Preventing Retail Shrinkage: Measuring the 'Value' of CCTV, EAS and Data Mining Tools

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Adrian Beck,
Reader in Criminology, University of Leicester, UK

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To contact ECR:

Efficient Consumer Response (ECR)
9 Avenue des Gaulois
1040 Brussels
Belgium

To contact the author:

Adrian Beck, Reader in Criminology,
University of Leicester, Department of Criminology,
154 Upper New Walk, Leicester LE1 7QR UK
Email: bna@le.ac.uk

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Executive Summary

This report presents findings from a study undertaken on behalf of the ECR Europe Shrinkage Group. Its aims and objectives were to better understand how retail loss prevention practitioners calculate the value of investments in CCTV, EAS and Data Mining technologies, develop better practice in this area and provide practical steps for the loss prevention community in measuring the impact of various types of technologies. The report offers the retail loss prevention practitioner:

- A step by step guide on how to develop a coherent and persuasive business case for investing in shrinkage solutions in the future, including a detailed worked example.
- Detailed understanding of how to measure the 'value' of such investments, including a comprehensive explanation of the four key measures commonly used: Return on Investment, Net Present Value, Discounted Pay Back Period, and Internal Rate of Return.
- Clear guidance on how these measures should be used when communicating with the rest of the organisation to ensure credibility.
- Specific information on how to measure the 'value' of investments where strict financial returns are not easy to identify such as with CCTV, including a comprehensive list of possible variables that can be used for CCTV, EAS and Data Mining technologies.
- Detailed information on what other retailers are using, how they rate CCTV, EAS and Data Mining technologies and how they go about measuring their performance.
- A comprehensive list of Data Mining exception reporting variables to enable loss prevention practitioners to make the most of the technology.
- A checklist of requirements to ensure that CCTV, EAS and Data mining technologies are implemented effectively.

The report found that:

- The loss prevention community in Europe needs to radically improve the way in which it measures the value of investments in shrinkage control technologies. As business competitiveness increases and demands for returns on internal investment come under greater scrutiny, the need to 'prove' value for money is becoming more necessary.
- There is a lack of understanding of how to measure the value of investments and too often loss prevention practitioners use the generic term 'Return on Investment' as a catch all phrase to suggest overall effectiveness rather than as a precise measure of value as it was originally created to convey.

- Loss prevention executives need to understand and use the language of senior management when making business cases for investment. Incorrect usage of financial terms and naïve cost/benefit models will undermine credibility, particularly when being compared with investment requests from other functions in the business.

- There is a dearth of published information available charting the value of investing in CCTV, EAS and Data Mining technologies in retailing. While some limited studies exist on EAS and Data Mining, virtually nothing has been written about the value of investing in CCTV. Those studies that do exist adopt overly simplistic methods to measure the value impact of the interventions.

If retail loss prevention practitioners are to be taken more seriously by other functions within the business, then they need to show greater rigour and professionalism in the way in which they go about developing business cases for investment, and how they measure and monitor the performance of 'solutions' they recommend. It is hoped that this report will help them to achieve this.

Introduction

After staffing, technology is probably the biggest investment organisations make in tackling the problem of shrinkage. It is a multi-billion Euro business with a plethora of organisations offering a multitude of technologies including: closed circuit television (CCTV), electronic article surveillance (EAS), data mining and analysis applications and display equipment. Some of these technologies have been in existence for many years, while others are new to the market. Much of the current data on the efficacy and value for money of these technologies in tackling shrinkage is at best patchy, and at worse unhelpful, as often self interested providers pedal yet more extravagant claims about returns on investment and associated reductions in shrinkage. In addition, how organisations decide to invest in a particular technology is not clear – do they carry out detailed and well designed pilots, what role does the technology supplier play in providing the 'evidence' for justifying its use, the potential value it will bring back to the business, and what is the available findings on its impact upon the problem of shrinkage?

This project was designed to contribute to the debate on technologies and shrinkage control by identifying a reliable way to assess the value of loss prevention interventions, and examining the benefits attributed to three types of technology: CCTV, EAS and Data Mining software.

Aims and Objectives

The project had four inter-related aims and objectives:

- To review the information currently available in the public domain on the value of shrinkage-related technologies.
- To understand how and to what extent retailers carry out pilots on the three types of technology under consideration.
- To discover how retailers and providers calculate the value of technology investments.
- To develop guidance on how the value of investments should be measured in the future.

It is important to note at this time, that the purpose of this study was not to come to a view on the overall effectiveness of each of these technologies. EAS in particular has been a technology that has aroused much debate about whether it is effective or not in reducing shrinkage. Published evidence to date is very mixed and few quality studies have been carried out that enable the reader to come to a firm conclusion on the impact technologies such as EAS, CCTV and Data Mining software have had on retail shrinkage. Instead, the purpose of the current study is to review what is known to date about the role of 'value' in decision making and understand how retailers take 'value' into account when they make investment decisions in these technologies.

The report is structured in the following way. Detailed below are the methods used to collect information for this study. This is then followed by a findings section, which is made up of four

parts: the first offers an overview of the existing literature on measuring the value of each of the technologies covered in this study. The second section summarises the findings from the survey of retailers on their experiences of carrying out measurements of value. The third section looks at how value can be calculated and the problems associated with its measurement. A matrix is provided for the three technologies, highlighting the variables that should be considered when developing a measurement of value. The fourth section provides details of how to put together a business case for justifying an investment in a given intervention. It provides a worked example of what this might look like. The final part of the report offers a series of recommendations for the use and development of value measurements for loss prevention practitioners.

Making Sense of 'Return on Investment'

The term 'ROI' or Return on Investment is a term that is often used to describe, in a rather generic way, the financial benefit/value (or not) of a particular intervention. In the world of accounting it is in fact a very specific type of measurement with a precise formula (the ratio of the net gain divided by the total cost of the investment) calculated to give a percentage figure. However, in the loss prevention community it is rarely used in this way and is more likely to be used to describe a range of different indicators employed to measure performance. For instance, some will use the amount of time it takes to 'pay back' the original investment as their 'ROI', while others will use something equating to 'Net Present Value' which measures the net benefit of a particular project. Indeed, others have used it simply as a catch-all phrase to suggest an intervention has 'worked'. This misuse of the term ROI while understandable does nothing to improve the way in which other functions within a business might view loss prevention professionals, and certainly discussions with finance functions will quickly flounder if such basic mistakes are presented as part of a business case for investment. It is proposed in this report, therefore, to not use the term ROI except when referring to the actual calculation and instead use the terms 'value' or 'benefit' measurement when discussing more generalised ways of considering the pay back of interventions. The only exception to this is in the section summarising the findings from the survey of European and US retailers where the term ROI was used more generically because of perceived prevailing conventions and to reduce misunderstanding.

Methodology

The project made use of a series of methodologies to meet the aims and objectives which are detailed below.

First, the project utilised a literature review to understand what has been published to date on the issue of measuring value and loss prevention technologies. This proved a very difficult and largely unproductive task. Almost nothing has been published specifically relating to this and the three technologies under consideration. Whilst research reports do exist that look at the 'effectiveness' of each of them, hardly any provided firm findings relating to the value of such interventions.

Secondly, in order to gauge the extent of the use and testing of the three technologies and the role of measuring value in this process by the retail loss prevention community, an online survey was developed. Initially the research used the existing contact database which has been used in the past by the ECR Europe Shrinkage Group to carry out its occasional surveys on stock loss, which covered major retailers in 21 European countries. The overall rate of response was low and so an additional list of US retailers was sent the survey (details of the survey were distributed by RILA in the US). The online survey was made available in March 2007 and respondents were able to provide data until the end of August 2007. Various methods were used to improve the response rate, including repeated email requests to prospective respondents and contact with ECR national groups. For instance, ECR France offered to translate the research instrument into French to improve the response rate in that particular country, but to no avail. Of course, respondent apathy is nothing new when carrying out surveys, but in the end the research was able to secure responses from 36 companies in Europe and the US. Perhaps not surprisingly, given the relatively complex and detailed nature of the questions being asked, most respondents were from large retail organisations. In addition, there is a danger that only those companies that had undertaken some form of measurement process decided to respond, skewing the data accordingly. However, despite the relatively low number replying, the survey did yield sufficient data to enable a relatively meaningful analysis to be undertaken.

Thirdly, the research planned to use a series of case studies to look at how particular organisations have gone about measuring the value of each of the technologies under consideration. Once again, this proved a difficult task as few were able to offer specific examples, either because it has not been carried out in any systematic fashion, or the information was deemed too sensitive to be made available to the project. In the end, no company case studies were judged suitable to be included as 'good' verifiable examples of how value had been measured in the real world. This in itself is an interesting finding from this study and highlights the overall lack of rigour within the industry in Europe in achieving robust measures of the value of loss prevention technologies employed.

Findings

Reviewing the Literature

Interest in measuring the impact of shrinkage-related interventions has grown considerably in the past few years. Indeed, more broadly within retailing, especially within the fields of marketing and advertising, there is a growing expectation that management will be held more accountable for their decision making, particularly when it has required expenditure by the business. As retail competition increases and budgets come under far more scrutiny, the need to 'prove' the value of an investment has grown considerably. Indeed, there is an increasing trend throughout business and government for functions to measure performance and justify their existence[1], part of which is ensuring that the value of an investment is clearly understood and transparent. Figlio argues quite rightly that the fundamental objective of a loss prevention programme should be to 'demonstrate convincingly the return on investment of the organisation's security programmes[2] – the days of being viewed as merely a cost centre are increasingly over and good loss prevention departments want and increasingly need to be seen to be contributing to the bottom line profitability of the business.

Companies increasingly require a calculation to be made of the value an investment will bring so that funds can be allocated within the business and also that the performance of a given function or intervention can be justified. For loss prevention departments this can be a tricky game to play, particularly when they have introduced measures whose outcomes are difficult to measure. For instance, CCTV may often be introduced to make staff feel safer, or deter would-be burglars. Putting a value on incidents that have not happened can be almost impossible – how many staff would have been victimised had the CCTV not been there, what is the absence of burglaries worth to the business? Calculating deterrence in purely financial terms is almost impossible and can therefore cause real difficulties when trying to understand the value of security-related technologies and interventions. However, loss prevention specialists can include 'non financial' risk-related variables in a proposal to the business to invest in a particular approach and these will be considered later in this paper.

A trawl through the security/retail loss prevention literature generates relatively little information on measuring the value of technology used in the retail sector. As an industry, the retail loss prevention world has been remarkably secretive about sharing information on either the rate of loss being suffered, or the impact initiatives have had. To a certain extent this is understandable – shrinkage is a sensitive issue that, when badly managed, could seriously undermine investor confidence. However, it has also been caused by a dearth of quality data on the subject – which

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1 This comment was echoed by Mark Kaline, Head of Marketing for Ford USA, who said in a public forum, that 'clients have entered the age of accountability … at Ford, marketing is looked at as an expense and we are under attack to prove our worth'. Published proceedings from the *Accountability of Audience Measurement* meeting, convened by the Advertising Research Foundation, January 31st, 2005.

2 Figlio, R. (2002) 'Using Data to Measure the Effectiveness of LP Programs and Limit Your Losses', *Loss Prevention*, May-June, pp.57-8.

has been described elsewhere as a 'Data Desert'[3]. It is difficult to publish findings on the impact of spending on shrinkage interventions when the data has not been collected in the first place. Up until relatively recently, there has been little emphasis within the loss prevention community to carry out well designed and properly evaluated trials of technologies they have invested in to supposedly deal with shrinkage. For the most part, trials have often been carried out by the self interested and the untrained – those who had too much to lose if a negative result was achieved and had little if any formal training in the most basic of statistical techniques to ensure results were both robust and reliable. It is also the case that when a retailer has properly tested and measured the value of a given intervention, there is little incentive to share this with the rest of the industry such as writing papers for practitioner and academic journals detailing what has worked and why (after all, their job is to help their business make money and not act as an oracle for the wider loss prevention community).

Some oblique references to 'return on investment' can be found in the loss prevention literature, but there is little in terms of specificity on actual technologies or more importantly value outcomes. For instance, texts such as Jones' early work *Retail Loss Control* published in 1990 makes no reference to specific methods of measuring value and merely states that a prospective investor should 'commit oneself to a detailed costing exercise'[4], although later on he does make reference to the amount of time that should be given to write off the initial cost and a sense of savings through reduced losses:

> Much will depend on the corporate write-off period, as the longer that period, say 7 or 10 years, the more likely will cost effectiveness be apparent … proven cost effectiveness … achieved on a calculation of a continuation of current losses … projected over a 3 or 5 year write-off period, must surely make provision a necessity.[5]

Unfortunately Jones makes no reference to any studies or evidence to support his assertions (there are no references throughout the book) and merely states that EAS and CCTV are 'effective' in dealing with external theft. The *Loss Prevention* magazine yields many articles that have 'ROI' in their title but have little detail in terms of specific examples of how it was calculated or exact examples of how the value of particular interventions was measured. For example the article 'Adding Value and ROI with your Distribution Center LP Team'[6], which offers nothing with regards to how the ROI was developed or measured – it merely uses the term (ROI) to suggest value being added through being more systematic in the way in which the LP team operated. This seems to be a common problem – ROI has entered the glossary of loss prevention but its use seems to be as a catch all to say that an approach adopted is effective rather than as a rigorous tool to prove value for money as originally intended.

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3 Beck, A. (2002) *Automatic Product Identification and Shrinkage: Scoping the Potential*, An ECR White Paper, Brussels: ECR Europe.

4 Jones, P (1990) *Retail Loss Control*, London: Butterworths, Page 219.

5 Ibid, page 221.

6 Batson, C. (2007) 'Adding Value and ROI with your Distribution Center LP Team', *Loss Prevention*, May-June, pp. 49-54.

