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**Institutional Perspectives for On-Line Learning: Policy and Return-on-Investment**

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## 1. Introduction

Most Western universities are currently introducing on-line learning facilities, primarily via use of WWW functionalities. When asked why, the most common answer is that they cannot *not* do it, as everybody else is doing it. Although specifics of their particular situations influence their decision making, a common reason seems to be not to loose (distance learning) students as those students' expectations include having on-line facilities. In addition most universities want to open new markets for (distance learning) students by offering new opportunities for groups who did not consider taking university courses before. Thus, economic reasons are a prime reason for the introduction of on-line learning. In addition quality and efficiency reasons are mentioned as well, although there is a general understanding that there is a long way to go before quality or efficiency improvement will show up. From a pure economic or return-on-investment (ROI) perspective, the equation still has to be worked out. It is generally agreed that investments in on-line learning are necessary. Return-on-investment will (hopefully) come later. However, even if implicitly, decision makers balance project budgets with potential benefits. Instructors balance costs in terms of energy and time with possible payoff. Return-on-investment guides decision making even if the actors involved do not identify it as such.

In this article an analysis will be presented about why, at the institutional level and in particular at the university level, on-line learning is being introduced. This will be done in the context of a general design approach to steer innovation in education. Costs and financial-benefit issues will be explored, including costing models, measurement of productivity increases, and return-on-investment. Although the article focuses on the university context, it can be predicted that similar issues will soon confront secondary schools.

## 2. Innovation and design

Introducing an institution-wide on-line learning approach is an innovative activity as well as a (re)design of the teaching-learning environment of an institute. Both aspects have to be taken into account when seriously considering a move from a traditional teaching-learning base towards the inclusion of an on-line learning approach.

There is a vast amount of literature about educational innovation and change. Major success factors in educational innovation and change processes are the positive involvement and support of the leadership and management of an institution; an already existing innovative culture within an institution; and the fact that each innovation takes time in order to grow, find its anchors and flourish. Technology push is one of the main initiators for change. Bates (1999) mentions 12 important aspects when managing technological change. He refers to (a) the importance of institutional vision, (b) strategies for inclusion, (c) new teaching models, (d) 'laisser-faire' planning, (e) project management, (f) technological and people infrastructure, (g) strategies for computer access, (h) faculty support, (i) funding, (j) collaboration and consortia, (k) new organizational structures, and (l) organizational models. Each of these factors is important, but at the same time their wide range illustrates the complexity of the process. Another interesting perspective comes from the viewpoint of institutional change. Fisser (1999) identifies six major categories of factors: (a) environmental pressures with factors such as new market, part-time students, lifelong learning, and flexibility; (b) technological developments; (c) institutional conditions; (d) educational developments; (e) cost reduction/cost-effectiveness; and (f) support facilities.

Identifying change factors is one element of the change process. Influencing and controlling them are much more difficult issues. It is unlikely to expect that it is possible to handle all of the potential change issues at the same time. Construction of an implementation strategy with identifiable phases as well as an assessment of influential factors for each of the phases will improve the control and the understanding of the change process. Policy to support this implementation process is critical.

A perspective to better understand an underlying change process is to look at it from a design-oriented point of view. A design approach can focus on the major results of the change activity: the new products and the new processes. New products include new kinds of learning and instructional material, as well as new instructional and learning processes.

Design is a very generic process. A design activity can be described referring to three so-called *activity spaces*: (a) the consensus space, (b) the task space, and (c) the implementation space (Moonen, 2000a). In the consensus space stakeholders negotiate the specifications of what has to be designed. The context, history, culture and what is already available as experiences and as products and processes, are determining factors. As soon as a consensus is reached and global specifications are agreed upon, these specifications form the starting point for the development of the products and processes in the task space. According to what has to be developed and the available expertise, particular methods will be used. The result of the activities in the task space will be products and processes, preferably in a format that can be further adapted in the implementation space. The adaptable products and processes will then be implemented in a real situation taking into account particular specifics determined by its implementation context.

A major aspect in such an approach, in particular from an institutional point of view, is to determine who the major stakeholders are in each space, as well as who will take the crucial decisions and in particular, based upon what kind of criteria. In the following section, we focus upon crucial decisions in the consensus stage.

## 3. Factors to stimulate the introduction of on-line learning

The introduction of on-line learning (initially via e-mail and computer conferencing) has already been happening for more than a decade, most often on the basis of an individual decision made by a faculty member. In addition, on-line learning is growing very fast in popularity, especially within the management of university institutions. When asking decision makers why their institutions are introducing on-line learning the major argument is that 'one cannot not do it, as everybody else is doing it'. In a more detailed analysis three kind of reasons, with a different emphasis, can be extracted (Collis & Moonen, 2000): (a) not to loose students (economic argument), (b) improve the quality of the instructional environment (quality argument), and (c) improve the efficiency of the institutional environment (efficiency argument). The emphasis on each of these reasons is different with respect to the function of the person interviewed. Managers of institutions emphasize the 'not to loose students' argument, while instructors and students emphasize the 'improve the quality' argument. All of the actors in the on-line learning situation (including the students) are interested in the efficiency argument, each from their own perspective: managers want to improve the financial basis of the institutions, instructors want to reduce their workload and students want to reduce their throughput time. However, each of the actors has doubts about the feasibility of the efficiency argument.

