The evaluation of ICT investment – a 50 year odyssey
Learning from history is never simply a one way process. To learn about the present in the light of the past means also to learn about the past in the light of the present. The function of history is to promote a profounder understanding of both past and present through the interrelation between them.


1.1 Introduction

Before examining the issues related to the measurement and management of ICT costs and benefits it is worth reviewing some of developments in ICT evaluation over the period of the last 50 years. ICT evaluation is a complex subject and 50 years is a long time. Consequently, this review of approaches to ICT evaluation must necessarily be at a high level of abstraction and be selective in the approaches reviewed.

The principal objective of tracing the evolution of ICT evaluation over this period is to try to develop an understanding of the thinking behind the use of ICT and how decisions have been made about the suitability of its use. As will be seen, the way ICT is evaluated has changed over time. An interesting question is why this has happened and whether the insights built up are cumulative or characterized by discontinuities.

1.2 The nature of evaluation

Evaluation seems to be a fundamental part of the human social behaviour. Humans evaluate and compare everything from football teams to corner shops. They evaluate governments and their policies, organizational performance and national characteristics. This type of evaluation is predominantly subjective, which does nothing to reduce the passion with which it is conducted and with which individuals sometimes argue for their point of view. Furthermore each and every one of us is in turn evaluated. We are evaluated by money lenders for creditworthiness. Professionals are evaluated by their clients; employees by their employers (and in some organizations vice versa). One of the characteristics of this type of evaluation is that some attempt is made to make it objective. Of course objectivity is always difficult and is at best only partially achieved. In the light of the above, evaluation may be defined as the act of comparing a process, an artefact, a person, an organization or any other situation with other comparable entities and/or with a set of standards which the evaluator regards as appropriate to that situation. Evaluation
may be formal, requiring a detailed study (taking time and resources) or it may be informal, even *ad hoc*.

### 1.3 Evaluation in business performance

Many people and most organizations continually evaluate their own performance. People monitor their business success, often in terms of their bank balance. They monitor the body mass index and their fitness by attending a gym regularly. Organizations monitor their success for a variety of reasons not the least of which is the impact that their performance will have on the probability of their survival. While commercial companies have long done this, a more recent phenomenon has been the application of this type of evaluation to public sector and not-for-profit organizations. However, the evaluation methods commonly used in commercial organizations do not always travel well when applied to the public sector. Concepts such as return on investment can be difficult to apply. Other approaches such as cost benefit analysis and value for money may be more meaningful. As will be shown later, analogous problems occur in the evaluation of ICT. It would be wrong to push this analogy too far, but the challenge of performance evaluation in the public sector provides interesting parallels to the challenge of evaluating ICT.

Prior to the 1930s, commercial investments were made on the expectation of making profits. The type of evaluation techniques used today were as yet unknown. The entrepreneurs who built the first railways and canals or who built the first chemical plants or commissioned the great ocean liners of the early 20th century did not do so on the basis of blind hope. But neither did they employ teams of financial analysts and specialist bankers to build sophisticated financial models of their projects. As a result, some became extremely wealthy, others went broke. In fact the concept of formal interest in investment appraisal arose well after the industrial revolution and can be traced back to the work of Fisher (1930) in his book, *The Theory of Interest*. Another early writer on this subject was John Maynard Keynes (1936) in his world changing book *The General Theory of Employment, Interest and Money*. These works discuss the idea that, under normal circumstances, an investment needs to earn a yield or a return on the money spent and this became the cornerstone of traditional investment appraisal.

Having pointed out that Keynes was one of the early writers on the subject of investment yields it is only fair to say that he was cognisant of the difficulty which
often beset attempts to perform such calculation. One of Keynes’ (1936, p. 149) more famous comments is that:

Our knowledge of the factors which will govern the yield of an investment some years hence is usually very slight and often negligible. If we speak frankly, we have to admit that our basis of knowledge for estimating the yield ten years hence of a railway, a copper mine, a textile factory, the goodwill of a patent medicine, an Atlantic liner, a building in the City of London amounts to little and sometimes to nothing; even five years hence.

Of course Keynes was more interested in the macroeconomic effects of investment than its impact on an individual enterprise. But his comments about the challenge of estimating the values needed to evaluate an investment are equally applicable to building a railway or buying a small computer. It is also remarkable that Keynes’ 1936 thoughts remain so relevant in the 21st century.

From the preceding discussion it is clear that investment appraisal is not trivial. If business computers had been in existence in 1936 it is probable that Keynes would have included them together with patent medicines, Atlantic liners and buildings in the City of London as difficult investment decisions. Nonetheless, despite these limitations, for a number of sound reasons, including those to do with probity and good corporate governance, modern organizations feel compelled to perform detailed and complex investment evaluation exercises. These calculations are normally performed before the investment, which is referred to as *ex-ante* although some are undertaken after the investment has been working for some time and are called *ex-post*. Perhaps fortunately, the calculation of yields is only one small part of the evaluation of ICT investment.

