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Research White Paper Series

CONTROLLING TROLLEY PUSH-OUT THEFTS:

An Evaluation

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Disclaimer

This document is intended for general information only and is based upon a review of the available literature together with primary research undertaken with retail companies in the UK. Companies or individuals following any actions described herein do so entirely at their own risk and are advised to take professional advice regarding their specific needs and requirements prior to taking any actions resulting from anything contained in this report. Companies are responsible for assuring themselves that they comply with all relevant laws and regulations including those relating to intellectual property rights, data protection and competition laws or regulations.

The author would like to acknowledge the financial support provided by Gatekeeper Systems that enabled this research to be undertaken. He would also like to thank the retail companies that agreed to participate and provide data and insights on the issue of trolley push-outs – their time and support is very much appreciated.

About the Author

Adrian Beck is an Emeritus Professor at the University of Leicester, UK where he was one of the founders of the Department of Criminology in 1988, and Head of Department between 2009 and 2015. Over the last 30 years, his research work has focused on helping retailers around the world better understand the impact all forms of loss have upon their businesses and how they can be more effectively managed. He is currently an academic advisor to the ECR Retail Loss Group.

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About Gatekeeper Systems

Gatekeeper Systems are the leading global provider of shopping trolley (cart) loss prevention technology. Gatekeeper is headquartered in California with direct offices in Canada, Australia, UK and a European office in Germany. Gatekeeper supplies solutions to many other regions using local and carefully selected partners.

Since 1998, Gatekeeper has supported retailers in protecting trolleys using their locking wheel technology. The foundation of Gatekeeper was built on their trolley containment system, preventing theft of trolleys from the store property. More recently, technology advancement allows Gatekeeper to provide a pushout theft prevention solution, Purchek, within the same wheel.

Gatekeeper is pleased to support and provide assistance using the Purchek solution within this research and is thankful to the retailers participating in this report.

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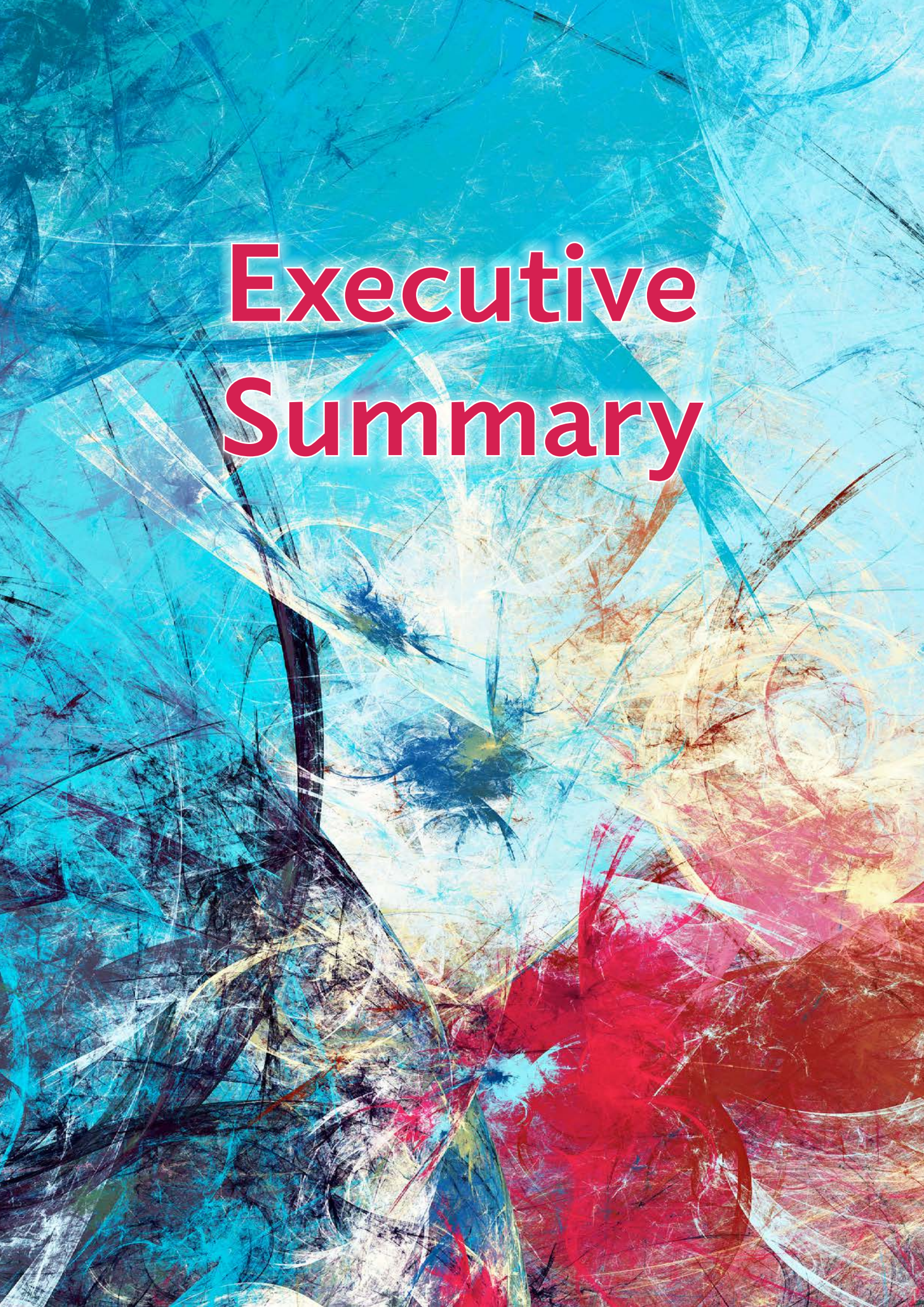


Executive Summary

Executive Summary

Background and Context

A perennial concern for many retailers is the extent to which they are victims of thefts where stolen items are simply wheeled out of their stores using trolleys provided to consumers – trolley push-out thefts. This study offers a unique insight into not only the scale and extent of the problem but also an evaluation of an intervention focussed upon addressing the issue of trolley push-out thefts – the Purchek technology developed by Gatekeeper Systems which utilises trolley wheel-locking technology.

The study is based upon the experiences of two major UK Grocers, with combined sales more than £50 billion a year and over 2,000 stores. Utilising data sets collected before and after the COVID-19 Pandemic, results are presented from 239 installations of the Intervention covering three 15-week periods of data collection. In addition, the study also carried out a detailed analysis of over 900 recorded incidents of trolley push-outs to understand more about the context in which these events take place.

Key Findings

Scale and Extent of Trolley Push-outs

- It is estimated that a Grocery retail store that has some indicators of elevated levels of overall risk, with annual sales of approximately £40 million, is likely to experience **at least** 140 trolley-push-outs a year (almost three a week), costing in the region of £31,500 a year. Put another way, it is calculated that trolley push-outs may account for approximately 4% of all unknown stock loss (shrinkage).
- It is estimated that the average cost of a trolley push-out incident is £224, although some incidents were valued at more than £2,000.

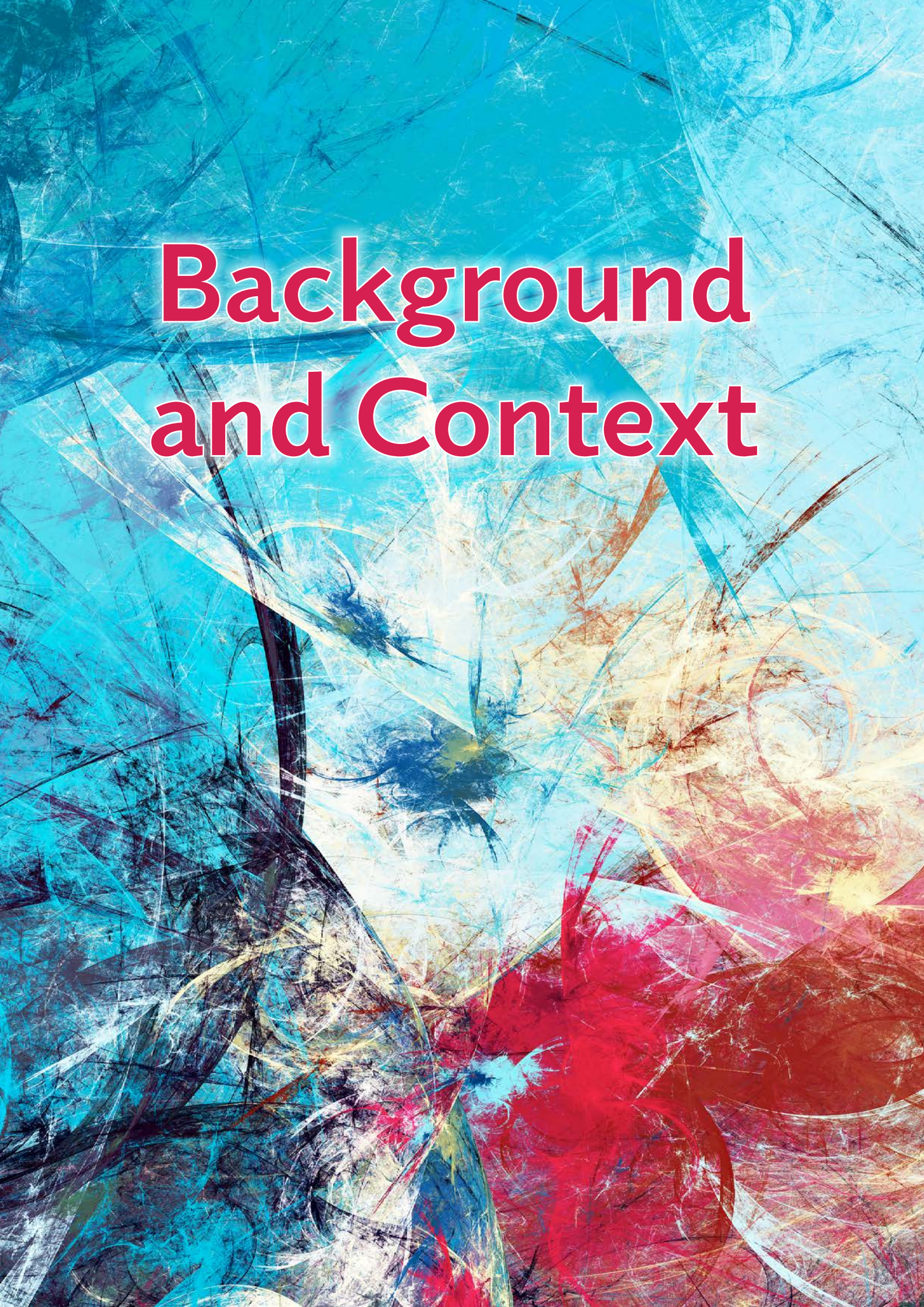
Profile of Trolley Push-outs

- Incidents costing £200 or more account for one-quarter of all recorded incidents (26%) but represent nearly two-thirds of all the value (64%). The data seems clear – a relatively small proportion of high-value trolley push-outs generate a significant amount of loss.
- Of those stopped, 21% went on to pay for the products they were trying to steal. Most acted alone, with just 10% being in concert with one or more other offenders. Those acting in a group (two or more) were far more likely to try and steal higher value quantities of stock – more than double the amount attempted by singleton offenders.
- Incidents of trolley push-outs rarely lead to the involvement of the police – just 3% of recorded incidents made any reference to them being called/intervening. Store records showed that they issued warnings/bans in one in nine incidents although this number is likely to be deflated by the number of offenders who left/fled the scene before any sanction could be imposed.
- There was little evidence that trolley push-out interventions were a generator of violence and/or verbal abuse – just 3% of recorded incidents, with no relationship found between the seriousness of the event (measured by value or number of offenders involved) and the likelihood of violence and verbal abuse to occur.
- There was no evidence that trolley push-out offenders were typically known to security staff – just one per cent of incidents mentioned that the perpetrator was a known previous offender. The data clearly shows that a very large proportion of trolley push-out offenders have been operating below the 'security radar' of most retail stores taking part in this study.

- When a trolley push-offender was stopped, some 18% offered a 'reason' for why they had no proof of purchase. The most common excuse offered was that a relative had the receipt, followed by a direct admission that they were trying to steal, then that they had forgotten to pay, or that they were on the way to their vehicle to get their wallet/cash to pay for the goods in the trolley. Interestingly, those that offered a reason were much more likely to go on and pay for the products they were attempting to steal.
- On average, offenders who were found to be employing techniques to defeat other forms of retail security present in the store (such as using foil-lined bags, de-tagging products and attempting to distract security staff) were much more likely to be attempting to steal significantly higher value goods – more than double the average.

Impact of Trolley Push-out Intervention

- The findings from all three datasets showed a marked decline in the number of incidents and weekly value of losses associated with trolley push-outs after the Intervention had been installed for three weeks. This 'golden period' of deterrence would seem to have a profound effect upon the regular trolley push-out community who were made starkly aware of the utilisation of the Intervention. The number and value of losses declined by on average 49% and 47% respectively after the initial period of use of the Intervention.
- A ROI model revealed that for a Grocery store with annual sales in the region of £40 million and an average installation cost of £30,000, the Discounted Payback Period for use of the Intervention was just over 1 year, generating a Net Present Value of £46,614 and an Internal Rate of Return of 70%.
- The research highlighted the value of Alarm Activation Visibility offered by the Intervention – Kinetic Crime Prevention – offering security staff a much more unambiguous method of identifying which customer had triggered the exit alarm.
- A key facet of the Intervention was its capability to deliver deterrence through an initial period of detection – a 'golden period' of potency in the early weeks after installation. For this to be achieved, however, the research found that it was critically important store staff were made available to respond to the alerts.
- Like other loss prevention initiatives, the Intervention may be prone to the problem of displacement – particularly more determined and professional thieves adopting alternative methods to circumvent the technology. It will be important, therefore, for both retail users and the technology provider alike to carefully monitor developments in retail stores where the Intervention is in use to ensure that future offending 'innovation' is recognised and responded to accordingly.
- The Intervention also generates a number of false positive alarms (incorrect alarm activations) – these need to be carefully controlled if the apparent potency of the Intervention is not to be undermined by growing user doubt about its efficacy and reliability. This might be achieved through future developments of the technology, perhaps bringing together the tried and tested benefits of the current (analogue) physical approach – the locking wheel – with the growing capabilities being offered by digital video analytics.
- Overall, the research concludes that for retailers that offer their customers the use of a trolley, the threat of push-out thefts is both real and significant. In addition, the evidence presented in this report suggests that the use of the Purchek wheel locking technology has a very positive impact on this type of crime, offering an attractive ROI proposition for retailers investing in this system.



Background and Context

Background and Context

A perennial concern for many retailers is the extent to which they are victims of thefts where stolen items are simply wheeled out of their stores using trolleys provided to consumers – trolley push-out thefts[1]. Data from companies offering ways to manage this problem reckon that it is a significant problem, with Gatekeeper Systems suggesting that each pushout in the US is valued at $803, with 14% of these incidents ending in violence[2]. Analysing data from users of their system they also provide a breakdown of the types of people involved in push-outs, time of day they are most likely to happen and the average age of those involved[3]. Certainly, the numerous industry surveys reviewing the experiences of retailers suggest that external theft remains the largest perceived cause of loss, but understanding the how, where and when of these losses remains difficult to ascertain[4]. Indeed, measuring the extent of retail theft is inherently difficult unless the perpetrator is caught in the act. This is largely due to the way in which retailers measure their losses.

Retailers calculate their stock loss, typically called 'shrinkage', or 'shrink', through measuring the difference between the amount of stock they think they should have (the remainder between actual goods purchased minus those sold) and what they have, usually ascertained through regular physical audits/stock counts. The difference is their 'shrinkage' number, which is often, but not exclusively, calculated as a percentage of sales[5].

The difficulty lies in trying to understand the cause of any missing stock, particularly when stock audits are carried out infrequently (often annually). The time lag between a loss event happening and it eventually being recorded can be considerable, making identification of the cause extremely challenging. Within the context of trolley push-out thefts, this inability to measure easily and accurately what the true causes of shrinkage are makes it difficult to understand what proportion of loss it may be accountable for – in effect, how much of the shrinkage pie is a direct consequence of them? Currently, this data seems to be missing from the debate concerning the significance of, and value in, minimising the risk from trolley push-out thefts – what proportion of retail losses are thought to be due to them and with what frequency are they happening?