The main criterion of success will be the eventual incentive for the actor involved as a result of the change process. Such incentives can be formulated in general terms depending upon the actor involved. For an institution the goal for the introduction of on-line learning, and therefore a main criterion of success, will be (at least) a stabilization and preferably an improvement of the financial basis of the institution. The main criterion for the average instructor to be fully engaged in the change process will be a confirmation and strengthening of his/her faculty position, a potential reduction of the workload and an improved quality of his/her tasks. The student will expect improved quality of the teaching-learning process and efficiency gains, the latter often in terms of more flexibility in time and place of participation. From a global perspective, each of the main actors wants a tangible incentive as a result of the change process. The instructors and students want to see the incentive in a short time. The institution will probably accept a longer-term perspective. However, for each of the actors, the change process and thus policy related to this process, has to be incentive-based.

Based upon these perspectives, a discussion about how and why to introduce on-line learning should take into account a number of dimensions: (a) the 'spaces' in the design activity, (b) the decision-making arguments and criteria, and (c) the main categories of actors. Each dimension has thereby a number of components. As noted, there are three design spaces to consider: consensus space, task space, implementation space. And there are three main arguments: economic argument, quality argument, efficiency argument. And, finally, there are (at least) three main actors: institution, instructors, and students. Thus, a 3x3x3 matrix (design space versus arguments versus actors) constitutes the framework for our analysis. In this framework each combination of components should be analyzed in terms of actions to improve the introduction and use of on-line learning (the design component), be related to the potential incentives (the argument component), for each category of actors (the actors component).

In order to simplify such an analysis, one can argue that the major involvement of the different actors will each be concentrated around a specific perspective. The influence of the institutional management will be maximized in the consensus space of the design process, when the decision making about the introduction of an institution-wide involvement in on-line learning has to be made. The contribution of the instructors and in particular the instructional designers will be maximized in the task space when the specifics of the instructional and learning materials and processes have to be determined and worked out into products. In the implementation space the involvement of the instructors and the students will be maximum as in this space the products and processes produced have to used in practice. For each actor however, the three arguments (economic, quality and efficiency) have to be taken into account, also in their interrelationships.

As the focus of this article is on the institutional perspective, and assuming that the main impact of the institution in the change process will occur in the consensus space of the design activity, the remainder of the article will concentrate on the arguments in the consensus space from an institutional perspective. In the following section main activities in the consensus space of the proposed design strategy are discussed.

## 4. Activities in the Consensus Space

Activities in the consensus space are a first crucial step in an innovative and change process. Such activities should concentrate around discussions among the decision-making members of an institution--the management--and should result in a satisfactory answer to the 'why on-line learning?' question; agreed-upon criteria in order to eventually measure its successful implementation; and functional specifications about how to work out the necessary steps, processes and products to be used in a successful implementation effort.

Crucial in this respect is to identify and agree upon the success criteria. Success criteria can be of a broad range, for example from specific financial gains to, less measurable, public relation impact.

Most institutions have, at least on paper, a consensus and explicit statements about their overall vision and the mission. Visions are, almost by definition, nicely phrased but at the same indicate the central commitment of an organization. Mission statements are further worked out in a strategic plan. It is noticeable that, in particular in newly published strategic plans, institutions are giving explicit references to the use of new technologies in their educational approach. Edith Cowan University in Australia, for example, states in its strategic plan: 'In pursuit of its mission, Edith Cowan University will provide high quality teaching, utilizing new educational and communication technologies' (Edith Cowan University, 1998, p. 8). And Southern Cross University (also in Australia) in its *On-line Learning Strategic Plan*, states that ‘budget constraints will lead to greater reliance on technology as an alternative to developing new physical infrastructure for on-campus learning’ (Southern Cross University, 1999, p. 17). Interesting is the remark made in that plan that ‘on-line learning will also encourage innovation, by placing new tools and methods in the hands of the staff and students of the University’ (p. 18).

But visions and strategic plans have to be worked out and specific objectives and criteria for the assessment thereof have to appear. As indicated in Section 2, and in addition to the more specific criterion of an incentive-based approach, there are many issues for which explicit criteria and methods have to be formulated. As an example, a discussion document for the reshaping of the University of Western Sydney mentions explicitly objectives ‘to improve the quality of services and educational experiences’ and ‘to provide these services in a coordinated and cost efficient way, building on all elements of best practice’ (Reid, 1999, p. 2). In the case of the economic argument there are issues about costs, and financial benefits. In the case of the quality argument there are issues in relation to quality measurement and effectiveness. The efficiency argument combines the previous ones and relates to issues with respect to productivity and return on investment.

In the following sections some of the issues relating to costs and financial benefits, and issues about quality, effectiveness, efficiency, return on investment and productivity will be further discussed.

## 5. Cost and financial benefit issues

As most universities are (partly) funded on the basis of the number of students, universities are competing to maintain or enlarge their student enrollment. Most universities are organized, in particular in relation to their physical and personnel infrastructure, according to a projected minimal number of students. When that number of students goes down each institution reacts, striving for stability, predictability and legitimacy, and in particular, institutional survival. Declining student numbers are seen as a threat. In addition, in many Western countries governmental funding for universities is in a slow but steady decline. That threat is not only the problem of individual universities. In some countries, and mainly because of demographic reasons---a typical example is Japan--- the university system expects the overall student enrollment will reduce dramatically in the near future.