### 1.4 ICT evaluation

If general business investment evaluation is challenging then ICT evaluation may be regarded at least in some respects as *super challenging*. The reasons for this will be explored in some detail later in this chapter, but for the moment it should be pointed out that it is no trivial matter to estimate the benefit flows or the cost implications of an ICT investment. To complicate things further, the economic life of such an investment is usually difficult to estimate. It is interesting to note that the early attempts at evaluation relied on techniques related to investment yield such as cost benefit analysis in the form of cost displacement or cost avoidance models. However, it was soon realized that there were a number of other ways of looking at the problem.
1.5 The first era in business computing

Business computing began in the UK\(^1\) in the early 1950s. The first functional commercial computer was Lyons Electronic Office (LEO\(^2\)), developed by the Lyons Tea Company (Ferry 2004). These early systems played a valuable role in business in that they demonstrated the ability of computers to perform large-scale clerical tasks such as payroll processing, invoicing and inventory recording. More important, they established the role of computers in areas beyond the military and radically changed the landscape of computing.\(^3\)

Where investment evaluation was performed, these early computer systems were usually justified on a cost displacement basis which compared the cost of labour saved against the cost of the computers and associated activities or expenses. Thus the question asked was: Is a computer system costing £\(y\) to purchase and £\(x\) to run per annum justified if it produces savings of £\(x + n\)? If \(n\) was big enough,\(^4\) then the investment brought value to the organization.

A variation of cost displacement calculations is cost avoidance. In this case the advantage of acquiring a computer system is compared to notional costs which are believed to have been (or which are expected to be) avoided as a result of acquiring the computer. In both these cases relatively unsophisticated calculations were normally performed such as those required to establish payback\(^5\) or a return on investment (ROI\(^6\)). Some organizations would have used the more sophisticated net present value (NPV\(^7\)) or internal rate of return (IRR\(^8\)) approach.

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\(^1\) In the USA in 1951/2 the first commercially successful electronic computer, UNIVAC, was also the first general purpose computer – designed to handle both numeric and textual information. Designed by J. Presper Eckert and John Mauchly, whose corporation subsequently passed to Remington Rand. The implementation of this machine marked the real beginning of the computer era. Remington Rand delivered the first UNIVAC machine to the US Bureau of Census. This machine used magnetic tape for input. http://en.wikipedia.org/wiki/Timeline_of_computing_1950-1979

\(^2\) It is interesting to note that although 3000 miles apart the LEO and the US Bureau of Census were commissioned at virtually the same time.

\(^3\) Thomas Watson, then chairman of IBM, famously said in 1945 that he thought there was a world market for maybe five computers. He was not alone in this type of thinking.

\(^4\) The size of \(n\) would have to exceed the opportunity cost of using £\(y\) plus £\(x\) per annum elsewhere in the organization.

\(^5\) The payback of an investment is the time period required to recover the investment cost.

\(^6\) ROI is normally calculated by dividing the annual net profit or net cash flow derived from the investment by the total cost of the investment. There are a number of variations on this.

\(^7\) The NPV of an investment is the sum of the discounted net cash flows arising in the investment.

\(^8\) The IRR is the discount rate which yields a net present value of zero.
One of the earliest contributions to the ICT evaluation literature is Boyd and Carson (1963).

1.6 The second era in business computing

The second era may be thought of as starting in the mid-1970s with the arrival of the affordable minicomputer. The first minicomputers were developed at the end of the 1960s, but it was only in the mid-1970s with the Digital PDP/11, the IBM System 34 and similar machines that smaller organizations could afford their own computers as opposed to buying time on other people’s.9 The explosion in available business software that followed this was one of the factors that drew attention to the idea of information as a management resource. In this period it was realized that computers not only automated dreary tasks, they could also deliver information using which, more informed management decisions could be made. Nonetheless during this period cost displacement and cost avoidance remained the central plank of ICT evaluation and measures such as payback, ROI, NPV and IRR continued to be regarded as the most important metrics to use. This position started to change as computing evolved with increasing rapidity during the early 1980s. By the mid-1980s following highly influential work by Porter and Miller, it had become common to discuss how ICT could be a facilitator of business success via competitive advantage and the concept of strategic information systems planning became fashionable. American Airlines and American Hospital Supply became urban legends in the world of corporate computing.