Others have looked in more detail at how value might be measured for different types of technology, noticeably EAS. For instance, DiLonardo in 2003 looked at the costs and benefits of source tagging and argued that introducing EAS systems across an entire retail estate is more cost effective than merely targeting the stores with the highest rates of loss[7]. He offers a costed hypothetical example showing how much cheaper it would be to do this, although it makes major presumptions about the outcome on shrinkage of adopting such an approach and that all manufacturers will agree to apply the tags at no cost to the retailer. He does cite two studies undertaken by PriceWaterhouse Coopers in 2000 that he states concluded that '[retailers] will earn an acceptable return on investment in EAS', although one of the studies (the only one where I could find any original data) was based upon a very small sample of stores (just 4) and their rate of store shrinkage was extraordinarily high (averaging between 29% and 69%)[8]. However, the PriceWaterhouse Coopers report did also conclude that: 'in low shortage, low sales volume stores, shortage reduction has been … and will continue to be … insufficient to justify EAS'. There was also no indication of whether control stores had been used to benchmark the data from the experimental stores.

In a more detailed piece published in 1997 in a volume on situational crime prevention DiLonardo presents a paper that aimed to define the economic benefits of EAS based upon 'more than 30 statistical studies' carried out in the mid to late 1980s while he was working as an account manager for Sensormatic in the US (a provider of EAS tagging technologies at the time)[9]. He offers three detailed case studies – one looking at how much EAS will reduce shrinkage when it is introduced, the second focussing on what happens when EAS is removed and then reinstalled, and the third looking at the long term impact of EAS on shrinkage. All show that EAS reduced shrinkage although only one offers any data other than a reduction in shrinkage as a percentage of retail sales. The second case study does provide some data that can begin to be used to piece together the value the investment brought to the business. His data can be summarised as follows:

	Pre-installation	**Post installation**
Sales	$8 million	$8.2 million
Shrinkage %	7.7	2.9
Cost of Shrinkage	$616,000	$238,000
Cost of Equipment		$105,000
Benefit of EAS		$133,000

The post installation period was one year after and while there is no mention of any statistical technique used to measure the actual value of the return (such as Net Present Value), the data suggests that in these very high shrink stores, EAS had a verifiable rate of return in the first year.

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7 DiLonardo, R. (2003) 'The Economics of EAS: Rethinking Cost Justification for Apparel Retailers', *Loss Prevention* , November-December, pp20-26.

8 http://www.checkpointsystems.com/download.aspx?page=superhyper&dir=d&file=EAS_smarkets_TestShow.pdf

9 DiLonardo, R. (1997) 'The Economic Benefits of Electronic Article Surveillance', in R. Clarke (ed) *Situational Crime Prevention: Successful Case Studies*, New York: Harrow and Heston, pp. 122-131.

In his article on EAS source tagging in the music and video industry, Wanke alludes to the benefits of an industry selecting one technology (in this case AM) and the extensive problems they faced in securing support from all manufacturers to use this type of source tag on all their products. The article charts the prolonged and painful journey of achieving conformity (a problem that has dogged the EAS industry since its inception) but offers little in the way of specific detail on measuring the actual value of the technology. It does conclude by stating that the results have been nothing less than phenomenal, with the music and video industry starting off with a rate of shrinkage 38 per cent above the retail average (as measured by the University of Florida National Retails Security Survey) and ending up in 2000 with an average rate of shrinkage at 1.13% compared with 1.69% for the national average – 33 per cent less.

Palmer has written a number of pieces in the *Loss Prevention* magazine which touch upon ROI both implicitly and explicitly. Indeed, he has produced the only article to be uncovered that actually offers loss prevention specialists a step by step guide as to how you go about calculating a number of indices that can be used to evaluate value[10]. He provides an excellent worked example of how a number of value measures might be developed and explains very well some of the accounting terminology necessary so that a loss prevention practitioner is more likely to be taken seriously by the rest of the business. However, he does make the common mistake of assuming that 'ROI' is an outcome of a series of indicators rather than an indicator in itself.

In another article Palmer reflects upon the factors necessary to ensure that loss prevention managers are taken seriously by the Board[11], and in particular that they need to understand and speak the language of senior management, which is frequently financial. He makes a telling point about the competitive nature of securing funds within a business:

> Remember, you are competing for a limited pool of funds within your organization. Your 'competitiors' are operations, HR, real estate, merchandising, buyers, and any other group who is seeking funding for initiatives. If they are all speaking in terms of ROI or payback period and you are not, you are out of step and have a harder sell for your initiative[12].

In a third article Palmer looks at the benefits and ROI of POS exception reporting systems (data mining technologies) and offers some of the experiences of providers and retail users[13]. He starts by reviewing the overall functionality offered by such systems, including a more user-friendly interface with company data, the ability to run queries and reports on a regular basis on high risk transactions and associates, 'drill-down' capabilities to analyse specific transactions, and the option to run specific queries on the available data. He quotes data from a number of data mining providers that state their clients are able to identify more dishonest staff more quickly and that the

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10 Palmer, W. (2001) 'Return on Investment: Turning Accounting Rules to Management Tools', *Loss Prevention*, Fall, pp. 40-44.

11 Palmer, W. (2005) 'Selling Your Proposal to Senior Executives', *Loss Prevention*, September-October, pp. 64-72.

12 Ibid, p.72.

13 Palmer, W. (2004) 'POS Exception Reporting: The Benefits and ROI', *Loss Prevention*, May-June, pp. 24-34.

dollar value of each case is much higher. For instance, Linens 'n Things, a US retailer claim they saw the total number of cases rise by 64% with a dollar value increase of 32% per incident (cases identified by their system were 200% higher than by other methods). In another example, the overall impact on shrinkage was deemed to be 50% better in the stores using the system compared to those not using it.

Data mining is also used to impact upon cash shortages and Palmer suggests that according to one study this problem was equivalent to 0.37% of sales. For another retailer, one of the pay offs was in the amount of time saved in carrying out investigations and auditing store activities – 54 hours a week in payroll was being saved which could equate to having an extra member of staff in the loss prevention group. Similarly, savings can be made in the amount of time it takes to identify and carry out an investigation on a member of staff. Palmer quotes one provider who suggested that only 8 per cent of cases are normally identified within 2 weeks but this jumped to 35% after the system was introduced. The article goes on to briefly explain how a loss prevention practitioner might go about measuring the 'ROI' on this technology, in particular trying to use benchmarking from those already using the system to help them gauge the expected financial benefits. He concludes that given the many and varied benefits that have been seen to date from this technology, it is not surprising that the loss prevention community is increasingly investing in it.

In a short article entitled 'Using Data to Measure the Effectiveness of LP Programs and Limit Your Liability', Figlio briefly considers the value of liability reduction for retail loss prevention practitioners[14]. Here is states that the 'ROI' of an intervention may need to consider the value it provides through reducing the likelihood of a company being sued for negligence. However, he offers no concrete examples relating to the technologies under consideration in this paper, but clearly his point is potentially very valid when considering CCTV interventions.

More broadly, Challinger has looked at measuring the value of corporate security and rightly concludes that it is much more challenging at this more macro level[15]. He notes that for a corporate security department they have to work on the organisation understanding that a number of assumptions have to be accepted when considering the 'pay back' on many of their activities, otherwise '… it is well nigh impossible to present a ROI for most of the security department's activities'[16]. For example, how can a value be put upon an access control system which has successfully prevented strangers from entering a corporations' premises? How many might have entered and what would they have stolen or how many staff would they have injured had the system not been in place? He argues that part of the answer is to ensure that the security department makes the rest of the business (in particular the finance department) appreciate the range of activities undertaken and the ways in which it makes sense to calculate the benefits.

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14 Figlio (2002) op cit.

15 Challinger, D. (2006) 'Corporate Security: A Cost or Contributor to the Bottom Line?', in M. Gill (ed) *The Handbook of Security*, Basingstoke: Palgrave Macmillan, pp. 586- 609.

16 Ibid, p.600.

Alternatively, he suggests, they could adopt a scare mongering campaign that highlights the potential dire consequences of not taking action although he rightly suggests caution as this could be perceived as simply incompetence on the part of corporate security and they may seek the employment of an alternative director!

When reviewing the literature in this field, it was not possible to find any studies relating to the financial benefit that CCTV brings to the retail loss prevention environment. While Gill's major review of public CCTV systems in the UK contains a section on measuring ROI (and concludes that in financial terms it does not provide an attractive business model), it does not refer to systems used by retailers within their own businesses. This is a striking finding given the enormous expenditure in the last 10 years on this technology.

As can be seen from this review of the available literature, the amount of hard evidence available in the public domain on measuring the benefit of the three technologies under consideration is very limited. Most has been written about EAS although hardly any provide actual verifiable information that can be used to come to a firm conclusion around financial value – simply offering a claimed reduction in shrinkage as a percentage of retail sales is not sufficient – reducing this is potentially relatively straightforward (close the stores and sack all the staff would also work!). The work by DiLornardo comes closest although even he does not use a particularly sophisticated approach to calculating value and uses only raw dollar values. This relative dearth of information is not meant to suggest that these three technologies might not have an impact upon shrinkage or offer value for money – it merely shows that for security practitioners trying to seek published information to help them make strategic decisions about whether to introduce them, then it is a rather barren landscape.

Return on Investment Retail Survey

As part of the research process an online survey was developed to gather information directly from retailers on the way in which they measuring the use of the three types of technology under consideration. As mentioned in the introduction, due to the generic use of the term 'ROI' to represent measurement of the value of an intervention, this is the term that was used in the survey and the subsequent summary of the findings below. The survey focussed on the following areas:

- The purpose of the investment.
- Nature of the trial undertaken.
- The use and design of an ROI calculation.
- Measuring the impact of the trial.
- The overall rating of the intervention and subsequent roll out decisions.
- Problems encountered with the technology.

Summary

The online survey was designed to find out more details on how retailers went about testing new technologies and the role ROI played in this process. While the sample was relatively small (36 valid responses on CCTV, 33 on EAS and 30 on Data Mining), the results do offer a useful insight into how some retailers in Europe and the US are undertaking evaluations on the three interventions under investigation. For a more detailed description of the findings from the survey, please go to Appendix IV.

Detailed below is a summary of the findings from the survey.

- Most retailers introduce CCTV to detect and deter internal and external thieves although a significant proportion also see a role for it in monitoring store compliance and reducing process failures.
- EAS is primarily used to detect and deter external thieves although some respondents also considered it valuable in reducing internal theft and monitoring store compliance.
- Data mining was used to focus on three areas: detecting and deterring internal thieves, monitoring store compliance and reducing process failures.
- The majority of respondents did carry out a trial on the technology, but a sizable minority did not – 34% for CCTV, 48% for EAS and 60% for data mining.
- For CCTV and EAS, most trials were limited to less than five stores while data mining trials tended to be carried using more than five stores.
- A significant percentage of trials did not include an ROI calculation – 44% of CCTV and EAS trials and 45% of data mining trials.

- US respondents were far more likely to have undertaken an ROI calculation than their European counterparts – 70% of US responses compared with only 39% of European responses.
- Most retailers used the impact on shrinkage and profit as the key variables to measure the ROI. CCTV had the broadest range of measures used to assess its performance.
- All three technologies were anticipated to have a pay back within 2 years, with EAS having one-half of respondents estimating it would meet its ROI in less than 12 months.
- In reality, respondents were overly cautious in calculating their ROI, with all three technologies being judged by a majority of those taking part in the survey to have reached pay back in less than 12 months. Data mining was seen to be the technology that was likely to pay back much quicker than originally anticipated.
- The vast majority of respondents said that they had collected data prior to the trial starting although US retailers were significantly more likely to do this than European retailers – 92% of US respondents compared with 60% of European respondents.
- Most companies collected their own data for the trial and virtually none left it to the equipment suppliers to undertake this task. About 1 in 5 respondents across all three technologies worked with equipment providers to collect the data to assess the trial.
- Nearly one-half of CCTV and 67 per cent of data mining trials did not make use of control stores. EAS trails were most likely to use control stores but even then, nearly one-third did not. Any trial that wants to be robust should make use of control stores to ensure that natural fluctuations in data are taken into account when an intervention is being evaluated.
- A majority of respondents said that they had measured the performance of the technology after the trial had ended with most stating that this was done on a constant basis. Data mining was the intervention most likely to be monitored constantly, followed by EAS and then CCTV.
- CCTV was deemed to be the technology that performed at or beyond original expectations the most, followed by data mining. EAS was also rated relatively highly, but one-third of respondents were less happy, thinking it was no longer meeting their original requirements or was now performing poorly or was a bad investment.
- Data mining was the technology most likely to be rolled out to the rest of the retail estate after a trial, with 100 per cent of respondents stating this was the case. The majority of EAS trials resulted in a complete roll out, although one-third said that it was subsequently used in only at risk stores. For CCTV, most stated that it was only subsequently used in high risk stores with just one-fifth suggesting it was rolled out across the entire retail estate.

- The vast majority of CCTV users said that they had not encountered any problems with the technology with only a small proportion identifying concerns about staff compliance and equipment-supplier support. Data mining technology was rated the next highest with nearly two-thirds experiencing no problems. However, one-quarter of data mining users did have problems with implementing the system. Finally, EAS interventions generated the largest number of problems, with a majority stating various concerns including staff compliance, equipment provider support and problems implementing the system.

Measuring the Value of an Investment

Much of the language in this field comes from the world of accounting and finance, but the principles are essentially relatively simple (even if the terminology is often incorrectly used):

> Return on Investment (ROI) over-simplified means that if I spend $100K on something, I want to know that in a certain period of time the money I spent is going to return something to me. I want to know how long that is going to take and what the percentage of return is so that I can make a business decision.[17]

Given the confusion within the loss prevention industry about what the actual terms mean when measuring the value of an intervention, the key terms are detailed below:

Capital Budgeting is the process of planning expenditure that will generate income (or in relation to shrinkage, savings) over a number of years.

