant costs per unit, secondly, identify the failure opportunities for students and, thirdly, reveal what the impact is of these failure opportunities on the total cost of the system? This study attempts to indicate in value terms the costs incurred as a result of the absence of better quality control.

3 Perspectives

In both 1998 and 1999, the Faculty of Economic and Management Sciences (E&MS) of the University of Pretoria was the faculty in which the most students enrolled for subject courses. This enrolment is illustrated in table 1, which is based on information provided by the Bureau for Institutional Research and Planning at the University of Pretoria.

Table 1
Number and percentages of courses for which students enrolled in the largest faculties of the University of Pretoria in 1998 and 1999.

	1998		1999	
Faculty	Courses	%	Courses	%
E&MS	38 063	24,8	41 140	25,9
Law	27 503	17,9	27 080	17,0
Natural Sciences	19 840	12,9	22 115	13,9
Humanities	19 429	12,7	21 855	13,8
Engineering	15 008	9,8	14 644	9,2
Others	33 614	21,9	32 023	20,2
Total	153 457	100,0	158 857	100,0

It is evident from table 1 that, on average, the Faculty of Economic and Management Sciences (E&MS) contributed more than 25% of all the subject courses for which students enrolled in 1998 and 1999. Therefore the Faculty could be considered to generate a large proportion of the income (subsidy and tuition fees) that the University received in 1998 and 1999.

For ease of calculation, the years 1998 and 1999 are treated as homogeneous groups. In terms of a product process, this approach is equivalent to focusing on three products, each at a different stage of the process. However, the focus in this instance is primarily on the general process and not on the specific products.

4 Review of relevant literature

With the cost of operating colleges and universities rising faster than the consumer price index, tertiary education institutions have begun to search for new sources of revenue (Junker 1990:23). Over the past number of years, there appears to have been an increase in the failure rate of students at higher education institutions (National Plan for Higher Education 2001:21). While the average failure rate of all undergraduate students is 20% per year, the average for first-time entering students is even higher, namely 25%. Furthermore, there is no evidence that the increase in failure rates (and the concomitant decline in retention rates) will be reversed.

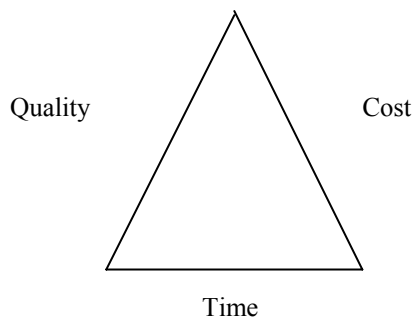
5 Strategic implications of quality costing

The emphasis on quality has caused accountants to rethink many ideas about the cost of quality. It is extremely difficult to measure and report the total cost of

quality. It is clear that some costs are opportunity costs and cannot be known, but only estimated. How can a tertiary education institution determine the cost of losing future income from dissatisfied (failed) students, let alone the cost that could result from these students telling other potential students of their negative experience? Research has revealed that, for consumer products on average, every dissatisfied customer tells 19 others of his or her negative experience (Ansari *et al* 1997a:5)

It is acknowledged that a single concept of cost cannot be appropriate for all purposes. The fundamental notion is that relevant costs should be identified in the context of the particular decision to be made. A system of measuring quality costs is essential for pursuing quality as a strategic goal. It also assists management to achieve other strategic goals, such as reducing costs and shortening the time that students need to complete their studies. For the purposes of strategic decision making, a tertiary education institution requires a method to estimate potential cost savings that result from improved quality management. A quality costing system is necessary for the achievement of key organizational objectives. It can be visualized as illustrated in figure 1.

Figure 1
The Strategic Triangle (Ansari *et al* 1997b)



Quality: A well-designed quality costing system supports effective quality management and assists a tertiary education institution to compete on the quality dimensions of the strategic triangle.

Cost: The total cost of a student includes the cost of tuition as well as all additional costs incurred as a result of quality control problems. This cost includes all costs of the resources expended by tertiary education institutions.