The purpose of this study, therefore, is to shed light upon this issue through an independent analysis of the scale and extent of losses associated with trolley push-out thefts together with a detailed assessment of the impact of an intervention designed to try and tackle the issue.

Aims and Objectives of the Study

The research has two key objectives:

- Estimate the extent and value of retail thefts due to trolley push-out thefts.
- Evaluate the impact of utilising the Gatekeeper Systems technology designed to prevent trolley push-out thefts.

The Retail Context

The modern retail environment has become an increasingly complex and challenging space within which to control the problem of retail loss, in particular the growing difficulty in differentiating between the behaviour of honest shoppers and shop thieves[6]. What were once regarded as highly identifiable shop-theft traits, such as putting items directly into a bag or a pocket in the aisle, are now part of a panoply of flexible options offered to the modern shopper demanding a more 'friction-free' experience[7]. For instance, developments such as Mobile Scan and Go, where a consumer is encouraged to use their own mobile device to both scan and pay for the items they wish to purchase anywhere in a retail store, without recourse to a member of staff, nor visiting a traditional fixed payment point, make identifying miscreant behaviour increasingly ambiguous and difficult for loss prevention operatives[8]. In addition, the mixing of multiple methods of checkout within the same store further adds to the blurring of honest and dishonest behaviours – customers can opt for a staffed checkout, decide to scan their own items at a Fixed Self-checkout machine, or make use of a Scan and Go form of checkout[9]. Indeed, by the time a consumer has reached the exit, they could have navigated the product purchasing journey in a variety of ways. To add yet further confusion to this already murky arena, growing environmental demands for a reduction in plastic bag use has led to customers being encouraged to bring their own bags to carry home the products they wish to purchase – removing another potential indicator that a customer may have passed through a point of payment (retailer branded bags issued at the checkout)[10]. Given all of this, it is perhaps not surprising that retail store staff and security operatives have an increasingly hard time identifying who has or has not paid for products as they leave a retail store.

Limitations of Existing Exit Alarm Systems

A longstanding strategy by retailers to address the issue of identifying products at the exit that have not been purchased is the use of Electronic Article Surveillance (EAS) systems[11]. This technology is designed to primarily create a deterrent effect by placing some form of identifiable taggant on to a product that will activate an alarm should the taggant not be removed or deactivated at the point of purchase. These are mainly in the form of soft and hard tags applied either at the point of manufacture or at some point in the retail supply chain, often at the back of the store[12]. As a technology, it has been in use for more than 50 years and can be found on millions of products across the globe[13]. While some research has shown that it can act as a useful deterrent

against opportunistic thieves in particular, its Achilles Heel has frequently been the relatively high level of false alarms it generates at store exits. Indeed, the rate has often become so high that it is frequently described as suffering from the 'Crying Wolf Syndrome' – those tasked with responding to the alarm disbelieve its veracity and simply ignore it[14]. As such, visits to many busy shopping environments where this technology is in use can often resonate with the constant sound of largely ignored EAS alarms.

Another problem for those tasked with responding to EAS alarm activations is the difficulty of identifying not only which product has triggered the alarm[15], but also which customer is carrying it. For instance, in a busy store, multiple customers could be exiting at the same time as the alarm is activated – identifying who is responsible, in the very short period in which it is possible to intervene, is less than easy. It is perhaps not surprising, therefore, that the rate of apprehending shop thieves at a store exit via EAS alarms is often very low indeed[16].

The Trolley Push-out Intervention

The Intervention designed by Gatekeeper Systems, which is the focus of this evaluation study, aims to deliver two key attributes: 1) identify trolleys that contain products that have not transitioned through a point of payment; and 2) ensure that these trolleys can be clearly and safely identified by a member of staff/security operative[17]. This is achieved using a locking wheel technology placed on all the trolleys in use in a store. This is then supplemented by underfloor cabling that can enable a software system to identify when any given trolley has transitioned through an agreed point of payment, such as staffed checkout lanes, Fixed Self-scan zones and Scan and Go payment areas. In simple terms, if a trolley has moved through a payment area, then the wheel will **not** lock. If it has not, then the wheel **will** lock and make any further movement of the trolley both difficult and obvious[18].

In addition, a locking wheel event will also trigger an audible and visual alarm at the exit to help stimulate a response from a staff member. Once the movement of the trolley has been inhibited, a member of staff can then request the customer to show proof of purchase via the production of a valid receipt. If this is forthcoming, the wheel can be unlocked via a handheld device and the customer can continue. If no valid receipt is produced, then the member of staff can take whatever action is sanctioned by the retailer, including an option for the miscreant to pay for the products, retrieval of the products and/or detainment of the offender with a view to arrest by the police for shop theft. In some circumstances, video cameras can also be installed to record the moments just before the alarm event and a short period of time after it has been triggered.

As a technology, it has been in use for over 20 years, with Gatekeeper Systems claiming that their various types of locking wheel systems have been installed on over 5 million shopping trolley/carts in 51 countries[19]. This is the first time, however, that the technology has been the focus of an independent evaluation on its impact upon levels of trolley push-out thefts.


Research
Methodology

Research Methodology

Methodological Context

As detailed earlier, identifying the root causes of retail loss is not easy. To deal with this issue, this study set out to adopt a trial-based methodology to both measure the frequency and value of incidents of trolley pushouts over time and in different types of retail store, and secondly, to evaluate the impact of introducing an intervention to minimise the likelihood of this happening.

At the start of the study, the researcher contacted several retailers to ascertain whether they would be prepared to act as case-study companies[20]. Given the Intervention[21] technology is designed only to work on trolleys, this clearly limited the types of retailers that could be approached. While a number expressed an interest, in the end three agreed to take part and provide data – all are based in the UK. One was a clothing/homeware retailer while two were large Grocery businesses. Because of limitations in the way in which data on the number and value of trolley push-out thefts were recorded, this study is only focussed upon the results from the two Grocery retailers.

The initial research plan was for the participating companies to trial the Intervention in a relatively small number of stores (less than 10), which would be selected to represent stores with varying degrees of retail risk. However, delays in recruiting retail companies to the trial and then further delays agreeing which stores will be included, meant that the original research plan was no longer viable. Instead, and because both participating retailers decided after the results from their first few installations were reviewed to quickly roll out the Intervention across a much larger number of stores, the research evaluation became a much more extensive review.

While data collection was started in the first store for one retailer in May 2019, due to a range of retail operational factors, only a further 7 stores became active in the next 5 months. From then on, the number of active stores grew quickly in this retailer, with 63 stores active by the end of December 2019. In 2020 a further 312 stores have been equipped with the Gatekeeper technology, making a potential database of 375 stores.

In the second retailer, while a very small number of stores had the equipment installed towards the end of 2019, the main roll out of the technology took place from July 2020 onwards. For the purposes of this study, data was collected from 60 stores.

Data from both participating retailers was provided on a weekly basis from the point of installation of the equipment in each of the stores. This data was derived from intervention data submitted by staff working in the stores on to centralised company recording platforms. While recording practices varied between the two participating companies, both tracked the same core data: date and time of the incident, and the value of goods in the trolley that has triggered the alarm. In addition, retailers also provided staff recording the event with an

opportunity to describe the circumstances, which enabled a number of further data points to be developed. This narrative analysis is based upon a detailed review of 963 incidents which took place between 19th November 2019 and 9th November 2020, although the vast majority are between 1st July 2020-9th November 2020 (96.4%) in 60 stores. This analysis was able to capture the following data about each push-out incident:

- Value of goods.
- Number of people involved.
- Whether the police were involved.
- Whether the offender was known.
- Whether the incident included any form of violence or verbal abuse.
- Outcome of the event (stopped, paid, fled).
- Any action taken (store ban, warning, no action).
- The reason provided for non-payment (such as: forgot to pay, needed to get wallet from car etc).
- Presence of Retail Crime Intention Indicators (use of foil to stop EAS activating, evidence of de-tagging, false receipts, use of distraction techniques).

The efficacy of data from both retailers is clearly highly dependent upon the recording practices of those tasked with completing the incident details - some provided a considerable amount of contextual data, others merely stated that the event had occurred together with the date, time and value of goods recovered.

In addition, there is the problem of non-reporting of incidents, something which both retailers were very aware of, and when they were first trialling the technology, tried to ameliorate through third party video review of alarm activations. While this is a plausible strategy with a small number of stores and incidents, it is not something which is deliverable across a larger number of stores and incidents on a routine basis with existing retail systems. It is also worth noting that the data provided by the retailers as part of this research rarely if ever includes events where the perpetrator was successful, where the system failed to activate, or where the alarm was activated but a trolley push-out theft was not occurring (false positives). However, it was possible to analyse some limited data on the number of false positive alarms triggered by the Intervention through the Gatekeeper Systems monitoring Portal. This receives a data point every time an Intervention alarm is triggered, recording where and when it occurred. In addition, the Portal has the capacity to store a video recording of the activation (if the retailer decides to instal this part of the system). Due to the volume of video data this can generate, only a small selection of events were analysed through this Portal to ascertain the possible reasons why a false positive alarm was triggered.

As with any research that relies upon often busy retail organisations to provide its core data, compromises must be made to take account of differences in business practices, recording conventions and appetite to share data. The researcher did provide guidelines on the data points that would be desirable, but inevitably not all the information requested was available or provided in a uniform format. Whilst unfortunate, this is the reality of carrying out research in the realm of retail loss prevention. The currency used throughout this report is the British Pound.

Impact of COVID-19 Pandemic

While the overall number of stores and weeks of data is good for a study of this kind, the research methodology has been seriously impacted by the outbreak of the COVID-19 Pandemic in early 2020[22]. At the time of writing this report, the effects of this Pandemic are still being felt by the global retail community – so far it has had a profound and lasting impact on the retail industry, leading to not only the closure of many established businesses, but also a profound change in the way in which retailers are currently able to operate[23].

The prevailing mantra before the Pandemic was to create ever more retail environments with fewer and fewer friction points – ensuring that customers could avoid the need to queue wherever possible. For the moment, the emphasis has been completely flipped, with the need to deliver socially distanced retail spaces, generating long queues, sometimes just to enter a store[24]. Moreover, because of the need to keep occupancy rates within stores to agreed numbers (often well below 50% of previous rates)[25] retailers have introduced strict door controls – often just one entrance/exit and permanently monitored by staff or in some cases electronically controlled doors/barriers[26].

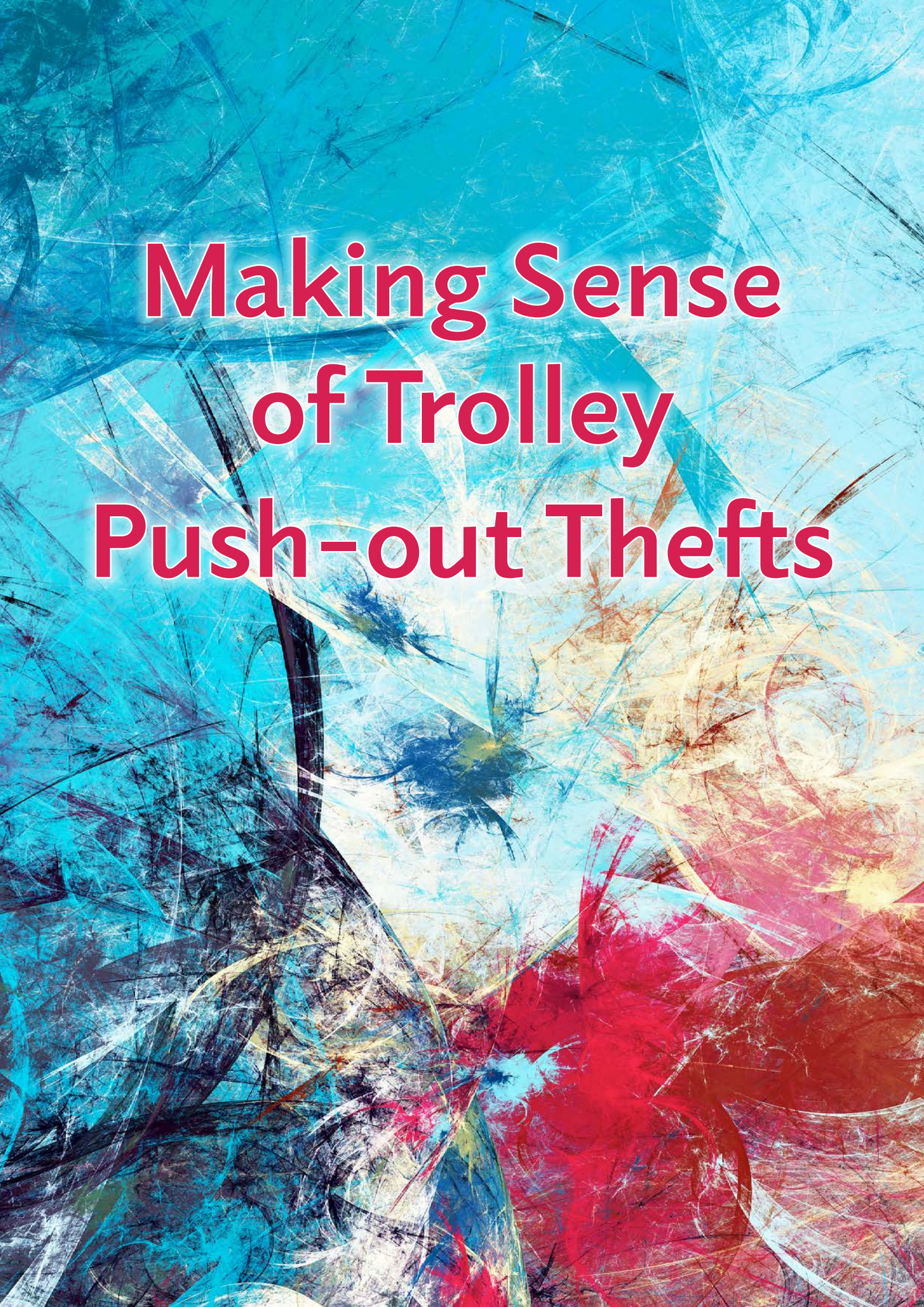
Without doubt, introducing this level of control into retail stores is bound to have a positive effect upon rates of retail loss – loss prevention executives prior to the COVID-19 Pandemic could only have dreamt of being able to exercise this level of control over their retail stores, particularly given the prevailing consensus to further strip away front-end controls and offer the consumer yet more flexibility in the way in which they accessed, selected, and paid for products[27]. As will be seen later in this report, the profound effect of these new controls can be seen when levels of Pre-COVID-19 trolley push-out thefts are compared with Post-COVID-19 levels in one of the retailers taking part in this study.

Certainly, in terms of carrying out a detailed and balanced assessment of the impact of the Gatekeeper Intervention on levels of trolley push-out thefts, it is simply not valid to combine the pre COVID-19 data with the Post-COVID-19 data, other than to show the impact of the new controls on levels of loss. Therefore, the data will be presented as three distinct datasets: Retailer A Pre-COVID store installations (prior to March 2020) – 92 stores; Retailer A Post-COVID store installations (July 2020 onwards) – 87 stores; and Retailer B (July 2020 onwards) – 60 stores. Each set is made up of 14 weeks of data, with a minimum of at least five stores in any given week and a minimum of five weeks of data for any one store. In addition, stores were only included that had an overall average (across the 14 weeks) of a recovered value of £50 or more (to exclude stores where the implementation/management/data collection was regarded as problematic). Because stores had installations at different times of the year, all the data has been normalised to reflect the number of weeks since system activation.

The selection of stores to take part in the study was made by the participating retailers based upon an assessment of the suitability of the retail environment to enable the Intervention to work as envisioned. In retailer A, an analysis of the annual store shrinkage and the company's overall store risk rating showed that there was no statistical difference between the Pre- and Post-COVID store groups. However, discussions with representatives of the company suggested that the initial selection of stores was based to some degree on those stores which were thought to be at a higher risk of trolley push-outs based upon an analysis of recorded crimes on the company's security system. In retailer B, stores were selected which were considered to be 'higher risk', based upon their shrinkage history, local demographics, crime statistics and the views of the Asset Protection team. Unfortunately, the company did not make available any contextual store data to allow a more detailed review of the risk profile of the stores to be developed.