Return on Investment (ROI) is the ratio of the net gain from a proposed project, divided by its total costs (over a given time period).

Discounted Payback Period is the time frame it takes for the project to yield a positive cumulative cash flow (using Net Present Value).

Net Present Value (NPV) is a measure of the net benefit of a project, in today's terms[18].

Internal Rate of Return (IRR) is the discount rate necessary to drive the NPV to zero; the value another investment would need to generate in order to be equivalent to the cash flows of the investment being considered.

Detailed below is a worked example of how these various measures can be developed and the way in which the different options of measurement are calculated[19].

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17 Wilson, M. (2004) *Demonstrating ROI for Penetration Testing (Part One)* http://www.securityfocus.com/infocus/1715.

18 For an NPV table, visit: http://www.babit.sunderland.ac.uk/BDL205/BDL205Present%20Value%20Table.doc.

19 I am extremely grateful to Walter Palmer for his help with this, particularly his article: Palmer (2001) op cit. I am also grateful to Simon Templar from the Cranfield School of Management for his invaluable input into this part of the report.

Figure 1 Example Worksheet

Cost of Intervention	€ 300,000					
Number of Stores	4					
Expected Impact on Sales	1.5%					
Current Rate of Shrinkage	3%					
Proposed Shrinkage Saving (%)	20					
Discount Factor (DF)	12%					
Expected Sales Growth	2%					

Present Value Table (12% DF)	
Year 1	*0.893*
Year 2	*0.797*
Year 3	*0.712*
Year 4	*0.636*
Year 5	*0.567*

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
Store Sales	€ 10,000,000	€ 10,350,000	€ 10,712,250	€ 11,087,179	€ 11,475,230	
Original Cost of Shrinkage	€ 300,000	€ 310,500	€ 321,368	€ 332,615	€ 344,257	
New Cost of Shrinkage	€ 240,000	€ 248,400	€ 257,094	€ 266,092	€ 275,406	
Shrinkage Saving	€ 60,000	€ 62,100	€ 64,274	€ 66,523	€ 68,851	**€ 321,748**
Additional Profit Improvement	€ 37,500	€ 38,813	€ 40,171	€ 41,577	€ 43,032	**€ 201,092**
Maintenance/Running Costs	-€ 10,000	-€ 10,200	-€ 10,404	-€ 10,612	-€ 10,824	**-€ 52,040**
Return on Investment						**57%**
Net Savings Before Tax	€ 87,500	€ 90,713	€ 94,040	€ 97,488	€ 101,059	
Present Value Before Tax	€ 78,138	€ 72,298	€ 66,957	€ 62,002	€ 57,301	
Net Present Value Before Tax						**€ 36,695**
Discounted Payback Period Before Tax						**4 Years 4 months**
Internal Rate of Return						**17%**

In this example, the proposed initial cost of the intervention (let us assume it is a CCTV system) is €300,000 and it is going to be installed in four stores. In order to understand the impact of the intervention, a number of variables are required to enable the calculations to be made. Firstly, in this worked example, there is a presumption that the intervention will have a positive effect upon sales (such as through giving store staff more confidence to put previously protected goods out on open display), in this case, it is estimated that sales will increase by a modest 1.5% due explicitly to the intervention. In other types of intervention there may be cost savings that can be included in the calculation. For instance, introducing a source tagging programme can reduce labour costs in the stores and this 'saving' should be included in the benefit calculation as a separate line.

Second, you need to know the current rate of shrinkage (3% in this example, which is measured using retail prices). Third, you need to have an estimate of what impact the intervention will have on the rate of shrinkage – in this example it is thought the CCTV system will reduce shrinkage by 20% and maintain this rate of improvement for 5 years. Fourthly, you need to know what your discount factor is. This is also referred to as the 'cost of capital' which calculates what the future cash savings are worth in today's money. For example, if the cost of the capital equipment for the CCTV system was being borrowed from a bank, then the rate of interest to be paid on the loan would be the discount factor. If the project is being financed internally, there will still be a cost of capital (a discussion with the finance department will probably get you this number). Finally, you will need to know what if any running or maintenance costs will be over the depreciation period. In the example above the cost of maintenance and running the system has been linked to the expected rate of sales growth, which has been calculated to be 2% per year (note this is what sales would have been expected to increase by regardless of the intervention).

Once you have these numbers, then you can begin to calculate the various ways in which the performance of the intervention can be measured.

The first measure to be calculated is the **Return on Investment (ROI).** This is the total shrinkage saving and additional increase in sales (above that originally expected) minus any maintenance or running costs and the original cost of the investment, divided by the original investment cost. So in this example, the calculation would be (€321,748 + €201,092) – (€300,000 + €52,040)/ €300,000. For this worked example it produces a ROI of 57% on the original investment.

The second value to be calculated is the net savings before tax – this is the actual reduction in shrinkage plus the increase in sales revenue minus the running costs. So, for the first year, a 20 per cent reduction in shrinkage will save the business €60,000, while an increase in sales of 1.5% will generate €37,500 (based upon a 25% rate of return); the running costs were calculated at €10,000, so the net saving is €87,500. Using the same method, the net saving can be calculated

for each of the 5 years. Note the issue of tax is purposefully ignored as methods of calculating and options for exemption vary enormously between different countries[20].

The Net Savings before Tax calculation is not the true value of the saving as it does not take into account the cost of the capital (as discussed above). Therefore, the **Present Value** needs to be calculated which uses a series of predetermined values (based upon the cost of capital and the period of depreciation) which are multiplied by the Net Savings Value. Computer programmes such as Microsoft Excel will calculate this value automatically, or alternatively, you can access Present Value Tables on the Internet[21]. As you can see from the example above, this reduces the overall value of the return, so for year one, the Present Value Before Tax is €78,138. This can then be calculated for the remaining four years. Once these have been calculated, the **Net Present Value** (NPV), which is simply the sum of the Present Values over the time period of the project minus the **Original Capital Investment** can be calculated. For the example above, the NPV is €36,695. Using this measure, the investment would yield a profit for the business.

The third measure that can be used to assess the impact of the intervention is to calculate the **Discounted Payback Period** – how long will it take before the investment has paid for itself. In the example above, it would take 4 years and 4 months to pay back the original €300,000 investment (note: you need to use **Present Values** to make this calculation).

The final method that can be used is the **Internal Rate of Return** (IRR). The IRR compares the rate of return to the cost of capital and provides investors with a ratio to compare various projects against each other – often the project with the greater IRR is more likely to succeed. This is a more difficult calculation to perform, although Microsoft Excel has a function to enable you to do this, or alternatively, there a number of on line IRR calculators that can help you with this[22]. In the worked example above, the IRR is calculated to be 17%.

The example above yields a return of €52,040 before tax over a relatively long period before it has paid for itself (over 4 years) and in light of the results presented earlier from the survey of retailers (when the average payback period is rarely more than 2 years), this investment might be considered somewhat risky. However, the world of loss prevention and risk management often need to consider other non financial factors when calculating the benefits of a measure and the following section goes on to look at the inherent problems relating to this and how these factors might be measured.

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20 See Palmer (2001) op cit for an excellent worked example of the impact of the tax system in the US, and how it needs to be factored into an ROI.

21 For an NPV table, visit: http://www.babit.sunderland.ac.uk/BDL205/BDL205Present%20Value%20Table.doc.

22 The calculator at: http://www.datadynamica.com/irr.asp is particularly easy to use.

Problems Developing Appropriate Measures of Value

In many settings, separating out the impact of particular security initiatives can be difficult as many confounding variables may be present[23]. This is known as *Collinearity* where various factors (or variables) are highly interconnected thus clouding the assessment of what has caused what[24]. For example, a company may introduce a series of measures at the same time, such as EAS together with CCTV, a change in guarding rotas, or better training for store staff. Identifying what has caused any subsequent reduction in shrinkage is highly problematic. There can also be problems created by *Simultaneity* which is when external factors can play a role in reducing shrinkage but are unrelated to the intervention. For instance, the introduction of an EAS system could coincide with the recent imprisonment of a prolific shoplifting gang or a major change in demand for seasonal goods (for instance the post Christmas period and a reduction in demand for stolen goods to be given as presents). Measuring value can also be compromised by *Specification* error where the wrong variables are used to measure the performance of an intervention. For instance, tracking the performance of data mining technologies on the number of customers apprehended for shoplifting. This will be considered in more detail below and a matrix will be discussed that details the key variables and how they should be measured for each of the three technologies under consideration.

In addition, an intervention may need to be seen within a broader risk management perspective, for example CCTV. Businesses may feel that they do not have to justify the investment in strict financial terms – the business needs this because it enhances the sense of security within the business and reduces their liability – both in terms of litigation and company reputation. It can also increase shareholder and customer confidence as the organisation is seen to perform due diligence by appropriately addressing potential liabilities[25].

Detailed below is a matrix that begins to look at the possible ways in which the performance of each of the three technologies might be measured – many of the variables would be very difficult to put a financial value upon, but could still be part of the rationale for investing in a given intervention. Each of the technologies is considered in turn and the nature and type of measurement available to assess performance is reviewed.

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23 Challinger (2006) op cit.

24 Bolstad, W.M. (2004). *Introduction to Bayesian Statistics*, Hoboken, NJ: John Wiley & Sons.

25 Garcia, M. (2006) 'Risk Management', in M. Gill (ed) *The Handbook of Security*, Basingstoke: Palgrave Macmillan, pp.509-531.

Closed Circuit Television			
Focus	***Purpose***	***Mechanism***	***Measure***
Security	**Detect external thieves**	View images of theft acts taking place	Number of thieves caught directly by staff viewing cameras
			Value of stock recovered
		Direct shop floor staff to suspicious behaviour	Number of thieves caught as a consequence of CCTV viewing
		Provide after the event images of incident	Number of thieves caught subsequently
			Value of stock recovered
		Record vehicle registration numbers	Number of thieves caught subsequently
			Value of cash recovered
	Deter external thieves	Increase perception of risk of apprehension	Value of stock losses
		Make offender feel security is taken seriously	Value of stock losses
		Alert staff to suspicious behaviour who then approach offender	Value of stock losses
	Detect internal thieves	View images of theft act taking place	Number of staff caught directly by staff viewing cameras
			Value of stock losses
			Value of cash losses
		Provide after the event images of thief (in support of other evidence collecting)	Number of thieves caught as a consequence of CCTV viewing
			Value of cash losses
	Deter internal thieves	Increase perception of risk of apprehension	Value of stock losses
			Value of cash losses
		Make offender feel security is taken seriously	Value of stock losses
			Value of cash losses
	Detect staff/customer collusion	Provide evidence of 'sweethearting' at the till or misuse of the till (voiding items, reducing the price, under ringing, using staff discounts etc)	Number of staff caught colluding with customers
			Value of stock losses
			Value of cash losses
	Deter staff/customer collusion	Increase staff perceptions of risk of apprehension	Value of stock losses
			Value of cash losses

Safety	**Speed up return of lost children**	Search premises quickly for missing children	Number of lost children identified on camera and returned to parents
	Increase customer safety	Make customers feel safer – company take security seriously and somebody will respond	Number of customers entering the store and Perceptions of feeling safe
	Increase staff safety	Make staff feel safer – company take security seriously and somebody will respond	Perceptions of safety in the workplace
	Reduce or confirm health and safety incidents	Provide evidence in the event of a claim	Number of claims dismissed or reduced
			Value of claims proved to be false
Compliance	**Improve staff performance**	Check staff are following procedures (eg locking doors, securing security cage, positioning of promotions)	Reduction in the number of instances of non-compliance
		Make staff feel they are more likely to be caught not following procedures	Reduction in the number of instances of non-compliance
	Improve footfall monitoring	Automatically monitor the number of customers entering a store	Number of customers entering the store

Electronic Article Surveillance			
	Purpose	***Mechanism***	***Measure***
Security	**Detect external thieves**	Tag triggers alarm at exit and offender is apprehended by store staff	Number of thieves caught at the exit when alarm is activated
			Value of stock recovered
	Deter external thieves	Offender perceives threat of apprehension to be high because of likely tag activation at exit	Value of stock losses
			Value of increased sales
		Tags make use of the product impossible (such as non-removable bottle tag)	Value of stock losses
			Value of increased sales
		Tags make reselling of product unlikely (such as dye tags)	Value of stock losses
			Value of increased sales
	Detect internal thieves	Tag triggers alarm at exit and offender is apprehended by store staff	Number of internal thieves caught at the exit when alarm is activated
			Value of stock recovered
	Deter internal thieves	Offender perceives threat of apprehension to be high because of likely tag activation at exit	Value of stock losses

Data Mining			
	Purpose	***Mechanism***	***Measure***
Security	**Detect internal theft**	Provide evidence of theft of cash from till	Number of staff caught stealing cash
			Value of cash losses
			Value of savings from thwarted future offending
	Deter internal theft	Increase staff perceptions of risk of apprehension	Value of cash losses
	Detect staff/customer collusion	Provide evidence of 'sweethearting' at the till or misuse of the till (voiding items, reducing the price, under ringing, using staff discounts etc)	Number of staff caught colluding with customers
			Value of stock losses
			Value of cash losses
	Deter staff/customer collusion	Increase staff perceptions of risk of apprehension	Reduction in stock losses
			Reduction in cash losses
Compliance	**Improve staff compliance**	Provide evidence of non compliance at the till (eg staff not scanning bar codes properly, using staff discount card inappropriately)	Reduction in number of non compliance issues at the till
			Number of till staff provided with additional training

For the mechanisms to be triggered, it is critical that the interventions are implemented and used properly, which has been a perennial problem for EAS and CCTV. Examples of the types of execution requirements for each of the mechanisms highlighted above are presented in Appendix III.