Time: Improving quality to obviate the non-productive time spent as a result of the extension of a student's period of study.

6 Quality costing

Ansari *et al* (1997a:3) define quality costing as the measurement and management of the costs related to satisfying a customer's required level of

product or service performance. A quality costing system makes the cost of 'non-value-added' activities visible. The failure of product performance creates costs for both the entity that produces the product and its customers. In a tertiary education environment, the failure of product performance refers to a failed student (the product) that creates costs for the university/technikon and for industry (the customer). The improvement of student performance reduces these costs, because there is less need to re-educate failed students.

One important aspect of quality is the absence of defects and failures. Defective products result in high quality costs, but, more importantly, they result in dissatisfied customers, which in turn is the worst type of advertisement. Similarly, a student that has failed a course has to be reprocessed (i.e. he or she has to repeat the course) before he or she satisfies the industry's (customer's) specifications.

The term "quality cost" refers to all the costs that are incurred to obviate defects or failures (Garrison and Noreen 2000:892). The objective of quality costing is to assist management to maximize the value that customers receive from a product or service. In a tertiary education environment, failure in respect of a product or service performance creates costs for the following stakeholders:

- The tertiary institution
- The taxpayer
- The student
- The industry

At present the total cost associated with student failure is not accounted for. Quality costs are also not visible in traditional management accounting systems. For example, the costs and income associated with failed students are not accounted for. When quality costs are not identified and accounted for separately, it is impossible for an entity to determine the opportunity cost of poor quality.

Total quality costs can be classified in the categories of prevention, appraisal, internal failure and external failure. In terms of student retention, the quality costs associated with student dropout or failure can be classified as follows:

6.1 Prevention costs

The most effective way to decrease quality costs is to minimize student dropout. Prevention costs refer to any activity that reduces the dropout rate. As more is spent on the prevention of failure (to improve quality), there is a multiplier effect on the reduction of failure costs. The following are examples of prevention costs:

- Cost of recruiting and selecting students
- Cost of bridging courses
- Bursaries for selected students

- Cost of motivating students
- Cost of re-examination

6.2 Appraisal costs

Appraisal costs are costs related to the measurement and monitoring activities that are associated with student retention. Any cost incurred to identify defects in the system or the causes thereof are classified in this category. The following are examples:

- Cost of feedback from students
- Cost of research on dropout
- Cost of implementing a quality costing system

The educational system is more concerned about the successful student than about the unsuccessful student. This discrepancy could be a major reason why appraisal costs have not been more widely used to measure the quality of the system. According to Ansari *et al* (1997a:5), failure costs are much larger than prevention and appraisal costs. The increased spending on prevention and appraisal required to improve quality is more than offset by the reduction in failure costs.

6.3 Internal failure costs

Internal failure costs are costs incurred as result of defects and failures in the system, which contribute towards student failure and dropout. The resulting decline in retention rates is further compounded by the fact that the higher education system is characterized by major inefficiencies in respect of the output of the system (National plan 2001:21). Internal failure costs could include:

- Costs incurred to lecture to students that eventually fail.
- Lost income as a result of lost customers.
- Bad debts as a result of failed students that do not pay their account.
- Opportunity cost as a result of seats being occupied by repeating students.

This research is based on the above-mentioned category of costs.

6.4 External failure costs

External failure costs are of particular concern, because these costs also represent quality problems that impact on students and the industry. While students are studying, they can be considered to be customers. The moment that their studies are completed, they become products and the industry becomes the customer. Moreover, the cost of those that drop out is incalculable, particularly in terms of the moral and psychological damage associated with “failure” (National plan 2001:21).

The external failure costs therefore refer to those costs that are incurred to remedy the defects that are discovered or experienced by the various stakeholders. The following are examples of such costs:

The student as a customer:

- Future tuition fees
- Loss of income during the remedial period(s)

The industry as a customer:

- Additional training costs
- Time lost as a result of products (students) not being job ready

The tertiary education institution:

- Lost goodwill and diminished reputation
- Loss of income as a result of failure

Although the financial impact of lost income is not a cost item that is recorded in traditional accounting systems, it is a quality cost in a very real sense.