Limitations

The results in this study have been derived exclusively from data collected from the stores of Grocers operating exclusively in the UK, as such its applicability to the circumstances of retailers operating in other countries needs to be considered. In addition, the data provided is derived from the participating retailers' own recording practices and of those utilised in each of the stores where the Intervention was installed. Inevitably, the data is therefore limited not only by the availability of staff to respond to alarm activations, but also subsequently record details about the event accurately, especially the value of recovered items. Sampled viewing of recorded videos of alarm activations in one retailer suggested that operating practices of some security operatives did vary in terms of their assiduousness in responding to alarms – some were ignored, while others received a limited response. It is therefore highly likely that the data presented in this report is an underestimate of the number and value of incidents taking place. However, given the number of stores included and number of weeks covered, this report represents one of the most complete series of datasets on the issue of trolley push-out thefts published to date.


Making Sense
of Trolley
Push-out Thefts

Making Sense of Trolley Push-out Thefts

This section of the report is based upon the various data sets made available by the retailers that agreed to participate in the study. As detailed in the methodology, the COVID-19 Pandemic added an unwelcome layer of complexity to this study, making the collection, collation, and interpretation of the data much more problematic. The results are organised into five main sections. The first focusses upon a review of the data on the average number and value of recorded trolley push-out incidents over time from the point when the Intervention was installed in a retail store. Here the data has been normalised to take account of different installation dates of the Intervention – week one represents the first week after installation and so on.

The second section then looks at how one of these data sets can be used to estimate the likely incidence and cost of trolley push-outs in grocery retail stores together with an estimate of the proportion of unknown store losses (shrinkage) that may be accounted for by trolley push-outs.

The third part then goes on to provide insights into the nature of trolley push-outs events, looking particularly at: the outcome of the intervention; the number of offenders involved; whether the police were involved and any sanctions imposed by the store; the extent to which violence or verbal abuse occurred; if the offender(s) was/were known to the store; what reasons (if any) were offered by offenders for the absence of payment; and whether there were any indicators present of organised retail criminality.

The fourth section provides an estimate of the likely Return on Investment (ROI) from using the Intervention based upon the data available from this study. The final section then considers the available data on the issue of False Positive alerts – the number of system activations when a trolley push-out theft is not occurring, and a review as to why these may be occurring.

Impact of Intervention Over Time

This data is based upon three data sets: the first from Retailer A that provided data from 92 stores where the Intervention was installed prior to the COVID-19 Pandemic Lockdown, starting in the Autumn of 2019; the second from Retailer B that provided data from 60 stores installed after the COVID-19 Pandemic, from July 2020 onwards; and the third dataset from Retailer A for 87 stores where installation took place from July 2020 onwards (Figures 1 and 2). All datasets cover a 14-week period.

Change in Average Value of Trolley Push-outs

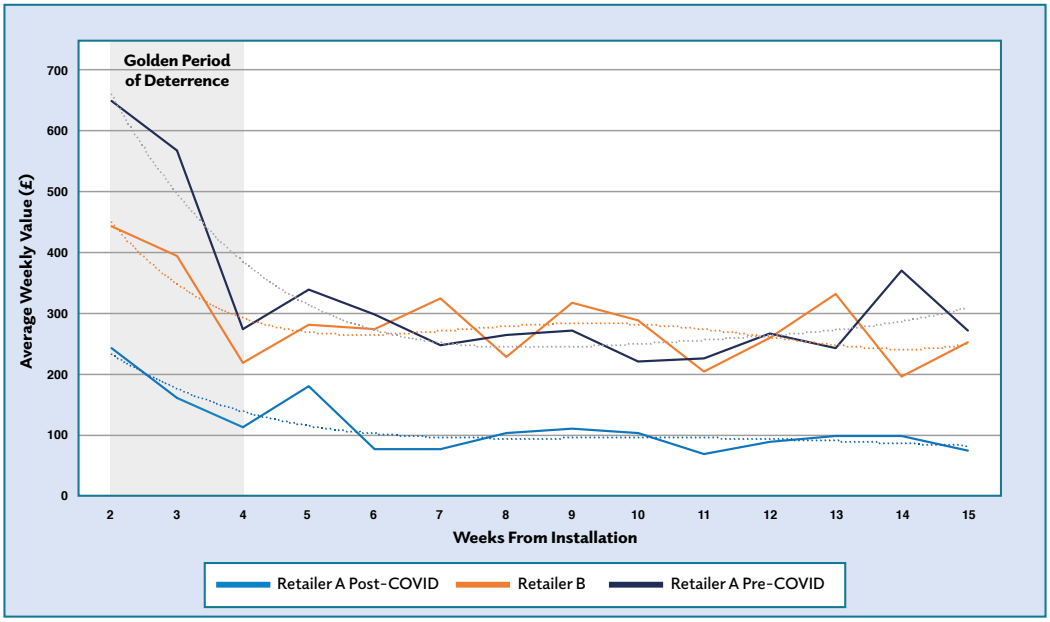
Each of the data sets has been normalised to begin all stores from the second week of Intervention activation[28]. As can be seen from Figure 1, the datasets follow a very similar pattern[29], with all three showing strong correlations with each other[30]. The data from Retailer A for their Pre-COVID store installations has an overall higher average starting point (£647) compared with Retailer B (£441) and Retailer A Post-COVID (£241).

The data from Retailer A's Pre-COVID stores shows an average weekly value of £606 being recorded across weeks 2-3 of operation, and then this drops significantly over the subsequent 12 weeks to an average of £272, a 55% reduction overall. Retailer B has the same pattern albeit at a lower initial starting value: an average of £417 across weeks 2-3, followed by a weekly average of £264 for the remaining 12 weeks, a reduction of 37%. For Retailer A's Post COVID stores the same pattern is evident but again a lower starting point: £200 for weeks 2-3, followed by an overall weekly average of £99 for the remaining 12 weeks (50% reduction).

As will be discussed below, there would appear to be a distinct period of impact for the Intervention, what might be considered a 'golden period' of deterrence, where those who have previously been engaging in trolley push-

outs on a routine basis are made starkly aware of the now significantly increased risk of apprehension. This then leads to a drop off in incidents, although not a complete cessation (possibly due to new offenders emerging, old offenders checking the Intervention is still being used and monitored, and offenders displaced from other nearby stores where the Intervention has also been recently introduced).

Figure 1 Average Weekly Value of Trolley Push-out Detections by Retailer



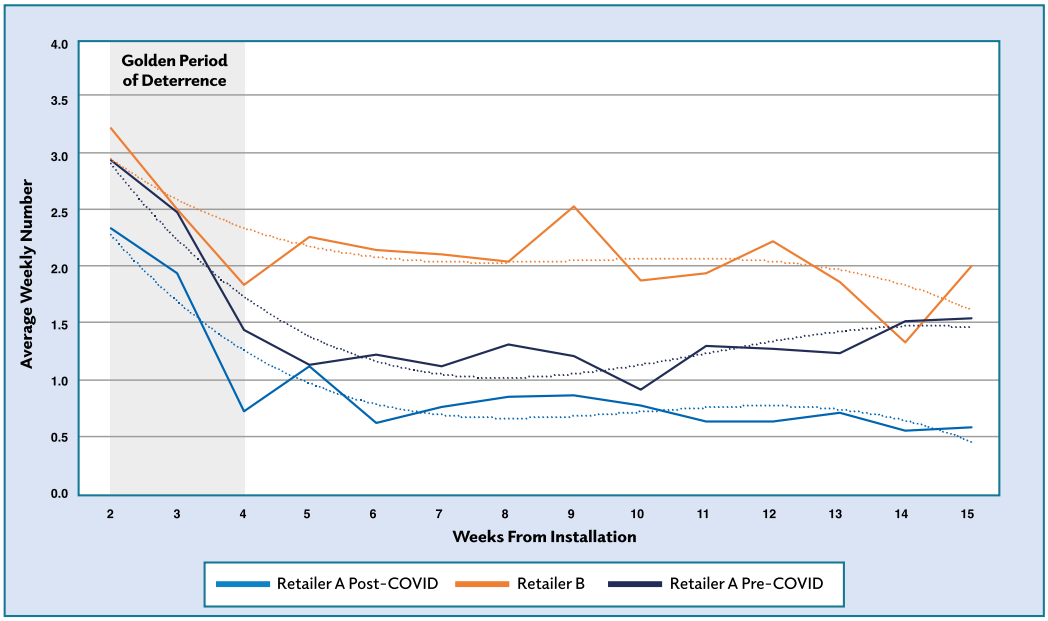
It is worth noting the overall difference in average values between Retailer B and the stores from Retailer A Post COVID. Both are in operation in the same period – some months after the original COVID-19 Pandemic Lockdown in the UK, but still operating within a much more controlled retail environment where social distancing and occupancy limits are in force. It might have been expected that Retailer B's stores would have been much near to Retailer A's Post-COVID stores' rates than found in the Pre-COVID stores[31]. However, the reality is very different and while it is not possible to conclusively explain this difference, at least four factors may be contributing to this difference.

The first is that there may well be different levels of rigour and approach in place in terms of store controls that differentiate the two retailers. This could take the form of single versus multiple entry/exit points and different customer flow controls in place. Secondly, Retailer A's post COVID stores could represent a lower risk profile of stores compared with those selected by Retailer B. Thirdly, while difficult to prove conclusively, Retailer B's stores could be experiencing a degree of displacement from the tranche of Retailer A stores that introduced the Intervention earlier in the year (this issue will be discussed in more detail later in this report). Fourthly, Retailer B may be the victim of a different and more pervasive trolley push-out community than Retailer A. Whilst it is not possible to know at this stage, certainly for Retailer A, there is a noticeable and significant change in the average value of incidents in Pre- and Post-COVID store installations, while Retailer B's data is a much closer match to the former.

Change in Average Number of Trolley Push-outs

Figure 2 looks at the average number of incidents per week of installation and as can be seen, there is once again a strong correlation between all three datasets[32], with the same trend apparent as the value data presented earlier[33].

Figure 2 Average Number of Trolley Push-out Detections by Retailer



Across all three data sets, the golden period of deterrence is also identifiable in the first two weeks – there is an average of a 49% fall in the number of incidents between weeks 2-3 and the remaining 12 weeks. On average, stores across all three datasets were recording between 2.1 and 2.9 incidents per week in the first two weeks compared with between 0.8 and 2 incidents in the subsequent weeks. It can also be seen that Retailer B has a higher overall average for weeks 4-15 compared with both datasets from Retailer A – 2 incidents per week compared with between 1.3 and 0.8 for Retailer A.

The data for both value and incidence comparing the 2-week 'Golden Period of Deterrence' averages with the remaining 12-week averages is summarised in Table 1.

Table 1 Summary of Changes in Average Value and Incidence by Time and Retail Dataset

Retail Dataset	Weeks 2-3		Weeks 4-15	
	Value (£)	Number	Value (£)	Number
Retailer A Pre-COVID	606	2.7	272	1.3
Retailer A Post-COVID	200	2.1	99	0.8
Retailer B	417	2.9	264	2.0

Estimating the Cost and Incidence of Trolley Push-out Thefts

One of the key objectives of this study was to develop an estimation of the extent to which retailers suffer from the problem of trolley push-out thefts – calculate how many were likely to be occurring and what proportion of retail losses may be accounted for by them. Developing a methodology to achieve this is less than easy. In theory, it is possible to record all intervention activations (where the system is triggered but no physical intervention on the trolley takes place) and then using in-store video, track back through the shopping journey of those that activated the alarm to see whether they did or did not pay for the goods in the activating trolley. Certainly, this would give a reasonably reliable measure of the number of trolley push-out events, but it would be a more challenging exercise to put an accurate value on the goods being stolen. It is also a very labour-intensive exercise which would be expensive to undertake across more than a few stores for a small period[34].

An alternative method, and the one employed in this study, is to use the initial period of active Interventions as a proxy for the likely number and value of events that would have happened had the Intervention not been in operation. As has been graphically shown above, the number and value of recorded incidents of trolley push-out thefts tail off very quickly after week three of the Intervention being installed in a store – the effect is consistent and profound across all three data sets being used. As shown above the drop off in average value between weeks 2-3 and 4-15 is 55% for Retailer A's Pre-COVID store installations, 37% for Retailer B and 50% for Retailer A's Post-COVID stores.

In addition, this method also enables a more accurate valuation of the contents of the trolley push-out to be calculated – the trolley has been recovered and the value of the goods has generally been recorded by the store operative. As will be discussed later in this report, the on-going trolley push-out offending group in any given store is made starkly aware of the new intervention in this 'golden period of deterrence' and thereafter, the rate of detections is significantly and consistently lower. Given this, if the intention is to use this data to calculate the likely rates of offending prior to the introduction of the Intervention, then it would not be appropriate to use an average derived from across the 14 weeks of data to act as a proxy – the 2-3-week period would seem to offer a much better and more realistic indicator of rates of trolley push-out thefts.

So, while using the 2-3-week store averages seems to have inherent logic, utilising this data range from all three datasets utilised in this study is more problematic. As detailed earlier, the COVID-19 Pandemic has had a dramatic impact upon the landscape of retailing and how Grocery retailers in particular, are now operating their stores – much higher levels of door control and limits on occupancy rates. This in turn has undoubtedly influenced rates of trolley push-out offending, as evidenced in the data from Retailer A, where Post-COVID stores are witnessing much lower levels. Therefore, given the growing positive news around the development of vaccines to counter the disease, and the undoubted desire to return societies to pre-COVID modes of economic behaviour as soon as possible, it would seem appropriate to base any estimates on the scale and extent of trolley push-out thefts, and the associated ROI for the Intervention under consideration, just upon the dataset from Retailer A's Pre-COVID store installations. It would seem to be far more representative of what 'normal' grocery retailing looked like prior to the Pandemic-driven upheavals still being experienced since March 2020.

Given these assumptions, the data suggests that for a Grocery retail store, with some indicators of elevated levels of overall risk, with annual sales of approximately £40 million, it can expect to be having **at least** 140 trolley-push-outs a year (almost three a week), costing in the region of £31,500. This equates to the average trolley push-out costing £224 per incident.

Put another way, it is calculated that trolley push-outs account for approximately 4% of the store's unknown losses (shrinkage)[35]. This is of course an average and naturally, some stores were calculated to be experiencing significantly higher and lower rates of loss in this period[36] (the highest was in the region of a rather shocking £153,000 a year and the lowest was just £624). As discussed earlier, the measure of 'shrinkage' is a measure of unknown retail loss, where the causes of losses are not known but can be many and varied, including process failures and errors (in the stores, in the supply chain and in business systems), internal theft, customer errors (such as through SCO systems) and of course external theft. But, as retail systems become more and more adept at beginning to turn unknown loss to known losses, it is highly likely that the proportion of unknown losses attributed to trolley push-outs thefts will increase.

Value and Occurrence of Recorded Trolley Push-outs Incidents

In addition to providing insights into the overall prevalence and cost of trolley push-outs, the three retail datasets also offer an opportunity to better understand the value of these incidents, their impact upon retail businesses and the types of offenders and offending taking place. Detailed in Table 2 below is a breakdown of all the incidents from all three datasets where a value for the recovered trolley was recorded, categorised into various bands of value.

Table 2 Aggregate Number and Value of Trolley Push-out Incidents

Incident Value	Number of Incidents		Value of Incidents	
	Number	Per Cent	Value	Per Cent
£1-£50	475	27	£12,521	4
£51-£100	365	21	£27,338	9
£101-£200	459	26	£66,119	22
£201-£500	359	20	£110,455	37
£501-£1,000	87	5	£57,885	20
£1,001 or More	13	1	£20,319	7
Total	**1,758**	**100**	**£294,637**	**100**

As can be seen the largest proportion of incidents are those where the value recovered was £50 or less (27%). Moreover, in almost three-quarters of incidents, the basket value is £200 or less (74%), with only 6% having a value of £501 or more. However, in terms of total value recovered, incidents of £200 or less only account for about one-third of the total value recovered (35%), whereas incidents of £501 or more represent 27% of the total value. This disparity between number of incidents and total value is even more starkly apparent for those where the trolley value was over £200 – they account for just over one-quarter of all recorded incidents (26%) but represent nearly two-thirds of all the value (64%). The data seems clear – a relatively few high-value trolley push-outs generate a significant amount of the loss generated by this type of offending.