Closed Circuit Television

The use of CCTV can be grouped around three areas: *Security*, *Safety* and *Compliance*. In terms of *Security*, CCTV can have an impact upon the detection and deterrence of internal and external thieves and collusion between customers and staff. This can be done through the ability to observe on camera deviant behaviour taking place, such as incidents of theft of goods from the store or theft of cash from the till, or the presence of the equipment can simply stop offending behaviour because of the perceived increased likelihood of detection. These types of impact can be more readily measured by the business, often in terms of the value and number of incidents recorded by the system, or a reduction in the value of the losses occurring in the place where the system is operating.

In terms of calculating value, these types of impact are more capable of being used as they can be relatively easily measured and incorporated into a cost-benefit model. CCTV also has a potential impact upon issues of *Safety* and this can prove much more problematic to measure and include in an econometric calculation. For instance, CCTV is increasingly recognised as an overt expression of a company's commitment to the safety of its staff and customers. Staff often feel safer if they think that they are working within an area that is under surveillance – it often offers a symbolic notion of oversight and control and a feeling that incidents are less likely to happen if a potential perpetrator notices the cameras and thinks it may increase the likelihood of detection, apprehension and punishment. Certainly in the UK, there is a growing expectation that stores will have CCTV – it is increasingly viewed as part of the retail fabric of the store – and those that do not have it are almost viewed as behaving negligently[26].

Putting a value on staff and customers' perceptions of safety and wellbeing is almost impossible and yet in 21st Century retailing its macro benefit is difficult to ignore. Where its impact might be more measurable within the field of *Safety* is relating to incidents of health and safety. Costly 'claims' by customers and staff for slips and falls within the retail environment are becoming more prevalent and CCTV can play a role in providing evidence of the legitimacy of any particular claim. For instance, if a customer claims to have slipped on a puddle of water in an aisle and is asking for payment of damages, then the CCTV footage can be quickly reviewed and the validity of the claim verified. Certainly the value of any claims that are subsequently proved to be false by the CCTV system could be included in a calculation of benefit.

The final area that CCTV can have an impact upon is *Compliance* within the store. Members of the management team could use the CCTV system to check that staff are following the correct processes and procedures within the store – are members of staff putting high value items into the secure cage? Are members of staff arriving and leaving through the designated entrances and

[26] This attitude can be traced back to the murder of a store manager in London in a Woolworths store in 1994. At the time the company did not use CCTV and the reaction of the media was one of surprise and concern that the company, by not investing in CCTV, at a time when it was being implemented very widely in a range of settings, was not take security and safety sufficiently seriously. The company reaction was to quickly install systems to reduce what they saw as their 'Safety Liability'.

exits? As with issues of *Safety*, calculating the value of store compliance is almost impossible, and yet much of the work by the ECR Europe Shrinkage Group has highlighted the apparent relationship between good store compliance and low levels of shrinkage.

Taken together, CCTV offers a very broad range of potential benefits to the retail organisation and recent developments in the use of digital systems linked with more sophisticated software programmes are likely to yield even further benefits, particularly relating to losses at the till[27]. While developing indicators to measure the value of *Security*-related outcomes of CCTV is relatively straightforward, trying to understand the 'benefits' of what CCTV can offer in the fields of *Safety* and *Compliance* are much more challenging. What this requires is a far more sophisticated approach to understanding the role of CCTV and how it may add 'value' to the business. Thinking purely in terms of a calculated ROI, Pay Back Period, NPV or IRR will undoubtedly miss the increasingly nuanced applications of this technology in modern retail spaces. This is not to suggest that CCTV should be introduced into all retail spaces regardless of the cost or application, but a loss prevention manager wanting to persuade the business of its potential value will need to adopt a broader value measure than one merely focused on the direct economic return.

Electronic Article Surveillance

In contrast with CCTV, EAS technologies are much more one-dimensional in the way they can be viewed – their focus is very much upon dealing with *Security* issues. EAS is a technology that has been utilised by retailers since the early 1970s and was designed to deal initially with detecting and deterring external thieves. This is done through goods having a tag of some form attached (either when the product is originally manufactured – source tagged, or applied at a later stage by the retailer themselves) which will set off an audible alarm at the store exit which in turn should provoke a reaction from a member of staff. Offenders would then be more likely detected and subsequently deterred from committing future offences within the EAS-protected retail environment. This technology has progressed significantly since its original development and many variations on this concept are now available. For instance, tags can be placed on bottles that offenders cannot remove without permanently and irrevocably damaging the product. Similarly, dye tags can make the reselling of the product difficult or seriously reduces the 'value' of the stolen product through damaging the item (spilling non removable dye on the product). Both of these are examples of 'benefit denial' techniques that are designed to deter would-be offenders. EAS has also been increasingly used to deter and detect internal offenders as well, with the positioning of alarm pedestals at staff entrances and exits.

Calculating the value of EAS has been the focus of a number of studies (see elsewhere in this report) and the *Security*-related focus has meant that the return has primarily been measured by its impact upon the overall shrinkage rate for the EAS-protected environment. This means that the

[27] See for instance the technology being developed by a company like stoplift: http://www.stoplift.com/.

example outlined earlier is highly applicable for this type of technology, particularly the way in which it factors in the positive impact the intervention may have upon sales. The theory goes that retailers are more likely to put goods out on open display if they are 'protected' with EAS, which in turn can lead to an improvement in sales as customers are more inclined to make impulse purchases of goods that are more readily available for perusal. It could also be that the increased deterrent impact of the technology also means that protected goods are less likely to go out of stock and so are more available for genuine sales. Measuring any uplift in sales on goods that have been protected by EAS needs to be included in any proposed measure of the value of this technology. In addition, the use of source tagging technologies (where the tags are applied directly by the manufacturer rather than in the store) can also lead to additional labour saving costs that will need to be factored in to the overall benefit model[28].

Data Mining

This technology can impact on both *Security* and *Compliance* in the retail store. When it was first introduced in the early 1990s it was seen primarily as a tool to try and tackle internal theft, particularly at the till. It does this by analysing EPOS data generated at the till and looking for discrepancies. For instance, the software can be used to identify unusual till activity by individual members of staff such as repeated refunds to their own credit card, above average discounting or voided sales. It works as both a detection tool (providing evidence of deviant behaviour) and as a deterrent to prospective offenders (increasing their perception of the likelihood of being caught). It can also be used to detect and deter staff and customer collusion at the till. This is increasingly seen as a major problem for retailers as the opportunities to carry out such activity are many and varied and the means for detection and apprehension are potentially difficult and time consuming. Data mining technologies offer the opportunity to begin to identify signals or traits of such behaviour in staff and provide investigative staff with powerful data to undertake more detailed analysis.

As such, measuring the value of data mining technology is normally focussed around a reduction in cash and stock losses and the number of staff dismissed or prosecuted for dishonesty. In addition to its *Security* focus, data mining technologies can also be used to help improve staff *Compliance*. This is focussed around the use of the till, such as not scanning bar codes properly, inappropriate use of 'dump' codes (generic codes that do not enable automatic reordering systems to know what specific products have been sold) or misuse of staff discount and reward schemes. Therefore, a key part of measuring the value of data mining technologies could be focused on how it impacts upon the number of non-compliance events in stores and perhaps the number of check out staff who are subsequently retrained. A detailed list of the possible ways in which data mining can be used is offered in Appendix II.

[28] Care needs to be taken when calculating this type of reduction in costs to ensure that the saving is real rather than merely a paper exercise where staff are simply diverted to another task within the store and there is no actual reduction in costs.

Impact on Future Offending Behaviour – Business Benefit Value

Some retailers have adopted a cost benefit model for justifying investment in data mining technologies based upon the savings made through thwarting dishonest behaviour that would have been committed had a member of staff not been caught at an earlier stage, described by one retailer as the Business Benefit Value[29]. The theory goes that if for instance, a member of staff was identified stealing cash and they admitted that over the previous 3 months they had stolen on average €100 per month, then this can be projected forward and an estimate be derived of what they would have gone on to steal. This method overlaps with the overall measure of shrinkage within the store, as a reduction in losses should be evident once the member of staff is apprehended. It also relies upon a number of assumptions, including: the member of staff continues to steal at the same frequency and value as their previously admitted offending behaviour[30]; and that they remain in post for the projected future offending period[31].

The attractiveness of adopting such a business model is very apparent to those wishing to justify investment in data mining technologies, but it is an extremely unusual approach and one which is rarely seen in other areas of loss and crime prevention. It would be considered odd (if not dubious) to try and predict what a store had saved through the use of the deterrent capability of say EAS through analysing the offending patterns of those previously caught and then projecting forward a cash equivalent. The most reliable and robust method is to look at the impact on the existing rate of loss in those stores that have had the intervention introduced. If a member of staff or customer has been stopped from stealing, then there future desistence will be reflected in a lower overall rate of loss.

Developing Direct and Indirect Measures of Value

All three technologies provide a *Security* functionality that lends itself to the development of relatively straightforward 'direct' value variables and measurement. However, for both CCTV and data mining, their potential moves beyond this dimension and also includes *Compliance* monitoring which can be vitally important in improving the overall efficiency and profitability of a retail organisation. Measuring compliance can be achieved but it less readily generates a financial return compared with security-related outcomes and therefore can be viewed as 'indirect' value variables. Moreover, CCTV also provides a *Safety* capability which is even more challenging to measure but can certainly provide real added 'value' to the business, particularly in terms of customer and staff safety. It would seem, therefore, that CCTV offers the greatest

29 This is the term used by a representative of Iceland at a recent British Retail Consortium conference held in London in November 2007.

30 Research with offenders would suggest that this is not an unreasonable assumption and indeed, they are likely to increase their rate of offending the longer they go undetected – they tend to steal more often and increasingly greater values (which is usually the reason why they are eventually get caught).

31 Retail staff turnover is notoriously high, particularly for part time and younger members of staff, although a member of staff who is 'supplementing' their income through offending may be more inclined to stay in post.

challenge when trying to measure its value to the business. While a range of *Security*-related variables can be of use in understanding its impact, to focus exclusively upon them would be a mistake when trying to measure its value to the business. For EAS, the value measure is much clearer and more readily identifiable – its primary purpose is to impact upon internal and external theft and as such, this can be readily measured with well established variables. Finally, data mining technologies are also relatively easy to measure as like EAS, they have a strong emphasis upon deterring and detecting theft (in this case primarily internal) although the added functionality of *Compliance* monitoring should also be factored into any assessment.

Direct and Indirect Measurement of Interventions

Measurement		**Intervention**		
		CCTV	*EAS*	*Data Mining*
Direct	Security	✓	✓	✓
Indirect	Safety	✓		
	Compliance	✓		✓

EAS can be viewed as an intervention that for the most part can be measured using primarily 'Direct' value measures, whereas CCTV and to a certain extent data mining technologies, require a more mixed approach based upon the use of both 'Direct' and 'Indirect' value measures.

Building a Business Case for Investment

Developing a robust business case to persuade senior management to invest in a particular intervention requires a series of steps to be completed. These are:

1. Develop a Call to Action
2. Identify the Problem
3. Identify Possible Solutions
4. Test an Intervention
5. Analyse Results
6. Prepare a Presentation for Senior Management
7. Establish an Implementation Plan
8. Roll out the Intervention
9. Evaluate the Impact[32]

Develop a Call to Action

A persuasive Call to Action needs to clearly articulate the measurable benefits to the business of addressing a given issue. It also needs to show how this fits with corporate priorities and objectives. The Call to Action needs to be measurable and realistic. For example:

Example	*Call to Action*
	• Shrinkage on Beers, Wines and Spirits (BWS) is currently 15% and costing the business €1,275,000 a year. • Most products are increasingly being 'protected' by some of form of defensive merchandising in the stores (bottles are either behind a counter or empty boxes put out on display). • There are high levels of out of stock on some BWS items. • The company is looking to increase sales across the business by 10%. • A 20% reduction in shrinkage will deliver savings of €255,000 per year. • Returning to full open display of products will increase sales by 10%, improving turnover by €850,000 per year.

[32] This approach relies heavily upon the methodology developed under the umbrella of the ECR Europe Road Map; see Beck, A, Chapman, P, and Peacock, C. (2003) *Shrinkage: A Collaborative Approach to Reducing Stock Loss in the Supply Chain*, Brussels: ECR Europe.

Identify the Problem

Once a Call to Action has been identified, the next stage is to clearly identify the problem as it is affecting your business. This includes measuring the scale and extent, where the problem is located within the business and what the underlying root causes might be. For example:

Example	***Identify the Problem***

- Shrinkage on BWS is currently 15% and costing the business €1,275,000 a year.
- Three categories account for 40% of all losses.
- Most losses are occurring when the products are out on the shelves (70%).
- 10 stores (out of 100) account for 60% of all losses on BWS.
- High levels of loss are causing problems with on-shelf availability – high loss lines are out of stock 25% of the time.
- There is little staff presence on the aisles containing BWS.
- There is no current CCTV coverage or EAS used in our stores.
- BWS is stored in a secure cage at the back of the store and weekly counts on stock are carried out. There are few recorded incidents of empty bottles being found at the back of the store.

Identify Possible Solutions

Once the available data has been collected and analysed and root causes identified, the next stage is to put together a list of possible solutions. This can be done through a brainstorming exercise with the team brought together to identify the problem, benchmarking with other retailers who have faced a similar problem, discussions with vendors and possible equipment providers, and reviews of existing reports and studies (when available). Identification of a series of possible solutions is important in terms of generating credibility within the business. For example:

Example	***Identify Possible Solutions***

- Install CCTV cameras with public display monitors to increase perceived risk of offending.
- Position a member of staff permanently in the aisle to act as a 'product champion' and to monitor customers.
- Increase the presence of the store guard in that area of the store.
- Attach EAS bottle tags to the most vulnerable items.
- Place only the most vulnerable products behind the counter.

