AN INTEGRATED SYSTEM FRAMEWORK FOR PREVENTING CRIME IN RETAIL SUPERMARKET

Christopher Ikenna Onumonu [1] and Kazeem Oluwakemi Oseni [2]

[1] Institute of Inner City Learning, University of Wales Trinity Saint David, London Campus, United Kingdom
[2] School of Computer Science and Technology, University of Bedfordshire, Luton, United Kingdom

ABSTRACT

Retail supermarkets have been investing billions of pounds to prevent and reduce crime in their stores, but the rate of crime keep increasing. Retail shrinkage monitoring as far back as 1995 showed that the retail stores were losing the equivalent of 0.3 per cent of their gross revenues which have taken up to 20 to 30 percent of their profit. Also recently, the British Retail Crime Report (2023) showed a significant increase from the 2019 report in retail crime and subsequent loss to retailers. In 2021/2022, the retail staff incidents of violence stood at 850 per day, and the cost of retail crime was £1.76b. There were eight million incidents of theft over the year and a total of £715 million was spent on crime prevention.

As crime keeps increasing, examining the three security solutions (Cyber, Physical and System) that are used in retail supermarkets becomes paramount. This article will look into if the lack of interconnectedness is the cause of continuous porosity in criminality in stores using Aldi and Sainsbury in the United Kingdom as a case study. A combination of mix method approach has been used in this study which allows a combination of quantitative data gathering through questionnaires and qualitative data through interviews. Accessing the current effectiveness of the three security solution (Cyber, System and Physical), it becomes important to identify the strategic gap between actual and potential performance so that steps can be taken to identify the shortfall in the Security solutions. The Ishikawa fishbone model is used as a theoretical tool to examine the cause and effect of retail crime. This will identify other causes that affect the effectiveness of security solutions. From the findings, a Hierarchical Taxonomy of Crime Prevention Framework in line with the Ishikawa fishbone theoretical tool was developed to help supermarkets reduce and prevent crimes. For many years supermarkets have been investing lots of money on security solutions but the rate of crimes keep increasing.

KEYWORDS

Physical, System, Cyber, Retail crimes and Supermarkets.

1. INTRODUCTION

Supermarkets use many security solutions to protect their goods, premises, employees and customers because of continuous increase in retail crime in the UK, Europe, USA and everywhere. The most notable security solutions that are being used by these industries are Cyber, Physical and System security solutions. Criminals act in supermarkets have become a

DOI: 10.5121/ijmit.2025.17201

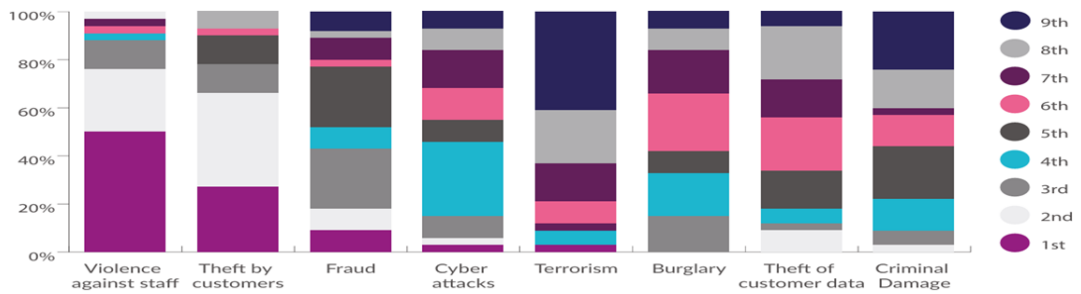
serious challenge for businesses while conducting their legitimate operations, these cause retailers to bring in situational crime prevention measures for routine precaution [11]. In the view that security is very sensitive, a mixed method of qualitative and quantitative reasoning has been adopted [1]. Adopting the qualitative method of research is so pertinent to this research to explore, describe and express the experiences of participants and characterise their thoughts on the subject matter which might have been difficult with the sole adoption of quantitative method [6]. Adopting quantitative methods only would not have helped in exploring the strategies used by retail supermarkets in curtailing crime as it is very important to understand certain patterns of behaviour and choices made by retailers in relation to the adoption of certain security measures in their stores [27]. This research is evident based as the aim of the study is to investigate how the three security can work effectively when interconnected in a supermarket with special focus to reduce and prevent crime in the store.