The term strategic information systems (SIS) was coined to describe these iconic systems. At the same time it became apparent that these types of information systems did not lend themselves to the established forms of investment analysis based on cost displacement and cost avoidance. Meanwhile, in another part of the forest, the proliferation of personal computers, often with useful commercial lifespans of less than two years, was raising other evaluation questions. Traditional forms of cost control were stretched by these new, low cost, items and the realization that the costs of a PC did not stop when you paid the invoice began to percolate into corporate consciousness. Terms such as ‘lifetime cost’ and ‘total cost of ownership’ were yet to appear, but the concepts were beginning to evolve. Even during this period there were dissenting voices. Disquiet in what computers were actually

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9 Buying time on other people’s computers was quite popular well into the 1980s. Organizations who sold time were generally referred to as computer bureaus. This type of business has been transformed with the largest computer bureaus becoming facility managers or outsourcers.
achieving was first voiced by Russell Ackoff in his classic paper, ‘Management misinformation systems’ (Ackoff 1967), which challenged some of the assumptions made about MIS. Ackoff was the first in a long tradition of doubting voices.

Although the term decision support systems had been around for quite some time (Keen 1991 and Scott Morton 1991) it was only towards the end of the 1980s that a new word was coined to describe the computerized information element referred to in making decisions. Shoshana Zuboff is normally attributed with first coining the word infomate which described the ability of ICT to deliver relevant information to the right managers at the right time for them to make appropriate decisions. Another word also came into the ICT vocabulary to describe certain types of SIS and that was transformate. It was now said that information systems could automate (make routine systems faster and more fault or error free), informate (deliver the right information to management at the right time and place) or transformate (make the organization more competitive). And, it was argued, each of these types of system needed a different approach to their evaluation.

This period also saw the publication of Paul Strassmann’s (1985) first book in which he convincingly argued that a correlation cannot be found between ICT corporate expenditure and improvements in ROI or return on equity (ROE\textsuperscript{10}). This marks the beginning of attempts by academics, consultants and practitioners to find other more sophisticated ways of evaluating ICT investments. Strassmann advocated the use of a metric which he called Return on Management (ROM\textsuperscript{11}). But this did not gain any real currency. Strassmann did make one insightful comment which was to the effect that if an ineffective organization computerizes it will become more ineffective. This of course would apply to the application of most technologies in such organizations.

One group of pioneers in developing a new approach to ICT evaluation were Parker et al. (1988) who developed what they called Information Economics. Information Economics was an innovative approach – at least in the world of ICT evaluation. The Parker et al. (1988) book is a tutorial. It is easy to read and their argument unfolds logically. It addresses both the theory and the practice of ICT evaluation and it made a contribution to widening the ICT communities' vision of this complex subject. They do not dismiss normal financial type measures. They point out the

\textsuperscript{10}The ROE is the return on equity and is calculated by dividing the net profit after tax by the total of the organization’s equity.

\textsuperscript{11}ROM is a ratio of the net after tax profit divided by the organization’s cost of management. This was a manipulation of accounting data which Strassmann claimed would reveal the real impact of ICT on the management of the organization.
limitations of simple ROI and they attempt to overcome these by incorporating business domain values and risks and technology domain values and risks into the evaluation process. Understanding corporate culture and its underlying corporate values are also part of their system. This is a complex approach which uses a variant of weighted ranking to help managers assess the value of information systems. The authors claim that Information Economics helps the planning of MIS so that maximum value may be derived from the system. This work is an important example of the efforts made to try to take ICT evaluation beyond the arena of the purely financial techniques which underlie the payback, ROI, NPV and IRR approaches. Information Economics did not receive the acclaim which it perhaps deserved, possibly because the technique required a considerable amount of subjective judgement to be mixed with the hard financial numbers. But Parker et al. made a valuable contribution to broadening the thinking in ICT evaluation.

1.7 The third era in business computing

The third era in business computing could be said to have begun with the publication of the results of the Massachusetts Institute of Technology report which is referred to as MIT 90.\footnote{MIT 90 is an abbreviation for Management In The 1990s.} MIT 90 was led by Michael Scott-Morton and was the largest business ICT research project of its time. Its budget was of the order of $15 million. It was funded by about ten of the largest business houses in the USA and the UK. Based at such a distinguished institution as the Massachusetts Institute of Technology its finding attracted much attention. This research did not address the problems of ICT evaluation as such. What it did was to strengthen the belief that ICT could transform organizations and, if this was the case, it followed that there would be a need for a different sort of metric to evaluate this activity. MIT 90 addressed the problem that it was difficult to see the effect of the use of ICT and it suggested that there may be a lag effect. The authors pointed out that despite the fact that the electric motor was patented in 1837 it did not come into common use until the 1920s, i.e. the roaring twenties (roaring being the noise of the machine powered by electric motors).\footnote{See http://www.tecsoc.org/pubs/history/2002/feb25.htm for a brief history of the patenting of the electric motor.} In that this study discussed both Business Network Redesign and Business Scope Redefinition, it laid the basis for the intellectual underpinning of the Internet and web-based businesses which were to follow ten years later.
The study was published in several different forms, one of which was the Oxford University Press book, *The Corporation of the 90s*. In this book the notion of evolutionary and revolutionary information systems was introduced to the wider world. Local exploitation of computer power and efforts to integrate information systems were regarded as *evolutionary* applications. Business process re-engineering (BPR), business network reconfiguration and business scope redefinition are all discussed as examples of *revolutionary* information systems. It is probably only by about this time that ICT began to be seen not as something in its own right but as a major facilitator of changing business processes. Concurrently with the MIT 90 book, two American consultants, Hammer and Champy (1991) wrote a paper in the *Harvard Business Review* and also published a book on BPR. This also helped reposition ICT as a major facilitator for transforming organizations.