Testing an Intervention

Once a solution has been selected, it is important to understand what impact (if any) it will have on the business. This can be done in three ways (these should not be viewed as merely different ways of proving effectiveness but more a series of processes to ensure an intervention is fit for purpose): A Proof of Concept Trial, a Pilot Study and a Field Experiment

Proof of Concept Trial

The purpose of this is to begin to understand how a particular intervention will work in a real world setting – it provides the opportunity to understand how it might interface with existing company systems, policies and practices, and identify any possible teething problems (it is sometimes described as a 'shake down' test). The outcome of such a trial is not data that will enable decisions to be made about further investment or roll out of the intervention across a retail estate – it is more designed to answer the simple questions 'will this work in our retail space?.

A Pilot Study

A pilot is designed to understand how an intervention will work within a small number of retail spaces as it is originally designed to operate. In many respects the results of a Proof of Concept Trial will feed directly into a Pilot Study and enable a retailer to begin to measure what impact the intervention may be having on the designated key performance indicators (KPIs). The outcome of a Pilot Study should be robust data that enables a retailer to understand how an intervention is performing in a relatively small number of retail spaces.

Very often retailers will stop at this stage and make decisions based upon the results from a Pilot Study. This is not recommended. Generally speaking, the data from a Pilot Study is not of sufficient quality to enable decisions such as the future roll out of the intervention across a retail estate. Such decisions require a more detailed study to be undertaken – a Field Experiment.

Field Experiment

A Field Experiment requires a far greater degree of investment (in time and money) but the results have a much high degree of rigour and robustness (investment grade data), that will enable roll out decisions to be made, compared with a Pilot Study.

A valid field experiment requires the use of 'control' and 'test' stores – a group of stores that are selected to have the intervention introduced (test group) and a set of stores that are selected to match the test stores – usually based upon similar size, location, rate of shrinkage and sales (control group). There are usually three stages to a field experiment: a period of time before intervention when data is gathered from the sites of the intervention and control locations (pre-measure phase); a period of time when the intervention is introduced into the experimental sites only (intervention phase); and finally measures are taken over a period of time, post implementation (post-measure phase).

Figure 1 Stages of the Experimental Approach

Outlets	Phases of Experiment		
	Pre-Measure	Intervention	Post-Measure
Experimental	√	√	√
Control	√	X	√

Assuming that conditions in the experimental and control stores have stayed more or less the same (this is something you will need to monitor throughout the process), then the difference in the scores before and after the intervention can be compared and any significant differences associated to the introduction of the intervention.

Points to note:

- The project team need to have identified the KPIs to be measured before, during and after the intervention – what is the intervention suppose to affect (level of shrinkage, on shelf availability, level of sales, number of thieves detected, amount of cash losses etc).
- No other intervention should be introduced into the experimental or control stores while the project is underway. Doing so will certainly invalidate the subsequent results. Important here is to not let the security providers do anything above and beyond what would normally be the case for such as intervention. So training the staff how to use the equipment is fine, but making regular visits to the store to 'check' on progress could be problematic.
- It is recommended that there are at least 5-10 stores in each group otherwise the subsequent data may lack validity. The period of time to measure before and after the intervention should be a minimum of three months and where possible, longer.
- Because of the impact of seasonality on the retail sector, where possible comparable data from the previous year should be used.
- Do not start the post measurement phase until all the experimental stores have had the intervention introduced, tested and where appropriate, staff trained to use it.
- The appropriate statistical techniques should be used to test for differences between the experimental and control stores. Simple differences in percentages is not a valid way of proving effect – tests such as chi square need to be used to check for whether the difference between the control and experimental stores is genuine or simply due to statistical error.

Example ***Undertake a Field Experiment***

- It has been decided to trial hard EAS tags on all the high loss BWS lines.
- Five high loss stores (on BWS) have been selected to take part in the trial and they have been matched with another 5 high loss stores (control stores) – they are roughly the same in terms of levels of BWS shrinkage, sales, location and sales.
- The KPIs for the trial have been identified:
- *Rate of shrinkage on tagged BWS lines.*
- *Rate of shrinkage on BWS lines not tagged (to measure for any possible displacement).*
- *Value of sales on tagged BWS lines.*
- *Level of out of stocks on tagged BWS lines.*
- Data for the KPIs has been collected for a period of 3 months prior to start of trial.
- The hard tags are to be introduced into the 5 control stores and installation, equipment testing and staff training is expected to take 1 month.
- Data for the KPIs will be collected again 3 months after the introduction of the tags (once the equipment has been tested and staff trained).

Analyse Results

Once a Field Experiment has been completed, the results can then be analysed. It is important at this stage not to look simply at the difference in the test stores before and after the introduction of the tags, but to compare the difference in values with those found in the control stores. Shrinkage data is notoriously variable and so the key purpose of the control stores in a trial is to provide a valid benchmark to compare the differences found in the test stores.

Example ***Analyse Results***

Stores	**Rate of Shrinkage**			
	Pre-test	*Post-test*	*Difference**	*Net Difference*
Trial Stores	16.2%	6.5%	-60%	-40%
Control Stores	16.5%	13.2%	-20%	
Stores	**Value of Sales**			
	Pre-test	*Post-test*	*Difference**	*Net Difference*
Trial Stores	€35,416	€38,958	10%	8.3%
Control Stores	€34,600	€34,011	-1.7%	

* The difference between the trial and control stores needs to be tested using a significance statistic to ensure that the difference is valid rather than simply due to error.

As you can see from this example, the trial stores performed very well on the two measures shown above. Shrinkage was 40% lower than the control stores and sales increased by 8.3%.

Prepare a Presentation for Senior Management

Once the results have been analysed from the Field Experiment and assuming that the outcome is positive, then the next step is to prepare a presentation to senior management to make the case for using the intervention (in the example above hard EAS tags) more widely in the business. A key part of this presentation needs to include the financial costs and anticipated returns of investing in the proposed solution (as detailed earlier). A good presentation should:

- Identify the problem.
- Describe possible interventions considered and why they were rejected.
- Describe the proposed solution.
- Present results from the Field Experiment.
- Offer evidence of the financial and other 'value' calculations for implementing the solution.

As with all presentations to senior management it should be to the point, well supported with statistical evidence, show that due diligence was observed in the selection of a particular solution, and use the language of senior management (particularly when relating to the cost benefits of the project). The key numbers from the worked example are detailed below:

Example ***Senior Management Presentation***

- Shrinkage in BWS is costing the business €1,275,000 per year or 15% of sales.
- Through out of stocks, inventory inaccuracies and defensive merchandising, shrinkage is further reducing sales by 8.3%.
- A detailed trial of a hard tag solution showed that introducing it into the top 10 worse shrinkage stores could reduce shrinkage by 40% and increase sales by 8.3% in these stores.
- The original investment cost is €100,000, which will produce a return on investment of 270% over 5 years. The anticipated pay back period is 1 year and 11 months and the net present value to the business is €159,916 over 5 years.
- Using the businesses discount factor of 12%, the proposed project offers an internal rate of return of 44%.
- The loss prevention team recommend this investment to the Board.

Example	***Cost Benefit Spreadsheet***					
Cost of Intervention	€ 100,000				***Present Value Table (12% DF)***	
Number of Stores	10				*Year 1*	*0.893*
Expected Impact on Sales	8.3%				*Year 2*	*0.797*
Current Rate of Shrinkage	15%				*Year 3*	*0.712*
Proposed Shrinkage Saving (%)	40				*Year 4*	*0.636*
Discount Factor (DF)	12%				*Year 5*	*0.567*
Expected Sales Growth	2%					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Total**
Store Sales	€ 850,000	€ 937,550	€ 1,034,118	€ 1,140,632	€ 1,258,117	
Original Cost of Shrinkage	€ 127,500	€ 140,633	€ 155,118	€ 171,095	€ 188,718	
New Cost of Shrinkage	€ 76,500	€ 84,380	€ 93,071	€ 102,657	€ 113,231	
Shrinkage Saving	€ 51,000	€ 56,253	€ 62,047	€ 68,438	€ 75,487	**€ 313,225**
Additional Profit Improvement	€ 17,638	€ 19,454	€ 21,458	€ 23,668	€ 26,106	**€ 108,324**
Maintenance/Running Costs	-€ 10,000	-€ 10,200	-€ 10,404	-€ 10,612	-€ 10,824	**-€ 52,040**
Return on Investment						**270%**
Net Savings Before Tax	€ 58,638	€ 65,507	€ 73,101	€ 81,494	€ 90,769	
Present Value Before Tax	€ 52,363	€ 52,209	€ 52,048	€ 51,830	€ 51,466	
Net Present Value Before Tax						**€ 159,916**
Discounted Payback Period Before Tax						**1 Year 11 months**
Internal Rate of Return						**44%**

Establish an Implementation Plan

If the presentation to senior management is successful, the next step is to develop an implementation plan to deliver the project. This requires the identification of all key stakeholders (in this example store managers, store operations, solution provider etc), selecting a project manager to oversee the implementation plan, setting a timetable and ensuring that store staff are provided with the appropriate training and resources to use the new intervention successfully.

Roll out the Intervention

The primary task of the project manager is to ensure that the proposed intervention is introduced into the stores successfully and with the minimum amount of interference to store operations. It is particularly important that any proposed training is provided at this stage to ensure that store staff are fully prepared and understand the rationale for introducing the intervention. The project manager will need to work closely with the suppliers to ensure compliance with agreed terms and conditions and act as an arbitrator between store management and installation staff.

Evaluate the Impact

Once the project has been rolled out to the selected store, it is important to continue to monitor the performance of the intervention as results from trials may not always been seen over longer periods of time. This can in part be due to what is known as the 'Hawthorne Effect'. This is where changes in the KPIs occur not because of the intervention itself but simply because an experiment was being carried out. For instance the presence of project staff in the experimental stores or the requirement of store staff to collect new data, may have an impact on the KPIs – store staff may become generally more vigilant because they know they are part of an experiment. Therefore, it is important continue to measure the performance of the intervention after it has been rolled out.

In addition, the performance of an initiative can change as its 'environment' alters. For instance criminals may gradually find ways of defeating the newly adopted approach or changes in product range or levels of staffing might reduce its effectiveness. Therefore, periodic reviews of newly adopted measures may need to be carried out in order to gauge their effectiveness over time and to evaluate whether any corrective measures need to be taken.

Recommendations

One of the original aims of this project was to gather verifiable evidence of the value of investing in three types of technology: CCTV, EAS and Data Mining, through the analysis of existing literature, a survey of European and US retailers and real world examples from retailers. Every year across the globe retail loss prevention practitioners decide to invest billions of Euros a year in these technologies with the intention, for the most part, to help their businesses save money through lower levels of shrinkage. Collating 'proof' of the value of these investments has proved largely fruitless – few case studies and examples of where interventions have had a verifiable impact on losses and business profitability reside in the public domain. This is not to suggest that all these investments are wrong – far from it – the survey of retailers in this report suggests that some retailers are carrying out detailed analysis of the positive impact some interventions are having. But there does seem to be a heavy reliance in the retail security sector on assumed impact, a belief that it must work because others are already using it, or a distinct lack of a requirement within retail businesses to prove the value of security-related investments. This has almost certainly been fuelled by a lack of understanding within the loss prevention community of how investments in technologies in this field can and should be measured. The widespread misuse of the term 'ROI' is perhaps a good example of this – much used to 'prove' effectiveness but rarely ever used correctly to measure the percentage return on an investment.

This report therefore, has focussed far more on trying to establish how retail loss prevention practitioners should go about measuring the impact CCTV, EAS and Data Mining technologies might have within their business environments. It has tried to create clarity in the meaning of the terms to be used, the types of variables that can and should be collected to measure different types of interventions, and the way in which a business case should be put together to persuade a business to invest in a particular 'solution'.

Given this, a number of overarching recommendations can be made about the process of measuring, monitoring and evaluating the value of interventions selected by retail practitioners.

- It is becoming increasingly important to establish a solid business case for any form of investment in the sphere of loss prevention – the expectation from the rest of the business (particularly senior management and finance) is that future investments should be based upon a calculation of the value to the business. Simply relying upon 'shock tactics' – if we don't do this then the business will suffer – is increasingly less likely to secure business support for any given initiative.

- US retailers are much more likely to have carried out a value calculation on an investment in CCTV, EAS or Data Mining technology than their European counterparts – it is only a minority of the latter who are currently doing this and it is time to 'catch up'.

- Loss prevention practitioners need to understand clearly how to calculate the financial value of an investment using the established measures of: Return on Investment, Net Present Value, Discounted Payback Period, and Internal Rate of Return. This is important if they are to be taken seriously within the business and compete effectively against other functions vying for internal investment.

- Some interventions, particularly CCTV and to a certain extent Data Mining technologies, will require a broader cost justification calculation than merely financial return, including risk reduction and issues of safety and increased procedural compliance. These 'Indirect' variables still need to be identified and included in a business case.

- The survey of European and US retailers suggests that most expect an 'ROI' within 2 years on an investment in CCTV, EAS and Data Mining technologies. While this may be ambitious for an intervention such as CCTV that relies upon a complex mix of direct and indirect measures, for EAS and Data Mining, it would seem appropriate.

- There is virtually no published material in the public domain on the efficacy of CCTV, EAS and Data Mining technologies relating to measuring the value of interventions – be wary of extravagant claims made by the technology providers. It is very important to carry out detailed and rigorous trials to establish the impact an investment might have prior to roll out across a business.