Table 1: The Retail Crime Costs in the UK (2016-2022) Source: brc.org.uk

What was the total cost of crime?						
	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Value	701,994,189	895,695,073	977,754,310	1,278,245,381	785,989,162	1,040,305,435
% Change from previous year		28%	9%	31%	-39%	32%

This research provides contextual mechanisms of action (MOA) that will evaluate the effectiveness of the systems and solutions which will be recommended for the purpose of future application. It will provide the accurate evidence of the three security solutions, the current mechanism of actions (MOA) on the supermarkets and the present real-world efficacy [24]. The effectiveness and interconnectivity between the existing securities solutions is hypothesised which leads the research to the triangular security systems. The essence of the investigation into their connectivity is to postulate how they can be improved upon to enhance the security of people, premises, and property in a typical retail supermarket in the UK. Data that will be gathered from selected retail supermarkets will come from primary sources such as questionnaires and direct interviews and secondary sources which are from existing literature, websites and articles or publications from the internet. This study of security solution very significant as this will benefit security companies and reduce crime in supermarkets.

Table 2: Significant retail crime threats in the UK Source: brc.org.uk



2. LITERATURE REVIEW

This section deals with the overview of existing studies carried out in the fields of security and retail crime. This section will also explore concepts that can help in explaining the relationship between security and retail crimes while some terminologies will be defined, clarified, and explained. It will explore the history of security and the workings of different security solutions. It is equally essential to explore the historical background of crime laying emphasis on different retail crimes, their causes, types, and preventive measures that have been explored by scholars in the field of security and retail crime. In discussing security solutions, efforts shall also be made towards determining what constitutes effectiveness in security solutions and the interconnectivity between them. Lastly, the introduction of the Ishikawa fishbone model as an analytical tool for the relationship between the dependent and independent variables will complete this section. Below is the diagram that depicts the exploration of contemporary and existing knowledge about security and retail crime and serves as the whole structure of the literature review:

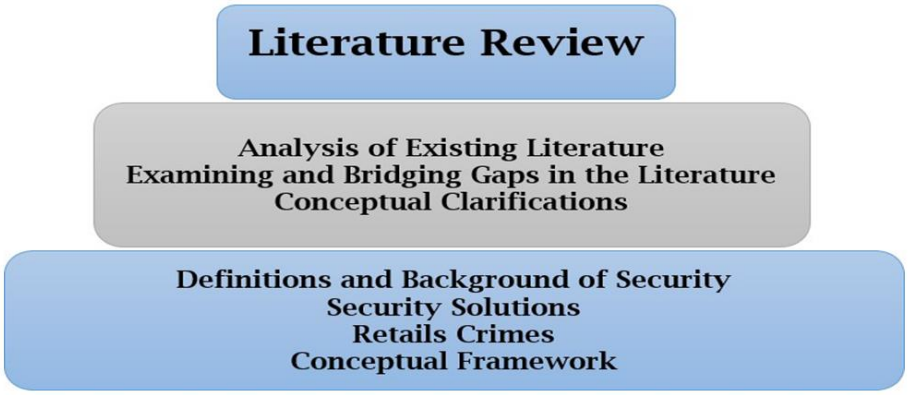


Figure 1: Literature Review Focus

2.1. Background and Definition of Security

Security is the state of being free from danger or threat. The history of security dates to the early times in ancient Egypt. The Egyptian kings called Pharaohs used security personnel as their bodyguards and to protect their property. In the same vein, the ancient Roman emperors used security guards to protect their family, properties, and business as well. In the history of the world, ancient Egypt was the first to employ encryption-based data security techniques to conceal and safeguard private information. Spartans in antiquity used Arabic characters as a secret technique to reposition letters or documents so that the opposition would not be aware of them. Julius Caesar was the first to use encryption for military purposes by sending documents and shifting the words around. In the early years of the Second World War in the 20th century, the Germans used the Enigma machine which is a machine-like typewriter that had codes with settings of more than 150 million, they believed that the codes were unbreakable.

Therefore, private security can be categorised into different dimensions which require a wide range of knowledge in many domains. The diversity in the sector makes the definition of security harder which necessitates segmentation of the sector for proper analysis and discussion. A single agreed definition of security is hard to come by because it has different meaning to different people depending on the situation [8]. According to [17], an in-depth study of security brings out different meanings due to different expectations in security solutions, different visions or paradigms, analysis and studies of security problems that come up. The

complexity of this situation means interested parties come with their understanding of security and so define it in accordance with their understanding. This unfortunate situation creates problems of finding out the methodology and justification used when measuring performance, investigating a situation, and determining who to blame in a critical situation. Critical examination of security can bring different definition as security measures, methodology, decisions, and performances are worthless without the definition of security [17].

According to [17], the issue of agreeing on an exact definition of security has made it imperative for urgent clarification which is felt by many in the security profession although academia is more than happy to discuss security without definition. Some agree that security could be assumed in relation to the general saying that 'security is in the eye of the beholder,' and what the 'beholder' sees could be poverty, beauty, or happiness. Security could thus be defined based on the context and who is defining it [26]. [17], however, disagreed with the notion that defining security should be based on the context and personality involved. He stated that there is a need for a general definition of security which will help in merging existing divergences in security solutions. There are many aspects of security with different explanations depending on their contextual application. These aspects include criminology; business continuity management; facility management; fire science; information and computer security; industrial security; security law and security technology.