Profile of Trolley Push-out Incidents

One of the retailers taken part in this study made available their incidents logs completed by staff responding to trolley push-out alarm activations. This was done via an online security portal which captured the place, date, time, value of goods, number of people involved in the incident and an option to provide a written description of the circumstances. Analysis of this descriptive text enabled a number of other variables to be collated: the outcome of the event (stopped, paid, fled); whether police were involved; whether the incident included any form of violence or verbal abuse; whether the offender was known; any action taken by the store operative (issue store ban, warning, no action); the reason provided for non-payment (e.g. forgot to pay, needed to get wallet from car etc); and whether any Retail Crime Intention Indicators were mentioned (use of foil to stop EAS activating, evidence of de-tagging, use of false receipts, distraction strategies employed). Detailed below are the findings from this analysis – it is important to note that this is a different data set than that utilised earlier in this report to calculate the likely incidence and cost of trolley push-outs.

Outcome of Activation

The textual descriptions of the trolley push-out incidents provided an insight into what happened when the alarm was activated, and the trolley wheel locked[37]. It was possible to group the outcomes into three broad types: 'Paid', where the offender went back/was escorted into the store and paid for the products they were trying to steal; 'Fled' where the member of staff describes how the offender abandons the trolley before they have had a chance to confront them; and the rest, which are described as 'Stopped', where the trolley is retained by the member of staff and the offender is challenged. As can be been seen in Figure 3, just over one-fifth of incidents result in the offender paying for the items they were originally trying to steal (21%). In over two-thirds of cases the offender is stopped, and the goods are retrieved without any payment (68%), while the remaining 11% of incidents are where the offender abandons the trolley and makes a quick exit before they can be approached.

The data also showed that the average value for these types of outcome vary considerably, with the difference being statistically significant[38]. For offenders who went back to pay for their goods, the value was 53% below the average, while for those who were stopped and did not pay it was 13% higher than the average, and for the group that fled the scene, it was higher still – 21% above the average. As will be discussed below in more detail, this data is highly indicative of very different types of offenders engaging in trolley push-outs.

Number of Offenders

Data was also collected on the number of people who were thought to be involved in the trolley push-out incident (Figure 4). For most incidents, only one person is recorded as being involved (89%) while in nearly one in ten cases, it is two people (9%) and in just one per cent of occasions three or more people were thought to have been involved.

Interestingly, as more people are involved in the incident, the higher the average value of the recovered goods, with the difference being statistically significant[39]. Where only one person was involved, the value was recorded as 9% below the overall average, when two were involved it rose to 74% above the average, and when three or more were part of the trolley push-out, the average value was significantly higher again than the average – 140%. Once again, this data is also highly indicative of different types of trolley push-out offending groups in operation.

Figure 3 Outcome of Trolley Push-out Interventions

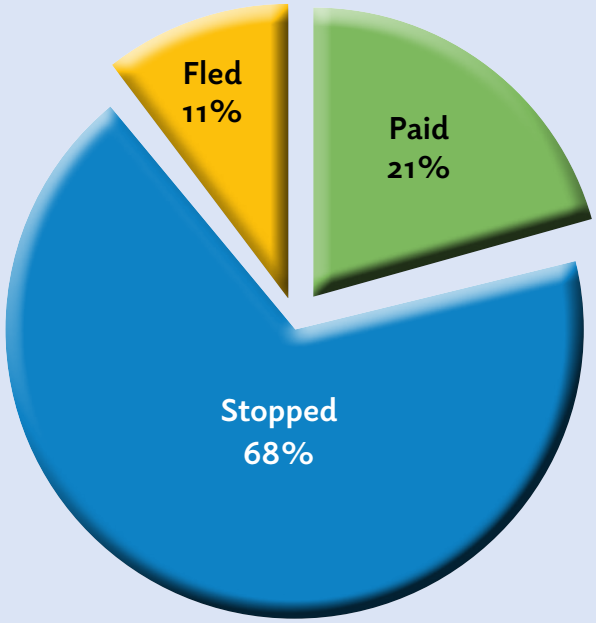
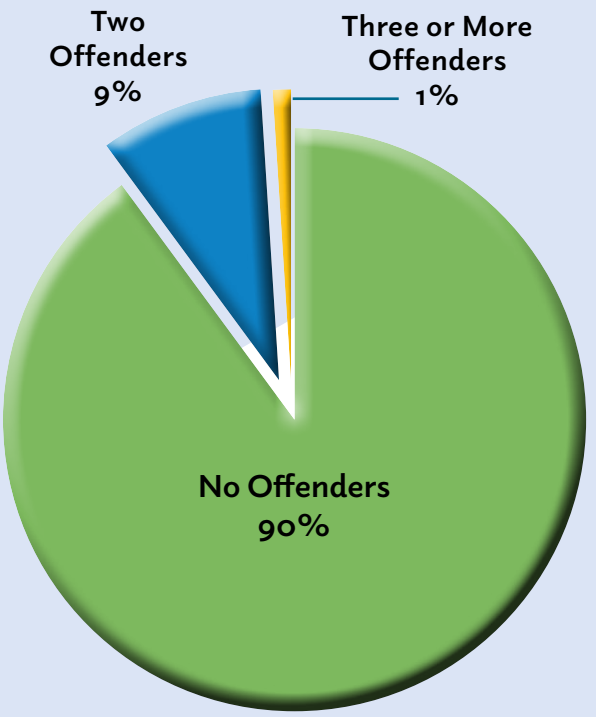


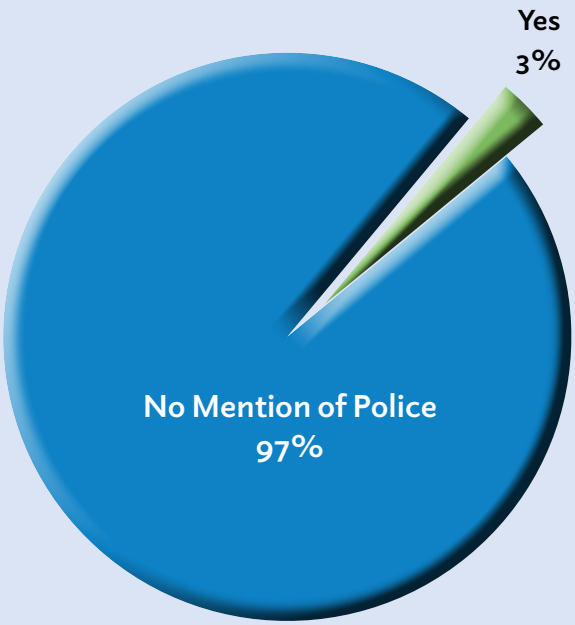
Figure 4 Number of Offenders Involved in the Trolley Push-out



Involvement of Police and Store Sanctions

While theft from retail premises in England and Wales is a criminal offence covered by the 1986 Theft Act (if the value is over £200) and the 2014 Anti-social Behaviour, Crime and Policing Act (for lower value offences), potentially punishable with imprisonment, the reality presented by this data is that offenders rarely face any official sanction for their actions. As can be seen in Figure 5, in just three per cent of cases was police involvement explicitly mentioned, while the vast majority led to the offender being either encouraged to pay or they walked away (97%). However, the data does show that higher value incidents were more likely to generate a police response – the average value when they became involved was 107% above the overall average[40].

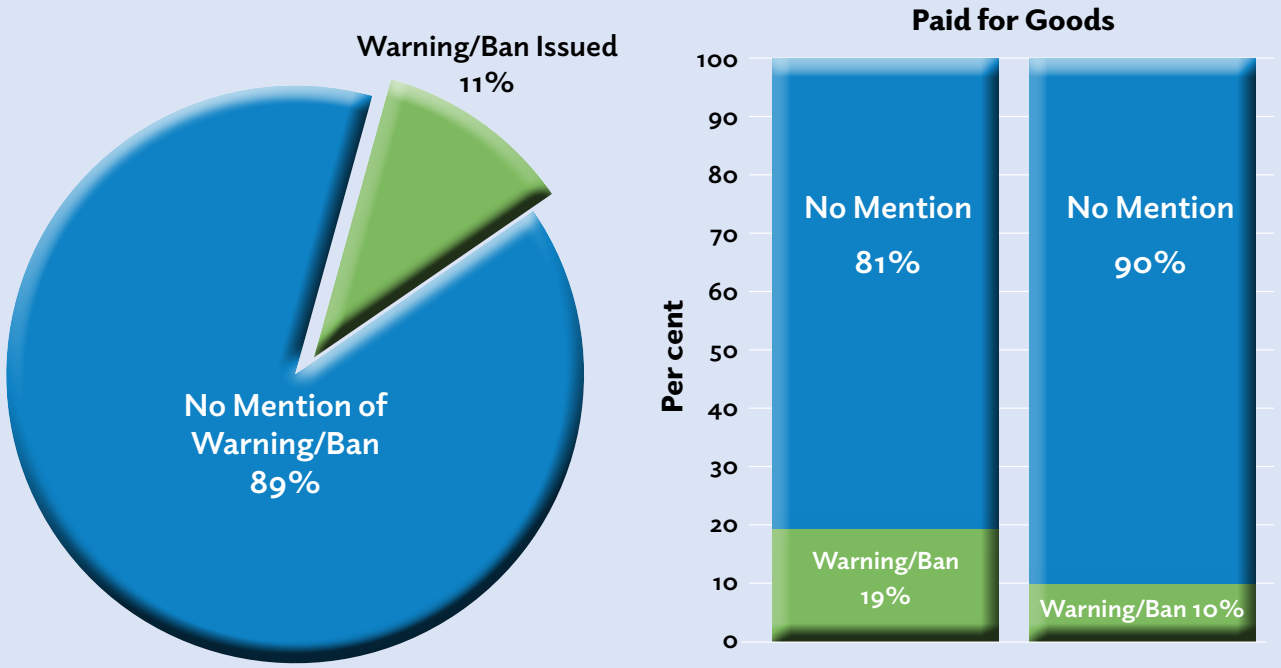
Figure 5 Involvement of Police in Trolley Push-outs



Equally, store-based sanctions were infrequent (Figure 6), with just 11% of offenders receiving any form of ban or warning, while nearly nine in ten were not issued with any form of sanction by the store (89%).

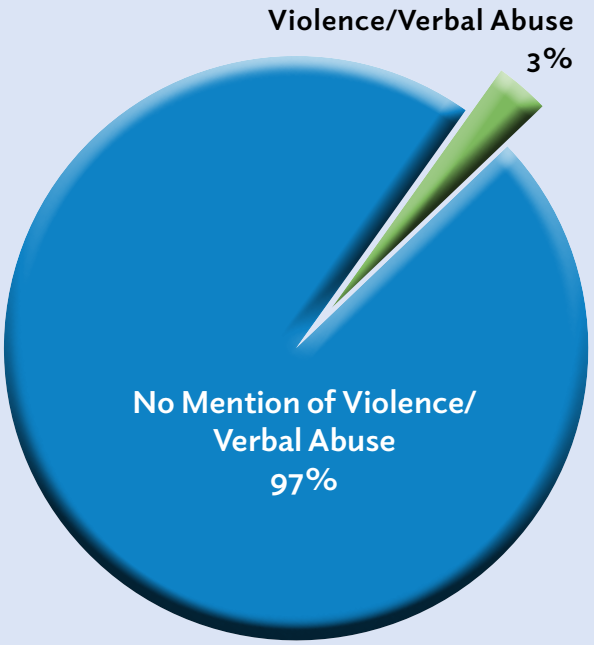
No doubt this statistic is partly deflated by the number of offenders that choose to walk away before the staff member had a chance to impose any form of sanction. This is confirmed by the data on the number of offenders who go on to pay for the goods that they attempted to steal – almost twice as many of this group are issued with a ban/warning than those that decide not to pay[41]. Within the payment window, the security operative/staff

Figure 6 Store Action by Number and Whether the Offender Paid



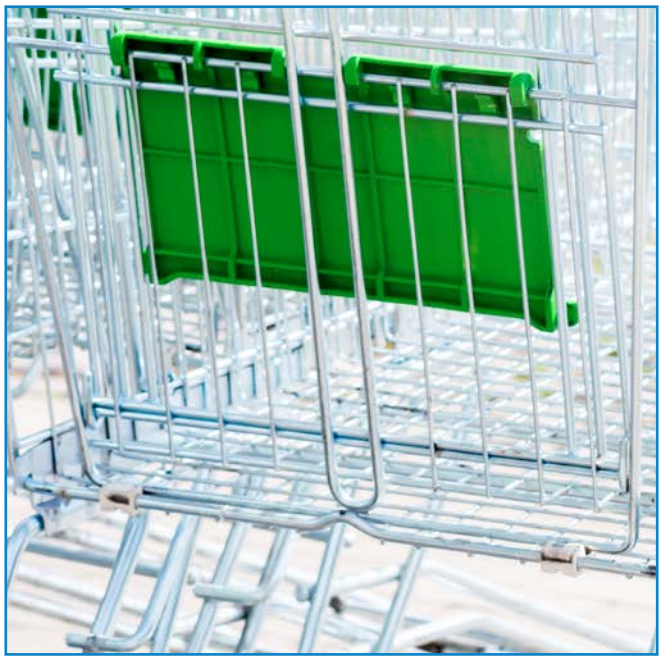
member has the time to issue the sanction. This data is also instructive in terms of portraying the extent to which any official law enforcement/government statistics on rates of shop theft are undoubtedly a gross underestimate of the true extent of the problem – stores very rarely report most incidents of theft, preferring to recover the goods rather than invoke the criminal justice system. This confirms yet again that using such statistics to comment on changes in industry-wide rates of retail crime is a highly unreliable exercise.

Figure 7 Number of Trolley Push-outs Causing Violence and Verbal Abuse



Violence and Verbal Abuse

One of the concerns of introducing some form of exit control to monitor and respond to trolley push-outs is the risk that this may consequently generate an increase in the number of incidents of violence and verbal abuse. Figure 7 below shows the number of events that were recorded as including some form of violence and/or verbal abuse. Of course, how individuals respond to, and perceive, violence and verbal abuse, differs markedly depending upon their outlook, attitude, and previous experience, which may well affect their likelihood to make a note of it when recording these events[42]. For instance, in environments where there is a considerable amount of ongoing day-to-day abuse, staff may become less likely to record incidents (it's just part of the job), whereas in locations where it is relatively rare, then this may create an increased likelihood to report (this event is unusual, and we must make a note of it). Consequently, the data presented below needs to be interpreted with some caution.



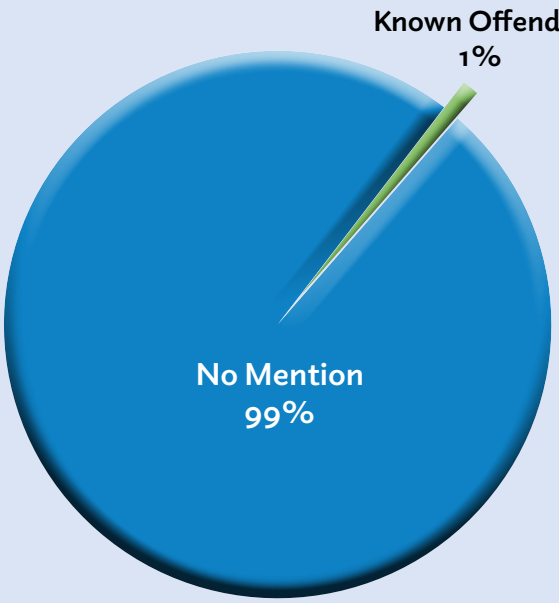
As can be seen, very few incidents were recorded where there was apparent violence and/or verbal abuse – just 3% of the total. For most trolley push-out events, therefore, there appears to be no evidence of violence or verbal abuse taking place. There was also no evidence of a corelation between the severity of the incident (measured by the value of the trolley contents or the number of people involved) and the likelihood of violence and verbal abuse being used – highly organised and determined thieves are not more likely to engage in this type of behaviour. In part this can probably be explained by the reluctance of those who are trying to steal large quantities of stock to increase the risk of apprehension and sanction when the trolley alarm has been activated – adding a charge of violence to an already arrestable offence (if the value is sufficiently large) is not a good outcome, and so flight rather than fight is likely chosen by these types of offender as the best response to a trolley that is no longer easily moveable and has attracted the attention of security staff.

Previous Offenders

The data also offered an interesting insight into the extent to which those tasked with delivering store security were familiar with those who were carrying out trolley push-outs (Figure 8).

As can be seen, very few of those who were responsible for trolley push-outs were known offenders – people who the security staff had encountered on previous occasions – just 1 per cent of all incidents. However, it is interesting to note that when known offenders were caught, they had statistically significantly larger quantities of stolen stock than those that were not known (112% higher than the average) – previous offending is clearly a good indicator of the likely seriousness of the event (as measured by value)[43].