In that context universities are looking for new markets, in particular to attract student populations that were not focussing on or not able to attend university education before. The need for lifelong learning and retraining feeds this potential. For example, the Hyogo University for Teacher Education in Japan is expanding its regular program with distance education. When asked why, the vice-president of the university states it very clearly: ‘in order to survive’. The University of Twente, and in particular the Faculty of Educational Science and Technology, has introduced on-line learning through its innovative TeleTOP WWW-based course-management system, making its regular program also available for part-time and distance learning students. But also in Australia, with the exception of the so-called *sandstone* universities, most other universities are introducing on-line learning to expand the student population.

Another new market for universities is that of foreign students. For a long time, and in particular in the English speaking world (UK, USA, Australia), universities have been very active in this market segment. Perth's Curtin University, for instance, grew 15,4 per cent from 1997 to 1998 in foreign students enrollment, from 4764 to 5500 students. However, other countries, in particular in Europe but also Japan, are discovering this market as well, thereby responding to the growing need in developing countries who are seeking for an enhancement of their educational systems and further economic development (Jongbloed, Maassen, & Neuve, 1999).

Another reaction by universities is the formation of strategic alliances. This is particularly the case for smaller or less prestigious universities. The University of Twente has formed a strategic alliance with other European partners in what is called a consortium of 'Entrepreneurial Universities'. In the Kyoto area of Japan 35 universities have formed a joint committee in order to discuss how to strengthen their positions. Even prestigious American Universities such as MIT, University of Berkeley, University of Stanford, University of British Columbia and 22 others promote their distance learning courses in a single on-line catalogue.

The basic issue of all of these activities is to enlarge the student population in order to balance budgets and avoid major restructuring, or even closing down institutions. More careful monitoring of spending and costs have become a very important issue. In particular the cost-benefit analysis of an innovative change process introducing on-line learning is crucial. The reasoning in this respect is straightforward. The financial benefits of opening a new market attracting new students are obvious and directly visible through the growth in enrollment tuition. However, an institution has also to be aware about the costs of such an operation, particularly when new instructional methods imply the use of new kinds of media and technologies. Ignorance about costs can become financially very risky.

Explicit awareness about the cost of providing instruction at the university level is a well known issue in the university *distance* education sector (Bates, 1995; Rumble, 1998). Because of lack of experience in the traditional university sector, but also because of the combined activities of staff members as instructors, researchers *and* course designers, traditional universities are much less aware of explicit costs of specific courses. As many are now starting to provide dual or mixed mode facilities, the financial consequences are unexplored territory. An interesting study in this respect is presented by Taylor and White (1991). They describe the transition from single to mixed mode, starting from a *distance learning situation.* Their analysis shows that 'cost controls are in the hands of the teaching institution which can vary costs by producing different standards of instructional materials, just as they can vary face-to-face teaching costs by altering the contact time'. They conclude that 'the crucial point is that mixed-mode teaching is not readily available on a cost-effective basis for non-distance education institutions. Only if the materials are already prepared as part of an institution's external teaching program or if already prepared materials can be purchased at less than full cost recovery is the option available on a comparative cost basis' (p. 36). This was written in 1991. However, a more recent analysis by Bates (1999) concludes that introducing technology in (higher) education will not save money. In a recent report about the costs of networked learning (Bacsich, Ash, Boniwell, & Kaplan, 1999), the authors indicate that 'the key comes from the earlier (and still ongoing) debates about finance and planning for

Information Technology. It is for educators (not planners or finance staff) to imbue and enliven financial and planning tools with a modern educational viewpoint' (p. iii). Not only a careful cost analysis of the new situation whereby traditional universities add an on-line learning component to its activities is necessary, but also an adequate positioning of the expected details of such an analysis in the broader context of educational and managerial decision making.

In the past, print material was the most important carrier of the instructional message. This situation has dramatically changed over the last decade in two perspectives: (a) a broad range of information and communication technologies (ICT) are being used as carriers for the instructional messages, and (b) teaching for students off-campus is no longer the unique task of distance learning institutions; many traditional universities now are providing on- as well as off-campus instructional and learning facilities. In The Netherlands, for example, the Minister of Education has announced (September, 1999) that as regular institutions for higher education are increasingly dealing with providing distributed learning facilities using technology, the typical open and distance learning task of the Dutch Open University has to be reconsidered. And, as another example, at Edith Cowan University (West Australia) 11,000 students are full-time, while 9,000 students are part-time or external students. At Charles Sturt University (New South Wales, Australia) two-thirds of their 27,000 students are distance education students.

A crucial question in this new situation, with (partially) on- and off-campus students, is if these two or three cohorts of students, in their instructional approach, should be dealt with separately or in a combined way. Many approaches are possible. At the Faculty of Educational Science and Technology of the University of Twente for instance, three cohorts of students (full-time and on-campus, part-time, and external) exist. The policy decision of the management is to offer those students a free choice of the modality (on-campus and very active, on-campus during a limited number of fixed days, or off-campus) through which they want to follow the courses. This choice is not necessarily related to their registration status, and can vary along the courses they want to attend. One of the aspects of this choice are the costs involved: costs for students as well as for the institute and the instructors.

Whatever the organizational context in which on-line learning will be introduced, the need for a thorough insight in the costs of different delivery methods is growing. This requires some form of costing model.