The South African taxpayer:

- Government subsidies wasted on university failures

To manage quality effectively, a tertiary education institution should evaluate whether spending is focused on the appropriate quality activities. An effective quality management programme can provide a positive financial return by improving quality through student retention, reducing costs and shortening the time that students study before entering the market. One method of measuring the financial impact of quality initiatives is to compare different categories of quality costs over time. Research indicates that entities that do not have a quality costing system have quality costs between 15 and 20 percent of their revenue. Entities that do have effective quality cost measurement systems normally have quality costs that are less than 5% of their revenue (Ansari *et al* 1997a). The reason for this difference is that when more funds are spent on prevention and appraisal, there is a substantial corresponding reduction in overall failure cost.

7 Aim of this study

The aim of this study is to apply the principles of quality cost management in a tertiary education environment. More specifically, the quality cost of the failure of students that study at the largest faculty of a large South African university is investigated. The primary question to be answered in this study is:

How can the principles of quality costing be applied to student performance at a tertiary education institution?

Secondary questions to be answered include the following:

- 1 What percentage of the students fail in each of the first, second and third year of study?

- 2 What is the current costing practice in the Faculty concerned and how does it work?
- 3 What is the total annual cost of internal failure in the Faculty concerned?

Answers to these questions could be of value to the managers of the system of student throughput. Other faculties may also benefit from the application of the principles of cost accounting in the management of the performance of their students. The findings could also have implications for the financial system by means of which the performance of these faculties is measured. Furthermore, the findings may have implications for the implementation of retention strategies that are aimed at improving the success rate of students once they have gained admission to specific courses.

8 Research methodology

The pass rates for various subjects that students study at the first-year level in the Faculty of Economic and Management Sciences were examined. The pass rates were provided by the Bureau for Institutional Research and Planning at the University of Pretoria (BIRAP 2001). The pass rates for all first-year students were added per semester to determine the average failure rates for students at the various identifiable failure opportunities during a semester. These failure opportunities comprise the discontinuation of study, not obtaining admission to an examination, failing the examination and failing the re-examination. Naturally, students that did not fail, passed the semester. This process was repeated for the second semester of the first year as well as for the first and second semester of the second and third year of study. The financial statements of the University of Pretoria for 1998 and 1999 were also studied to determine the average cost per student in the Faculty of Economic and Management Sciences.

9 Student pass and failure rates

When students enrol for a semester course, they are permitted a specified period in which they may discontinue the course without being liable for the fees for the course. This represents the first failure opportunity of the course. In the course of the years that they studied (i.e. 1998-1999), students had to achieve a satisfactory performance in order to gain admission to the examination. Students that could not fulfil this requirement also dropped out. This represents the second failure opportunity. Students that wrote the examinations, either passed, failed or were given permission to write a re-examination. Failing the examination represents the third failure opportunity. Students that wrote the re-examination, either passed or failed, which makes this the fourth failure opportunity. Students that did not fail along the way, passed the degree course and can be regarded as successful. Therefore the four failure opportunities investigated in this study are:

- Discontinuation of studies (Disc)
- Failure to gain admission to the examination (BB)
- Failure of the examination (Failex)
- Failure of the re-examination (Failre)

High dropout rates are unacceptable and represent a huge waste of resources (National plan 2001:21). The number of enrolments for semester courses and the number of failures at the various failure opportunities for courses offered in both the first and the second semester at the first-year, second-year and third-year level in 1998 are presented in table 2. Adjustments had to be made for year courses, such as the courses offered by the School of Accountancy at the second-year and third-year level. These courses were counted in both the first and the second semester in order to be able to compare them with semester courses that run for half a year only.