During this period, Strassmann’s was not a lone dissenting voice. From the mid-1980s an increasing number of authors were expressing doubts about the returns on ICT investments. Various articles questioning the value of IT started to appear and the issue was aired in leading business journals such as *Fortune Magazine* (Bowen 1986) and the *Financial Times* (Griffith 1997). Dier (1992) cites a litany of reports expressing, in one way or another, concern about the lack of return from IT investment.

Meanwhile, a significant amount of energy was being devoted to try to find methods of evaluating the impact of ICT as a transformer of organizational performance. A group at the Massachusetts Institute of Technology, using macroeconomic data, declared that they could not find evidence of increased productivity resulting from the use of computers. This was clearly articulated by the Dean of MIT and Nobel Laureate Robert Solow who (reportedly) said:

> You can see the computer age everywhere but in the productivity statistics.

Following on from this, researchers from MIT such as Erik Brynjolfsson (1993) declared that there was a *productivity paradox*, i.e. the productivity paradox referred to the fact that record sums were being invested in ICT, but there was no apparent increase in the national productivity statistics. Another way of seeing this paradox is that there was a *gap* between corporate computerization expenditure and corporate output or productivity improvements.

In 1996, along with Lorin Hitt, Eric Brynjolfsson published a paper entitled ‘Paradox lost: firm level evidence to high returns to IS spending’. The reaction to this recantation of the previous productivity paradox did not produce much excitement.
It is worth pausing at this point to note that, by this stage, three distinct strands had emerged within the ICT evaluation literature. The first was the one that had dominated discussion of the benefits and value literature of which the ‘hard numbers’ school of thought, which used tradition financial and/or economic metrics, was an important subset. Solow and Brynjolfsson were (and are) part of this latter tradition. Their research focused on economic type measures. Unfortunately, these approaches have exhibited similar types of problems to those generated by accounting measures, albeit in this case compounded by a serious lack of good and relevant data. Within a few years Brynjolfsson (Brynjolfsson and Hitt 1996; Hitt and Brynjolfsson 1996) had admitted errors in his approach and was then claiming that ICT offered exceptionally large (arguably ludicrously large) ROIs. By this time, some scholars were becoming sceptical of such econometric methods, not least because of the questionable nature of the data underlying them. There were, however, two other strands to which they could turn. These are the methodological literature and the cost focused literature and it was out of the first of these that many new ideas now started to emerge.

### 1.8 Some non-accounting approaches

The early 1990s began to see other approaches being explored, in particular in the United Kingdom at the National Computing Centre (NCC) in Manchester. There they attempted to develop a single metric by which ICT could be evaluated. This led to a ranking system which employed a dozen dimensions and the results of which were reported using a spider chart. A variation of this was a method which was developed by the Prudential Insurance Company (Coleman and Jamieson 1994). Much like Information Economics which had been developed about five years earlier the NCC approach did not make a big impression on academe, consultants or practitioners, again possibly because it was too complicated and not easy to understand. However, a few consultants picked up some of the ideas of the NCC\(^\text{14}\) and started to offer value for money studies which addressed many of the dimensions suggested by the NCC.

At around the same time Kim (1990) presented a paper at the International Conference of Information Systems (ICIS) on the use of gaps to conceptualize IS user satisfaction. This technique was then adapted for ICT. It was originally developed by Parasuraman \textit{et al.} (1985) and called ServQual. ServQual was

\(^{14}\text{The NCC work conducted in the UK was referred to as Health Check Reviews (HCRs). An HCR gave a high-level comment on how the ICT operation was being managed.}\)
designed for the measurement of service quality in the marketing arena. Kim argued that Parasuraman’s ServQual could be used as a surrogate measure for IS effectiveness. This was a major step forward in the non-monetary measurement of ICT systems’ success. Unfortunately this type of analysis which is sometimes referred to as User Information Satisfaction (UIS) analysis can only be used in an ex-post situation. It does not provide a means of assessing the viability of an ICT investment before it is initiated. Kim (1990) certainly moved the evaluation debate forward. While Kim’s approach was an important development, it was only of value in as far as one could accept that user satisfaction was a suitable proxy for ICT effectiveness. (A variety of sophisticated mathematical techniques may be used on the data created by one of these studies which can give it the feeling of a genuinely scientific approach.)