The development of loss prevention as a 'profession' is still underway – for many in retailing it is still viewed as being primarily about locks, bolts, alarms, catching thieves and providing muscle in uniform. However, to others it is about making a valuable contribution to the profitability of a business through understanding the root causes of shrinkage and developing solutions that are fit for purpose. The former approach relies upon hearsay, guesswork and intuition, while the latter develops a credible business case based upon rigorous evidence and a verifiable impact upon a specific problem. It is hoped that this report contributes to making the latter the norm.

Appendix I: Survey of European Retailers

SURVEY OF EUROPEAN RETAILERS

Evaluating the Return on Investment on Loss Prevention Technologies and Devices

The University of Leicester (UK), in conjunction with ECR Europe, is carrying out a survey of European retailers to discover the extent to which various types of loss prevention technologies and devices are used to try and detect and prevent shrinkage. The results will be used to develop a clearer picture of the way in which such technologies and devices are used within Europe and help to identify best practice in dealing with the problem of shrinkage.

We would be extremely grateful if you could spend a few moments filling in the questions below. We appreciate that the information being collected is of a sensitive nature – all will be treated in strictest confidence and no company will be identified in any way. The questionnaire is divided into three areas. The first is interested in **any** recent investments you have made in **closed circuit television** (CCTV). The second section focuses on **electronic article surveillance** (EAS) type technologies and devices. This includes hard and soft tags and bottle tags (either applied at source or by your own company) and plastic safer cases and loop alarms. The third section is interested in any type of **data mining** technology you may have invested in recently. This includes both systems that have been developed within your company and those purchased from an external company. Where possible, please complete each section.

In each section we are only interested in the most **RECENT** investment you have made, regardless of whether it was in one country, across a region or globally, and the questions are primarily focused on how you went about evaluating the value of the investment to your business. The ECR Shrinkage Group would like to thank you for taking the time to provide this information. The results of this study will be made available to all the companies taking part.

What is the name of the company you represent?	
How many stores does the company have?	

Section 1 Closed Circuit Television

This includes all forms of surveillance technology, including remote monitoring, overt and covert cameras, dummy cameras, public display monitors, digital and analogue etc.

1a What was the most recent investment you have made in closed circuit television technologies? Please briefly describe the product and who supplied it.

1b What was its primary purpose? *Tick all that apply*

Detect and deter external thieves	
Detect and deter internal thieves	
Reduce process failures	
Monitor Store Compliance	
Health and Safety monitoring	
None of the above, please specify	

1c Did you undertake a trial before deciding upon this system? *Tick one*

Yes	
No	

1d If yes, what form did this trial take? *Tick one*

Piloted in one store only	
Piloted in a small number of stores (less than 5)	
Piloted in a number of stores (more than 5)	
Other, please specify	

1e Did you carry out a Return on Investment (ROI) on this system (or an earlier specification or installation of it)?

If you answer yes, please go to the next question
If you answer no, please go to question **

Yes	
No	

1f How was the ROI measured? *Tick all that apply*

Impact on shrinkage	
Impact on profit	
Impact on product availability	
Impact on out of stocks	
Cash loss	
Staff Productivity	
Customer Satisfaction	

1g Was data collected before it was introduced? *Tick one*

Yes	
No	

1h Who was primarily responsible for collecting this data *Tick one*

Your company	
The supplier of the equipment	
A combination of both	

1i Did you use 'control' stores to compare the performance in the pilot store(s)? *Tick one*

Yes	
No	

1j What was the ANTICIPATED period of time for the ROI? *Tick one*

Within 3 months	
Between 3 and 6 months	
Between 7 and 11 months	
Between 1 and 2 years	
Between 2 and 4 years	
Between 4 and 6 years	
More than 6 years	

1k What was the ACTUAL period of time for the ROI? *Tick one*

Within 3 months	
Between 3 and 6 months	
Between 7 and 11 months	
Between 1 and 2 years	
Between 2 and 4 years	
Between 4 and 6 years	
More than 6 years	
Never	

1l Was the system rolled out across the business? *Tick one*

Yes, all stores now have the system	
Yes, but only a selection of high risk stores	
No, left in pilot stores only	
No, removed from business completely	
Other, please specify	

1m If yes, have you measured the performance since? *Tick one*

Yes	
No	
Don't Know	

1n If yes, how long after did this take place? *Tick one*

Constantly measuring performance	
3 months after	
6 months after	
1 year after	
More than 1 year	

1o Overall, how would you describe the performance of the system? *Tick one*

Continues to perform beyond expectations	
Continues to deliver original aims and has created new opportunities for its use	
Continues to deliver as anticipated when first introduced	
Performed well when first introduced but is now less effective	
Worked well and met some but not all of our original expectations	
Has performed poorly and not met the majority of our expectations	
Has been a poor investment and made little difference	
None of the above	
Don't know	

1p Have you encountered any problems with the system? *Tick all that apply*

No	
Yes, difficulties implementing the system into the business	
Yes, problems with staff compliance	
Yes, problems getting support from the provider	
Yes, system not dealing with the problems it was originally designed to deal with	
Other, please specify	

Section 2 EAS Technologies and Devices

This includes all forms of EAS (AM, EM, RF), types of tags, such as soft, hard, bottle and dye tags, and whether the tags are applied at source or in your own companies. In addition, please use this section to describe other EAS-related devices such as safer cases, loop alarms or particular types of display equipment

2a What was the most recent investment you have made in EAS technologies and devices? Please briefly describe the product and who supplied it.

2b What was its primary purpose? *Tick all that apply*

Detect and deter external thieves	
Detect and deter internal thieves	
Reduce process failures	
Monitor store compliance	
Allow products to be on open display	
None of the above, please specify	

2c Did you undertake a trial before deciding upon this system? *Tick one*

Yes	
No	

2d If yes, what form did this trial take? *Tick one*

Piloted in one store only	
Piloted in a small number of stores (less than 5)	
Piloted in a number of stores (more than 5)	
Other, please specify	

2e Did you carry out a Return on Investment (ROI) on this system (or an earlier specification or installation of it)?

If you answer yes, please go to the next question	Yes	
If you answer no, please go to question **	No	

2f How was the ROI measured? *Tick all that apply*

Impact on shrinkage	
Impact on profit	
Impact on product availability	
Impact on out of stocks	
Cash loss	
Staff Productivity	
Customer Satisfaction	

2g Was data collected before it was introduced? *Tick one*

Yes	
No	

2h Who was primarily responsible for collecting this data *Tick one*

Your company	
The supplier of the equipment	
A combination of both	

2i Did you use 'control' stores to compare the performance in the pilot store(s)? *Tick one*

Yes	
No	

2j What was the ANTICIPATED period of time for the ROI? *Tick one*

Within 3 months	
Between 3 and 6 months	
Between 7 and 11 months	
Between 1 and 2 years	
Between 2 and 4 years	
Between 4 and 6 years	
More than 6 years	

2k What was the ACTUAL period of time for the ROI? *Tick one*

Within 3 months	
Between 3 and 6 months	
Between 7 and 11 months	
Between 1 and 2 years	
Between 2 and 4 years	
Between 4 and 6 years	
More than 6 years	
Never	

2l Was the system rolled out across the business? *Tick one*

Yes, all stores now have the system	
Yes, but only a selection of high risk stores	
No, left in pilot stores only	
No, removed from business completely	
Other, please specify	

2m If yes, have you measured the performance since? *Tick one*

Yes	
No	
Don't Know	

2n If yes, how long after did this take place? *Tick one*

Constantly measuring performance	
3 months after	
6 months after	
1 year after	
More than 1 year	

2o Overall, how would you describe the performance of the system? *Tick one*

Continues to perform beyond expectations	
Continues to deliver as anticipated when first introduced	
Performed well when first introduced but is now less effective	
Worked well and met some but not all of our original expectations	
Has performed poorly and not met the majority of our expectations	
Has been a poor investment and made little difference	
None of the above	
Don't know	

2p Have you encountered any problems with the system? *Tick all that apply*

No	☐
Yes, difficulties implementing the system into the business	☐
Yes, problems with staff compliance	☐
Yes, problems with tags not deactivating properly (false alarms)	☐
Yes, problems getting support from the provider	☐
Yes, system not dealing with the problems it was originally designed to deal with	☐
Other, please specify	

Section 3 Data Mining Technologies

This includes all types of data mining technology (the analysis of EPOS data), including systems designed within your own company and those provided by a third party.

3a What was the most recent investment you have made in data mining technology? Please briefly describe the product and who supplied it.

3b What was its primary purpose? *Tick all that apply*

Detect and deter external thieves	☐
Detect and deter internal thieves	☐
Reduce process failures	☐
Monitor store compliance	☐
None of the above, please specify	

3c Did you undertake a trial before deciding upon this system? *Tick one*

Yes	☐
No	☐

3d If yes, what form did this trial take? *Tick one*

Piloted in one store only	☐
Piloted in a small number of stores (less than 5)	☐
Piloted in a number of stores (more than 5)	☐
Other, please specify	

3e Did you carry out a Return on Investment (ROI) on this system?

If you answer yes, please go to the next question	Yes	☐
If you answer no, please go to question **	No	☐

3f How was the ROI measured? *Tick all that apply*

Impact on shrinkage	☐
Impact on profit	☐
Impact on product availability	☐
Impact on out of stocks	☐
Cash loss	☐
Staff Productivity	☐
Customer Satisfaction	☐

3g Was data collected before it was introduced? *Tick one*

Yes	☐
No	☐

3h Who was primarily responsible for collecting this data *Tick one*

Your company	
The supplier of the technology	
A combination of both	

3i Did you use 'control' stores to compare the performance in the pilot store(s)? *Tick one*

Yes	
No	

3j What was the ANTICIPATED period of time for the ROI? *Tick one*

Within 3 months	
Between 3 and 6 months	
Between 7 and 11 months	
Between 1 and 2 years	
Between 2 and 4 years	
Between 4 and 6 years	
More than 6 years	

3k What was the ACTUAL period of time for the ROI? *Tick one*

Within 3 months	
Between 3 and 6 months	
Between 7 and 11 months	
Between 1 and 2 years	
Between 2 and 4 years	
Between 4 and 6 years	
More than 6 years	
Never	

3l Was the system rolled out across the business? *Tick one*

Yes, all stores now have the system	
Yes, but only a selection of high risk stores	
No, left in pilot stores only	
No, removed from business completely	
Other, please specify	

3m If yes, have you measured the performance since? *Tick one*

Yes	
No	
Don't Know	

3n If yes, how long after did this take place? *Tick one*

Constantly measuring performance	
3 months after	
6 months after	
1 year after	
More than 1 year	

3o Overall, how would you describe the performance of the system? *Tick one*

Continues to perform beyond expectations	
Continues to deliver as anticipated when first introduced	
Performed well when first introduced but is now less effective	
Worked well and met some but not all of our original expectations	
Has performed poorly and not met the majority of our expectations	
Has been a poor investment and made little difference	
None of the above	
Don't know	

3p Have you encountered any problems with the system? *Tick all that apply*

No	
Yes, difficulties implementing the system into the business	
Yes, problems with staff compliance	
Yes, problems getting support from the provider	
Yes, system not dealing with the problems it was originally designed to deal with	
Other, please specify	

Thank you for taking the time to complete this questionnaire. I would be grateful if you could now email this document back to Adrian Beck at the University of Leicester:
email: bna@le.ac.uk

A copy of the full report will be sent to you later in 2007.

Appendix II: Example Data Mining Exception Reporting Variables

1. Multiple use of a credit/debit card
2. Multiple refund of the same product by the same operator
3. Refunds to credit/debit card where card has not been used for a purchase
4. Sales less than a particular value
5. Voids over £X value or frequency
6. Refunds over £X value
7. Hand Keyed Credit/Debit Cards
8. No Sale Transactions
9. Refunds Greater that the TC amount
10. Denied Gift Cards
11. Gift card activation greater than £X where the tender is a credit card
12. More than X price changes in the same transaction and colleague discount card used
13. More than X line voids within the same transaction
14. Transaction where the last item is voided
15. Handkeyed refund Items
16. Cashed out gift cards
17. Cheques greater than £X
18. Transactions greater than £X value
19. Gift cards paid for by cheques
20. Cashback where the debit card has been handkeyed
21. Cashback velocity process
22. Operator performance scorecard –eg voids/refunds/scan speed/handkey all vs median
23. Transactions (sales and refunds) outside trading hours
24. Use of colleague discount and gift card/Christmas special discount in same transaction
25. Bulk purchases – large quantity/value purchases of particular lines, BOGOF lines.
26. Gift cards with repeat loads (velocity process –eg more than X times in 24 hour period)
27. Supervisor overrides
28. Ability to search for a single bar-coded item
29. Scan gaps greater that the median determined by the system.
30. Refund overrides
31. Credit card denials
32. Cashier Sign on and off

33. Excessive time with register open
34. More than 3 item inquiries in the same transaction
35. Transaction where coupons over X% of the transaction value tender type
36. Linked items (items bought in the same transaction i.e. lithium batteries, starter fluid)
37. Cheque overrides
38. Multiple transactions paid for with the same cheque account number
39. Handkeyed 'Not on File' items
40. Receipted refunds with the TC# that have been overridden
41. E Top up transactions which are voided after the airtime authorisation has been activated.
42. Gift cards used in conjunction with a colleague discount card where the operator number who issued the refund is the same person who uses the card for a purchase with their discount.
43. Operators who have transactions where the same colleague discount card is seen a disproportionate amount of times
44. Colleague discount transaction where there is a high level of item voids.