Table 2
Total enrolments and failures for first-year, second-year and third-year courses for both semesters of 1998

	Total	Disc.	BB	Failex	Failre	Pass
Year 1, Semester 1	10766	417	423	1018	857	8051
%	100,0	3,8	3,9	9,5	8,0	74,8
Year 1, Semester 2	10130	230	696	921	352	7931
%	100,0	2,3	6,9	9,1	3,5	78,2
Year 2, Semester 1	5117	177	283	436	175	4046
%	100,0	3,5	5,5	8,5	3,4	79,1
Year 2, Semester 2	4705	111	201	274	118	4001
%	100,0	2,4	4,3	5,8	2,5	85,0
Year 3, Semester 1	3649	47	146	201	202	3053
%	100,0	1,3	4,0	5,5	5,5	83,7
Year 3, Semester 2	3368	42	142	129	143	2912
%	100,0	1,2	4,2	3,8	4,3	86,5
Total	37735	1024	1891	2979	1847	29994
%	100,0	2,7	5,0	7,9	4,9	79,5

It is evident from the content of table 2 that the pass rates for the first-year courses in both semesters (74,8% and 78,2% respectively) are lower than the pass rates for the second-year courses (79,1% and 85,0%), which are lower than

the comparable figures for the third-year courses (83,7% and 86,5%). It appears that the success rate increases as weaker students are weeded out in the preceding semesters of a three-year degree course. There is also a higher pass rate in the second semester of each year of study than in the first semester.

In the first semester of 1998, students enrolled for a total of 10766 courses at the first-year level, while they enrolled for only 5117 courses at the second-year level and 3649 courses at the third-year level. However, these enrolment figures should not be considered to represent a significant decrease in student numbers, because students are required to enrol for six subjects in the first-year, four in the second year and three in the third year of study. For purposes of comparison between various years of study, the percentages of students that fail at the individual failure opportunities are more important than the exact number of courses for which the students enrolled. For all the failure opportunities over the six semesters concerned there appears to be a general trend towards a decreasing number of failures as the weaker students drop out.

It is also clear from table 2 that there were fewer enrolments for the second-semester courses than for the first-semester courses for each of the years of study. In the first year of study the decrease was 5,9%, in the second year 8,1% and in the third year 7,7%. Therefore, on average for 1998, 7,2% less students enrolled for courses in July than the number that enrolled in January.

Table 3 presents the comparable figures for 1999, namely the number of failures at the various failure opportunities for courses offered in both semesters at the first-year, second-year and third-year level.

Table 3
Total enrolments and failures for first-year, second-year and third-year courses in both semesters of 1999

	Total	Disc.	BB	Failex	Failre	Pass
Year 1, Semester 1	11627	496	536	1305	1158	8132
%	100,0	4,3	4,6	11,2	10,0	69,9
Year 1, Semester 2	10375	196	917	618	543	8102
%	100,0	1,9	8,8	6,0	5,2	78,1
Year 2, Semester 1	6236	132	414	650	243	4797
%	100,0	2,1	6,6	10,4	3,9	76,8
Year 2, Semester 2	5658	73	384	386	120	4695
%	100,0	1,3	6,8	6,8	2,1	83,0
Year 3, Semester 1	3903	47	170	241	127	3318
%	100,0	1,2	4,4	6,1	3,3	85,0

Table 6 (continued)						
Year 3, Semester 2	317	31	157	195	92	3342
%	100,0	0,8	4,1	5,1	2,4	87,6
Total	41616	975	2578	3395	2283	32385
%	100,0	2,3	6,2	8,2	5,5	77,8

Table 3 indicates that in 1999 the pass rates for the first-year courses in both semesters (69,9% and 78,1% respectively) were also lower than that for the second-year courses (76,8% and 83,0%), and lower than the pass rates for the third-year courses (85,0% and 87,6%). Once again it appears that the success rate increases as weak students are weeded out in the preceding semesters. The increased success rate is also evident if the failure rates at the failure opportunities that are analysed for all the semesters of 1999. Similar to 1998, it appears that there is a general trend of fewer failures as students progress in their studies.

Table 3 also reflects that the decrease in the number of enrolments from the first semester to the second semester of 1999 was 10,8% for courses at the first-year level, 9,3% for courses at the second-year level and 2,2% for courses at the third-year level. On average for 1999, 7,4% fewer students enrolled for courses in July than the number that enrolled in January.