## 6. Costing models

Many costing models have been developed in order to measure the costs of educational delivery in particular in relation to the use of new technologies. Conferences are dedicated to this topic (see for example in the UK: Flish, 1999), and many projects are tackling this problem (Moonen, 1999b; De Vries, 1999; Bacsich, Ash, Boniwell, & Kaplan, 1999). Bacsich and his colleagues mention, among others, costing models by KPMG ( 1997), Jewett & Young (1998), Shepherd (1999), and Boeke (1999) and present their own. However, they conclude in their report that 'there are organizational barriers to accurate costing' (p. 75). The NCHEMS project (1999) reports that 'the ability of instructional technology to reduce costs in higher education is unknown. Current costing formulae suffer from several drawbacks: they cannot be generalized beyond a campus or set of institutions; they require a level of detail and specificity that is not easily adapted; or they view technology implementation in isolation from the remainder of the campus'. There is indeed a significant difference between a strong rational for costing models and the applicability of such models in practice (Moonen, 1998). Bacsich, Ash, Boniwell and Kaplan (1999) mention in this context: 'If asked to distill our conclusions to the utter minimum, I would say that in order to understand the "true" costs of Networked Learning, the only way forward is to have a framework to understand the costs of teaching and learning, and in turn, the costs of universities, together with costs falling on the wider society of stakeholders (p. ii)'. One can wonder about the likelihood of success of such a broad endeavor.

In addition, the cost issue is only one side of the story: the other side represents the benefits when using on-line learning. Measuring the benefits of using networked learning is an even more difficult task than measuring costs. Arguments about benefits relate to the discussion about the productivity paradox when introducing information technology in industry. This topic will be more explicitly discussed in the next section.

When making a decision about a major change in an organization, such as the introduction of on-line learning, explicit criteria should be used to measure the likelihood of success. At the management level of an institution, and in particular with respect to the activities in the consensus space of the design strategy, those criteria relate to the cost and the benefits, and in particular to the perspective of a positive return-on-investment. However, arguments presented earlier in this section as well as the conclusions of a recent study (Moonen, 1999a) imply that, when the management of a traditional higher education institution wants to make a decision about a substantial change such as the large scale introduction of on-line learning, there are no realistic cost or benefit data available to back up such a decision.

How then to proceed in the decision-making process? The management will have to decide to go on with on-line learning mainly based on positive speculation. However, is there serious ground for such speculation?

## 7. Productivity

A comparable problem has arisen in industry where investments in ICT have already been going on for many years. However, unlike in education there has been a constant discussion in the corporate world about the productivity gains as a result of investments in ICT. One argument is that such gains are unclear, certainly when compared to other major changes in industrial activity such as the introduction of steam machines or electricity. This phenomena has been called the 'productivity paradox' (Brynjolfson, 1993; Brynjolfsson & Yang, 1996; Rower, 1999). Nevertheless, industry is still investing huge amounts of money incorporating ICT for appropriate functionalities. Economists have tried to explain this 'strange' behavior and came op with four explanations. The first, and maybe most relevant explanation for the missing although expected productivity gain is caused by a measurement problem. As computers are often being used to offer faster, more personal and more varied services, those advantages are not taken into account in the traditional data that are collected and used in statistical overviews. A second explanation is that in industry only a small percentage of their total operational budget is used to introduce ICT. As a consequence, often a critical mass to create a clearly visible productivity gain is not yet reached. A third potential explanation is the fact that each change needs a long incubation time before it will lead to a productive exploitation of the new situation. Comparisons can be made to earlier important industrial innovations that took tens of years to succeed. The last argument has to do with the kind of applications for which ICT is being used. One has to acknowledge that many of the current applications probably only provide us with products that are in fact still a kind of 'interim' development and that the real breakthrough will only be realized when computers and applications really are adapted to the task for which one wants to use them.

Particularly in 2000, the relationship between productivity gains and ICT investment in business seems to have become more obvious. Economists are reviewing their opinions. Greenspan, chairman of the Federal Reserve of the USA, said in January 1999 that 'the economy is enjoying higher technology-driven technology growth'. Since then there is a growing support for the so-called 'New' Economy' as a result of the integration and use of information technology (Business 2.0, 2000). However, in 2001, the general mood about productivity gains related to the use of ICT is changing again. This problem will probably be unsolved for many years to come.

How to explain this changing opinion? Probably aspects of each of the reasons given earlier- measurement problems, critical mass, incubation time, adequate applications— contribute to the explanation. One explanation could relate to changes in measurement, in particular with respect to the costs and intangible advantages. In the new economy business spending on software is now being considered as an investment. Previously, it was considered as a cost. Support for this position can be seen in revisions of official statistics: 'for many years the notion of the New Economy received little support from the government's official statistics…..On November 12, 1999 the Bureau of Labor Statistics released an upward revision of the productivity data, counting software production for the first time as output and making other upgrades…..Indeed, sharp upward revisions to reported productivity for the 1980s and 1990s mean that the so-called technology paradox---the apparent ineffectiveness of high-speed tech spending during that period—may no longer exist' (Mandel, 1999, p. 40, 41). The more explicit awareness of the existence of intangible costs and benefits clearly also stimulates the search for operationalisation of those costs and benefits in measurable terms which eventually will show up in equations and calculations.

Critical mass and incubation time are also related. The continuing investment in ICT advances the chance of having a critical mass of ICT investments. As PCs were introduced in the beginning of the 1980s, there is an 'incubation' time of already 15-20 years. By coincidence (?) this period is comparable to the timespan of a new generation of employees to enter the workforce. This new generation has grown up with computers around them, used them at school and in different situations, in particular in the contexts of entertainment and therefore is much more familiar with them then the previous generation.

