IoT Adoption and Dynamic Capabilities: A Qualitative Study on the International Chilled Beverages Industry

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by

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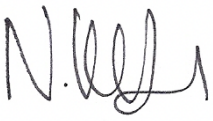
DECLARATION

I declare that works carried out in this thesis is that of the author and has been carried out in accordance with ethical guidelines and clearance from the Brunel Research Ethics Committee.



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ABSTRACT

This thesis aims to contribute to knowledge of organisational Internet of Things (IoT) adoption through the development of a new adoption framework for IoT. The study involved semi-structured interviews with leaders from thirteen countries on five continents.

This study addresses the gap in research on organisational IoT adoption and dynamic capabilities, whilst considering environmental turbulence such as the Covid-19 pandemic and other internal or external factors. An empirical, theory-developing set of qualitative case studies from the international chilled beverage industry is used in this thesis to advance knowledge of organisational IoT adoption informed by dynamic capabilities theory.

In broad terms, combining organisational IoT adoption and dynamic capabilities, this study found the constituent and aggregated dimensions of organisational awareness, competitiveness, leadership, and capabilities. These dimensions are key elements of a derived and novel IoT adoption framework. They help inform and drive senior executives, leaders, and management towards successful strategies for the organisational IoT adoption within the chilled beverages industry.

The theoretical contribution of this thesis is that it expands on dynamic capabilities theory and proposes a new approach to organisational IoT adoption. In practical terms, this study contributes an innovative yet generalisable organisational IoT adoption framework informed by dynamic capabilities.

An evaluation of research paradigms and genres was undertaken to identify an approach suitable for this study. This resulted in the adoption of qualitative research and analysis using the Gioia methodology.

This timely research emphasises the importance of dynamic capabilities in reconfiguring national and international organisational environments to adapt swiftly for effective and efficient IoT adoption. As a final note, the doctoral thesis identifies several areas for future quantitative and qualitative research.

PUBLICATIONS BASED ON THIS STUDY

A call for papers on ‘Dynamic Capabilities and International Entrepreneurship’, a special issue from the International Business Review journal (IBR) was responded to and a submission made based on this study.

A call for papers on ‘Logistics 4.0: The path to sustainable development’, a special issue from the Journal of Industrial and Production Engineering (JIPE) was responded to, and a submission made based on this study.

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1 INTRODUCTION

This chapter outlines the overall purpose of this doctoral thesis. It introduces a qualitative research approach, the market sector on which this study is focused. It also introduces the type of participants, companies and countries included in this research. It provides background information on the chilled beverages industry, its typical mode of operation, and the challenges of IoT adoption for organisations in this sector. An exploration of the limitations of existing knowledge of this topic within the context of dynamic capabilities and environmental turbulence (Khandwalla, 1977, 1985; Volderba, H W; Bruggen, 1997; Calantone, Garcia and Dröge, 2003) such as a global pandemic. Finally, within this section, there is an overview of the researchers' aims, objectives, methodology and contribution to this topic.

This section is essential for understanding the research that has been conducted, as it provides an overview of the research aims, objectives, and methods. It also offers insights into the likely outcomes of the research and its potential implications. This information is essential for understanding the findings and how the research contributes to the existing body of knowledge.

It was found that senior executives and managers should consider several dimensions when adopting IoT, including awareness, competitiveness, leadership, and capabilities. These were addressed within the dynamic capabilities' components of sense, seize, and transform. There were challenges for organisations to effectively address various themes within these dimensions, which are discussed further in this thesis.

Environmental turbulence such as the Covid-19 global pandemic affected the chilled beverages industry and its IoT adoption strategy, resulting in the requirement to swiftly address external business challenges from policy makers, retailers, consumers, and suppliers. In addition, key stakeholders within the organisation, such as workers and management, presented internal challenges.

From its findings, this research explored critical dimensions using technology adoption literature and dynamic capabilities theory. Through the lens of dynamic capabilities theory and the context of environmental turbulence, this study produced an IoT adoption framework.