The average pass rate per semester in 1998 and 1999 can be calculated from the data in tables 2 and 3. For these two years, the average pass rate for the first semester was 78,2% (with a failure rate of 21.8%). Considering that, on average, there were 7.3% fewer enrolments for all second-semester courses, it is not surprising that the average pass rate in the second semester was somewhat higher at 83.1% (with failure the rate lower at 16.9%). A comparison of tables 2 and 3 also reveals that the overall pass rate for all courses declined somewhat over the two years from 79,5% to 77,8%. This could be due to any of a number of reasons. However, if the principle of a continuously improving process are borne in mind, the pass rate could be expected to rather increase over time.

10 Income and expenditure of the faculty of economic and management sciences

The various sources of income of the Faculty of Economic and Management Sciences in the years 1998 and 1999 and the expenditure in these years were analysed. The results are summarised in tables 4 and 5. The impact of pricing decisions and inflation is ignored in the figures presented.

Table 4
Sources of income of the Faculty of Economic and Management Sciences in 1998 and 1999

	1998 R'000	%	1999 R'000	%
Subsidy	52 263	56,4	52 614	57,9
Tuition fees	38 590	41,7	36 729	40,5
Other	1 734	1,9	1 430	1,6
Total income	92 587	100,0	90 773	100,0

It is apparent from table 4 that government subsidy (and therefore the taxpayer) finances approximately 57% of the cost of a student's studies. Approximately 41% of the cost is borne by the student's parents (or sponsors) while the university contributes about 2% from other sources.

Table 5
Expenditure of the Faculty of Economic and Management Sciences in 1998 and 1999

	1998 R'000	%	1999 R'000	%
Direct academic costs	40 789	100,0	44 942	100,0
Operating costs	3 836	9,4	3 709	8,3
Salaries	36 602	89,7	40 636	90,4
Other	351	1,9	597	1,3
Contribution to overheads	51 798		45 831	
Total expenditure	92 587		90 773	
Contribution margin to University overheads	56%		50%	

It can be deduced from table 5 that the Faculty contributes approximately 53% of its income towards the University's overheads. Although it can be argued that indirect costs should be allocated to the various faculties in accordance with each faculty's cost drivers, such an allocation model was only introduced in 2000. In line with general practice, direct costs were deducted from income received and the remainder transferred to cover the University's overhead costs.

The assumption is made that total income equals total costs. The assumption is true for this faculty as a result of the transfer of all residual income to cover University overheads. It should, however, also be acknowledged that some of

the overheads are probably spent on recruitment (for instance by the Department of Marketing Services) and initial selection.

11 Cost escalations as a result of courses failed

Prevention and detection of and dealing with defects (or failure) cause costs that are called cost of quality. The term “quality cost” refers to all the costs incurred to obviate defects or that are incurred as a result of failure. An important aspect of quality is the absence of failure and defects.

The traditional zero defect concept assumes that hidden quality costs exists only for units (students) that fall outside the specification limit. The “Taguchi Loss Function” (Albright and Roth 1992) assumes that any variation from the target value of a quality characteristic causes hidden quality costs. Hidden quality costs increase exponentially as the actual value deviates from the target value. This function was not used, because the particular tertiary education institution had not set a target value for the period studied. Such a target value could be introduced to manage and cost student dropout.

To determine the average cost per course per student for 1998, if there had been zero failure, the total cost of R92,587 million in table 5 was divided by the total number of courses (37 735) in table 2. The result of approximately R2 453 was applied to all courses. Of course, it could be argued that the courses at the third-year level are more expensive to present than those at first-year level, and that large classes cost less per student to present than small classes, but the assumption of an equal cost per course had to be made as a consequence of a lack of more detailed information and to illustrate the escalation of costs. The escalation of the costs per course per semester in 1998, as a result of the number of failures at the various failure opportunities, is presented in table 6. The formula for calculating the effect of each failure opportunity on the increasing cost is as follows:

Cost per zero failure rate * number of courses per year of study (see table 2) /
(number of courses per year of study – cumulative failures up to that failure opportunity)

For example: For year 1, semester 1, the number is derived as follows (see also table 2):

$$10766 * 2453 / (10766 - 417) = 2552$$

Table 6
Escalation of cost per course per semester at the various failure opportunities in 1998

	Costs per zero failure	Disc	BB	Faillex	Failre	Increased cost per unit (%)
Year 1, Sem 1	R2 453	R2 552	R2 661	R2 965	R3 280	33,8
Year 1, Sem 2	2 453				3 133	27,7
Year 2, Sem 1	2 453				3 103	26,5
Year 2, Sem 2	2 453				2 883	17,5
Year 3, Sem 1	2 453				2 933	19,6
Year 3, Sem 2	2 453				2 836	15,6
Average	R2 453	R2 522	R2 659	R2 908	R3 087	25,8%

In table 6, the cost increases for all failure opportunities can be calculated in a similar way. The most important conclusion to be drawn from table 6 is that the average cost escalation as a result of the high failure rate is as high as 25,8%. The total cost in terms of expenditure that has been incurred for students that eventually failed, can be termed a quality cost of dropout and calculated as follows:

Quality (hidden) costs in terms of dropout:

$$\frac{25,84}{125,84} \times 92\,587\,000 = R19\,008\,110$$

The average cost per course per student for 1999 has been calculated, in a similar way, to be R2 181. The escalation of this cost at every failure opportunity and for every semester is presented in table 7.

Table 7
Escalation of cost per course per semester at the various failure opportunities in 1999

	Costs per zero failure	Disc	BB	Failex	Failure	Increased cost per unit (%)
Year 1, Sem 1	R2 181	R2 278	R2 393	R2 729	R3 118	43,0
Year 1, Sem 2	2 181				2 792	28,0
Year 2, Sem 1	2 181				2 835	30,0
Year 2, Sem 2	2 181				2 626	20,4
Year 3, Sem 1	2 181				2 563	17,5
Year 3, Sem 2	2 181				2 491	14,2
Average	R2 181	R2 234	R2 385	R2 618	R2 803	28,5%

It follows from table 7 that the average cost escalation as a result of the high failure rate is as high as 28,5%. The total cost in terms of expenditure that has been incurred for students that eventually fail, can be termed a quality cost of dropout and can be calculated as follows:

Quality cost in terms of dropout:

$$\frac{28,5}{128,5} \times 90\,773\,000 = R20\,124\,374$$

It is clear from tables 6 and 7 that student dropout adds substantially to the increased cost per unit. Starting with a rate of 34% in the first semester (first year) of 1998 (43% for 1999), it decreases to 16% in the final semester (third year) (14% for 1999). The reason for the lower dropout is that the students are adapting to failures in the education system. It is unacceptable to blame the student (customer) for the failures of the education system. On average, the failures in the system added 25,8% (for 1998) and 28,5% (for 1999) to the cost per course per semester. Based on the information contained in table 4, and allocated proportionally, these increases are being financed as indicated in table 8.

Table 8
Providers of funding for the cost increases as a result of courses failed

	1998	1999
Government subsidy	R10,7m	R11,6m
The student	7,9	8,2
The university	0,4	0,3
	R19,0m	R20,1m

It could be argued that the cost of failure should be borne by the providers of funding. The taxpayer bears the largest part of this cost increase.

12 Subsidy forfeited as a result of student failure

The scale of the inefficiencies in the tertiary education system requires the inclusion of the output of graduates in the new funding framework (National plan 2001:21). The financial impact of forfeited subsidy and forfeited income from student fees as a result of student failures is also not accounted for at present in traditional accounting systems. In terms of a quality costing system it is a real and important quality cost.

Table 9 presents the average subsidy and the average tuition fees received per semester course in 1998 and 1999. The average subsidy is based on the assumption that no subsidy is realized on the dropout number at the Disc failure opportunity, in other words if a student discontinues his or her studies early in the semester. The average tuition fee is based on the experience of the Faculty that one-third of the courses that were discontinued were discontinued early enough for the students not to be liable for fees.