And finally, the computer and its software have escaped their previous (pre 1980s) image of (mainly incomprehensible) mainframe applications, as ICT is becoming more powerful almost each day, allowing substantial improvements in the area of the human-computer interface and user friendliness.

Developments in education follow, at a certain time distance, developments in society. Therefore ICT has been introduced in education as well. With respect to the impact of ICT on education, the introduction of ICT in education seems to follow the same pattern as the introduction of ICT in industry. As with industry, past and current results about productivity gains in education because of ICT are not that obvious (Moonen, 1994). On the other hand, governments all over the world continue to invest huge amounts of money into ICT in education. To explain this paradox for the educational sector the same four arguments used in industry can be used: measurement problems, lack of critical mass, long incubation time, and finding the right applications. To begin the analogy, indeed there is a severe measurement problem in education, especially when new instructional approaches such as a constructivist approach, supported by ICT are introduced. Educators believe that by following such an approach higher cognitive skills and even meta-cognitive skills will be stimulated. However, how do we measure those skills? Current test techniques have difficulties dealing with such outcomes. One can also assume that many of the positive results of using ICT in education, for instance to be better prepared for the current society and a more competitive commercial world, only will show up after many years. How do we measure those gains now? A second problem is the need for a critical mass. Certainly in education the critical mass problem relates to the technical infrastructure, but also, and more importantly, to the human (teacher/instructor) infrastructure needed to teach about and integrate the new technologies in existing curricula. That critical mass for technical infrastructure is already there in many educational institutions, certainly in the Western world. However, the needed critical mass of well-trained and knowledgeable instructors is another matter. Many efforts in the teacher-training area have not yet reached a satisfying result. May be the final solution will come from a new generation of teachers, educated in another era and familiar with using ICT as a common commodity. Therefore the incubation time for the introduction and productive implementation of ICT in education probably also needs 10-15 years. The last of the four explanations relates to the kind of ICT applications. Until now, many of the ICT applications in education can be referred to as tutorial-type educational software or courseware. Courseware, however, is not popular in education, nor does the use of it improve student performance in a significant way (with the exception of certain drill-and-practice programs in certain situations). In addition, educational publishers are not eager to invest in the development and production of educational software as there is, so they claim, no real market for it. However, the Internet and the WWW are now creating a wealth of new application areas for ICT. Maybe this will create the momentum for educational ICT applications to escape from a still existing 'antiquated' paradigm about how to apply ICT for educational purposes.

In summary, and following what has happened in industry, one could ask the question: 'Is there a new economy in education?' (Moonen, 2000b). One could argue that as education is going through a comparable cycle as has happened in industry, a future prospect of productivity gains as a result of using ICT in education is a reasonable one. As in industry, there are two conditions in order to reach that point: (a) traditional measurement methods must adapt to the new technologically supported approaches in education so that potential gains can be made visible and measurable;

and (b) ICT has to find its productive niche, probably through applications that make adequate use of the Internet. In the next section, such a measurement method based on return on investment is examined.

## 8. Return on Investment

What are the consequences of the reasoning in the previous section with respect to the activities in the consensus space of the 3-Space Design Strategy introduced in Section 2? In the consensus space of the 3-Space Design Strategy, a major item is to agree upon the major functional specifications of what has to be designed, in our case an on-line learning system for an educational institution. Another crucial part of the decision-making process in the consensus space is to decide upon the criteria that will eventually determine if the chosen strategy is successful. In Section 4 it was argued that the main criterion for the management of an educational institution with respect to a decision about change and investments will be related to the return-on-investment (ROI) ratio.

Return-on-investment is a well known concept in the business world and is used for decision-making criteria within industrial and corporate activities. In training situations ROI is often used a criterion for decision making (Shepherd, 1999). In education however, ROI is not common as an explicit concept, although there are some indications of a renewed interest (Gustafson & Watkins, 1998).

Conceptually, ROI is very simple. In order to measure the ROI of an activity one has to compute the benefits of the activity and compare (by dividing or subtracting) them with the costs. Both aspects have to be expressed in monetary terms in classic ROI. The simplicity of the concept immediately disappears however, as soon as one want to calculate both items. As has been argued in Section 6, benefits or results in education are not so easy to measure. Education is intended to result in benefits, but often benefits will be hidden, be implicit or only show up a long time after graduates have left the institution. But even when the benefits are explicit and overt, it is often difficult to transform them into a number let alone converting that number into a monetary value. A comparable problem arises when calculating the costs. Although there are many items of which the cost can immediately be expressed in monetary terms, there also many other costs which have to be accounted for, in particular costs which are hidden or not explicitly available, such as the frustration costs of an instructor when working with crashing technology or the huge amount of extra time an instructor has to put into answering continuously incoming e-mail from students. In addition, arguments about the calculation of a ROI are only relevant after a change has been introduced and data about how the change is evolving become available. Using costs and benefits as a criterion at the start of the decision-making process, when no reliable data are available at all, is a much more difficult issue.

There are a number of ways to deal with these problems. First of all one has to agree that collecting *exact* costs and benefits data at the start of a process is impossible. An alternative then is to rely on data of comparable situations. However, no two situations are really alike. Comparable situations can therefore only give global indications. Based upon comparable situations, such data can be used as estimates, maybe even estimates weighted by a certain probability. Manipulating the entries of the data and probabilities offers an output for decision support. In summary, a major issue in order to be able to carry out this process is that for the costs as well as for the benefits the relevant items have to be identified, estimated and put in the ROI equation (Moonen, 1999b).