2.2. Security Solutions

Security is both a product (intangible and tangible) and a solution. As a product, security has the potential and capacity to meet identified needs in a particular industry it is designed for. As a solution, security services are meant to solve specific industry needs or identified challenges. These challenges can be derived from the variables put forward by [17]. Security was defined as the interaction between Asset (A), Protector (P) and Threat (T) in a given situation (Si). In this respect, security is seen as a reaction to a particular situation, making it a solution created in a specific sector known as the private security industry. The solution is targeted at a particular business problem which is why businesses seek for the adoption of security solutions to tackle identified issues relating to their operation. There are three main security solutions that will be the subject of this research. These solutions will be examined to determine their interconnectivity and effectiveness in relation to combating crimes in a retail supermarket setting. They are:

a. **Physical Security**: The task with protecting businesses, organisations and other entities against threats from criminals have become imperative that the need for physical security has become increasingly demanding [4]. Several companies and organisations have experienced data breaches against businesses over the last decade with billions of records stolen which cause a lot of financial loss to these entities [10]. Therefore, physical security can be defined as the protection of an organization's infrastructure, goods, customers and employees. This involves loss of good, infrastructure, properties and individuals [4]. Physical security solutions are used to deter potential intruders, for instance in supermarkets, warning signs such as 'out of bound,' 'staff only,' security lighting and perimeter markings are put in place to alert unauthorised persons. When designing supermarkets, the architects, designers, and security analysts must balance the risk against security control by considering the cost of development, managing, monitoring, and maintaining with wider issues such as the structural outlook and societal norms before progressing to build the property. Physical security such as manned guarding is used for many premises including high security buildings like prison, military base, and retail outlets. The purpose of this method is to warn possible attackers that they will not be successful.

Figure 2: Physical security (manned guarding) [29]

Manned guarding is the process carried out by security guards to protect goods, property, and personnel. They are an aspect of physical security put in place to protect premises, site, facility, supermarkets, and other physical assets. They prevent unauthorised access to the goods, prevent harm to the employees by shoplifters and reduce destruction of properties which make them an essential part of physical security. [21] reveals the importance of security guards in protecting public infrastructures and assets with the example of the Bush government strategically employing about one million security guards to protect critical infrastructures such as airport screeners and key assets in the USA in the year 2003.

b. **System Security**: The system security (CCTV) can be defined as a surveillance system which uses video cameras to capture or monitor images of a given location and this can be transmitted to a specific set of monitors through a wireless communication links. Once the photos are saved, the supermarket's management and security personnel can study them to learn about past incidents and how they might assist lower crime in that specific store. CCTV came up in 1940s and it was initially for military purposes [14].

Figure 3: CCTV camera in a retail supermarket setting [30]

The main function of system security in supermarkets is to detect and alert situations that can impact businesses. Therefore, the use of CCTV in stores help in reducing crime [16] and most potential offenders avoid committing these crimes where the CCTV is covered in order to avoid possibilities of being arrested in the stores and other places that the cameras are covered [28].

c. **Cybersecurity**: Cybersecurity can be described as security systems put in place to deter criminal activities that occur over the internet. When computers are used for illegal activities, such as fraud, identity theft and violation of people’s privacy, these are referred to as

cybercrime. Cybersecurity is the security software installed in computer systems to protect organisations against cybercrimes such as fraud, identity theft, computer virus, software piracy, and data infringement. It is imperative for businesses to develop processes that encompass cyber security. Cyber and physical security work together as there is a mutual concern about the vulnerabilities present in both security types meaning that they can both be exploited which warrants the importance of employing one with the other. Cybersecurity is a prominent issue in the business world today which has demanded a paradigm shift on the Internet of Things (IoT) [15].

2.3. Retail Crimes

Retail crimes come in different shapes and forms. Some crimes are committed by external people like customers and suppliers in collaboration with internal criminals among staff while some are committed by internal people especially the employees of retail supermarkets. This section would examine various types of retail crimes, they are:

a. **Shoplifting**: This can be defined as the act of stealing from a supermarket by a customer during the opening hours of the business. Shoplifting occurs when a customer deviates from the normal behaviour expected of them while shopping. In the United States of America, according to the National Association for Shoplifting Prevention (NASP), there are about 27 million shoplifters and 1 in every 11 customers is a shoplifter. In these figures, 25 percent are juveniles and 75 percent are adults [19]. The British Retail Consortium (BRC) published in their retail crime survey (2023) showing the scale of violence in the stores and the abuse faced by the staff. It shows that there were 455 incidents of abuse or violence each day in the UK between 2019/20 which is a 7% rise from 2018/19. The studies also show a total cost to retailers on these crimes and their prevention was £2.5 billion which is an increase of 14% on the previous year of £2.2 billion [7].