Table 9
Average subsidy and average tuition fee per course per semester received in 1998 and 1999

Year	Average subsidy	Average tuition fee
1998	R1 567	R1 032
1999	R1 441	R 890

Table 10 reflects the loss of subsidy as a result of student failure in 1998. The calculations are based on the provisions of the current subsidy formula that 50% of the subsidy per course is earned when a student enrolls (and does not discontinue) and 50% when the student passes the course (BINEB 2001). If a student enrolls, but does not pass the course, 50% of the subsidy is forfeited. Table 11 indicates the comparable forfeiture of subsidy as a result of student failure in 1999.

Table 10
Average subsidy cost (forfeited) as a result of student dropout in 1998

	Courses failed	Early Disc	Failed courses subsidized	50% subsidy	Subsidy forfeited
Year 1, Sem 1	2 715	417	2 298	783.5	1 800 483
Year 1, Sem 2	2 199	230	1 969	783.5	1 542 712
Year 2, Sem 1	1 071	177	1 894	783.5	700 449
Year 2, Sem 2	704	111	593	783.5	464 616
Year 3, Sem 1	596	47	549	783.5	430 142
Year 3, Sem 2	456	42	414	783.5	324 369
Total	7 741	1 024	6 717	R783.5	R5 262 770

Table 11
Average subsidy cost (forfeited) as a result of student dropout in 1999

	Courses failed	Early Disc	Failed courses subsidized	50% subsidy	Subsidy forfeited
Year 1, Sem 1	3 495	496	2 999	720.5	2 160 780
Year 1, Sem 2	2 273	196	2 077	720.5	1 496 479
Year 2, Sem 1	1 439	132	1 307	720.5	941 694
Year 2, Sem 2	963	73	890	720.5	641 245
Year 3, Sem 1	585	47	538	720.5	387 629
Year 3, Sem 2	475	31	444	720.5	319 902
Total	9 231	975	8 256	720.5	R5 948 448

Tables 10 and 11 indicate that the subsidy forfeited (the opportunity cost) as a result of failed courses amounted to almost R5,3 million in 1998 and R5,9 million in 1999. These costs are not accounted for.

The difference between the information contained in table 8 and that contained in tables 10 and 11 is that the values of the figures in table 8 are based on incurred expenditure. A certain percentage of this expenditure did not lead to value for money as a result of the failure of some students. On the other hand, tables 10 and 11 indicate additional income (subsidy) that could have been earned if the students did not fail.

13 Potential bad debt as a result of student attrition

One of the side effects of student failure is that it could have a major impact on the amount of bad debt outstanding. If a student that failed a course is still in the

system, then repeats the course and intends to complete his or her studies, there are mechanisms in place to encourage the payment of the tuition fees. However, if a student drops out and does not pay his or her account, it could lead to an increase in the bad debt of the University.

The national average for undergraduate students that drop out of the higher education system each year is 25% (National plan, 2001:21). The 25% (used as an approximation for the Faculty of Economic and Management Sciences) could be allocated proportionally to the first-year, second-year and third-year of study, the number of lost courses calculated as well as the total amount of funds involved. Table 12 indicates the cost of student attrition in 1998 while table 13 indicates the cost in 1999.

Table 12
Tuition fees forfeited as a result of student attrition in 1998

Year	Average semester courses	% attrition	Courses forfeited	Average tuition fee	Total attrition cost
1st	10 448	11	1 149	1 032	1 185 768
2nd	4 911	7	344	1 032	355 008
3rd	3 509	7	246	1 032	253 872
		25%			R1 794 648

Table 13
Tuition fees forfeited as a result of student attrition in 1999

Year	Average semester courses	% attrition	Courses forfeited	Average tuition fees	Total attrition cost
1st	11 001	11	1 210	890	1 076 900
2nd	5 947	7	416	890	370 240
3rd	3 860	7	270	890	240 300
		25%			R1 687 440

It is clear from tables 12 and 13 that the potential cost as a result of bad debt that results from students dropping out of the system may be significant, although it is not as high as the other costs related to internal failure.