Figure 8 Extent to Which Trolley Push-out Offenders Were Known

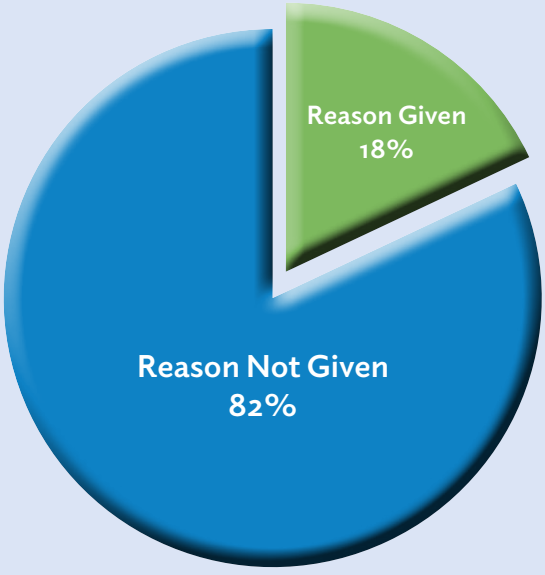


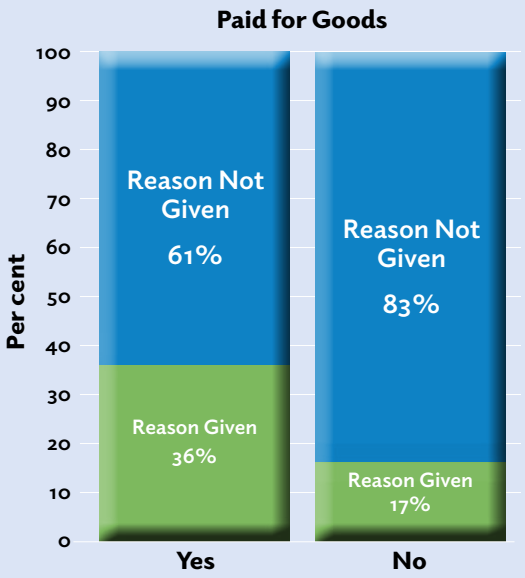
In many respects this is a very significant finding. Some industry stereotypes portray trolley push-outs as the domain of the serious and committed offender who is likely to have a long track record of notable offending. Whilst this type of offender is certainly involved in this type of offence, what this data shows is that there is also a previously unseen, unknown, and potentially significant group of push-out offenders that have been operating well below the radar of most store security staff prior to the introduction of the trolley push-out intervention.

Alarm Activation 'Reasons'

The textual commentaries offered by those recording incidents of trolley push-outs also provided rich insights into some of the 'reasons' provided by those who had triggered the alarm and associated locking wheel. Before considering the main reasons proffered, it is worth looking at the data on those who were more likely to offer an explanation, focussed particularly on whether they went on to pay for the goods they were trying to steal or not (Figure 9).

Figure 9 Whether a 'Reason' for Alarm Activation was Given and Payment Outcome





Perhaps unsurprisingly, given the number of offenders who chose to walk away once the alarm was triggered, and the vagaries of reporting procedures, only about one in five events generated some form of 'explanation' or 'reason' as to why a trolley was appearing at an exit without passing through a point of payment (18%). Interestingly, those that went on to pay for the items they were attempting to steal were significantly more likely to offer a reason than those who simply left and abandoned their trolley – 39% of those who paid compared with only 17% of those who did not pay[44]. As will be discussed below, this is potentially indicative of a particular type of trolley push-out offender, one that is undoubtedly deliberative in their intentions, but also highly concerned about the consequences, are shopping for personal consumption, and keen to avoid recourse to the criminal justice system. As will be seen below, they can be highly creative in 'explaining' away their apparent offending behaviour.

Detailed below are the 12 most common reasons offered by those who were stopped and questioned about whether they had evidence to show that they had purchased the products in their trolley (Table 3).

Table 3 Most Common Reasons Offered by Trolley Push-out Offenders

Reasons	Number[45]	Per cent
Relative had Receipt	34	20
Admits Theft	28	16
Forgot to Pay	25	14
Going to Vehicle for Payment/Wallet/Receipt	17	10
Thought had Paid	10	6
Claimed to have Paid	7	4
Looking/Waiting for Friend/Partner	7	4
Purchase Post Checkout Item	7	4
Health Issues	5	3
Change Trolley/Basket	4	2
Going to Cash Machine	4	2
Inability to Pay	4	2
Other	21	12
Total	**173**	**100**

The most common excuse offered when confronted by store staff was that a relative, who had (conveniently) left the store or was elsewhere in the store, had the receipt for the products in the trolley (20%). This would often then be used as a way for the offender to offer to go and get the 'missing' receipt, enabling them to leave without any further sanction being applied. The second most offered explanation was a direct exclamation of guilt – they admitted that they had committed the offence (16%). Of those, nearly one half (46%) agreed to pay for the items they had been trying to steal. In third place was 'forgot to pay' (14%) and given that proffering such a reason left little room but to pay, some 68% went on to do so.

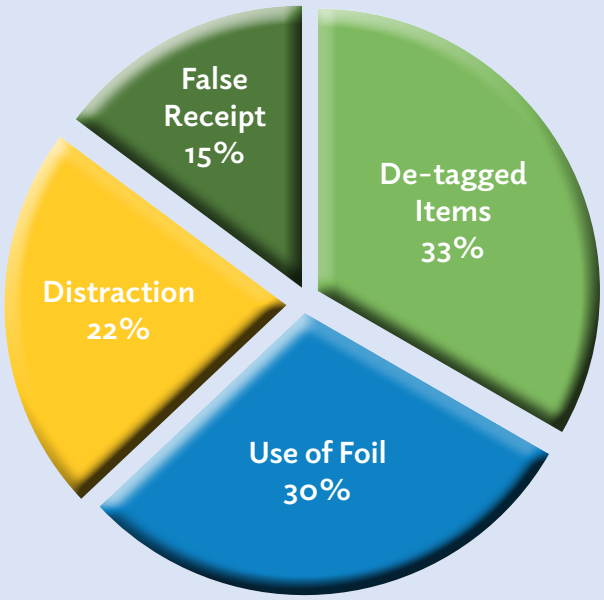
Another favourite was that they were on their way to their vehicle to get their wallet/payment, or that the receipt was in the vehicle (10%)! As with the earlier excuse, this provided the offender with a way to extricate themselves from the situation by offering to go and get these items. Perhaps unsurprisingly, virtually none of these offenders ended up returning to pay for the stolen goods. Then in fifth place was 'thought I had paid' (6%), an interesting explanation, but one which rarely generated a subsequent payment (just 10% of these offenders went on to

pay). As can be seen in Table 3, there were plenty of other 'reasons' offered including looking for friends, wanting to buy goods that were placed beyond the checkouts (another 'excuse' that left non-payment a hard option to follow – 71% did pay), changing trolley and so on.

Presence of Intention Indicators

The final piece of data presented from this analysis of recorded trolley push-out data is evidence of highly premediated and organised forms of retail criminality relating to trolley push-outs. Here, references to a number of retail crime 'Intention Indicators' were collected, such as using a foil lined bag to neutralise Electronic Article Surveillance (EAS) tags, wrapping EAS tags in foil, evidence of products having been de-tagged, presenting a false receipt, and acting in concert with others to distract store staff (Figure 10).

Figure 10 Extent to Which Retail Crime Intention Indicators Were Present



In total there were just 27 reported cases where a report included reference to any of these forms of retail crime Intentions Indicators, usually associated with more professional, pre-meditated and organised shop thieves (3% of all the incidents recorded). Of those, the most common was evidence of products in the trolley that had been de-tagged (9 cases). The second most common method identified in trolley push-outs was the use of foil, either bags that had been lined in foil or where EAS tags had been wrapped in foil (8 cases). This is a relatively common technique to stop active EAS tags triggering the alarm at the exit.

The third most common indicator was efforts to try and distract store staff when the trolley was being pushed out the store (6 cases). This included an associate purposefully triggering the EAS alarm with a previously purchased tagged product or approaching the security staff with questions and queries. Finally, there were four cases of offenders presenting a false receipt for the goods they had in the trolley.

When Intention Indicators were employed by offenders, they were typically attempting to steal large quantities of goods. In all cases, the average trolley value was significantly higher than the average, with those utilising distraction techniques (183% above average) and de-tagging goods (58% above average) being especially high[46]. It was also interesting to note that the method that required the least preparation and organisation – a false receipt – was also associated with the lowest average value of the Intention Indicators identified (15% above average).

What seems clear from this data is that those who were adopting a planned and prepared approach to neutralise two of the most common and longstanding methods to securing retail stores (Security Operatives and EAS Tags) were evidently unaware of the trolley-push-out intervention in operation – de-tagging protected goods and using foil-lined bags will have no impact upon the activation of this intervention. It was clearly something for which this type of thief was evidently unprepared. As will be discussed below, this is often a highly determined and adaptive group of offenders and therefore the prospect of them re-evaluating their methods to defeat this new security intervention is a very real prospect, although the design and application of the Intervention does have various pathways to try and mitigate this issue.

Calculating 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[47].

However, in the retail loss prevention community (and others) it is often used to describe a range of different indicators employed to measure the performance of a given intervention[48]. Some of these indicators can be viewed as being 'soft' in nature, such as when an intervention is deployed to make staff and customers 'feel' safer, while others are much 'harder', requiring the calculation of the precise value an intervention can generate, such as a financial reduction in unknown losses or an increase in sales for instance.

One of the many challenges faced by the loss prevention industry has been the difficulty in acquiring robust and reliable data on the impact any given intervention might have[49]. Where the objective is to measure changes in 'soft' indicators, such as staff and customers perceptions, then methodologies exist that can enable this to be done relatively easily (such as through surveys conducted before and after the introduction of an intervention)[50]. However, it is less easy when 'hard' indicators are trying to be measured, such as changes in the levels of unknown loss. As discussed earlier, unknown store losses or 'shrinkage' as it is often termed, is a rather blunt and unreliable statistic when it comes to evaluating the impact of any given intervention[51]. Often calculated on an infrequent basis and impacted by a myriad of potential causes, it can be a poor indicator when trying to establish cause and effect. That is not to say that 'hard' indicators measuring the impact of an intervention cannot be generated – they can – but it often requires more detailed and involved data collection methodologies. For instance, changes in levels of loss may need to be measured on an ad hoc basis through regular counting for a period, including the use of 'control' and 'experimental' stores, to ensure that observed differences are statistically valid[52].

It is certainly the case that not all loss prevention/security initiatives and investments can and should be measured exclusively utilising strict financial analyses of the 'value' it generates to a business. Indeed, some have argued that when it comes to macro level initiatives, such as corporate security, then several assumptions must be accepted when considering 'pay back'[53]. For example, how can a value be put upon an access control system that has successfully prevented strangers from entering a corporations' premises?

However, as retailing has become an ever more complex and competitive environment, and operational budgets and investment decisions come under ever more scrutiny, then the need to 'prove' the value of an investment has become ever more important. In many respects, this approach is not unusual in other parts of retail businesses such as marketing and advertising, but it has historically been relatively slow to evolve within loss prevention functions[54]. Indeed, when reviewing the available literature measuring the 'value' of a range of loss prevention interventions, such as video technologies, EAS and data mining systems, the evidence is at times painfully thin and largely bereft of the accountancy/methodological rigour normally employed by other retail functions[55]. While this may partly be a function of retail companies and their intervention providers not being willing to publish the results from their trials and experiences, it is also likely to be the case that the loss prevention industry has lagged in understanding and adopting the return-on-investment methodologies employed elsewhere[56]. To put the ROI model outlined below in context, it may be of value to quickly recap the common terms and approaches adopted to measure ROI.

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 £100,000 on something, I want to know that in a certain period the money I spent is going to return something to me. I want to know how long it is going to take and what the percentage of return is so that I can make a business decision[57]. For some, the important measurement of ROI will be the amount of time it takes to 'pay back' the original investment, while others will use something equating to what is known as the 'Net Present Value', to calculate their ROI, which measures the net benefit of a particular project over a set period.

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

- **Discount Factor** is the rate of return that a capital expenditure project must meet to be accepted. It is used to calculate the net present value of future cash flows from a project and to compare this amount to the initial investment.
- **Net Present Value (NPV)** is a measure of the net benefit of a project, in today's terms.
- **Discounted Payback Period** is the time frame it takes for the project to yield a positive cumulative cash flow (using Net Present Value).
- **Internal Rate of Return (IRR**) is the discount rate necessary to drive the NPV to zero; the value another investment would need to generate to be equivalent to the cash flows of the investment being considered.

While some of these terms may sound intimidating, the underlying calculations can easily and automatically be done by basic spreadsheet programmes such as Microsoft's Excel.

Trolley Push-out Theft Intervention ROI Model

Detailed below is the ROI calculation using data presented earlier in this report, based upon the data from Retailer A's Pre-COVID store installations. It utilises the following assumptions:

- The average annual store saving in terms of a reduction in unknown losses is assumed to be £31,537 and this saving is achieved consistently across the three years presented in the model[58].
- The average cost of installation has been calculated at £30,000 per store[59].
- Maintenance costs for the first three years have been estimated by the Intervention provider.
- Retail organisations vary in terms of the Discount Factor they employ, but a poll of retail contacts suggested that a figure of 8% was not an unreasonable rate to use.
- While the provider of the Intervention suggests that their technology has an average lifespan of about five years, discussions with the retailers taking part in this study indicated that they would rarely if ever develop an ROI model beyond three years for evaluating the 'value' of a loss prevention investment.
- The model does not include any potential costs associated with providing staff to monitor and react to the Intervention's alarm activations, nor any additional store alteration costs to reduce the likelihood of the Intervention being subverted.

Table 4: Projected ROI for the Trolley Push-out Intervention

RETURN ON INVESTMENT CALCULATION			
Average Store Installation Cost	(£30,000)		
Discount Factor	8%		
	Years		
	1	**2**	**3**
Factors			
Unknown Loss (Shrinkage) Saving	£31,537	£31,537	£31,537
Intervention Maintenance Costs	(£1,500)	£1,500	£2,500
Return on Investment Indicators			
Net Saving Before Tax	£30,037	£30,037	£29,037
Present Value Before Tax	£27,812	£25,752	£23,051
Net Present Value Before Tax (NPV)	£46,614		
Discounted Payback Period Before Tax	1.08 Years		
Internal Rate of Return	70%		

The first value to be calculated is the **Net Savings Before Tax** – this is the actual reduction in shrinkage minus the running costs. So, for the first and second year, the business will save £30,037 and in the third year it will be £29,037. Note the issue of tax is purposefully ignored as methods of calculating and options for exemption vary enormously between different countries. Of course, the Net Savings before Tax calculation is not the true value of the saving as it does not consider factors such as the cost of the capital (as discussed above). Therefore,

the **Present Value Before Tax** 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[60]. 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 £27,812. This is then calculated for the remaining two years. Once these have been calculated, the **Net Present Value (NPV)**, which is simply the sum of the Present Values over the time of the project minus the original capital investment can be calculated. In this case, the NPV is £46,614. Using this measure, the investment would yield a profit for the business.

The second 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 1.08 years to pay back the original investment.

The third 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. In the example above, the IRR is calculated to be 70%.

Taken together, the overall ROI package for this Intervention is financially attractive (assuming the reduction in unknown losses are maintained over the three-year period). In the model above, an average store is likely to yields a return of £46,614 before tax, with a relatively short return period of about 1.08 years. Moreover, with an Internal Rate of Return at 70%, it would be regarded by most retailers as an attractive proposition.

Incidence of False Positive Alarms

Retail spaces are complex environments that can undermine the performance of all forms of loss prevention technologies and practices. Approaches that work flawlessly and according to plan in a laboratory setting can often falter when exposed to the 'real retail world'. Not only can the physical environment have an adverse effect (e.g. changes in store and product layout, lighting), but also the behaviour of staff and customers can have an impact as well – humans can be very unpredictable beasts, often defying any sense of perceived rationality and logic! Of course, a well-designed loss prevention intervention should, if possible, aim to take account of these vagaries to maximise its potential to meet its intended objectives – the growing interest and use of Machine Learning (ML) is certainly testament to this.