When a complete set of data for comparable situations are not available, another way to solve the ROI-in-education problem is to abandon the idea of a ROI calculation in a 'absolute' way, and concentrate on a more simplified calculation that emphasizes the relative comparison of ROI in one situation with another situation. We will call this simplified ROI.

## 9. Simplified ROI

A simplified ROI approach is to replace the 'absolute' ROI calculation with a more 'relative' or 'simplified' ROI calculation (Moonen, 1999b). To reduce the complexity of the data gathering and calculation, a simplified ROI takes only those (positive and negative) items into account that are substantially different in the new situation. The result of the calculation gives an indication of the 'gain' in ROI if a situation is changed from A to B. This change can also be expressed when specific data are not, or only partially, available. A first and major task however is to identify these 'substantially' different items. As such identification is dependent upon a specific situation, the example given in the section 9.4 can only be worked out in a generic hypothetical way.

### *9.1 Cost issues in a simplified ROI*

When introducing ICT in a teaching-learning situation, major tangible differences in cost items when compared with a traditional situations will be: (a) additional specialized personnel; (b) acquiring and depreciation of hard- and software; (c) new physical facilities; and (d) the production, distribution and maintenance costs of digital learning material.

Besides such measurable costs, other more implicit, hidden, or estimations of costs will occur such as: (e) necessary training for staff to be able to handle the ICT; (f) time spent by teaching and help-desk staff accommodating the requests for on-line help and communication by students; (g) hidden and estimations of non-monetary costs such as the frustration of students and teaching staff as a result of misfunctioning of the technology and the time spend to identify the problem and repair it; (h) opportunity costs, relating to the time that staff spend on technology which they could have spent on other things. This list is only meant as an example. In a specific situation much care is necessary to identify those items that really will make a difference.

### *9.2 Benefit issues in a simplified ROI*

A comparable approach can be worked out with respect to the benefits, whereby one should concentrate on those benefits that are potentially different in a new situation. Such a list could be based upon the literature about the effects of ICT and media. The most commonly expected benefits will be in the area of (a) performance; (b) attitude; (c) motivation, (d) completion and dropout rates, and (e) throughput time.

Besides the measurable effects as mentioned, one can also think about a number of estimations of benefits such as: (f) flexibility; (g) time-place independence; (h) communication facilities; (i) marketing value; (j) impact of working with ICT on future professional career. This list of benefit items is also only meant as an example. In a specific situation much care is necessary to identify those items that really will make a difference.

### *9.3 Simplified ROI matrix*

After identifying cost and benefit items that are 'substantially different' in an ICT-based situation versus a traditional situation, a calculation method has to be used in order to come up with some interpretable numbers. What is considered as a 'substantial difference' will have to be defined by the user of the method. In addition a measurement method will have to be designed in order to quantify the substantial differences.

A first issue to deal with, also with reference to the analysis proposal in Section 3, is that a simplified ROI calculation should distinguish between the different aspects (economic, quality and efficiency) and between the different actors (institution, instructor, student). The distinction in design space as mentioned in Section 3 will often not be made, although it is important to realize that a ROI calculated when a change process starts, can be significantly different after a change process is broadly implemented.

Another important issue is to distinguish between measurable items (such as the cost of hardware), difficult to measure items (because they are hidden or for which no data exist; such as projection of growth of enrollment), and obviously subjective but nevertheless important items (such as opinions or beliefs or traditions).

- For measurable items, one can use the available data. Those data can be monetary data when dealing with economic aspects indicating the difference in costs and benefits when moving from situation A to situation B. Or the data can be otherwise quantitative such as, for instance, performance results indicating higher or lower test results of students when they study according to approach A or B.
- For items that cannot be measured precisely or for which exact data are not available, one can use estimates. Estimates can be based upon comparable situations. If those are not available one can estimate of how the change will be perceived by a specific actor. In order to quantify the estimation one can use, for example, a scale (+100 to –100) indicating the ‘expected’ percentage of difference with respect to a specific economic, quality or efficiency item, when moving from situation A to situation B. Using this approach a '-100' indicating a complete disaster in comparison to the original situation, and a '+100' indicating a golden opportunity in that respect. For instance, how to estimate the gain or loss with respect to 'general feelings towards a course' after the introduction of e-learning. On the one hand one can construct an attitude questionnaire in order to assemble data for that purpose. However, often time and needed effort will

not allow to go through this exercise. As an alternative one can estimate the change in 'general feeling' based upon the opinion of experts, the literature or/and the instructors involved. On that basis one can, for instance, estimate that the 'general feeling' of students after introducing e-learning will raise by 20%. In that case +20 will be the estimate for this item in the ROI calculation. Of course, an estimate of this kind assumes that one can explicitly or implicitly compare the new situation with the original situation.

- But also when specific non-monetary quantitative data are available, one can transform these results to a position on the '-100--+100' scale. For instance, if the average test results of students in a new situation are 20% better than in the original situation, this result can be indicated as a +20 on the scale. In this way all the results, with the exception of the results expressed in monetary terms, are scaled in a comparable way. This makes it possible to combine them and come to comprehensive conclusions. But again, this reasoning assumes specific knowledge about the original situation.
- The same estimation approach can be used when very subjective issues are added to the ROI equation.