By implementing the IoT adoption framework proposed in this study, an organisation can be successful in adopting IoT.

1.1 BACKGROUND

Globally, the chilled beverages industry experienced significant sales losses during a period of environmental turbulence, namely the Covid-19 pandemic. This is evident in many sectors where sales of chilled beverages are traditionally found, such as restaurants, bars, leisure centres, retail outlets and petrol or gas stations (Fairlie and Fossen, 2022). As a result, an organisation’s Internet of Things (IoT) adoption strategy needs to be accelerated and redesigned for a 'new normal' when physical store visits by chilled beverage sales representatives become restrictive and costly. In this context, the aim is to propose an IoT adoption framework by examining the sense, seize and transform phases in Dynamic Capabilities theory for organisations in this sector. In this study, semi-structured interviews with 19 senior executives from 14 chilled beverages companies across 13 countries in Asia, North America, South America, Europe, and Australia were undertaken. The results reveal key factors related to IoT adoption including awareness, competitiveness, leadership, and capabilities. The study illustrates the importance of dynamic capabilities for reconfiguring international business environments to adapt to rapidly changing contexts, including global pandemics.

1.1.1 CHILLED BEVERAGES INDUSTRY AND IOT CONTEXT

In addition to 25 years of experience in the software and internet businesses, the researcher has been working in the IoT space for 8 years. In this time, the researcher has managed, delivered, and worked with senior executives in the delivery of technology solutions ranging from e-commerce to data capture, document management and internet of things. The researcher worked for companies that produced and sold IoT devices, known as controllers, in the software and hardware sectors. These devices were sold to the chilled beverages industry. Back then, coolers were equipped with simple controllers that controlled the cooler's temperature, among other things. Therefore, technology at this time was not innovative or advanced. It is important to note that these controllers were not IoT enabled. They could only be setup by pressing button combinations on the display panel. Thus, these controllers were unable to take advantage of the vast potential of IoT technology, limiting their capabilities and preventing chilled beverage producers from reaching their full potential.

The researcher has been involved in deploying these technologies internationally across several businesses. This study focuses on the chilled beverages industry and IoT adoption. The researcher is highly intrigued by the challenges faced by international businesses engaged in IoT adoption, as such adoption in the chilled beverages industry is relatively new. The reason for this is because the technology available for IoT enabled chilled beverage coolers is also relatively young, originating as far back as 2016. Chilled beverages organisations are commonly known as ‘Bottlers’ (see Figure 1). As early as 2016, bottlers began to investigate the possibility of integrating IoT into their coolers. The researcher worked for an IoT company that produced the earliest versions of IoT enabled controllers for commercial coolers at the time. Globally, these controllers, as well as the competitor versions that followed shortly after, were introduced to the largest original equipment manufacturers (OEMs) of commercial refrigeration and coolers on or after 2016. These OEMs were based in Mexico, Argentina, Brazil, Turkey, and China.

However, these organisations would have been considered early adopters, and as a result, their experience would have been limited to small trials of an exploratory nature. In these early years, it was also evident that the business case for IoT adoption and integration into coolers was focused primarily on the tracking of assets. The combination of technological advances and the beginnings of commercially viable business cases for IoT enabled chilled beverage coolers led to an increase in interest in this innovative technology.

Bottlers began to see that with IoT enabled coolers, they could not only track the location of their assets but also monitor temperatures and other relevant metrics, such as humidity, energy efficiency and the commercial performance of the cooler. This increased accuracy and visibility meant they could develop a data driven salesforce, improve customer experience, and increase profits.

It is also worthwhile noting that original equipment manufacturers (OEMs) responsible for the manufacturing of commercial coolers and other refrigeration equipment were not familiar with IoT technology. It is not uncommon for OEMs to take orders for thousands of new coolers from bottlers every year. This is because bottlers aim to place coolers in new markets, as well as replacing retired coolers in their fleets. OEMs were driven by bottlers to change their model of building coolers with non-connected controllers in 2016 to build coolers with IoT enabled controllers. As a result of IoT adoption, both bottlers and OEMs have been faced with many organisational changes and adaptations to embrace the innovative technology that is available due to IoT as a new business model. Consequently, both OEMs and bottlers have needed to re-evaluate their strategies and operations to take advantage of the opportunities that IoT provides.