Appendix III: Execution Requirements for Proposed Mechanisms

Closed Circuit Television			
Focus	***Purpose***	***Mechanism***	***Execution Requirements***
Security	**Detect external thieves**	View images of theft acts taking place	Staff need to be monitoring cameras
		Direct shop floor staff to suspicious behaviour	Need to be able to communicate with shop floor staff
		Provide after the event images of incident	Tapes/Digital images need to be stored effectively
		Record vehicle registration numbers	Cameras need to be in correct locations
			Appropriate lighting may be required
			Tapes/Digital images need to be stored effectively
	Deter external thieves	Increase perception of risk of apprehension	Cameras/Monitors/Signage visible to thieves
		Make offender feel security is taken seriously	Cameras/Monitors/Signage visible to thieves
		Alert staff to suspicious behaviour who then approach offender	Need to be able to communicate with shop floor staff
	Detect internal thieves	View images of theft act taking place	Staff need to be monitoring cameras
		Provide after the event images of thief (in support of other evidence collecting)	Tapes/Digital images need to be stored effectively
	Deter internal thieves	Increase perception of risk of apprehension	Cameras/Monitors/Signage visible to thieves
			Incidents of staff being dismissed through use of cameras advertised
		Make offender feel security is taken seriously	Cameras/Monitors/Signage need to be visible to thieves
			Incidents of staff being dismissed through use of cameras advertised
	Detect staff/customer collusion	Provide evidence of 'sweethearting' at the till or misuse of the till (voiding items, reducing the price, under ringing, using staff discounts etc)	Tapes/Digital images need to be stored effectively
			Images may need to be linked to POS data
	Deter staff/customer collusion	Increase staff perceptions of risk of apprehension	Cameras/Monitors/Signage visible to thieves
			Incidents of staff being dismissed through use of cameras advertised

Safety	**Speed up return of lost children**	Search premises quickly for missing children	System needs good coverage to view all areas and be of sufficient quality to recognise faces/clothing
	Increase customer safety	Make customers feel safer – company take security seriously and somebody will respond	Cameras/Monitors/Signage visible to customers
	Increase staff safety	Make staff feel safer – company take security seriously and somebody will respond	Cameras/Monitors/Signage visible to staff.
			Need to have a viable security response within the store to respond to the cameras
	Reduce or confirm health and safety incidents	Provide evidence in the event of a claim	System needs good coverage to view all areas and be of sufficient quality to recognise incidents
			Tapes/Digital images need to be stored effectively
Compliance	**Improve staff performance**	Check staff are following procedures (eg locking doors, securing security cage, positioning of promotions)	System needs good coverage to view all areas and be of sufficient quality to recognise incidents
		Make staff feel they are more likely to be caught not following procedures	System needs good coverage to view all areas and be of sufficient quality to recognise incidents
	Improve footfall monitoring	Automatically monitor the number of customers entering a store	Exits and entrances need to be covered by cameras and be linked to appropriate software to measure footfall

Electronic Article Surveillance			
	Purpose	***Mechanism***	***Execution Requirements***
Security	**Detect external thieves**	Tag triggers alarm at exit and offender is apprehended by store staff	Tags need to work properly
			Tag needs to be present on protected products
			Tags need to be difficult to remove or deactivate
			Exit gates need to alarm when tag is in range
			Staff need to respond promptly to alarm activation
	Deter external thieves	Offender perceives threat of apprehension to be high because of likely tag activation at exit	Tags need to work properly
			Tag needs to be present on protected products
			Tags need to be difficult to remove or deactivate
			Tag needs to be visible
			Exit gates need to alarm when tag is in range
			Staff need to respond promptly to alarm activation
		Tags make use of the product impossible (such as non-removable bottle tag)	Tags need to work properly
			Tag needs to be present on protected products
			Tags need to be impossible to remove
		Tags make reselling of product unlikely (such as dye tags)	Tags need to work properly
			Tag needs to be present on protected products
			Tags need to be impossible to remove or will permanently damage product
	Detect internal thieves	Tag triggers alarm at exit and offender is apprehended by store staff	Tags need to work properly
			Tag needs to be present on protected products
			Tags need to be difficult to remove or deactivate
			Exit gates need to alarm when tag is in range
			Staff need to respond promptly to alarm activation
	Deter internal thieves	Offender perceives threat of apprehension to be high because of likely tag activation at exit	Tags need to work properly
			Tag needs to be present on protected products
			Tags need to be difficult to remove or deactivate
			Tag needs to be visible
			Exit gates need to alarm when tag is in range

Data Mining			
	Purpose	***Mechanism***	***Execution Requirements***
Security	**Detect internal theft**	Provide evidence of theft of cash from till	See Appendix II for example data requirements
	Deter internal theft	Increase staff perceptions of risk of apprehension	
	Detect staff/customer collusion	Provide evidence of 'sweethearting' at the till or misuse of the till (voiding items, reducing the price, under ringing, using staff discounts etc)	
	Deter staff/customer collusion	Increase staff perceptions of risk of apprehension	
Compliance	**Improve staff compliance**	Provide evidence of non compliance at the till (eg staff not scanning bar codes properly, using staff discount card inappropriately)	

Appendix IV: Detailed Findings From the Survey of European and US Retailers

An online survey was developed to gather information directly from retailers on the way in which they were using the three types of technology, focussed on the following areas:

- The purpose of the investment.
- Nature of the trial undertaken.
- The use and design of an ROI calculation.
- Measuring the impact of the trial.
- The overall rating of the intervention and subsequent roll out decisions.
- Problems encountered with the technology.

The Purpose of the Investment

The starting point of the survey was to identify what measures the respondents had recently invested in. In terms of CCTV, the investments were in three main areas and virtually all were based on digital technology. The three areas were: general CCTV systems to monitor events happening in the stores; public display systems to bring the systems attention to customers; and remote monitoring technologies either for in house or third party reviewing. In terms of EAS, a range of technologies were being used, supplied by all the major providers, including AM and RF, and soft and hard tags. The respondents to the data mining set of questions predominantly used third party providers (16) although a fair proportion had created the software internally (10).

Table 1 below outlines the key reasons why they had decided to invest in the technology. The percentages do not add to 100 as respondents could choose as many options as they liked.

Table 1 Purpose of Investment

Purpose	CCTV	EAS	Data Mining
	Per cent		
Detect/Deter External Thieves	88	94	34
Detect/Deter Internal Thieves	71	39	84
Reduce Process Failures	15	3	47
Monitor Store Compliance	29	36	69
Monitor Health and Safety	0	0	0
Allow Open Display	21	27	0

CCTV: Perhaps not surprisingly, most had introduced the technology to deal with the detection and deterrence of internal and external thieves (88% and 71%), although a significant minority – nearly one-third – did say that it was being introduced to deal with store compliance, and 15%

said it would be used to reduce process failures. There was also one-fifth who suggested that the CCTV system would enable them to increase the number of products on open display.

EAS: Virtually all respondents had introduced their EAS system to detect and deter external thieves (94%), although nearly 40% also stated it was also there to deter and detect internal theft. Perhaps surprisingly, a similar proportion also suggested the EAS system was introduced to monitor store compliance (36%). A significant minority also thought that their EAS system would help to improve on shelf availability (27%).

Data Mining: The focus of this technology was geared towards the detection and deterrence of internal thieves (84%) followed by the monitoring of store compliance (69%) and the reduction of process failures (47%). However, a sizeable minority – one-third – also felt it had a role to play in deterring and detecting external thieves as well.

The results are perhaps not surprising, although the spread of activities for CCTV is highly indicative of the increasingly broad array of issues this technology is being employed to address. The impact of CCTV and EAS on enabling open display of product is also instructive and indicates how these technologies may be being used as a means to improve in-store confidence. The breadth of use for data mining software is also very interesting and highlights the role it is perceived to have away from the traditional areas of shrink focused on internal and external theft. Like CCTV it is seen as a more generalised tool that can improve store compliance and retail efficiency.

Nature of the Trial Undertaken

The second area of investigation was on the extent to which a trial had been undertaken for the technology under consideration and how large that trial had been.

Table 2 Whether a Trial Was Undertaken

Trial	CCTV	EAS	Data Mining
	Per cent		
Yes	66	52	40
No	34	48	60

For CCTV technologies, two-thirds suggested that they had undertaken a trial (66%) while just over one-half of those introducing an EAS initiative (52%) said that they had carried out some form of trial. For data mining, the majority had not undertaken a trial of the software (60%). At one level, this is very revealing data suggesting that a significant proportion of technologies in these three areas are simply introduced without any recourse to a test to evaluate its impact and usability, this being especially the case for data mining software. However, the apparently low level of testing of data mining may be explained by the relatively high number of in-house systems that are under consideration in this survey. In terms of EAS, this data can be read in two

ways – a large proportion of companies are introducing systems based on little or no evidence of how the equipment will work in their particular context, or they have previous experience of using this technology and feel confident it will work.

Table 3 Extent of the Trial

Form	CCTV	EAS	Data Mining
	Per cent		
Pilot in 1 Store	23	0	0
Pilot in Less than 5 Stores	54	65	43
Pilot in More than 5 Stores	23	35	57

CCTV: The vast majority of CCTV trials take place in less than five stores (77%), with only 23 per cent utilising a larger proportion of their retail estate.

EAS: Similar to CCTV, the majority of EAS trials take place in less than 5 stores (65%), although a slightly larger proportion makes use of more than five stores (35%).

Data Mining: In contrast to the two other technologies under consideration, data mining systems tend to be tested in a greater number of stores with well over one-half of respondents (57%) suggesting that their system was tested in 5 or more stores.

The data mining findings compared with the other two technologies is probably explicable given the nature of the technology – it is often cheaper and easier to draw data from an EPOS system than introduce more cameras or tagging systems into retail stores. The degree of interruption for stores is also much less. In terms of CCTV and EAS, the majority of systems are tested using less than 5 stores which will clearly have an impact upon the efficacy of the results from such trials. Increasingly complex retail environments with different types of format, product ranges and locations require sample sizes within trials to be larger if validity is to be ensured.

The Use and Design of an ROI Calculation

The next set of questions focused on whether respondents had carried out an ROI on their investment, how it was measured and what was the anticipated and actual ROI period.

Table 4 Whether an ROI Was Carried Out

ROI	CCTV	EAS	Data Mining
	Per cent		
Yes	56	56	55
No	44	44	45

The data across all three types of technology were virtually identical, with just over one-half of respondents stating that they had performed an ROI. Of more concern is that between 44-45 per

cent had not. The difference, however, was much starker when the data was analysed comparing responses from the US with Europe (Table 5).

Table 5 Whether an ROI Was Carried Out by Regional Response

ROI	Europe	USA
	Per cent[33]	
Yes	39	70
No	61	30

Two-thirds of US respondents stated that they had carried out an ROI (70%) compared with only 39 per cent of European respondents. In contrast, the majority of European retailers taking part in this survey indicated that they had not performed any form of ROI analysis on a recent investment in CCTV, EAS or data mining software. It would seem from this data, that there is a greater culture of ROI measurement in the US then there is in Europe.

Of those who said that they had measured the ROI, the next question asked them to identify how they had gone about measuring it (Table 6). Percentages do not add to 100 as respondents could choose more than one option.

Table 6 How the ROI Was Measured

Measure	CCTV	EAS	Data Mining
	Per cent		
Impact on Shrinkage	50	58	44
Impact on Profit	26	30	34
Impact on Availability	12	15	0
Impact on Out of Stocks	3	9	6
Impact on Cash Loss	15	0	28
Staff Productivity	15	0	6
Customer Satisfaction	0	3	0

CCTV: Exactly one-half of respondents stated that CCTV was measured based upon its impact upon shrinkage within the business, with a further one-quarter suggesting it was measured against retail profits. While these two categories were the most likely to be used, the impact of CCTV on product availability, cash losses and staff productivity were also selected by a sizable minority of respondents (12%, 15% and 15% respectively).

EAS: The measurement of this technology was much more focused around just three variables: impact on shrinkage was the most popular with the majority of respondents choosing this option,

[33] $x^2 = 9.492$; df 1; p = 0.002

followed by impact on profit (30%) and impact on product availability (15%). Very few other measures were used for EAS.

Data Mining: Similar to EAS, data mining was also based around just three measures: impact on shrinkage (44%), impact on profitability (34%) and impact on cash loss (28%).

Once again, the more diversified application of CCTV compared with EAS and data mining was evident in this data, with a larger basket of measures being employed to gauge its impact. However, the impact on shrinkage was not surprisingly the key variable for all three technologies followed by their impact on business profitability.

A key part of measuring ROI is the amount of time it is calculated it will take to recoup the investment in a given intervention. Detailed below in Tables 7 and 8 is what the initial or planned ROI period was and then the actual ROI period for the given technologies.

Table 7 The Calculated ROI Period

Anticipated ROI	CCTV	EAS	Data Mining
	Per cent		
Within 3 Months	0	0	0
Between 3 and 6 Months	19	22	12
Between 7 and 11 Months	29	28	24
Between 1 and 2 Years	43	44	59
Between 2 and 4 Years	5	6	6
Between 4 and 6 Years	5	0	0
More Than 6 Years	0	0	0

CCTV: The largest single proportion of respondents estimated that the payback on their CCTV investment would be between 1 and 2 years (43%) although nearly one-half (48%) were more optimistic and thought that it would pay for itself in less than one year. Very few had a calculated ROI period above 2 years.

EAS: Respondents held similar views about the payback for EAS technologies – 50 per cent thought it would pay back within 12 months, with a further 44 per cent thinking it would be within 1 to 2 years. Hardly any respondents took a longer term perspective on the investment.

Data Mining: The majority of investors in this technology calculated that it would take between 1 and 2 years to get their return on investment (59%), although a sizable minority (36%), were more optimistic and thought the payback would be quicker (within 12 months). As with the other two technologies, hardly any respondents looked beyond a two-year horizon for a payback on data mining technologies.

The picture across the three interventions is very similar – virtually no respondents build their ROI to be beyond 2 years and most are confident that it will be achieved within 12 months. Of the three technologies, investors in data mining are the most cautious, with the majority predicting a payback within 1-2 years. The next table considers how the planned ROI compared with the actual ROI.