Understanding Intervention Outcomes

For most forms of 'alarming' interventions – such as EAS exit gates and burglar alarms, there are a finite number of outcomes that can occur:

True Positive: the system correctly alarms when a genuine pre-defined and proscribed activity takes place – a thief trying to remove a product without paying for it or a burglar entering a building.

False Negative: the system does not generate an alarm when a genuine pre-defined and proscribed activity takes place – the thief does not trigger the alarm and the burglar enters the building unnoticed.

False Positive: the system triggers an alarm, but it is 'incorrect' – the product activating the alarm has in fact been paid for and the burglar alarm has been triggered by something other than a burglar, such as a flapping display board in a store.

These are typically regarded as the three main outcomes that can occur, although Beck added a fourth in relation to his recent work on video analytics: **Overload Positive** – ill-defined and overly inclusive system parameters generating an unacceptably high number of trigger events that are technically correct[61].

Not surprisingly, intervention designers and users prefer alarm activations to be predominately 'true positives' with as few as possible 'false negatives' and 'false positives'. While it can be notoriously difficult to identify false negatives on a routine basis (there is no alarm), false positives are much more capable of being measured (the alarm has gone off). A particular danger of false positives is that they can undermine confidence in the veracity and efficacy of the intervention – those tasked with responding to the alarm begin to assume it is probably false and change their response behaviour accordingly – do not respond at all or simply cancel the alarm without checking properly.

Understanding the reasons behind false positives can be an important step in improving the overall performance of an intervention – if the flapping advertising display board that keeps triggering the burglar alarm can be identified, then the false positive problem can be fixed. Equally, if the location of an EAS tag on a particular product is making it difficult for staff to de-activate it, then perhaps it can be repositioned, or a different type of tag applied.

Incidence of Trolley Push-out Activations

The Intervention under consideration in this report is an 'alarming' technology and therefore it is important as part of the evaluation to look at the available data on the extent to which it generates the various types of outcomes highlighted above and what some of the drivers of them might be.

The first part of this report has very much focussed upon an analysis of the True Positives – when the system has correctly identified events where an offender is trying to steal products by pushing them out of a store in a trolley. When analysing only the Retailer A Pre-COVID data, across the 14 weeks, the 92 stores averaged 1.5 True Positives a week. Over the same period and controlling for the number of weeks that the Intervention had been installed, the stores averaged 66 alarm activations a week, a ratio of roughly 1 to 44. Put another way, stores are likely to have about 9 alarm activations a day, most of which will not be a True Positive.

Understanding Trolley Push-out False Positives

Given this ratio, it is important to consider the drivers of these false positives and what impact they might have on the behaviour and attitude of those tasked with responding to the alarms. As described earlier, the

Intervention is based upon a locking wheel technology that is triggered when a trolley is leaving a store without first passing through a designated payment area within a given time. Inevitably, this operating milieux creates false positives, the main drivers of which are: Empty trolleys leaving the store (staff and customers); legitimately utilised trolleys not passing through a designated payment point; legitimately utilised trolleys passing through a payment point but not leaving the store within an agreed time; and system failure. Accessing data on the incidence rates of these various false positive drivers is not easy – store staff typically do not record the outcome of an alarm unless it is a true positive although the Intervention provider is developing a more user-friendly way of collecting this information in the future[62].

However, a review of recorded trolley-push-out videos in a small selection of stores, together with feedback from the participating retailers reveals that by far and away the largest contributor to false positives is the movement of empty trolleys by store staff, followed by customers leaving with an empty trolley, and then customers that appear to have some form of legitimate receipt.

The movement of empty trolleys by staff is, in many respects, an inevitable and predictable component of the day-to-day operations of a retail store – customers bring them in, complete their shopping, and then often leave the trolley in the store. In other circumstances, staff may be using a trolley for restocking purposes (where stock is placed beyond the payment point for instance).

Understanding why customers leave with an empty trolley is a little more difficult to ascertain – it could be that the product(s) they wished to purchase was/were not available and so they leave but decide to put the trolley back in its original position outside the store. Alternatively, it could be that some customers use the trolley as a form of walking aide while partners carry out the process of selecting and purchasing products. Or it could be that some customers simply enjoy walking around a store without any intention to purchase any products whatsoever (a form of consumer therapy). Regardless of the motivation, the outcome is that the empty trolley will activate the alarm.

Although empty trolleys were by far the most common type of false positive driver, their impact on alarm responders' confidence is likely to be relatively minimal, not least because they are visually very apparent – there is nothing to check because the trolley is clearly empty, or it is a member of staff that is pushing it out. This makes them easy to identify and deal with.

More challenging are the false positives where the customer has used the trolley legitimately but navigated the store in a way that has avoided crossing a payment verification point. For example, one of the retailers taking part in this study had introduced a buy online pickup in store (BOPIS) facility that was located within the store. It was found that customers would enter with a trolley, go to the BOPIS point, collect their purchase, and then leave, avoiding all existing payment verification zones. In these circumstances, alarm responders are much more likely to become wary of the efficacy of the alarm, potentially undermining their confidence in the system. As will be discussed below, the issue of how to manage the various types of false positives that can be generated by this technology needs to be carefully managed – potential mitigations are possible at the design stage but these need to be balanced against cost of equipment and installation – there is a relationship between the number of false positives and overall system costs, and a retailer will need to assess this issue on a case by case basis.

Discussion and Conclusions

Discussion and Conclusions

Understanding Trolley Push-out Theft

To date, there have been few if any independent reviews of the problem of trolley push-out thefts in retailing. It has certainly aroused sporadic interest but like many forms of crime and other forms of loss that occur in a retail environment, it has largely been shrouded by a lack of data. The current study set out to try and resolve this issue – to develop not only a measure of the scale and extent of the problem, but also understand the context within which it happens, and crucially, assess the value of one approach designed to try and minimise the problem.

As detailed throughout this report, the COVID-19 Pandemic, which has wreaked enormous economic and social havoc across the globe, also significantly undermined the capacity of this project to meet its original objectives – getting consistent, verifiable, and reliable data from retailers on the problem of trolley push-outs. It is important, therefore, that the results presented in this report are interpreted with this in mind. Ideally, the data sets would have been more complete and less affected by the impact of the Pandemic. However, the available data has enabled some fascinating insights to be developed and the key objectives of the research to be largely met. The research has shown that trolley push-outs do represent an appreciable problem for Grocery retailers – accounting for about 4% of their unknown losses. In addition, it has shown that the Intervention under consideration can have a demonstrable impact upon the prevalence of this problem, achieving an impressive ROI. The research has also enabled several other insights and conclusions to be drawn and these are presented below.

Developing Insights on Shop Theft

There has been much research undertaken focussed upon understanding and categorising the various types of people who steal from retail shops, including understanding their motivation, background, methods, and interventions likely to stop them from offending[63]. Most typologies tend to make a generalised distinction between 'amateur' and 'professional' thieves, with the former regarded as stealing primarily for personal consumption, and the latter being more driven by an imperative to convert stolen goods into cash through reselling[64]. In addition, amateurs are regarded as more opportunistic, stealing relatively small amounts, and likely to be deterred by various forms of security, such as EAS tags and attentive store personnel, although some research also shows that professional thieves are equally wary of these types of preventative approaches[65]. When it comes to thinking about trolley push-out thefts, however, this broad dichotomy between amateur and professional while still valid, may not be suitably nuanced to understand the impact of any given intervention. What is perhaps more important is understanding the extent to which the theft event is purposefully planned or not – less the taking of an opportune moment and more a deliberate and pre-determined course of action.

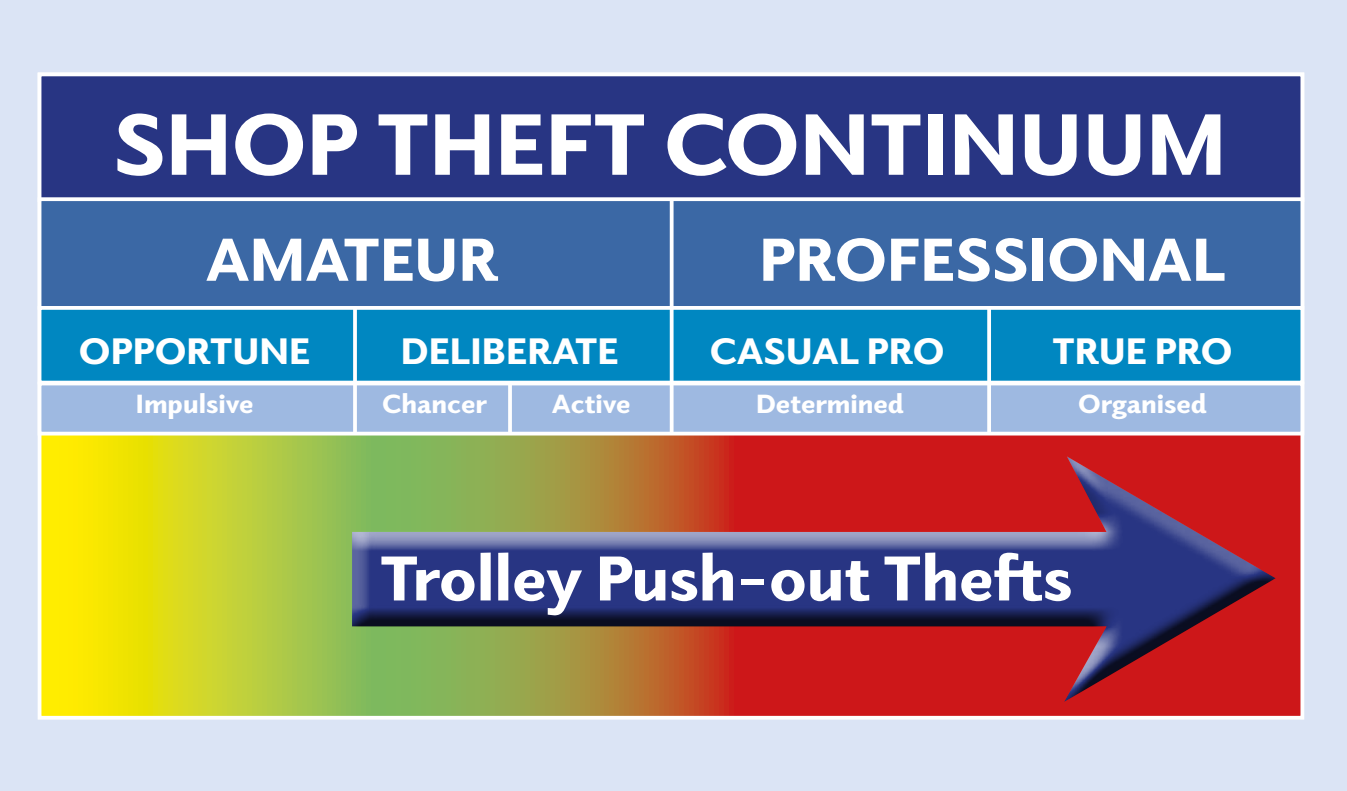
Categorising Trolley Push-out Thieves

Certainly, as a Modus Operandi, trolley push-outs are arguably a much more deliberate and potentially organised form of shop theft behaviour, certainly compared with the recent growing trend in losses associated with self-checkout technologies (SCO), where there is a high degree of potential ambiguity about the extent to which Mens Rea can be determined[66]. The act of non-scanning an item at a SCO can often be excused away as due to 'error' or oversight – a opportune and potentially impulsive form of theft that is highly unlikely to lead to any form of prosecution or sanction[67].

Trolley push-out thefts on the other hand, are a much more deliberate form of criminal activity, which are considerably harder to characterise or 'neutralise' as a 'mistake' or something which is a consequence of machine error[68]. With self-scan thefts/errors, there is often a shroud of doubt surrounding them – was it deliberate or just an innocent mistake, something which has been called the 'self-scan defence'?[69] For the most part, it is far clearer cut when it comes to trolley push-out thefts – it is much more difficult to persuasively make the 'error' argument – few 'customers' will have much hope convincing a judge that after filling up their trolley with goods, they then simply 'forgot' to pay and walked out the store oblivious of their actions[70].

The data presented earlier suggests that there is a marked difference in types of trolley push-out thieves, certainly when considering the value of the goods they are attempting to the steal and their reaction to being actively stopped by the Intervention and associated security operative. The data suggests that while the Amateur/Professional differentiation is still apparent – with Professionals being subdivided into the 'Casual Pro' (attempting to steal large amounts with little or no intention of paying or waiting to be challenged) and True Pros[71] (also stealing large amounts with little intention of paying or hanging around, but also employing other strategies such as distraction and evidence of tag deactivation/removal), Amateurs can also be subdivided as well into types of dishonest actors (Figure 11).

Figure 11: The Shop Theft Continuum



While there are those that are genuinely opportunistic (SCO abusers for instance), those engaging in trolley push-outs are arguably much more Deliberative, made up of what can be described as 'Deliberative Chancers' and 'Deliberative Active Amateurs'. The former has recognised the 'relative' ease of conducting a trolley push-out and use this method to procure their regular shopping requirements for 'free', but, when confronted, will make excuses to plead their innocence, backing this up by often going on to pay for the goods they were originally attempting to steal. For the most part, they are probably unlikely to be adaptive, and, if given the opportunity to return to the store, will decide to pay for future purchases. The *Active Amateur* on the other hand, while probably still attempting to steal their typical shopping requirements, will be more reluctant to pay, and will make highly implausible excuses that often enable them to abandon their trolley and leave the store with little or no meaningful sanction. They too will probably be deterred to a great extent, although they may be more inclined to think about some potential displacement behaviours, as discussed below.

This distinction and defining of trolley push-out thefts as a deliberate and potentially 'organised' form of shop theft behaviour is important when it comes to beginning to understand how offenders might be prevented from carrying out this form of shop theft. Both Amateur and Professional trolley push-out thieves are likely to be mindful of the security practices of a retail store, perhaps noting the presence of guards and the use of Electronic Article Surveillance (EAS) gates at stores entrances/exits[72], but they are also very aware that the modern retail environment, especially that found in the Grocery sector, is an increasingly complex space within which loss prevention teams must operate. They recognise that the swathe of other shoppers leaving with trolleys containing products at the same time, provides a high degree of cover and risk dilution, especially when customers are increasingly encouraged to use their own shopping bags and avail themselves of various forms of self-scan checkout options. Trolley push-out thieves pray upon this increasingly thick vail of shopper-status ambiguity, particularly in busy retail environments[73].

For those tasked with preventing retail thefts occurring, this increasingly blurred space, has made differentiating between the actions of honest shoppers and those of shop thieves, increasingly problematic, especially where actions which once would have been a clear indicator of dishonesty, such as putting items directly into a bag in the aisle, are now actively encouraged to facilitate more 'frictionless' shopping. Indeed, for a store guard/security operative standing at an exit, the day-to-day reality is that their chances of identifying a trolley containing goods that have not been paid for, amongst all the other trolleys where the goods have been paid for, is vanishingly small. The data from this study certainly backs up this conclusion – very few of those successfully stopped were known offenders – they were operating below the 'security radar'.

The Value of Alarm Activation Visibility: Kinetic Crime Control

What is also evident is that this growing retail complexity has increased the pressure on one of the longstanding mainstays of retail store protection designed to deter customers leaving with goods without first paying for them – EAS systems. For instance, the growth of various forms of self-scan technologies have made it more difficult to ensure that they work reliably (not generating false alarms yet deterring would-be thieves) and at the same time minimise customer friction (such as waiting for tags to be removed).

Certainly, as a technology it has long had a problem with high rates of false alarms, particularly due to tags either not being removed or deactivated at the point of payment. This has led to an excess of alarm triggers at store exits, most of which are false, causing a reduction in responder confidence, creating a 'crying wolf syndrome'. In addition, those tasked with responding to an EAS exit alarm have little or no indication as to who has triggered the alarm nor which product it might be. In busy Grocery stores, multiple customers could be exiting at the same time as an alarm activation – who should the security operative approach and if they detain the wrong person, what might be the consequence? Perhaps not surprisingly, few retailers record much success in catching thieves at the exit via EAS alarms[74].

In contrast, the Intervention under consideration in this report is purposefully designed to generate a much clearer and overt indication as to which customer has triggered the alarm – the suspect trolley is physically stopped in its tracks, making identification by a security operative relatively straightforward. Indeed, the review of video footage of numerous alarm activations as part of this study graphically showed the extent to which a suspect trolley's progress is curtailed, with offenders often resorting to physically dragging it to continue moving it away from the store exit. While the issue of false positive alarms remain, and will be discussed below, the capacity of the system to significantly help the alarm responder to identify the actual trolley triggering the alarm, in what can often be a short window of opportunity to respond, is a significant benefit of this Intervention.