b. **Self-scanning**: This is also known as self-service technology (SSTs) which is a technological interface that gives the customer opportunity to serve themselves without direct employees' involvement [9]. There are limited studies on the impact of service delivery, customer satisfaction, and retention of customers on self-service technology. Some customers evaluate the quality of service they get from self-scanning based on five different attributes: speed, ease-to-use, control, reliability, and finding the usage enjoyable. Some customers evaluate the quality of service they get from self-scanning based on five different attributes: speed, ease-to-use, control, reliability, and finding the usage enjoyable. Customers also consider (i) whether the quality of service differs according to demographics and usage frequency; and finally (ii) if the quality of service delivered by self-checkout will bring overall customer satisfaction and future retail patronage [9]. In the last decades, many customers' interactions with supermarkets have changed because of self-service technology (SSTs). Therefore, some of the retailers that have embraced self-scanning are looking for ways to minimise losses by theft or customer errors when they are using self-scanning machines [20].

c.

d. **Employee Theft**: It is very hard to estimate the cost of staff theft as it is not easy to detect. [3] estimated that staff theft will be around 22.1% of shrinkage or £1,305m. Employees steal by colluding with customers who are friends, relatives or outsiders who intimidate them. They carry out this crime by deliberately over-looking to scan goods bought by their collaborators, give excess change or place goods where they can steal them later. Goods can be left near the waste bins for later collection and sometimes fake refunds can be given to their friends for goods that are not bought.

e. **Refund Fraud**: This is the act of defrauding a supermarket by way of returning the goods stolen from the store. In addition to returning stolen goods with the intention of cashing in some money, criminals use many avenues to defraud retailers which include stealing a receipt and trying to come and pick up items that will match the receipt from the store. The most commonly used tactic is called "wardrobing" or "free renting" where a person buys a product, uses it, and returns the product to get the money back.

2.4. Gap Analysis

Ishikawa Fishbone analysis cannot be introduced without strategic gap analysis as Ishikawa Fishbone is an analytical tool that is used to identify strategic gap in the performance of products within an organisation or the productivity of the organisation itself. The literature of gap analysis involves the comparison of the actual performance with what is expected to be achieved, which is, the potential or desired performance of any business, organisation, or service in industry. When an organisation fails to exploit all of its current resources and neglects to make necessary technological investments, it is considered to be operating below its full potential. According to [12], when strategic gap analysis is conducted, the gap identified can be small or big and the size will determine the extent to which the strategy will change. In every organisation, there is always a general expectation which has to be agreed by the management and once those performing the duties understand what is expected of them, the comparison will be between what is achieved and the expected outcomes. A shortfall becomes the gap which is the difference between the expected outcome and the actual. The analysis of gaps can help in the implementation of supermarket's security solution plan leading to the store's effectiveness in security operations.

The importance of identifying these gaps is that the more they are left unattended, the more they widen which can adversely affect the survival of the supermarket and the security solutions. When looking at these gaps, it would be necessary to find out where they are and their exact cause. Each Gap in security requires different solutions and identifying the gap is very crucial for the supermarkets with the aim of developing strategies to close them. The gap analysis will assess the security solutions' past trends and determine where the gaps are, how they can be improved and closed, leading to the profitability of the stores. By analysing how the stores are correcting making use of security solutions, new ideas will be developed to close the identified gaps.

2.5. Ishikawa Fishbone Analysis

Many studies have supported the adaptation of Ishikawa Fishbone Analysis (FA) and its application to current issues in identified sectors. Many strategies have been developed through Ishikawa fishbone's application to combat strategic issues facing any organisation at a particular point in time. The framework was developed originally for the manufacturing industry which he termed the fishbone depicting the cause-effect diagram used as a tool used to search for problems especially their root. Ishikawa Fishbone is depicted in the diagram below. In this diagram, there are questions of what is going wrong, when, how, why and going through how the root of the problem can be resolved.

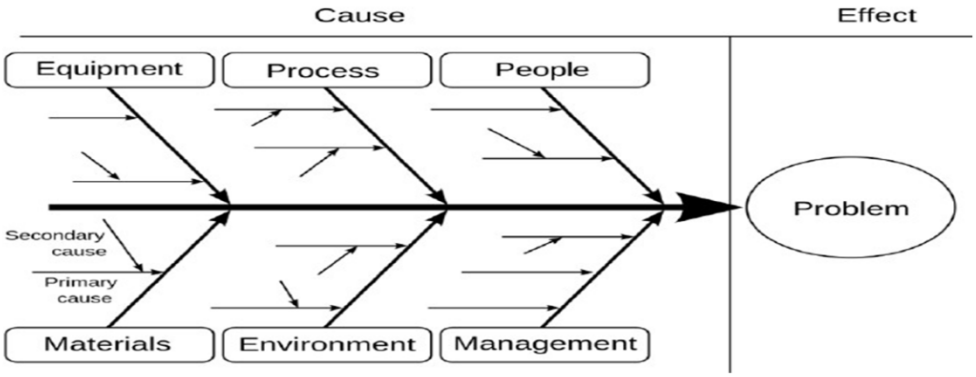


Figure 4: The Original Ishikawa Fishbone Diagram (1976) [31]

Fishbone diagram has been used to evaluate many services leading to solutions in many sectors some of which will be explored further. Fishbone diagram has been used to evaluate healthcare service in hospital environment to reduce and assess some of the patients that were undergoing coronary thrombolytic therapy and find out the improvement needs of the physicians, nurses, carers, and the method that could be used in applying for that [5].