In the researcher's knowledge, and based on the literature review, there are no other studies on IoT adoption in this industry. The existing literature on the effects of IoT adoption focuses on the technological aspects of IoT. However, there is a lack of comprehensive research examining the effects of organisational adoption of IoT within the chilled beverages and other industries. Although there are studies on technology adoption, as discussed further in this thesis, there are nuances in respect of IoT adoption

that differ from traditional technology adoption. This study explains this in more detail. It is also evident that technology adoption and research on dynamic capabilities are limited. While previous studies have contributed valuable insights into IoT technologies, many of these studies tend to be limited to the technical benefits of IoT. This limitation underscores the need for a more nuanced and balanced approach to studying the effects of organisational IoT adoption. The research gap becomes evident in the absence of studies that comprehensively explore the impact of an organisations IoT adoption strategy and the role of dynamic capabilities.

What is unique about this study is that it does not focus on the technological aspects of adoption. This is because, as evidenced in the literature review, most other studies on technology adoption or even IoT technology, focus on technological aspects in their research. A lack of literature exists regarding the organisational view, particularly the perspective of leadership, senior executives, and management. This research is aimed at understanding the IoT adoption strategies from an organisational standpoint with focus on an organisation's dynamic capabilities, resources, and employees. It is for these reasons that the chilled beverages industry requires the researchers' effort to create new knowledge on IoT adoption. To address this gap, this study aims to create an IoT adoption framework to support the chilled beverages industry with their IoT adoption strategy whilst considering the dynamic capabilities of their organisation. Furthermore, this research will provide the chilled beverages industry with the necessary knowledge to help organisations understand the impacts and benefits of IoT adoption, so that they can make informed decisions when planning their adoption strategies.

Arguably, the IoT adoption framework is generalisable and can be used in other industries or sectors and may be a valuable resource for future researchers. Existing literature does not explain this phenomenon. This is because it is a relatively new phenomenon with recent advancements in IoT technology and cooler controllers dating back to 2016. The chilled beverages industry has only recently begun to explore such innovations, and as found in this research, have challenges recognising, adjusting, and preparing their organisation for such innovation. Arguably, between 2019 and 2022 the global pandemic hindered progress. Therefore, this timely research should be of value to many

organisations in the chilled beverages industry. As the world begins to recover, this research should provide these organisations with the insight they need to capitalise on IoT opportunities. This insight should also drive innovation within the chilled beverages industry.

1.1.2 RATIONALE FOR CHOOSING THE CHILLED BEVERAGES INDUSTRY

The chilled beverages sector was chosen for this study for several reasons. First, typical chilled beverage suppliers include soft beverage bottlers and beer beverage bottlers. In all cases, these organisations represent, or are, global brands with an international presence. In this study, the industry term ‘bottlers’ describes licensed organisations who are the producers and suppliers of chilled beverages on behalf of the brands themselves. Bottlers are invested in ensuring their chilled beverage products reach the market and are served at the optimum temperature. Coolers are critical, as offering chilled beverages at the point of sale often affords retailers the opportunity to charge premium prices. Therefore, coolers play an essential role in the profitability of bottlers, allowing them to maximise their profits and remain competitive in the market.

Bottlers invest heavily in purchasing and supplying, free-on-loan, coolers to many outlets, including retailers, restaurants, and bars. In this scenario, the bottlers own the coolers and are vested in ensuring they are optimally placed in retail outlets, restaurants, and bars. They are also committed to ensuring they are switched on, clean, diligently maintained, well stocked, continuously replenished, and chilled at the optimum temperature. Chilled beverages are often impulse purchases; therefore, a consumer may expect a product to be chilled at the point of purchase. Bottlers often own the distribution channel, so they invest in a workforce of sales reps and maintenance teams. Sales reps visit outlets regularly, check coolers are switched on, that there are no foreign products present, take orders to replenish stock, and organise distribution.