Certainly, there are much more 'hi tech' digital approaches emerging to begin to identify trolleys containing stolen items, such as sending an image of a suspect trolley to a handheld device given to store operatives, but the critical importance of immediacy and overt visual awareness, is an alluring and powerful attribute of this Intervention. This was supported with feedback from the retailers taking part in this study. One described feedback from a security guard, who commented: 'were we blind before we had this...very hard to know who had set it [the alarm] off'. Another said: 'It gets so busy here, loads of people leaving at the same time when the system goes off – at least now we can see who's dragging the trolley!'.

Taking Account of Displacement

As detailed in this report, the available evidence suggests that the trolley-push out theft intervention utilised by the two case-study companies is likely to lead to a significant reduction in the level of unknown stock loss in the retail stores where it is employed and a healthy ROI. However, it is important to reflect upon the issue of displacement and whether some of this benefit may not be realised as fully as suggested in the ROI model. Displacement is the relocation of crime (or criminals) because of the introduction and use of some form of crime prevention programme/initiative[75]. In the realms of retail loss in general, and trolley push-out thefts in particular, the criminological literature suggests it can occur in six ways:

- **Temporal Displacement:** the offender changes the time of day when they commit their crime, such as when security guards are not present. This will not of course stop the intervention activating, and making the trolley hard to manoeuvre, but the offender may well be able to complete their theft event.
- **Tactical Displacement:** the offender changes their method or modus operandi. This could mean that the offender no longer uses a trolley to transport the goods they wish to steal but instead uses a basket to carry them out of the store or secretes the goods in their clothing or bags.
- **Target Displacement:** the offender switches to other targets to focus upon. Within the retail environment, this is unlikely to occur as it is hard to imagine thieves identifying anything else to steal beyond the retail goods they originally targeted.
- **Type of Crime Displacement:** the offender moves to a different type of crime, such as robbery and/or burglary. While this is certainly possible, for most shop thieves, this would amount to a significant escalation in offending behaviour, with the increased consequence of apprehension probably deemed unacceptably high.
- **Spatial Displacement:** the offender decides to carry out their offending at another location. Given that stores are often grouped together in retail districts, then it is certainly possible that an offender could relocate to another similar store where the Intervention is not in use.
- **Perpetrator Displacement:** the original trolley push-out thieves that have been deterred are replaced by new offenders who are unaware of the presence of the Intervention.

In terms of the Intervention under review in this report, then some forms of displacement may take place. For instance, it is possible that offenders could switch the time when they enter the store to coincide with periods when they know staff monitoring the exit will be absent. To counter this, stores should ensure that, wherever possible, store exits where the Intervention is being monitored receive adequate staff coverage throughout the trading period. As the data shows, while there is a dramatic impact in the few weeks after the Intervention is introduced, there is also an ongoing trickle of incidents in the following weeks, some of which may well be previous offenders coming back to check whether the Intervention is still being used and monitored.

In addition, there is the very real prospect that former trolley push-out thieves may well be Tactically Displaced. This could include:

- Switching to using a basket to carry stolen goods out of the store.
- Carrying stolen goods out in their own bags (leaving the trolley inside the store).
- Secreting stolen goods in their clothing.
- Deactivating the trolley by steering it through 'payment areas' such as closed staffed checkout lanes, Fixed Self-scan and Scan and Go checkout areas, or attending a customer service desk to make a small-value purchase.

In terms of the first three options, while losses will still be incurred because of these forms of displacement, they are highly likely to be at a much lower level than previously experienced – baskets and bags can hold a much smaller quantity of goods than a trolley can. In addition, the perceived risk of apprehension may be elevated with this switch in tactic – in many circumstances it might be regarded as unusual for customers to leave a store carrying a basket. Similarly, filling bags or putting goods into pockets while walking around the store, or abandoning a trolley before exiting a store may draw attention from store staff – all these methods benefit less from the veil of ambiguity provided by trolley push-outs. Certainly, the sense of risk for Amateur trolley push-out offenders, would be significantly elevated with this type of switch of tactic.

The deactivation of the trolley is certainly a risk once the offender has realised how the system operates, and one of the retailers in this study has already started to take measures to try and address this issue. They have begun to invest in increased access/exit control hardware around SCO payment areas and closed staffed checkout lanes. In addition, they have started to look at ways of monitoring trolley dwell times in Scan and Go payment areas – those that move too quickly through these areas will not be deactivated for instance.

So, this form of displacement is certainly possible although it would be hard to measure with any degree of accuracy. One option could be to factor in some form of displacement weighting into the ROI model – reduce the projected

savings in future years although by how much is very hard to decide. Alternatively, as discussed earlier, the projected savings from utilising this Intervention could be viewed as an underestimate due to variability/reliability issues concerning the response to alarm activations. In which case, any increase in losses from displacement behaviours may be offset by unrecorded events in the 'golden period of deterrence' measurement phase.

It is also worth noting that the Intervention could certainly create spatial displacement to surrounding stores – offenders simply decide to 'shop' elsewhere to continue their offending. Where this form of displacement pushes offenders to another retail chain, then the company investing in the Intervention may be less concerned about this outcome. But if the offender is 'brand loyal', then they may decide to continue offending at another branch of the same retailer, displacing the loss from one location to another. If this is the case, then it may well be prudent for those companies investing in the Intervention to adopt a clustered approach to its use – equipping all stores in each area with the technology.

Finally, the data presented in this report suggests that while there is indeed a golden period when an existing community of trolley push-out thieves can be effectively deterred using the Intervention, the ongoing 'tail' of offending after this period suggests that it is not something which can be turned off – either new offenders emerge (Perpetrator Displacement), or initially deterred offenders return to reassess whether the Intervention is still in operation. Either way, the Intervention is a classic example of a loss prevention strategy that needs to be maintained and effectively managed in the long term – it should not necessarily be viewed as a one-shot silver bullet, but more another useful tool in the store loss prevention armoury. It is also worth noting that a major meta-analysis of over 100 crime prevention initiatives found that while 25% experienced some form of displacement, overall, the effect of the displacement was less than the treatment effect, suggesting that the intervention was still beneficial[76].

Responding to False Positives

It is rare for any intervention designed to work in the world of retail loss prevention to operate with 100% accuracy. The Intervention under consideration in this report is no different and two key drivers of false positive alarms were identified.

The first issue related to false positives generated by empty trolleys. This could be either members of staff repositioning trolleys back outside the store and/or customers leaving with trolleys that contain no items. In terms of the former, this would seem to be largely a process and training issue – store staff moving trolleys across the alarm activation zone need to be aware that the wheel locks should be de-activated prior to moving them. In terms of the latter, it remains perplexing to understand why, certainly in one of the retailers taking part in this study, that so many customers (prior to the COVID-19 Pandemic period) decide to leave a Grocery store with an apparently empty trolley. More positively, it is unlikely that this type of false positive will have too much of an adverse impact upon responder faith in the efficacy of the system – empty trolleys are very easy to identify, especially when being pushed by a member of staff.

The second issue relates to false positives driven by legitimate trolleys navigating a store in a way that does not trigger the correct alarm deactivation signal. As discussed earlier, one retailer taking part in this study had introduced an option whereby customers could pick up Click and Collect items within the store. These customers would then exit the store (quite rightly) without passing through the designated payment points (such as staff checkouts, Fixed Self scan and Scan and Go areas), triggering the alarm. Examples such as this suggest that retailers and the Intervention provider need to work closely to fully understand and design store systems that are cognisant of the uniqueness of any given operating environment. While cutting corners at the design stage may help the capital budget go further, the consequent impact on false positives and user confidence in the system may prove to be a false economy.

One option to begin to resolve these issues could be to develop the Intervention further whereby it combines the benefits achievable from 'digital' technologies (such as video analysis of trolleys to identify whether they are empty or not or have passed through a payment point) with the existing 'analogue' capacity of the alarm triggering a physical intervention (the wheel being locked, impeding movement). Through this type of approach, it could enable the Intervention to address some of the readily apparent drivers of false positives found in this study. In many respects, this could be the potential cumulative value achieved through amalgamating 'analogue' and 'digital' components – both bring advantages and together offer significantly enhanced value – Digital Kinetic Crime Prevention. This would seem a logical progression for the Intervention provider.

Key Role of Alarm Responders

While seasoned shop thieves may be on the look-out for the tell-tale sign of an oversized wheel on a trolley indicating that the Intervention is in use in a store, most customers will be blissfully unaware of its presence and use. In this respect, the Intervention is somewhat different from other forms of loss prevention interventions that are designed to try and actively discourage deviant behaviour by making their presence abundantly clear. For instance, Hard EAS tags placed on clothing and bottles of alcohol are designed to draw the attention of the would-be thief to them – to amplify their sense of risk by inflating their perceived chances of being caught. The hope is that this will be sufficient to prevent theft and therefore not require any other form of intervention, such as responding to an alarm triggered by a tag at an exit.

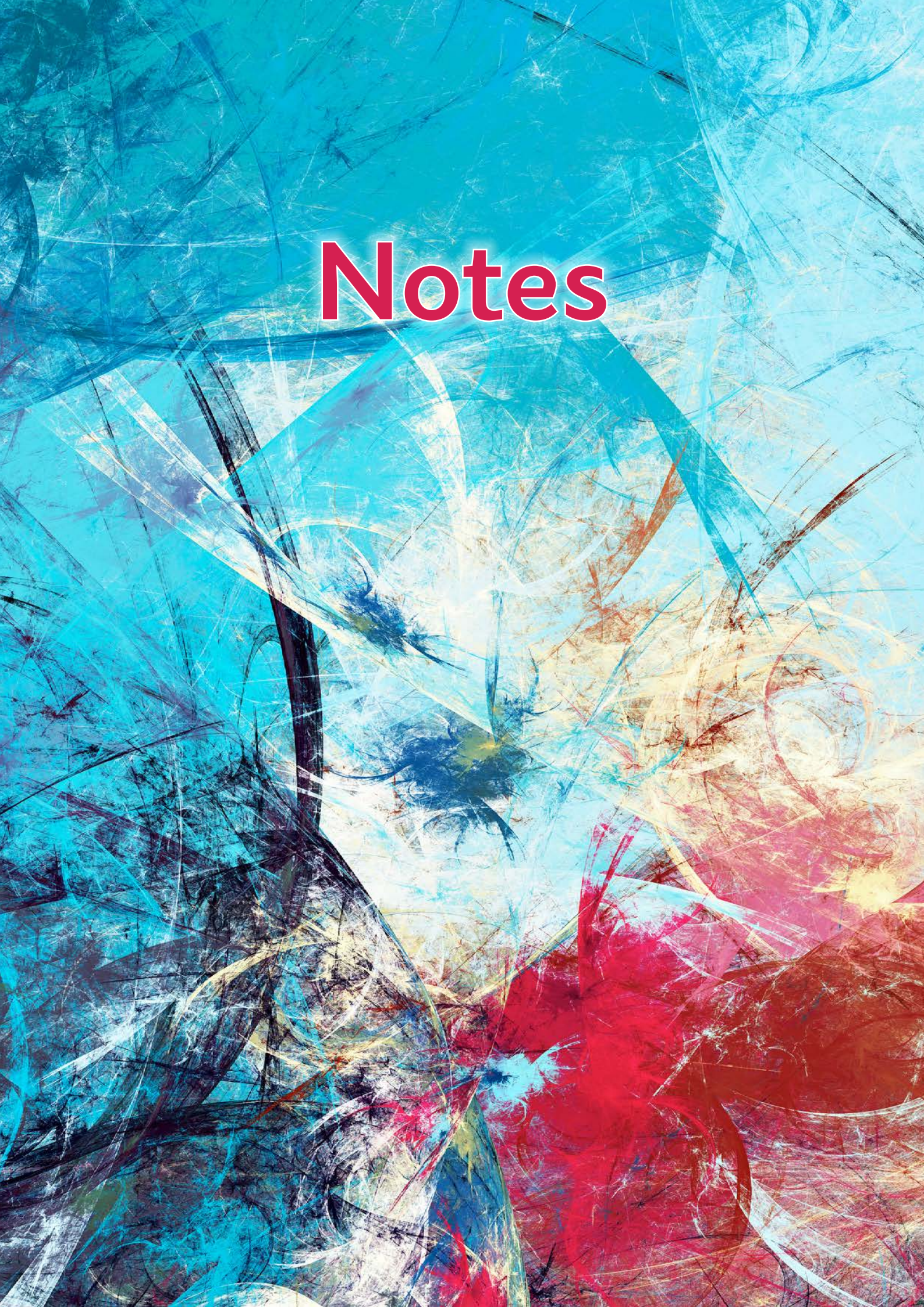
Certainly, the Intervention under consideration also generates deterrence but it is done in a different way, primarily through active engagement with the trolley push-out community, who in turn may then communicate its presence to others they know. This delivery of deterrence through detection requires the active presence of engaged alarm responders – staff who are capable and equipped to respond in a timely fashion to the alarms, particularly in the 'golden period' of potency in weeks 2-3 after activation. While the COVID-19 Pandemic has dramatically altered the way in which store entrances/exits are now monitored, providing almost constant oversight, prior to this time, stores varied in the extent to which staff would be made available to oversee this space. What seems clear from this research is that if retail businesses plan to invest in the Intervention, then to ensure its deterrent capability is triggered and maintained, they need to ensure alarm responders are also available and suitably trained.

From Intervention to Workable 'Solution'

The Loss Prevention industry is not short of apparent 'solutions' to fix the problems of the retail industry. Take a visit to any of the annual trade shows and you will be confronted by a plethora of businesses offering a bewildering array of technologies and approaches to resolve retail loss. But as was highlighted in considerable detail in the ECR study reviewing the available published evidence on the efficacy of a range of regularly used technologies and other loss reduction approaches, the evidence base is painfully thin, with few studies adopting sufficiently rigorous and robust methods to enable meaningful conclusions to be drawn[77]. This was particularly the case when it came to understanding return on investment.

As the report says, part of the problem could be that retail companies and their technology providers are simply unwilling to share the results of their trials and evaluations, preferring to reap the rewards offered by competitive advantage. It could also be the case that, as discussed throughout this report, collecting reliable data that can be used to evaluate interventions focussed upon reducing retail loss is notoriously difficult and potentially expensive. But it is certainly the case that the Loss Prevention industry has a long history of making claims about efficacy that have rarely been backed up with detailed published studies where the methodology is made clear and the results are sufficiently robust. Hence, the author continues to refer to all proposed loss prevention 'solutions' as 'interventions' in the first instance, suggesting that they can only be regarded as the former when there is compelling evidence to support its case.

Accordingly, throughout this report, the Gatekeeper Systems technology under consideration has been referred to as the Intervention – its efficacy required investigation. At the end of this study and after reviewing the available evidence, it would seem that, in the right operating environment, and supported by a clear organisational commitment, it can be regarded as a useful and cost effective 'solution'. More specifically, that it can be viewed as providing an effective approach to minimising the impact of trolley push-out thefts and consequently playing a useful role in reducing the cost of unknown store losses.


Notes

Notes

1 Throughout this report, the word 'trolley' will be used to describe a metal frame on wheels provided by retailers for use by their customers to transport the goods they wish purchase within a retail store and also in the surrounding parking areas. In other countries they are often referred to as carts or shopping carts.

2 https://www.pushouttheft.com.

3 https://gatekeepersystems.blog/wp-content/uploads/2018/06/2017_Pushout_Snapshot_Email_V2.pdf.

4 See: Beck, A. (2016a) *Beyond Shrinkage: Introducing Total Retail Loss*, Washington: Retail Industry Leaders Association; Beck, A. (2019) *Total Retail Loss 2.0: From Theory to Practice*, Washington: Retail Industry Leaders Association.

5 See Beck (2016a), Ibid, for a review of the various ways in which the term shrinkage has been defined in the literature.

6 Grewal, D., Roggeveen, A. and Nordfält (2017) 'The Future of Retailing', *Journal of Retailing*, 93 (1): 1-6; Treadgold, A. and Reynolds, J. (2016) *Navigating the New Retail Landscape: A Guide for Business Leaders*, Oxford: Oxford University Press; Trentmann, F. (2016) *Empire of Things: How we became a world of consumers, from the fifteenth century to the twenty-first*, London: Allen Lane; Dawson, J., Findlay, A. and Sparks, L. (2008) 'Introduction', in J. Dawson, A. Findlay, and L. Sparks (Eds), *The Retailing Reader*, 1-8, London: Routledge; Peterson, R. A. and Balasubramanian, S. (2002) 'Retailing in the 21st Century', *Journal of Retailing*, *78*: 9-16.