3. METHODOLOGY

This section provides an overview of the different research techniques which are employed in this study. The research explores the hypothesised connection between the three security solutions and their effectiveness in reducing crime in a retail store as any security breach can be catastrophic to any business. The mixed method involves the collection of data through questionnaires for quantitative purposes and interviews (semi-structured) for qualitative purposes.

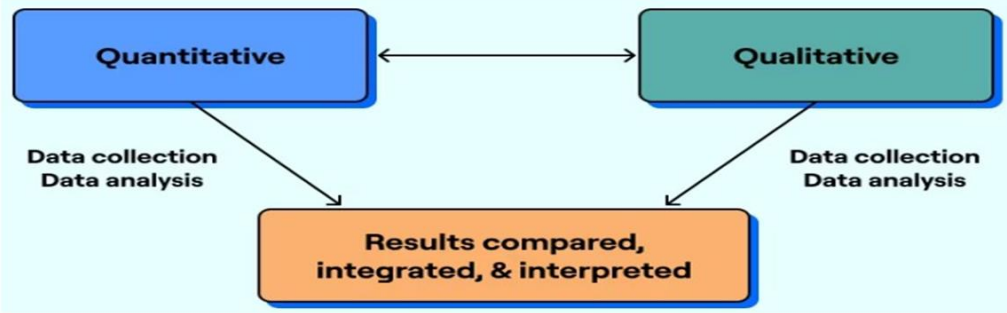


Figure 5: Mixed method triangulation [18]

The recognition of method as an important tool in case studies regarding the issues on community-based problems is applicable in this research [13]. The design of this study involves selecting managers and security personnel that have the mindset to relate to the researcher. The method adopted in getting data from them are two questionnaire and interview.

4. RESULTS AND DATA ANALYSIS

This section deals with study results and analysis of data. In data analysis process, the use of NVivo for qualitative data and SPSS for quantitative data will be employed. Because a strong

and good data collecting and execution approach makes evaluating and analysing data easier, the data in this research were collected with a clear view to attaining the study purpose. Any divergence could jeopardise predicted outcomes [22]. The data are analysed by applying logical techniques to describe, summarise, and evaluate so as to move towards possible recommendations and conclusions [25]. The data to be analysed have been collected through interview and questionnaire in order to further establish the reliability and credibility of this research. Interviews were carried out face to face and on zoom while the questionnaires were sent out through google forms.

4.1. Questionnaires

a. **Age**: Out of the 103 questionnaires that were sent out to the sample population, 98 responses were collected. From the table above, a combined 83.7% of the respondents are between the ages of 30 to 59 which is usually the most common working age in the UK. This is followed by the age group 25-29 which is 10.2%. Those in the category of 60 years and above are 4.1% while the lowest category includes those who are less than 25 years. It could be seen that under 25 and over 60s are less likely to work in the security and retail sectors

Table 3: Age analysis using SPSS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-25	2	2.0	2.0	2.0
	25-29	10	10.2	10.2	12.2
	30-39	31	31.6	31.6	43.9
	40-49	23	23.5	23.5	67.3
	50-59	28	28.6	28.6	95.9
	60 and above	4	4.1	4.1	100.0
	Total	98	100.0	100.0	

b. **Gender**: The respondents are made up of 13.3% female and 86.7% male. This is a reflection of the general workforce that have access to the three security systems in the two supermarkets under study. It is very important to note that the respondents are made up of managers of retail stores, supervisors both for the security personnel and the stores and security guards on the shop floor.

Table 4: Gender analysis using SPSS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	female	13	13.3	13.3	13.3
	male	85	86.7	86.7	100.0
	Total	98	100.0	100.0	

c. **Organisation**: This study is focused on the retail sector with special emphasis on supermarkets that are operating in the UK. Two supermarkets were chosen as representative

samples from the pool of retail supermarkets. Out of 98 completed questionnaires sent out, 54.1% came from Aldi while 45.9% came from Sainsburys.