14 Total internal failure cost

The total of the three components of the internal failure cost of the educational system that have been identified (and could be calculated/estimated), are presented in table 14.

Table 14
The total cost of internal failure of the educational system in 1998 and 1999

	1998	1999
Potential bad debts	R1 794 468	R1 687 440
Lost subsidy	5 262 770	5 948 448
Quality cost (dropout)	19 008 110	20 124 374
Total	R26 065 528	R27 760 262

It is clear from table 14 that the average cost of internal failure of the educational system was approximately R27 million in 1998 and 1999. A sound argument can therefore be made for the formulation and implementation of a retention strategy that aims to prevent those students from enrolling that are most likely to fail, retain those that are admitted to a course and reduce the overall costs by increasing the pass rate.

15 Implementing a quality cost strategy

Before a quality cost strategy can be implemented, a root cause analysis should be undertaken (Ansari *et al* 1997b:7). A root cause analysis determines the underlying cause for internal and external failure and assists an enterprise to identify the corrective measures that are needed. The findings could be used to redesign work processes in order to obviate the recurrence of similar problems or reduce the incidence of such problems.

The strategy for using quality cost should incorporate the following:

- 1 Attack failure costs directly.
- 2 Invest in the appropriate prevention strategies to bring about improvement.
- 3 Reduce appraisal costs in accordance with the results achieved.
- 4 Continuously evaluate and redirect prevention efforts to gain further improvement. Prevention is better and cheaper than cure.

15.1 Arguments in favour of a retention strategy

The following are the most important arguments in favour of a retention strategy:

- Working in a zero-defect quality framework will ensure that the greatest possible number of students that enrol will complete their studies in the minimum time.

- If a student fails during a particular year, it involves wastage of the money that is spent by the community (the student's sponsors) and the Government (in the form of subsidy).
- A failed student also represents a loss of, or at least a postponement of, potential income for the University in future years.
- If a student takes one more year to graduate, it implies that that student loses potential income for a year while not being an economically active worker for the year that is lost.

16 Conclusions and recommendation

This study attempts to make certain aspects of quality costs visible in the tertiary education environment. These costs have been found to be significant in terms of the total cost. There is a need to monitor and report on the progress being made in respect of implementing quality improvement programmes. Authorities should know what quality costs are and how they change over time. Reporting and measuring quality performance is essential to the success of total quality management. It is therefore necessary that retention strategies (which would reduce failure while standards are maintained) be put into operation to ensure that dropout is limited to the minimum.

Retention strategies should also become part of the critical performance areas of academic departments. It is proposed that departments should be evaluated in respect of their strategies for retention of students, similarly to their evaluation in respect of research output. The costs in a tertiary education institution are relatively fixed. Salaries generally change little in the course of the study period. It is therefore difficult to find a break-even point in terms of student retention. In practice, the person responsible for costs and income is also responsible for reducing costs and increasing income. Each lecturer responsible for a course should be part of the strategy to reduce costs. Lecturer efficiency in terms of student retention can be related to quality costs.

17 Areas for further research

Prevention costs, appraisal and external failure costs are not addressed in this study. For example, the cost of external failure includes the cost to the community of a student that graduates but does not fit the specifications of the market. This situation would be evident in cases in which employers find the need to "retrain" employees before they are given productive work, or if a student remains unemployed for an abnormally long period. Future studies could be undertaken to determine this cost of external failure, possible ways to decrease the cost and the implications of possible experimental interventions in aligning education to a greater extent with the needs of the marketplace.

When the initial study has been completed and is proven to be successful, it is possible that other faculties may express a similar need and request that a

similar analysis be undertaken to improve the throughput of their students. If a system can be developed in terms of which one tertiary education institution is able to successfully manage the throughput of its students, other similar institutions may follow suit. This progression may lead to the principles of quality costing having a major impact on the improvement of successful throughput at South African tertiary education institutions.

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