7 See Miller, G. (2017) The future of self-checkout means no check out at all, *Teledyne Imaging*, http://possibility.teledyneimaging.com/future-self-checkout-means-no-check/; Beck A. (2018) *The Rise of Self-checkout in Retailing: Understanding the Risk and Managing the Problem*, Leicester: Erudite Publishing.

8 See Beck (2018), Ibid.

9 Bulmer, S., Elms, J. and Moore, S. (2018) 'Exploring the adoption of self-service checkouts and the associated social obligations of shopping practices', *Journal of Retailing and Consumer Services*, 42: 107-116.

10 See: *The Guardian* (2007) *Retailers to Cut Plastic Bag Impact by 25%*, https://www.theguardian.com/environment/2007/feb/28/uknews.waste; *The Guardian* (2020) *Japan wins war on plastic, but shoplifters bag hidden spoils*, https://www.theguardian.com/world/2020/oct/07/japan-wins-wars-on-plastic-bags-but-shoplifters-bag-hidden-spoils; Security Concepts (No Date) *Plastic Bag Ban & Its Effect On Increased Shoplifting/Retail Loss Prevention*, https://securityconcepts.com.au/retail-loss-prevention/.

11 Beck A. with Peacock. C. (2009) *New Loss Prevention: Redefining Shrinkage Management*, Basingstoke: Palgrave Macmillan; DiLonardo, R. (2014a) 'EAS Source Tagging: 20-plus Years of Innovation, Part 1', *Loss Prevention Magazine,* January-February: 15-20, 22, 24; DiLonardo, R. (2014b) 'EAS Source Tagging: 20-plus Years of Innovation, Part 2', *Loss Prevention Magazine,* March-April: 39-46, 48; Dilonardo, R. (1997) 'The Economic Benefit of Electronic Article Surveillance', in R. C. Clarke, *Situational Crime Prevention: Successful Case Studies*, New York: Harrow and Heston, pp. 122-131.

12 Beck, A. and Palmer, W. (2011) 'The Importance of Visual Situational Cues and Difficulty of Removal in Creating Deterrence: The Limitations of Electronic Article Surveillance Source Tagging in the Retail Environment', *Journal of Applied Security Research*, 6 (1): 110-123.

13 DiLonardo (2014b) op cit.

14 Beck with Peacock (2009), op cit; Handford, M. (1994) 'Electronic Tagging in Action: A Case Study in Retailing', in M. Gill (ed), *Crime at Work: Studies in Security and Crime Prevention,* Leicester: Perpetuity Press, pp. 174-184.

15 Developments in RFID enabled taggants, which uniquely identify any given product, have enabled some retailers to be able to provide the alarm responder with information about which product has triggered the alarm. However, this does not address the problem of identifying which customer is in possession of the product triggering the alarm.

16 Hayes, R. and Blackwood, R. (2006) 'Evaluating the Effects of EAS on Product Sales and Loss: Results of a Large-Scale Field Experiment', *Security Journal*, 19 (4): 262-276.

17 See: https://www.gatekeepersystems.com/us/solutions/pushout-prevention.

18 For further information about this technology, visit the Gatekeeper Systems website, op cit.

19 See: https://www.gatekeepersystems.com/us/our-company.

20 The researcher utilised his connections made through the ECR Europe Retail Loss Group and his previous work with retailers across Europe.

21 Throughout this report, the technology installed by Gatekeeper Systems to tackle the problem of Trolley Push-out thefts

will be referred to as the 'Intervention'. All too often providers of loss prevention technologies describe their products as 'solutions' and while their intention and belief is that it will and does 'work' to 'solve' a prescribed loss prevention problem, until verifiable evidence is available to back up these claims, they remain, in the view of the researcher, merely an 'intervention' that may or may not deliver what is being claimed.

22 https://www.who.int/emergencies/diseases/novel-coronavirus-2019/interactive-timeline#!

23 See: KPMG (No Date) *The Realities of Retailing in a COVID-19 World,* https://home.kpmg/xx/en/home/insights/2020/03/realities-of-retailing-in-covid-19-world.html; Deloitte (No Date) *Understanding COVID-19's Impact on Grocery and Food Retailers,* https://www2.deloitte.com/global/en/pages/about-deloitte/articles/covid-19/understanding-covid-19-s-impact-on-grocery---food-retailers.html.

24 Beck (2018) op cit.

25 In the UK, the British Government has provided detailed guidance for retailers to follow: HM Government (2020) *Keeping workers and customers safe during COVID-19 in shops and branches*, https://assets.publishing.service.gov.uk/media/5eb9703de90e07082fa57ce0/working-safely-during-covid-19-shops-151020.pdf.

26 See: Insider Trends (2020) *How 5 retailers are changing the way we queue*, https://www.insider-trends.com/how-5-retailers-are-changing-the-way-we-queue/.

27 For a discussion of how these new restrictions may reduce retail risk, see: Beck, A. (2020a) *Some Reflections on Retail Loss Prevention in a Time of COVID-19*, https://www.linkedin.com/posts/adrian-beck-951b153_retail-loss-prevention-in-a-time-of-covid-activity-6669165591166758912-5DoB.

28 Analysis of all stores taking part in this study found that the data was patchy and often incomplete in the first week of activation, probably due to staff familiarising themselves with the equipment and the reporting processes, and so a decision was taken to exclude this week from all the analysis presented in this section.

29 Polynomial trend curves have been applied, using an order factor of 4.

30 Retailer B and Retailer A Pre-COVID: Pearson Chi Square: 0.799; p 0.001; Retailer B and Retailer A Post-COVID: Pearson Chi Square: 0.685; p 0.007; Retailer A Pre-COVID and Retailer A Post-COVID: Pearson Chi Square: 0.838; p <0.00.

31 There was no significant difference in the risk rating and levels of shrinkage in Retailer A's Pre-COVID versus Post-COVID stores.

32 Retailer B and Retailer A Pre-COVID: Pearson Chi Square: 0.661; p 0.01; Retailer B and Retailer A Post-COVID: Pearson Chi Square: 0.813; <p 0.00; Retailer A Pre-COVID and Retailer A Post-COVID: Pearson Chi Square: 0.892; p <0.00.

33 Polynomial trend curves have been applied, using an order factor of 3.

34 This was something that both retailers did for a small number of stores at the start of their trials.

35 This refers to only the value of losses represented by the difference in expected and actual stock counts. It excludes any losses associated with food wastage, cash losses and any other forms of loss where the cause is specifically known and recordable.

36 The Standard Deviation was £585.83.

37 This data does not include alarm activations which were false – store staff rarely if ever record these types of activations.

38 Anova: [F(2,958)=26.470; p <0.00].

39 Anova: [F(2,955)=27.813; p <0.00].

40 Anova: [F(2,959)=24.675; p <0.00].

41 Pearson Chi Square: 0.212; p <0.00.

42 Beck, A., Gill, M. and Willis, A. (1994) 'Violence in Retailing: Physical and Verbal Victimisation of Staff', in: M. Gill (ed), *Crime at Work: Studies in Security and Crime Prevention*, Leicester: Perpetuity Press, pp. 83-102; Pizzino, A. (2000) 'Dealing with Violence in the Workplace: the Experience of Canadian Unions', *Security Journal*, 13 (3): 53-62.

43 Anova: [F(2,959)=11.371; p 0.001].

44 Pearson Chi Square: 0.212; p <0.00

46 Anova: [F(2,956)=4.327; p 0.002].

47 https://www.business.org/finance/cost-management/how-to-measure-your-return-on-investments-roi/.

48 For a review see: Beck, A. (2008) *Preventing Retail Shrinkage: Measuring the 'Value' of CCTV, EAS and Data Mining Tools*, Brussels: ECR Shrinkage Group.

49 Beck (2008) op cit.

50 For a discussion on measuring the 'value' of video technologies, see: Beck, A. (2020b) *Reviewing the Use of Video Technologies in Retailing*, Brussels: ECR Retail Loss.

51 Beck with Peacock (2009) op cit.

52 Beck (2008) op cit.

53 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.

54 See for instance a series of articles by Palmer making the case for measuring the value of loss prevention investments: Palmer, W. (2001) 'Return on Investment: Turning Accounting Rules to Management Tools', *Loss Prevention*, Fall, 40-44; Palmer, W. (2005) 'Selling Your Proposal to Senior Executives', *Loss Prevention*, September-October, 64-72; Palmer, W. (2004) 'POS Exception Reporting: The Benefits and ROI', *Loss Prevention*, May-June, 24-34.

55 For instance see: Jones, P (1990) *Retail Loss Control*, London: Butterworths, p. 219; Batson, C. (2007) 'Adding Value and ROI with your Distribution Center LP Team', *Loss Prevention*, May-June, 49-54; DiLonardo, R. (2003) 'The Economics of EAS: Rethinking Cost Justification for Apparel Retailers', *Loss Prevention*, November-December, 20-26; 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.

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

57 See Beck (2008) op cit. for the results from a survey of loss prevention practitioners on the extent to which they understood and measured ROI.

58 While this is based upon an unlikely assumption that the Intervention will stop **all** trolley push-outs that were estimated to be happening before its introduction, the significant issues of under-reporting inherent in the data used to calculate this estimate, suggest that this assumption is not unreasonable. The issue of the potential impact of displacement is also a factor to be taken into consideration in this calculation although at the moment, there is simply no available data to accurately determine how future savings will be eroded by this factor. For the purposes of this ROI, the measure of value will only be the saving in unknown stock loss, measured as retail prices. It is recognised that other measures of 'value' may be achieved from the use of this type of Intervention, such as: a potential increase in sales as a consequence of fewer out of stocks caused stock loss; a reduction in guarding hours as fewer staff are required to secure store entrances and exits; a reduction in the cost of stock deliveries because less stock is stolen; and the amount of sales that need to be made to replace stock that would have been stolen. However, many of these factors are very hard to measure and attribute accurately to any given intervention. In addition, the reality for most loss prevention teams, including those taking part in this study, is that a reduction in stock loss is likely to be the primary variable used to measure the performance of an intervention such as the one under consideration in this report.

59 The cost of installation varies considerably between stores depending upon the number of trolleys in operation, number of entrances and exits and other building-specific complexities. The suggested figure is an amalgam of estimates from the two retailers taking part in this study.

60 For an NPV table, visit: https://www.cimaglobal.com/Documents/Student%20docs/2010%20syllabus%20docs/P1/P1-performance-operations-tables-2010-syllabus.pdf?utm_source=referrer&utm_medium=banner&utm_campaign=p1samples.

61 Beck (2020b) op cit.

62 For the purposes of this research, the Intervention provider adapted the deactivator device used by staff to enable them to quickly record the outcome of the alarm: confirmed push-out or not.

63 Gibbens, T.C.N. and Prince, J. (1962) *Shoplifting*, London: The Institute for the Study and Treatment of Delinquency; Cameron, M.O. (1964) *The Booster and the Snitch*, New York: Free Press of Glencoe, Collier Macmillan; Walsh, D.P. (1978) *Shoplifting: Controlling a Major Crime*, London: The Macmillan Press Ltd; Guffey, H., Harris, J. and Laumer, J. (1979) 'Shopper Attitudes Toward Shoplifting and Shoplifting Devices', *Journal of Retailing*, 55 (Fall): 75-89; Kallis, M.J. and Vanier, D.J. (1985) 'Consumer Shoplifting: Orientations and Deterrents', *Journal of Criminal Justice*, 13(5): 459-473; Murphy, D.J. (1986) *Customers and Thieves,* Aldershot: Gower Publishing Company Limited; Schlueter, G.R., O'Neal, F.C., Hickey, J. and Seiler, G.L. (1989) 'Rational vs. Nonrational Shoplifting Types: The Implications for Loss Prevention Strategies', *International Journal of Offender Therapy and Comparative Criminology*, 33 (December): 227-239; Cox, D., Cox, A.D. and Moschis, G.P.

(1990) 'When Consumer Behavior Goes Bad: An Investigation of Adolescent Shoplifting', *Journal of Consumer Research*, 17 (September): 149-159; Klemke, L.W. (1992) *The Sociology of Shoplifting: Boosters and Snitches Today*, New York: Praeger; Butler, G. (1994) 'Shoplifters Views on Security: Lessons for Crime Prevention', in Gill, M. (ed.) *Crime at Work: Studies in Security and Crime Prevention*, Leicester: Perpetuity Press: 56-72; Hayes, R. (1999) 'Shop Theft: An Analysis of Shoplifter Perceptions and Situational Factors', *Security Journal*, 12(2): 7-18; Tonglet, M. (2000) 'Consumer Misbehaviour: Consumers' Perceptions of Shoplifting and Retail Security', *Security Journal*, 13(4): 19-33; Gill, M. (2007) *Shoplifters on Shop Theft: Implications for Retailers*, Perpetuity Research & Consultancy International, Leicester; Carmel-Gilfilen, C. (2013) 'Bridging security and good design: Understanding perceptions of expert and novice shoplifters', *Security Journal*, 26(1): 80-105; Cardone, C. and Hayes, R. (2012) 'Shoplifter Perceptions of Store Environments: An Analysis of how Physical Cues in the Retail Interior Shape Shoplifter Behavior', *Journal of Applied Security Research*, 7(1): 22-58; Clarke, R.V. & Petrossian, G. 2013 *Shoplifting*, Center for Problem-Oriented Policing, Washington.

64 For a thorough review of the various typologies on shop thieves see: Hayes and Cardone (2006) op cit.

65 See Cardone and Hayes (2012) op cit.

66 For a review of self-checkout risks and the challenges of ascertaining shopper intent see: Beck (2018) op cit.

67 Ibid.

68 The pioneering work of Sykes and Matza identified the concept of Moral Neutralisation, whereby offenders develop a range of 'excuses' to justify their offending, such as 'the system did not work properly so it is not my fault' (Denial of Responsibility); 'they can afford it' (Denial of Injury); or, 'they are making me work for them by scanning my own products' (Denial of the Victim): Sykes, G. and Matza, D. (1957) 'Techniques of Neutralization: A Theory of Delinquency', *American Sociological Review*, *22*: 664-670; Cromwell, P. and Turman, Q. (2003) 'The devil made me do it: Use of neutralizations by shoplifters', *Deviant Behaviour,* 24 (6): 535-550. In addition, consumers can also begin to 'normalise' the behaviour with other justifications such as: 'everybody is doing it, so it is now OK'.

69 See: Beck, A. and Hopkins, M. (2017) 'Scan and Rob! Convenience Shopping, Crime Opportunity and Corporate Social Responsibility in a Mobile World', *Security Journal*, 30 (4): 1080-1096.

70 One potential argument against this assumption is that the growing use of Scan and Go (scan device provided by the retailer) and in particular Mobile Scan and Go (consumer uses their own device) technologies could make errors in payment potentially more likely – users may think they have 'checked out' via the on-hand technology, when in fact they have not.

71 This distinction was originally developed by Read Hayes, who suggested eight types of shoplifting offender: three types of Professional thief and five types of Amateur thief: Hayes, R. (2007) *Retail Security and Loss Prevention*, Palgrave Macmillan.

72 Hayes (1999) op cit.

73 Hayes, R. 2008 *Lessons Learned: Shoplifter Interview Results*, Florida: Loss Prevention Research Council.

74 This is not to suggest that this technology does not provide value – its capacity to provide a visual deterrence at the shelf edge, particularly when hard tags are used, is often cited by retailers as an important part of their loss prevention strategy.

75 See: Cornish, D. and Clarke, R.V. (1987) 'Understanding Crime Displacement: An Application of Rational Choice Theory', *Criminology*, 25 (4): 933-948; Guerette, R. (2009) *Analyzing Crime Displacement and Diffusion*, Problem-Oriented Guides for Police-Solving Series, Guide No 10, Washington: US Department of Justice: www.cops.usdof.giv.

76 Guerette, R. and Bowers, K. (2009) 'Assessing the Extent of Crime Displacement and Diffusion of Benefit: A Review of Situational Crime Prevention Evaluations', *Criminology*, 47 (4): 1331-1368.

77 Beck (2016b) op cit.

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