This helps to ensure that chilled beverages remain at the optimal temperature and that they are available to customers for impulse purchases. Additionally, the sales reps and

maintenance teams help improve the visibility of the product in stores. They are often involved in the merchandising of the cooler when stock arrives.

The benefits are arguably severalfold. A well-stocked, frequently replenished and maintained cooler should boost product sales. Arguably, this is a favourable outcome for all stakeholders. For the consumer, their preferred chilled beverage is always available for purchase. Sales for the retailer increase due to the high availability of chilled beverages, and the bottler receives more orders from the retailer to keep the cooler adequately replenished. A sales rep is also a key stakeholder, as many are compensated for the presentation and performance of coolers within their territory. Finally, the brand benefits from higher turnover of their products and brand recognition.

Therefore, all stakeholders benefit from the availability of chilled beverages, with the consumer receiving the product they desire, the retailer seeing increased sales, the bottler receiving more orders, the sales rep earning a potential commission, and the brand gaining higher turnover and recognition.

In summary, a bottler supplies the outlets with coolers, product, distribution channel and supports sales and maintenance workforce. This ensures coolers are efficiently operated and replenished to maximise commercial returns.

The chilled beverages industry is ideal for this study as it is affected by many challenges from consumers to retailers and the supply chain. Bottlers rely on their sales force to regularly visit outlets to carry out the activities described earlier. The chilled beverage industry was immediately and adversely affected by closures in the hospitality, leisure, and retail sectors. Sales were abruptly halted, the sales force forbidden or restricted from making onsite visits to customer locations, and in many cases this will have resulted in redundancies.

To overcome pandemic related restrictions, bottlers may choose to employ IoT technology, fitted to coolers with multiple sensors (temperature, light, door opening, cameras, telemetry) to remotely monitor and report on the commercial and operational performance of coolers in essential stores open during a pandemic, such as supermarkets

and local retail outlets. In doing so, daily business intelligence from coolers can be made available via telemetry upload to cloud platforms. This can include information such as the operational and commercial performance of a cooler, including stock levels and replenishment requirements of a retailer. This will enable the automated ordering and delivery of depleted products. Additional intelligence such as cooler temperature, door openings, asset location, planogram compliance and foreign products is also available to the bottler.

This data helps ensure that the right products are distributed to the right retailers, at the right time and in the right quantity - optimising order cycles, reducing inventory costs and decreasing waste.

Organisations need to adapt and find effective ways to increase sales, improve their competitiveness whilst implementing efficiency gains. A driver for this research is to understand if or why organisations in the chilled beverages industry struggle with IoT adoption within their organisation. This will enable us to discover how this can be overcome. There are many challenges and successes in the chilled beverage industry as described in Table 20.

1.2 STUDY CONTEXT

As a result of environmental turbulence, the international chilled beverage industry suffered significant sales losses. Organisations need to be aware of the opportunities that IoT presents and have the capability to integrate it into their existing business model. To do so, they need to have strong leadership that can help to set the direction of the organisation and build the necessary capabilities to be competitive in the best of times, not least during environmental turbulence.

1.2.1 THE CHILLED BEVERAGES SECTOR AND COOLERS

The researcher has been involved in business for many years, focused on the scoping, delivery and implementation of technology and professional services. Many projects involved the deployment of IoT enabled technology for various companies around the world, primarily within the chilled beverages sector. The chilled beverages sector is focused on ensuring their products are readily available at numerous locations. These generally include retail outlets, restaurants, bars, supermarkets, petrol stations and a variety of other locations. Chilled beverages include soft drinks, typically various branded flavoured drinks such as cola, orange, lemonade, and various other carbonated and non-carbonated products, such as water and juice. Other companies in this sector are alcohol companies selling canned or bottled beer, many in similar types of outlets and locations. In addition to these types of organisations, companies that produce 'chilled' products, such as non-carbonated beverages, water, yoghurts, dairy products, and cold meats, are relevant to this study as well.