Table 5: Organisation analysis using SPSS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Aldi	53	54.1	54.1	54.1
	Sainsbury's	45	45.9	45.9	100.0
	Total	98	100.0	100.0	

d. **Security Solutions Awareness:** CCTV and physical security seemed to be the most popular as 39.4% of the population indicated their awareness while 29.3% of the population were aware of all the security solutions. Individually, the awareness of physical security seemed to be more that CCTV with 17.2% and 13.1% respectively. Cybersecurity did not show here because none of the respondents ticked the box allocated to it. However, this does not indicate that they were unaware of cybersecurity because from subsequent responses to questions relating to it, it has been established that they were aware of it.

Table 6: Security solutions awareness analysis using SPSS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid					
	physical security	17	17.2	17.2	18.2
	Cctv	13	13.1	13.1	31.3
	all of the above	29	29.3	29.3	60.6
	Cctv and physical security	39	39.4	39.4	100.0
	Total	98	100.0	100.0	

e. **Current use of Security Services:** The nature of the responses to this question was a multiple choice. This shows in the responses of participants to the questions as we see 34.3% indicating that they use security personnel while 2% use CCTV. Whereas from the analysis, we see 62.6% indicating that their organisations use both the security guards and CCTV. This shows the familiarity of the respondents to a particular security solution which does not mean that their organisation does not use the other security service.

Table 7: Current use of security services analysis using SPSS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid					
	Security guards	34	34.3	34.3	35.4
	cctv	2	2.0	2.0	37.4
	all of the above	62	62.6	62.6	100.0
	Total	98	100.0	100.0	

f. **CCTV Operation in Stores**: The respondents have 3 options: "Yes", "No" and "Can't Say". 66.3% of the respondents have those monitoring the CCTV in the stores, 30.6% of the respondents do not have those monitoring the CCTV in their store. Only 3% responded that they can't say.

Table 8: CCTV operation in stores analysis using SPSS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid					
	yes	65	66.3	66.3	66.3
	no	30	30.6	30.6	97.0
	can't say	3	3.1	3.1	100.0
	Total	98	100.0	100.0	

g. **CCTV in Stopping Shoplifters**: This question is one of the numerous ones targeted at discovering the effectiveness of the security solutions employed in retail stores. They are set to know the frequency of CCTV effectiveness in catching shoplifters. The answers range from 'never' to 'everyday' while a column 'can't say' was dedicated to those who were not sure. A total number of 71 participants which form 72.4% of the 98 respondents believed that the CCTV was effective in catching shoplifters. These are made of those who responded 'often,' 'very often' and 'everyday' to the question. 17.4% of the respondents thought CCTV cameras did not catch shoplifters often, 4.1% believed it had never worked while 6.1% were not sure.

Table 9: CCTV in stopping shoplifter analysis using SPSS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid					
	never	4	4.1	4.1	4.1
	not often	17	17.3	17.4	21.5
	often	38	38.8	38.8	60.3
	very often	22	22.4	22.4	82.7
	everyday	11	11.2	11.2	93.9
	can't say	6	6.1	6.1	100.0
	Total	98	100.0	100.0	

h. **Security Guards Compare to other Security Solutions**: From table 10 below, a combined 52% of the sample populations (partially agree, agree, or strongly disagree) are of the view that security guards are an important aspect of security which must be added to the other two security solutions. While the remaining 48% thought the opposite. The higher disagreement showed that although the majority of the respondents were security personnel, they still did not think that security guarding is more important than other security measures in reducing or preventing crime.

Table 10: Security guards compare to other security solutions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly disagree	36	36.7	36.7	36.7
	disagree	11	11.2	11.2	48.0
	partially agree	9	9.2	9.2	57.1
	agree	26	26.5	26.5	83.7
	strongly agree	16	16.3	16.3	100.0
	Total	98	100.0	100.0	

4.2. Interview

A total number of 15 participants were interviewed, and NVivo was used to record and analyse their responses. There was a lot of discussion around the interconnectedness of security solutions and their effectiveness in preventing or reducing crime. From the various responses, inferences have been made which will form the basis for discussion and recommendations on this research. The study aims have been met from these results as analysed below. The result from the qualitative analysis will also be used to test both hypotheses. H1 was initially set out to be tested while H2 was generated during this study.
Study Aims:

- Firstly, to establish the role of Interconnected Security Solutions in relation to Crime Prevention and Reduction in Retail Supermarkets.
- Secondly, to explore the extent to which UK retail supermarkets understand the importance of the security solutions they employ in their businesses.

Therefore, the participants' responses were carefully sorted and analysed, and the following are the results from the analysis which point to the achievement of the study aims. The conclusion has been categorised as N (NVivo) for identification starting with N1.

a. N1: Awareness of security solutions: The result of the analysis shows all the participants are aware of the security solutions that are currently in use in their stores as each of the security solutions serves a different but interconnected purpose in the supermarket.

b. N2: Security Solutions are interconnectedly used in stores: The use of security solutions (security guards, CCTV and Cybersecurity) was a recurrent answer among the participants. Most of the fifteen participants representing the two retailers use Physical security and CCTV while a certain number of them are not aware of the usage of Cyber security in the store as this is managed by their head offices. It can safely be concluded that the interconnectedness of the security solutions that the participants are aware of is between the security guarding (physical security) and CCTV which are mostly in use or visible most of the time in the stores.