The idea that there was a need for a wider view continued to gain support in the early 1990s. The pioneering work in this was, as noted above, done by Parker et al. Symons (1990, 1994), for example, argued the case for multiple perspectives. In 1993, Barbara Farbey, Frank Land and David Targett published their findings from five years of research which emphasized that the only way of understanding ICT evaluation is through the business processes it facilitated. They argued that context was of paramount importance in ICT evaluation. They also pointed out that it was important to focus on who was asking the question about success of the ICT investment and they made the point that evaluation is a political act. As part of their work, they proposed that different methods of evaluation should be used in different contexts and provided a map of which methods were appropriate where.

In 1992 Remenyi, Money and Twite published a comprehensive review of most of the different approaches to ICT evaluation. This work encompassed accounting techniques, ranking and scoring techniques and value for money studies. It also featured the beginnings of a multi-dimensional approach to the problem. However, it remained for Kaplan and Norton (1992) to take the next step in this thinking and to publish both in the Harvard Business Review and in a textbook the multi-dimensional approach that they called the balanced scorecard. Although Kaplan and Norton designed the balanced scorecard as a method of assessing business performance, it was a potentially powerful tool for ICT evaluation and consequently was a further important step forward in ICT evaluation thinking. Meanwhile, the Remenyi, Money and Twite book emphasized that the value from ICT does not materialize without effort, and thus management needs to have a benefit realization programme in place.

Another approach which for a while appeared to have great potential was the Options Pricing Model for ICT evaluation. The limitations of traditional financial
models such as discounted cash flow (DCF) for ICT evaluation have led researchers to explore alternative methods that allow for incorporating risk analysis and the value of deferral options in information technology investments. One of these alternatives has been to borrow Option Pricing Methods (OPM) from financial markets analysis and apply it to information technology investments. Although this technique is at an early stage and further research needs to be done before it can be used by practitioners, its capability for managing asymmetric returns and deferral options looks promising.

In cases where the firm has a deferral option (delay deployment), the OPM method has significant advantages over the traditional discounted cash flow (DCF) method. The most basic advantage is that, unless an attempt is made to explicitly model asymmetric returns, NPV will always undervalue; another more operational one is that OPM takes into account the fact that changes in revenue will occur as time passes and no parameter adjustments (e.g. discount rate or expected value of revenues) are needed. Examples of how OPM can be adopted in ICT evaluation are the following:

- Organizations that adopt an enabling view of information technology infrastructure often make ICT investments without any immediate expectation of payback. They do this to create the opportunity for later operational ICT projects that support a specific business process which yields measurable revenue (e.g. intranet and multi-media user interface technologies, portal technology, etc.). This is handled in OPM by considering that this opportunity is the option’s underlying asset.

- Application design prototyping investments also provide significant option value. With prototyping, the firm aims to maximize the value of an application development project whose value will ultimately be determined by how well its functionality can remain in synch with the needs of a changing business process. Clearly, when there is considerable uncertainty in an organization about whether an application will be able to perform when it is delivered, efforts to break down such projects into phases, and monitor their payback over time, are an appropriate approach. From this perspective, much of the value of a prototype project will be in the options that it offers the firm in the future.

The main criticism made to the application of OPM to ICT is that ICT investments are not tradable, which is one of the underlying assumptions of OPM. However, the finance literature offers several strong arguments in support of the case for using the Black–Scholes version of OPM to price ICT investment options. An intuitive
argument is that, in capital budgeting, irrespective of whether a project is traded, the aim is to determine what the project cash flows would be worth if they were traded (i.e. the contribution to the firm’s market value).

By the middle of the 1990s e-commerce or e-business was well on its way to becoming a new phenomenon in business. The wave of enthusiasm that followed resulted in a much greater interest in ICT among business and the general public than there had ever been before. But the scramble to create web facilitated businesses did not lead to any improvements in ICT evaluation. On the contrary it could be argued that this rush led to a deterioration of the ICT evaluation practice as preposterous ‘new business models’ were proclaimed and an army of false prophets foretold the death of traditional business values. Between approximately 1995 and 2000 a whole range of potential businesses, some with very little prospect of success, were launched. Little or no evaluation was performed and most of these businesses failed losing substantial sums of money for their sponsors and shareholders.