In summary. Measurable economic aspects will be expressed in monetary terms (costs and benefits). Measurable quality and efficiency items will be expressed in numbers based upon the specific measuring scale and unit used. These can then be transformed to a position on the '-100--+100' scale. Difficult to measure or subjective economic, quality and efficiency aspects will be handled by using estimations on a scale from -100 to +100 whereby the gain or loss (better or worse, more or less, higher or lower, etc.) in the new situation will be expressed on the scale as a proportion of that gain or loss.

*9.4 A hypothetical case*

*9.4.1 Context*

Assume that in an educational institution the management considers moving from a traditional learning-teaching situation (regular lectures + computer laboraties) towards a situation whereby each instructor and each student, instead of using a computer laboratory, will be provided with a laptop computer to be used at home and at the institution. In real life it is more likely that laptops would be added to the availability of computer laboratories rather than replace them. For the purpose of illustrating the simplified ROI approach, the example will assume that laptop computers will replace the computer lab. In both home and institution, connection to the university network will be available. In addition the number of lectures will be reduced to a minimum and activities will mainly be focussed on on-line learning activities.

In order to support the decision about this approach the management wants a simplified ROI calculation. First of all we will assume that we are dealing with activities in the consensus space, meaning that the management is making up its mind about how to proceed. The consequence is that for many of the data, estimates should be used. Only for some of the economic aspects and based upon previous experience (or a quotation) real data about costs and benefits can be used.

*9.4.2 Setting up tables*

Table1 and table 2 illustrate the results of such a calculation. Only a limited number of items is chosen as an illustration. An explanation of how the numbers in the cells of the tables were obtained follows each table.

**Table 1**. Economic arguments, simplified ROI (measurable costs and benefit items; in units of 1,000 US$)

| Actors: | Institution | Instructor | Student |
|---|---|---|---|
| Items: | Costs/Benefits | Costs/Benefits | Costs/Benefits |
| Extra hard- and software | -110 | +5 | +50 |
| Reduction in hard- and software | +20 | - | - |
| ROI (benefits – costs) | -90 | +5 | +50 |

*Explanation*

Assume that:

- The institution is providing the hard- and software equipment out of its own funds and that the calculation is being made for the period of one academic year, involving 100 first-year students and 10 instructors. For reasons of simplicity, no depreciation period is used.
- A laptop computer costs US$ 1,000. Thus the costs for extra hardware are US$ 110,000
- The institution will not have to replace their 40 old desktop computers (at US$500 per computer): a benefit of US$ 20,000
- Benefits for instructors (who do not have to buy a new desktop computer) equal US$ 5,000
- Benefits for students equal US$ 50,000 (who will get a laptop for free)

Although the previous arguments in the article focus on the institution as an 'actor', data for other actors (instructor and student) are included in Table 1 as well. This makes the table more interesting as it shows that a negative ROI for one actor can be complimented, as is shown in this example, by a positive ROI for other actors. This can be useful information in the decision-making process. From table 1 we can conclude that from the institutional point of view, the ROI result, given the change as described, is equal to - 90.000 $. For the instructor and student however, the change results in a positive ROI. Of course, this is not the end of the ROI story. Many more aspects should be taken into account.

The next table 2 explores the simplified ROI, again with respect to economic aspects, but now for estimates of costs and benefits items whose measurement is difficult or even not possible. Therefore an estimate (based upon the experience of the assessor) on a scale from -100 to +100 is used.

**Table 2**. Economic argument, simplified ROI (estimations of costs and benefits items)

| Actors: | Institution | Instructor | Student |
|---|---|---|---|
| Items: | Costs/Benefits | Costs/Benefits | Costs/Benefits |
| Completion and dropout | +10 | - | - |
| Potential growth in enrollment | +20 | -10 | - |
| Marketing value | +20 | +10 | +10 |
| Extra time needed because of malfunctioning of systems | - | -20 | -10 |
| ROI (benefits – costs) | +70 | -20 | 0 |

*Explanation*
Assume that:

- Values in this table are chosen on the basis of an estimate of a positive (benefit) or negative (cost) impression or expectation, based upon a scale from -100 to +100
- The institution get its budget from the university according to the numbers of 'graduating' students each year. Assume that in the new situation the completion rate will raise and the dropout rate will go down, resulting in a 10% increase of the enrollment in the second year. In the table this results in a + 10 for the institution.
- If more reliable data were available this percentage could be transformed towards a monetary value. Assume, for instance, that on the average 60 out of 100 first students graduate to the second year. A 10% increase means that the number of students in the second year will increase by 6 students. If in the budget allocation the university pays the institution US$2,000 per student, the new situation creates a benefit of US$ 12,000 for the institution. When these kind of data are available, this item could be included in table 1.
- Giving a free laptop computer to students will attract more students and potentially raise the enrollment. As a result the (subjective) economic benefit on the scale for the institution is estimated as +20 (meaning that an extra enrollment of 20% is expected).
- As in the previous item, the availability of more reliable data can move this item to table 1, as it is easy to calculate the exact monetary benefit of an extra enrollment of 20%.
- Besides of the benefits for the institution, the larger enrollment will also result in larger classes and therefore larger effort (assignments, feedback) for the

instructors. For them this item will result in a negative incentive, estimated with an increase in effort (cost) of about 10%.