Their responses affirm that the interconnectedness between the security solutions gives the supermarket more protection when they are working together in the store. While studying the concertizing smart hospitality enterprise of the future proposed a smarter ecosystem that could benefit the stakeholders. When this is related to this study, the identified interconnectivity of security solutions from the outcome of this research could benefit the security operators and the retail owners as they work together to combat retail crime. All the participants agreed that when security solutions work together, they can reduce retail crime.

c. **N3: Assessing the effectiveness of security solutions:** Security guarding, CCTV, and Cybersecurity are effective. The participants that are conversant with the use of cybersecurity and others, their responses identified the effectiveness of cybersecurity which is to protect customers' details. This protection includes the use of their payment cards in stores instead of paying by cash and safety for customers buying online.

d. **N4: The Possibility of a Crime Prevention Framework**: One of the major areas of this research is the exploration of the possibility of a crime prevention framework that can be used in retail supermarkets in the UK. Having analysed the responses of the participants, the results have shown the achievement this and provided answers to the aims.

e. **N5: Adoption of Crime Prevention Framework (CPF):** Although not every participant agreed on the possibility of a crime prevention framework for retail supermarkets in the UK, yet almost all of them wanted its adoption.

4.3. Ishikawa Fishbone Application

In adapting the Fishbone Model for the security cause and effect analysis, the major causes are in yellow with sub-causes in blue while the effect is in red. The fishbone analysis has been used to address security-related problems in the three security services used by retail supermarkets under study. It has also been used to formulate end-of-life strategies for deteriorating security systems which have been supported by many studies.

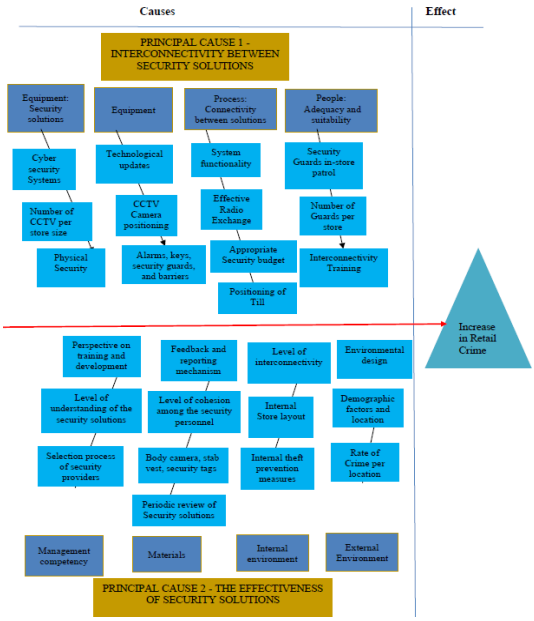


Figure 6: Ishikawa Fishbone Model Application Diagram

5. CONCLUSION

This study was carried out to evaluate the interconnectivity between different security solutions and their effectiveness in preventing crime in retail supermarkets in the United Kingdom. Retail supermarkets all over the world are constantly experiencing crime in their vicinity despite the heavy investment in security solutions aimed at deterring criminal activities. Retail crime has been in existence for as long as retail supermarkets started operating. Criminals have become so bold in their activities in stores with shoplifting being reported nearly every day in retail supermarkets. This had led to retail shrinkage and according to the British Retail Crime Survey (2023), the total cost of retail crime stood at £1.76 billion in 2021/22. Out of this figure, £953 million was lost to customer theft, with eight million incidents of theft over the year. £715 million was spent by retailers on crime prevention in 2021/22 and this would have included money spent on security solutions. Despite this heavy investment in retail crime reduction, retail supermarkets are not having a respite. So, this has necessitated study into why and how retail crimes escalate despite the presence of security solutions.

Lastly, the study's findings also addressed the importance of linked security systems in preventing and reducing crime in retail supermarkets, a topic that was addressed in both the literature review and participant replies. Many participants were excited about the potential for the creation of a crime prevention framework that would be appropriate for UK retail supermarkets in comparison to other developed nations, as well as the advantages that these organisations would be able to reap from it.

REFERENCE

[1] Brannen, J. (2005). Mixing Methods: The Entry of Qualitative and Quantitative Approaches into the Research Process. International Journal of Social Research Methodology, 8(3), 173–184. https://doi.org/10.1080/13645570500154642

[2] brc.org.uk

[3] Centre for Retail Research (2019). The Global Retail Theft Barometer. Nottinghamshire, UK.