1.9 The turn of the millennium

It took until the e-bubble burst in 2000 to prove that this gung-ho approach was not sound. Hundreds of billions of dollars were lost during this period. The George Soros Quantum Fund alone lost $2.5 billion. This period was also marked by the Y2K problem. There were many computer systems which were written in the 1970s, 1980s and 1990s which used a date format of two digits. With the ending of the century and the millennium on 1 January 2000 these elderly pieces of software were suspect and could easily have crashed with catastrophic consequences. This potential problem inspired many organizations to have their old systems, generally referred to as legacy systems, redeveloped or replaced. Much of this work was seen as obligatory and was not subjected to the type of scrutiny which it might have otherwise deserved. There was a general feeling in many circles that the ICT community exaggerated the potential disruptions of the Y2K situation to benefit at the expense of business and society in general. In summary this period was not a vintage one for ICT evaluation as a general euphoria temporarily swept the doubters aside.

In the relative calm that followed the dot.com storm, ICT evaluation has been evolving slowly. The large sums that are being spent on this technology are in themselves a form of confirmation that ICT is producing organizational value (Bannister et al. 2003). Furthermore the issue of the challenges involved in producing reliable ICT cost estimates has been raised (Bannister and Remenyi 2000). The idea of the balanced scorecard, which incorporates financial figures with non-financial metrics, or similar multi-dimensional perspectives, is increasingly accepted as a
respectable approach. However, as the world emerged from the financial debris of the dot.com crash, the stage was set for a more cold blooded and negative approach to ICT investment. The years from 2000 to date have seen both a more reflective attitude towards ICT evaluation and something of a ‘back to basics’ backlash. A renewed emphasis on things like value for money and ROI has accompanied the greater acceptance of the principle of using multiple lenses. There has also been the realization that ICT should not be evaluated by specialist evaluators, but rather by those who use the technology themselves (Keen 1991; Remenyi 2005). The one noticeable exception to this has been the HBR paper by Nicholas Carr (2003). In this paper and a book that followed Carr (2004) argued that ICT had lost its capacity to offer competitive advantage. The argument was that ICT, like many other revolutionary technologies that preceded it, was getting closer to its phase of advanced build-out and becoming an infrastructure. It has thus become a cost of doing business that must be paid by all, but provides distinction to none. From an evaluation point of view, if this is the case then it would seem that it is hardly worth spending effort on evaluation at all.

1.10 Some other ICT evaluation issues

As part of the search for a robust method of evaluating ICT several important issues emerged which offered additional understanding of the problems and challenges faced by those who would evaluate their ICT investment. The first of these was the process nature of any evaluation, especially ICT evaluation. The second was the fact that any evaluation is quintessentially a political act.

The process nature of ICT evaluation was addressed in the Remenyi, Sherwood-Smith and White book *Achieving Maximum Value from Information Systems: A Process Approach*, in 1997. One of the contributions made by this book was to argue that ICT evaluation was not short of tools. It was perhaps even hampered by the proliferation of different approaches. What ICT evaluation required was to be placed in the context of a management process and before this could be done it was necessary to position evaluation in terms of some basic attitudes to evaluation itself. Thus the terms summative\(^\text{15}\) and formative evaluation were introduced. In general evaluation, especially *ex-post* evaluation, could not be competently performed without it being part of a greater process of ICT management.

\(^\text{15}\) The concepts of summative and formative evaluation are discussed in *Achieving Maximum Value from Information Systems – A process approach*, Wiley, Chichester, UK, 1997 by D. Remenyi, M. Sherwood-Smith, with T. White.
The fact that ICT evaluation has a political dimension was also discussed in this book. The process of appraising new investment is always a political process in so far as it touches on the diverse interests of many people and stakeholder groups. Farbey et al. (1993) stated that:

The process of appraising new investment is always a political process in so far as it touches on the diverse interests of many people and groups.

This thought brings home the fact that an ICT investment may well have a wide range of stakeholders some of which may be friends and others enemies and that the attitudes of the different stakeholders need to be taken into account when an evaluation of the investment is made.

The book by Remenyi et al. (1992) emphasizes the need to explore the context of the ICT investment before it can be evaluated. In stating that evaluation was a political act, Farbey et al. (1999) made us aware of the need to examine the motives for evaluation. Remenyi et al. (1992) discuss the multi-dimensional or multi-perspective approach to ICT evaluation without giving it the name balanced scorecard. That was to remain incomplete until Kaplan and Norton arrived and created a whole industry out of this concept.

1.11 Examining the timeline in more detail

Examining the past 50 years of ICT evaluation it can be seen that it is characterized by a number of waves of thinking which have to be understood in terms of their times and the maturity of the use of the technology. Table 1.1 shows the different waves and the uses of the technology together with other evaluation issues. One of the important issues which has arisen is that an ICT evaluation study is actually a research study and it needs to be thought of as such. There are several implications resulting from this way of looking at ICT evaluation which will now be discussed.