The assets used to make these products available are known as coolers, essentially refrigerators. These are typically vertical coolers with glass doors and internal lighting. This is done to aesthetically present a company or brands' products to attract customers to the cooler, opening the door and taking one or more products. The cooler is a valuable marketing or sales tool for brands in that they are typically covered in decals or marketing material promoting the actual brand, whether it is a soft beverages company or a beer company. The placement and distribution of coolers is often managed by a brand or chilled beverages bottler.

Bottlers are licensees responsible for mass production and distribution of branded beverages, essentially licensed to manufacture, bottle, and sell brands. To do this successfully, a licensee not only has to produce and bottle products to the brands formula, but ensure the necessary distribution, logistics and equipment required to serve beverages are appropriately placed in the market. This therefore requires a bottler to source coolers from original equipment manufacturers (OEMs) for distribution into the market (see Figure 1).

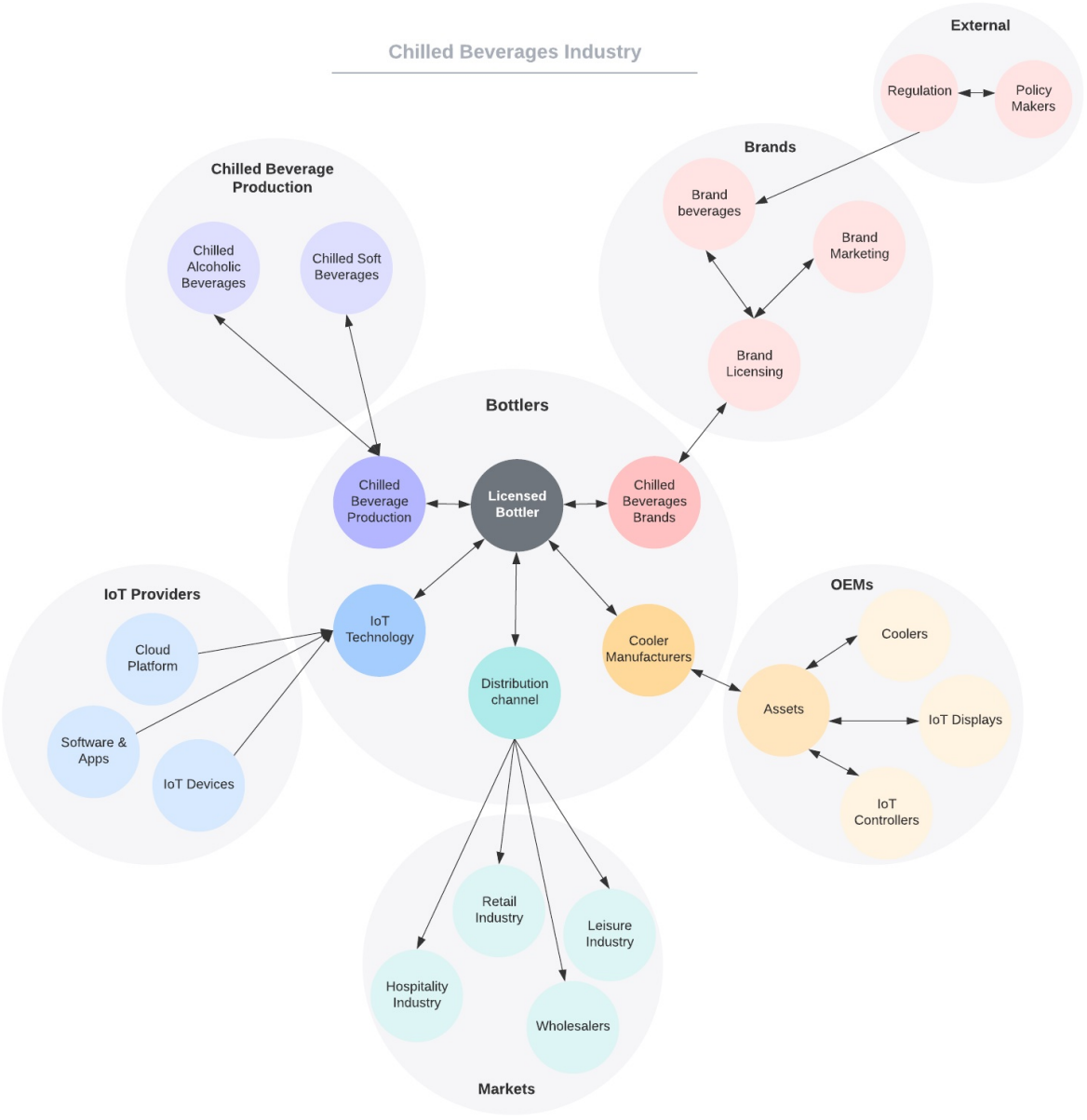

Figure 1: Chilled beverages industry and bottler relationships

The bottler is generally responsible for the procurement of tens of thousands of coolers annually to be placed in the market. Retailers and others usually receive coolers on a free-on-loan basis. As a result, the retailer does not pay for the cooler, but must maintain the brand or bottler's beverages in it once it has been placed in their outlet.

The beverages in the cooler are typically chilled to what is expected to be the optimum temperature. This is essential as purchases of single chilled bottled or canned beverages are typically impulse purchases. Depending on the beverage, soft drink, or beer, the typical serving temperature could range between 1 and 6 degrees Celsius. The rationale for this is based on the expectation that a product is being purchased for immediate consumption. In many countries, cold beverages, for example in retail outlets, are often sold at a higher price margin than if the same beverage was purchased at ambient temperatures, typically found on shelves in store aisles. This is supported by impulse purchases of ready-to-consume chilled beverages. Furthermore, in many countries where the climate is generally hot, retail outlets are often awash with coolers, wall to wall, as selling chilled products is key to their business.