- The 'free' laptop computer for staff and students will certainly contribute to a positive image of the institution and is therefore an important marketing instrument. The incentive in marketing terms is estimated as a benefit of about 20%.
- In the long term working at a highly appreciated institute will contribute to the 'personal value' of the instructors as well as to the 'value' of the diploma of the students. Both are valued as benefits of 10%.
- The new hardware and systems will certainly create extra malfunctions, leading to frustration and investment of extra time by instructors and students. Both are evaluated as extra costs estimated at 20% and respectively 10%.

Of course each of these scale values are subjective and therefore open to debate. If possible the opinion of stakeholders (actors) should be collected (informally or even formally) in order to see if there is some convergence in those opinions. This kind of data collection and debate can be beneficial for the decision makers. By quantifying (using exact data or estimates) the costs and the benefits of the items mentioned, it becomes necessary to form an opinion about these issues. Furthermore and because of the distinction between the different actors, it becomes visible who is getting a positive ROI and vice versa. In the example in Table 2, it is clear that the institute gets a very positive ROI out of what is been proposed while the instructors seem to pay the bill. This is certainly an interesting issue in discussions about the proposed policy change, but also an interesting issue in comparison to the results in Table 1.

Comparable tables can be set up for dealing with items related to the quality and efficiency issues. In those cases and given the difficulty (even impossibility) to convert results of those issues into monetary values, the use of a scale as in Table 2 is a reasonable solution.

*9.4.3 Problems*

When applying the simplified ROI method there still remain problems:

- A first one is how to identify the major items that cause substantial differences in costs and benefits (economic aspects), becoming better or worse (quality aspects), or getting more or less (efficiency aspects). And how to measure or estimate the cost/benefits, quality and efficiency improvement or decrease, in particular with respect to the different actors involved. In the current example only three actors are mentioned: institution, instructors, students. But there can be many more or/and different ones, for instance the parents, the national government, the educational publishers, etc. Maybe the appreciation of the ROI in their situation will strongly stimulate or prevent that a change process becomes successful.
- Another important aspect is how to combine values within a table. The simplest assumption is that all of the items have an equal weight in the decision-making process. In practice, this is not the case. A simple solution is to give a weight to each of the items involved and combine the results taking into account those weights.

- An even more complicated issue is how to combine the different tables. Two issues have to be solved in that respect: (a) does the decision maker allocate equal weights to each of the tables?, and (b) how to combine the ROI-results of each table, given the fact that the measurement scales are not the same (monetary values versus percentage points) and that the number of items in a table influence the magnitude of the results? How to solve the latest issues is particularly difficult.

#### *9.4.4 Computer program*

In practice, the tables mentioned above can be set up using a spreadsheet program. Items in the different tables could be listed in pull-down menus to be chosen by the executor of the simplified ROI approach. And databases with known practical results can be made available to help the user to make a justifiable guess about the scale values for different items. All of this can be combined into a software program. Such a program is in development at the University of Twente.

However, be reminded that the purpose of these simplified ROI activities is not to calculate a final *specific result*, that determines a clear decision. On the contrary, the simplified ROI approach is to give the decision maker a easy-to-use type of metric to increase systematic awareness and discussion points about important factors related to return on investment in a situation of change.

### 9.5 Some examples

The simplified ROI approach has been used on an experimental basis at the University of Twente. Three cases have been studied (Mombarg, 2000; Smits, 2000; Schoenmaker, 2001). In the first case the transformation of a regular course in the curriculum of the Faculty of Informatics towards a course using e-learning has been investigated using the simplified ROI approach. The second case dealt with the change process in a high school in Heerlen (the Netherlands) were ICT was introduced in the curriculum. The third case related to the impact of introduction of e-learning in an academy (school) for the performing arts in The Netherlands.

In each of the cases much effort went into the identification of the items that made a substantial difference in the new situation, in particular with respect to the quality and efficiency aspects. Although collecting data about measurable cost and benefit items seemed to be easy, many problems occurred, often at a conceptual level. For instance, what to do with the costs of the time an instructor provided for 'free'? What to do with the costs of the time of another person who was paid for that time by another institution? Probably the 'ingredient' method (Levin, 1983) should give a guideline for such problems. There was also confusion where to put an item: in the tables related to quality or to efficiency. And it appeared that in the selection of the items for the tables as well as the estimation of the scale value, the personal perspective of the assessor was an important determining factor. However, for each case a simplified ROI was calculated for each of the actors involved (institution, instructors, students). And the reaction of the decision makers about the simplified ROI approach was very positive, not necessarily because of the specific results, but because of the systematic overview of important items to reflect upon the method provided.

## 10. Conclusions

Colleges, universities, regions, governmental agencies, and private foundations are making large investments in instructional technologies on the assumption that technology will somehow lead to improvements in educational quality and an eventual reduction in costs through greater efficiency. Although there are no concrete data available (yet) to prove this assumption, the likelihood of this claim is certainly realistic. However, efforts should be made in order to move from the potential to the reality, for instance by calculating the return-on-investment (ROI).

Calculating ROI, however, is a complex matter leading to major objections for its use in practice. A potential solution is to reduce the complexity by using a simplified ROI whereby the focus is on those items that differ significantly in a new situation. Eventually the simplified ROI approach will be supported by a computer program, backed up by a database with relevant information based upon experience. However, the major benefit of a simplified ROI approach is the affordance it creates by triggering the debate among decision makers. Using a simplified ROI approach will stimulate the awareness among those involved in policy making about education and training situations.

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