[4] Ciagala, K. R; Reichi, L. S; Parsons, K; and Hunter, S. T (2024) 'Physical security culture: The neglected foundation for effective security', Safety Science, Vol 175, No 106518

[5] Cohen, N., Gattuso, J. and MacLennan-Brown, K. (2009) 'G.B.H.O.S.D. CCTV Operational Requirements Manual' Criminal Justice System Race Unit, The Home Office: London, UK.

[6] Cottrell, Susan and Donaldson, Jayne H (2013) Exploring the opinions of registered nurses working in a clinical transfusion environment on the contribution of e-learning to personal learning and clinical practice: Results of a small scale educational research study. Nurse Education in Practice, Volume 13, Issue 3, Pages 221-227.

[7] Crime Survey (2023), The British Retail Consortium (BRC), available at: enlaps.io/us/guide/ishikawa-diagram.html

[8] Dillon, M. (1996) The Politics of Security. London: Routledge.

[9] Fernandes, Earlence; Jung, Jaeyeon; and Prakash, Atul (2016) Security Analysis of Emerging Smart Home Applications, IEEE Symposium on Security and Privacy.

[10] Hammouchi, H; Cherqi, O. Mezzour, G; Koutbi, M (2019) 'Digging Deeper into Data Breaches: An Exploratory Data Analysis of Hacking Breaches Over Time'. Procedia Computer Science, Vol 151, Pages 1004-1009.

[11] Hayes, R. (2006) "Effective loss prevention means protecting lives, selling more, and losing less," Security Journal, 19(4), pp. 211–215. https://lodgeservice.com/brc-crime- survey-2023-alarming-rise-in-retail-violence-and-abuse, access on 09/03/2025

[12] Johnson G; Whittington R; Scholes K; Angwin D and Regner P (2017) Exploring Strategy – Test and Cases, 11th Edition, Pearson Education Limited, United Kingdom.

[13] Johnson, B. and Clarke, J. M. (2003) "Collecting sensitive data: the impact on researchers," Qualitative health research, 13(3), pp. 421–434.

[14] Kroener, I. (2014). CCTV: A Technology Under the Radar? (1st edition), Routledge. https://doi.org/10.4324/9781315571089
[15] Kumar, S., & Mallipeddi, R. R. (2022). Impact of cybersecurity on operations and supply chain management: Emerging trends and future research directions. Production and Operations Management, 31(12), 4488-4500. https://doi.org/10.1111/poms.13859
[16] Lum, C., Koper, C., & Willis, J. (2018).' Understanding the limits of technology's impact on police effectiveness'. Police Quarterly, (0) 1–29
[17] Manunta, G., (1999) 'What is security?' Security Journal, 12 (3), pp. 57-66
[18] Maze.co/blog/mixed-methods-research
[19] National Association for Shoplifting Prevention (2018) Shoplifting statistics, http://www.shopliftingprevention .org/WhatNASPOffers/NRC/PublicEducStats.htm, accessed 09/03/2025.
[20] Orel, Fatma Demirci and Kara, Ali (2014) Supermarket self-checkout service quality, customer satisfaction, and loyalty: Empirical evidence from an emerging market, Journal of Retailing and Consumer Services, Volume 21, Issue 2, Pages 118-129
[21] Parformak, P. (2004) "CRS Report for Congress, Guarding America: Security Guards and U," CRS Report for Congress. Available online at https://apps.dtic.mil/sti/pdfs/ADA454027.pdf (accessed on 02/03/2025)
[22] Peersman, Greet (2014) Overview: Data Collection and Analysis Methods in Impact Evaluation, Methodological Briefs: Impact Evaluation 10, UNICEF Office of Research, Florence.
[23] Saunders, M., Lewis, P. & Thornhill, A. (2009) Research methods for Business Students, 5th edition, Harlow, Pearson Education. S
[24] Security Journal (2017) thinking thief' in the retail environment, 30, pp.772–792. doi:10.1057/sj.2015.21; published online 31 August 2015.
[25] Shamoo, A.E and Resnik, B.R (2003) Responsible Conduct of Research. Oxford University Press.
[26] Sutherland, G. E. (1992) Answering the Question: What is Security? Security Management.June, p. 59.
[27] Venkatesh, Viswanath; Brown, Sue; and Bala, Hillol. (2013) "Bridging the Qualitative–Quantitative Divide: Guidelines for Conducting Mixed Methods Research in Information Systems," MIS Quarterly, (37: 1) pp.21-54.
[28] Willis, N., Taylor, E., Leese, M., & Gannoni, A. (2017). 'Police detainee perspectives on CCTV'. Trends and Issues in Crime and Criminal Justice, 538. Canberra: Australian Institute of Criminology.
[29] www.deviantart.com/security-services/art/Retail-Security-914528531
[30] www.intelligenthq.com/small-business-security-5-biggest-benefits-installing-cctv- cameras/
[31] www.enlaps.io/us/guide/ishikawa-diagram.html