The early applications were thought of as primarily being direct interventions into the cost structures of organizations and the ICT community at that time saw the cause and effect relationship between costs and benefits as being the primary issue. The relationship between ICT investment and corporate costs were seen through a positivist16 lens. This assumed that ICT investment costs could be accurately measured and the effects could be identified and also measured. This was to change when it was realized that the cause and effect relationship was more subtle and complicated than had been thought heretofore.

16The term positivist is used here to denote a purely quantitative view of evaluation which would rely exclusively on physical measurements including money measurements.
Table 1.1 A timeline-based view of ICT evaluation thinking

<table>
<thead>
<tr>
<th>Date</th>
<th>Primary applications</th>
<th>Approach to evaluation</th>
<th>Metrics</th>
<th>Who should be the evaluator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950 to mid-1970s</td>
<td>Labour saving devices</td>
<td>Simple cost reduction or cost avoidance</td>
<td>Payback ROI</td>
<td>Accountants or auditors</td>
</tr>
<tr>
<td>Late 1970s–1980s</td>
<td>More sophisticated applications including automate and informate applications</td>
<td>Still a strong emphasis on Accounting-based approaches Strassmann suggests a new metric</td>
<td>Payback ROI but also NPV, IRR and other discounted measures Return on management</td>
<td>Mostly accountants or auditors</td>
</tr>
<tr>
<td>1990s</td>
<td>The concept of infomate is strengthened and transformate becomes an issue BPR becomes a fact in how ICT investment is viewed</td>
<td>Although cost reduction or cost avoidance are still used they are now in a more sophisticated arena The search for other metrics is heated up with work being done on both sides of the Atlantic</td>
<td>An increasing wide range of metrics which are then combined into a multi-perspective format the best known of which is the balanced scorecard</td>
<td>A combination of organizational officers including accountants and auditors but also IS staff and consultants</td>
</tr>
<tr>
<td>Late 1990s experiences the e-bubble and the Y2K effect</td>
<td>Evaluation takes a back seat</td>
<td>The idea of the new economy gains currency</td>
<td>Metrics are underplayed</td>
<td>Little evaluation done</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th>Date</th>
<th>Primary applications</th>
<th>Approach to evaluation</th>
<th>Metrics</th>
<th>Who should be the evaluator</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>e-bubble bursts</td>
<td>Calculation of money lost</td>
<td>Stock market evaluates the range of investments made during the e-rush to invest</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Senior corporate executives complain that there was an overspend on Y2K</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Entrepreneurs and investors bemoan their losses on the stock exchanges</td>
<td></td>
</tr>
<tr>
<td>Since 2000</td>
<td>Increasingly wide range of applications</td>
<td>Some form of multi-dimensional perspective with emphasis on the strategic impact of ICT</td>
<td>A series of balanced scorecard type metrics</td>
<td>Managers who are using the technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Realization of the importance of management instinct in ICT evaluation</td>
<td></td>
<td>Senior and top management</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Realization of the challenges inherent in producing relevant cost data</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In understanding how the ICT evaluation lens changed, it is important to remember that ICT evaluation theory and practice has been, and still is, a moving target with a continuous stream of new ideas emerging. This is why this field of study is sometimes referred to as eclectic. The wide range of approaches is indicative of the fact that there is little consensus in this field of study and practice. Sometimes regarded as evolving, ICT evaluation may also be thought of as somewhat chaotic, there being so little consensus and so many different views. The evolution in this field of study is triggered by new minds coming to this subject and bringing to it fresh outlooks, often being borrowed from other fields of study which have a different research paradigm. Despite this, the one constant has been the crucial significance of a financial dimension.

Examining Table 1.1 it is not difficult to see just how important financial analysis has always been and still is in the evaluation of ICT investments. This is despite the fact that cost benefit analysis is seldom if ever accurate, though cost benefit calculations may be accurate enough to give adequate insight into the investment decision and to be able to subsequently comment on its success. It is also worth pointing out that the financial approach is the only one that has been available from the earliest days in the 1950s. Such methods continued to be used despite the fact that during this period high levels of inflation were experienced in many countries and this damaged the credibility of the accounting systems and methods.

One of the main reasons why financial-based evaluation systems have persisted is that they are easy to understand and that they are the common currency of managers, even non-financial managers. The variables required for their use are clearly defined and, while there are technical arguments about nuance, there is little disagreement among exponents as to how to use them or interpret them. The problem which arises is that it may be exceedingly difficult to estimate the necessary input values. It has been previously believed that the benefits of ICT were difficult to measure but that the costs were not. In their 2001 paper Bannister et al. demonstrated that ICT costs can be quite difficult to measure.

Research today tends to look at issues to do with the implementation of different techniques of evaluation and observes their impact on organizations and the individuals involved.

17 It is now suggested by some that the flow of new ideas has slowed down and this may be the case. On the other hand it is likely that new ideas will still emerge to help understand how ICT costs and benefits may be controlled.