Table 8 The Actual ROI Period

Actual ROI	CCTV	EAS	Data Mining
	Per cent		
Within 3 Months	0	0	0
Between 3 and 6 Months	32	11	23
Between 7 and 11 Months	26	44	39
Between 1 and 2 Years	37	39	31
Between 2 and 4 Years	0	6	8
Between 4 and 6 Years	0	0	0
More Than 6 Years	5	0	0
Never	0	0	0

The data provided on actual ROI suggests that most respondents were overly cautious in their predictions about how long it would take to get payback on their investment. For CCTV, while 48% had thought it would occur within 12 months, in reality, 58% found that it had paid back in this time span. For EAS the trend was in the same direction although less dramatic, with one-half predicting a payback in less than 12 months when in reality 55% claimed that ROI had been achieved in this time period. The biggest change can be seen in the results for data mining. While about one-third had thought that the system would pay for itself within 12 months, in reality, nearly double this amount had found it had achieved payback within this time period (62%).

This data suggests that most investors work on a timescale for ROI of 2 years or less, and all seem to achieve this, usually at a faster rate than anticipated – this being especially the case for data mining technologies.

Measuring the Impact of the Trial

The survey was also interested in understanding how respondents had gone about collecting data as part of the trial process – was data collected prior to the trial starting, who had responsibility for collecting the trial data, whether control stores were used as part of the process, and whether the technology's performance was measured after the end of the trial.

Table 9 Whether Data Was Collected Prior to the Trial

Data Collected	CCTV	EAS	Data Mining
	Per cent		
Yes	81	84	75
No	19	16	25

For all three interventions, the vast majority of respondents suggested that they had collected data prior to the trial starting, although a significant minority in each case had not – one in five for CCTV, one in six for EAS and one-quarter of those investing in data mining. If any form of trial is to be successfully evaluated, then having good quality data for each of the variables that will be used to measure the performance is vital. While most suggested that they did, a significant proportion did not which could seriously undermine their capability to understand the impact of the investment.

Table 10 Whether Data Was Collected Prior to the Trial by Regional Response

Data Collected	Europe	USA
	Per cent[34]	
Yes	60	92
No	40	8

There was a significant difference between European and US respondents on this issue (Table 10). Only 60 per cent of European respondents said that they collected data prior to the trial commencing compared with 92 per cent of US-based respondents. There clearly seems to be a higher degree of rigour in preparing for a trial amongst US participants in this survey than amongst their European counterparts.

The next question was interested in who actually collected the data as part of the trial process: the retail company itself, the equipment supplier or a combination of the two (Table 11).

Table 11 Who Collected the Trial Data

Collected by	CCTV	EAS	Data Mining
	Per cent		
Company	81	76	83
Equipment Supplier	0	6	0
Both	19	18	17

There was little difference across all three types of technology – the vast majority of respondents indicated that they themselves took responsibility for collecting the data (between 76% and 83%).

[34] $x^2 = 9.468$; df 1; $p = 0.002$

Virtually no respondents indicated that they left it to the equipment supplier to perform this task although a sizable proportion for each of the technologies suggested that data collection was a combined effort between the retailer and the equipment provider (between 17% and 19%). These results are perhaps not surprising as traditionally data relating to shrinkage is considered highly sensitive and therefore retailers are unlikely to allow third party companies access to this information.

The backbone of any good experimental trial is the need to be able to compare the results in the stores that have had the intervention with a group of similar stores that have not. This is vitally important to ensure that any changes in the trial stores have been genuinely created by the intervention and not simply by random fluctuations in data that affect all stores. Control stores are the benchmark against which trial stores need to be compared to enable valid and robust results to be established.

Table 12 Whether Control Stores Were Used as Part of the Trial

Control Stores	CCTV	EAS	Data Mining
	Per cent		
Yes	52	72	33
No	48	28	67

For CCTV, just over one-half of respondents said that they had used control stores as part of their trial, although perhaps more worryingly, 48 per cent said that they had not. For EAS the number using control stores was much higher – nearly three-quarters (72%), although again, a sizeable minority did not (28%). For data mining, the majority of respondents suggested that they did not use control stores – two-thirds, with one-third stating that they did.

The results for CCTV and data mining in particular are disappointing as they suggest that very significant numbers of trials are being undertaken without any recourse to benchmarking data within the organisation carrying out the trial. In such circumstances, it is highly probable that such trials will not generate results that have much internal validity.

Research evidence suggests that the impact of any intervention can be relatively short lived as the perpetrators that it was designed to deter or detect become accustomed to it and find new or alternative ways to continue with their deviant behaviour. Therefore, measuring the impact of an intervention after a trial has ended is an important part of the overall evaluation process. Table 13 summarises the data on the extent to which respondents measured the performance of their intervention once the particular trial had ended.

Table 13 Whether Performance was Measured Subsequently

Measured Performance Since	CCTV	EAS	Data Mining
	Per cent		
Yes	65	74	67
No	35	21	22
Don't Know	0	5	11

Perhaps somewhat surprisingly, the majority of respondents for all three technologies said that they had measured the performance subsequent to the trial ending, with EAS receiving the highest score at 74 per cent. The technology least likely to be measured was CCTV with about one-third of respondents stating that they had not measured it performance once the initial trial had ended.

The survey then went on to find out how long after the trial the technology's performance was measured (Table 14).

Table 14 The Length of Time After Which it was Measured

Length Measured	CCTV	EAS	Data Mining
	Per cent		
Constantly	54	64	75
3 Months After	15	0	0
6 Months After	15	7	8
1 Year After	15	21	8
More Than year	0	7	8

The majority of respondents for all three technologies said that they continued to monitor the performance constantly after the trial period had ended – 54 per cent for CCTV, 64 per cent for EAS and 75 per cent for data mining. CCTV had the broadest spread of responses, with an equal proportion (15%) stating that they had measured performance 3 months after, 6 months after and one year after the trial had ended. For EAS, just over one-fifth of respondents stated that they had re-evaluated the intervention one year after the trial had been completed.

The Overall Rating of the Intervention and Subsequent Roll-out Decisions

The penultimate section of the survey asked those taking part to reflect upon on how well they thought the intervention had performed, rating it on a scale from beyond their expectations through to a bad investment (Table 15).

Table 15 Overall Rating of Performance

Performance	CCTV	EAS	Data Mining
	Per cent		
Beyond Expectations	6	3	18
Met Original Aims and Offered New Opportunities	33	15	43
Continues to Deliver as Expected	50	46	21
Initially Good But Now Less Effective	3	15	0
OK, But Not Met all Expectations	6	6	7
Performed Poorly	0	6	0
Bad Investment	3	3	0
None of Above	0	0	4
Don't Know	0	6	7

CCTV: The majority of respondents felt that their CCTV investment continued to deliver as it was originally expected (50%). For a further one-third, the system had not only met its original aims but had also delivered new opportunities not originally envisaged (33%). For a small minority (12%) the technology had not performed so well and was now either less effective, had not met all their expectations or was considered a bad investment.

EAS: This technology was not given as high a rating as CCTV, although a sizable proportion indicated that it continued to deliver as expected (46%), while 18% thought it had gone beyond this and had offered new opportunities. However, approximately one-third of respondents were less positive about EAS (30%) and felt its performance had dwindled in effect, had not met their original expectations, performed poorly or was generally a bad investment.

Data Mining: this technology received the highest rating amongst the three under consideration – 82 per cent felt that it was either delivering as expected or had gone well beyond this and was offering new opportunities. Just 7 per cent felt that it was OK but had not met all their expectations.

Overall, this data is very positive, particularly relating to CCTV and data mining, the latter receiving a ringing endorsement from its users. While most EAS users were relatively happy with their technology, a sizable minority were less impressed and felt that this intervention was no longer delivering as originally envisaged.

Respondents were then asked whether in the light of the trial experience with each of the interventions, they had decided to roll out the technology across their entire retail estate (Table 16).

Table 16 Whether the Investment Was Subsequently Rolled Out

System Roll Out	CCTV	EAS	Data Mining
	Per cent		
Yes, All Stores	21	58	100
Yes, Only High Risk	68	32	0
No, Left in Pilot Stores	10	5	0
No, Removed	0	5	0

A mixed picture emerged – the majority of CCTV users said that they would only put the technology in their high risk stores (68%), with one-fifth indicating that they had rolled it out to the entire estate. For EAS, the majority said that they had rolled the programme out to all stores (58%) although one-third had used it in a targeted way in their high risk stores only. The response on data mining was emphatic – all respondents had decided to roll it out across the retail estate.

Problems Encountered with the Technology

The final section asked respondents to reflect upon any problems that they had encountered with the technology they had trialled and subsequently used (Table 17).

Table 17 Whether Any Problems Were Encountered

Problems	CCTV	EAS	Data Mining
	Per cent		
No	70	42	60
Yes, Implementing System	6	6	24
Yes, Staff Compliance	12	36	4
Yes, Provider Support	12	13	12
Yes, Not Dealing With Problems	0	3	0

CCTV: The vast majority had not had any problems with the technology (70%) while a small minority (30%) had faced some difficulties, namely with staff compliance and not getting sufficient support from the supplier.

EAS: This technology was rated the lowest amongst the three under consideration. A majority of respondents had faced some sort of problem (58%), most noticeably with staff compliance (36%), poor provider support (13%), difficulties implementing the system (6%), or simply that the system was not dealing with the problems it was originally brought in to address (3%).

Data Mining: Nearly two-thirds of respondents had not faced any problems with this intervention (60%), although a sizable minority had. The main problems were associated with implementing the system (24%) and not getting sufficient support from the supplier (12%).

Overall, CCTV generated the least problems, followed by data mining and then EAS. Problems with EAS have been well documented in other studies, particularly relating to getting store staff to use the system as it was originally designed (such as applying and deactivating tags properly or not responding to store alarm activations). The main concern relating to data mining was perhaps predictable (implementing the system) as this technology can be complex to set up and establish in a retail business (for instance getting POS feeds and ensuring that the data is clean and effectively analysed).

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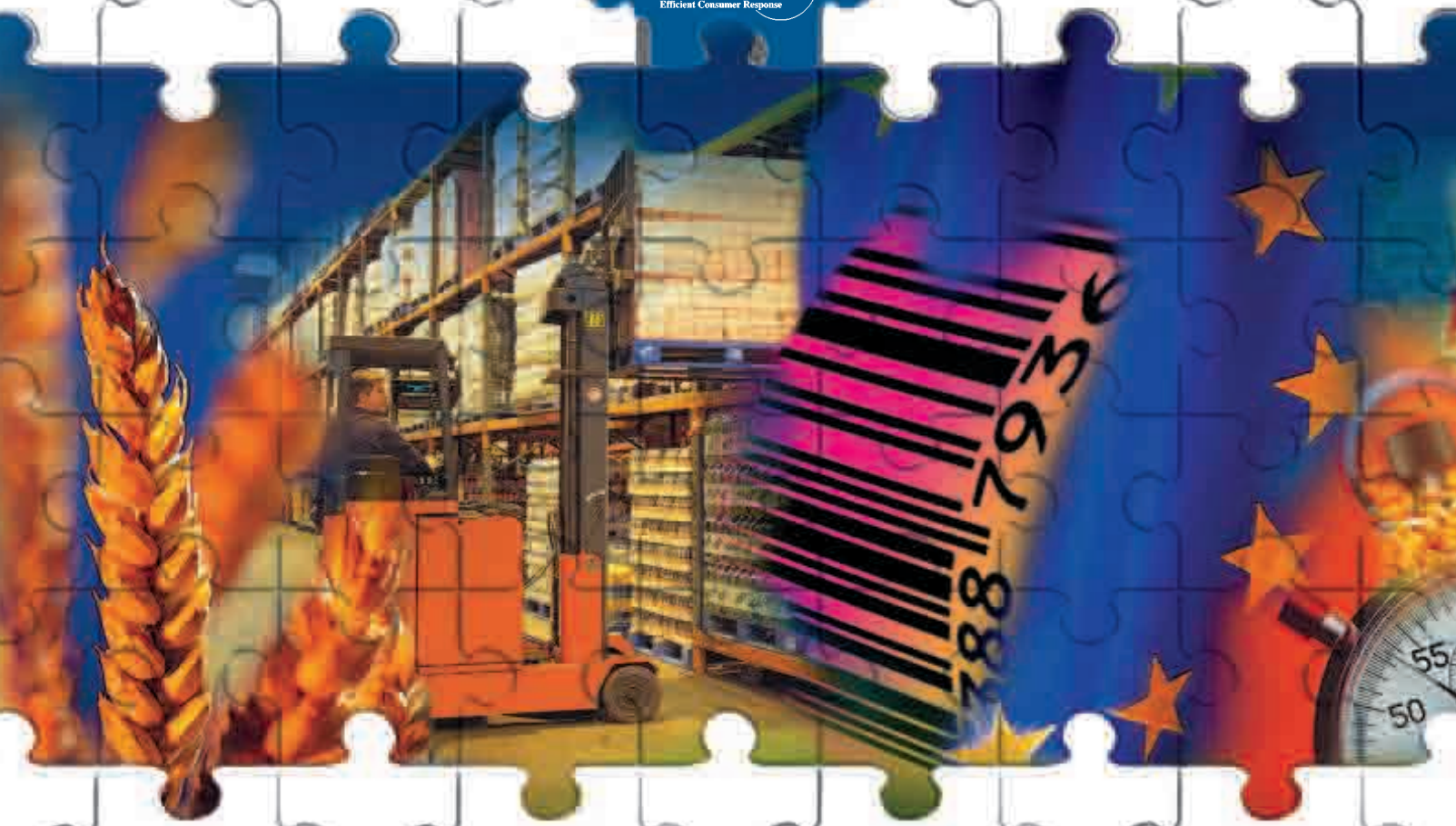

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