18 For more on inflation see http://en.wikipedia.org/wiki/Inflation
1.12 Lessons learnt

A striking, and perhaps disappointing, fact is that over the past 50 years, no core or overarching theory of ICT evaluation has emerged despite an exceptional effort to find one. It is clear that ICT has a substantial impact on organizations and that this impact is generally for the better (Bannister and Remenyi 2000). There was probably a brief moment in the late 1980s or early 1990s when some members of the ICT community thought that a single ICT evaluation metric and supporting theory would be developed. This is no longer the case. It is now understood that there are many metrics which are capable of reporting the success or otherwise of ICT investment. In addition new metrics are likely to be developed as the ICT community continues to struggle with the challenges of evaluation, although the emergence of genuinely novel ideas is becoming increasingly rare. It was noted above that the context of the evaluation and the motives of the evaluators are important. Thus it is important to bear in mind why the ICT is to be evaluated and then to select the appropriate metrics. This, in essence, is the approach recommended by Farbey et al. in 1999. The choice would appear to boil down to two poles: look at the context and choose the best method; or apply a number of methods and combine these in some way. In so doing there is always the danger of relying on numbers as a crutch (Bannister and Remenyi 2000; Boyle 2001). It is important to note that there are many different ways of using ICT evaluation metrics and these will produce different results. This is what is meant by the eclectic nature of ICT evaluation.

So is the search for a definitive theory of ICT evaluation, like the quest for the Holy Grail, a vain pursuit? If one is to believe Carr, the answer is yes. His view may be summarized as organizations should make modest, follow-the-leader, low risk investments in ICT and not worry too much about returns on investment or improved competitive advantage. However looked at from a wider perspective, the answer is a definite no and for at least two reasons.

The first of these reasons is that there is still a great deal that we do not understand about how and what humans value. Furthermore human values change, not only over time but also from one situation to another.

Consider return on investment. First, this metric simply looks at an investment from the perspective (or the values) of one group of stakeholders and ignores the potential interest (or the values) of others. Just because an investment profits one group does not necessarily mean that it will be valued by other stakeholders. Second, there are new challenges continually coming down the pipe. Developments in ICT, particularly in areas like artificial intelligence and robotics, pose...
entirely new problems and questions for evaluators and may change the locus of some questions entirely. So the struggle is far from over. On the other hand, an overarching theory, like a definitive theory of the universe, may prove elusive. In the paper referenced above, Ackoff famously concluded that ‘the business of managers is managing messes’. ICT evaluation is just such a mess and like all management problems, while it can be frustrating, it always offers opportunities for fresh thinking and thus fresh insights.

But whatever novel insights are developed it is most likely that they will be part of a multi-dimensional framework of which the balanced scorecard is but one.

From another perspective lesson learnt regarding decision-making quality is that there is a difference between the (perceived) success of an evaluation and the effect of an evaluation (Nijland 2004). Evaluation methods have a major effect on decision making, even though the evaluation activity, as such, might be perceived as unsuccessful. This continuous interaction between evaluation and organization also implies that evaluation continuously needs to be adapted to the changing organizational setting (among others, caused by evaluation itself). Understanding the complex phenomenon of evaluation requires notions from social, economical, political, cultural and historical perspectives.

The lesson learnt regarding the economic perspective is that successful (upfront) ICT evaluation requires a lifecycle approach (Berghout and Nijland 2002). We assume that a major problem in cost benefit management is the relative isolation in which the various lifecycle evaluations take place. Investment appraisal is treated separately from system development, which is again dealt with separately from operations. Most cost and all benefits, however, occur during operations. A professional and learning organization is required to build up the knowledge base to link existing cost and benefits to future investment evaluations.

1.13 Summary

In the past 50 years the evaluation of ICT has attracted a great amount of research, comment and debate. Although this work has not led to a single evaluation method or generally agreed approach to ICT evaluation, it has led to a much greater understanding of the issues involved and this research has pointed out many interesting attributes of the use of ICT in organizations. Furthermore this research has led to a less naïve approach to ICT investment and to a greater understanding of the behaviour of ICT costs and benefits.
However, the research activity in ICT evaluation is by no means finished. Academics, consultants and practitioners are still active in this arena and there does not seem to be any converging of the findings of this work. There is little doubt that there are more insights to be found and a more complete understanding to be achieved in this difficult field of study as was pointed out by Checkland (1986, p. xii):

*Obviously the work is not finished, and can never be finished. There are no absolute positions to be reached in the attempt by men to understand the world in which they find themselves: new experience may in the future refute present conjectures. So the work itself must be regarded as an on-going system of a particular kind: A learning system which will continue to develop ideas, to test them out in practice, and to learn from the experience gained.*