Chilled beverages are sold by brands globally and large companies will have 100,000’s if not 1,000,000s of coolers throughout the market. As described earlier, these coolers are valuable assets as they provide ready-to-consume products in stores and retail outlets, which are often purchased on an impulse basis. Although bottled or canned beers can be purchased in larger packs for in-home consumption, these are usually preferred chilled before consumption. Coolers often have digitised controllers, which are devices that are used to set cooler configurations such as parameter values and display data. Typically, one would see the current temperature of a cooler displayed on the controller’s electronic display panel (see Figure 2). The controllers are designed to maintain a steady, cool temperature for extended periods of time, which is important for keeping soft beverages and beers at their optimal temperature for a better tasting experience during instant consumption.

This is useful to the consumer and store owners as it indicates the likely temperature of chilled products within the cooler. As previously mentioned, this is often as low as 1 and

often anywhere up to 6 degrees Celsius. The controller is not merely measuring and displaying the cooler temperature but is also configured with a vast array of parameters that help maintain the operation of the cooler. This includes managing compressor cycles and other energy saving settings to ensure the cooler is optimised to serve chilled beverages. In addition, the controller must maintain the operational health and energy saving capabilities of the cooler.

The relationship between IoT technology and the chilled beverages sector can be explained primarily by the controllers used in coolers that store chilled beverages (see Figure 2). Historically, controllers on coolers were exactly that, controllers that controlled the behaviour of the cooler. Any data or information about the operational health or performance of the cooler was non-existent or held within the controller. To make changes or read values related to the cooler, users must visit the cooler and use the digital controls. This will enable the user to access the controller menu to view, change or update settings and configurations. In this scenario the controller has limited capability and value beyond the immediate function of the cooler.

In recent years, controllers have been developed with extended capabilities that allow the transmission of, and access to, parameters and configurations stored on the controller. Utilising either smartphone apps or smart modems, the ability to connect to, update or set configurations remotely has become possible. Enabling this is possible due to the inclusion of various communication components, such as Bluetooth LE, WIFI and cellular technology. Furthermore, additional sensors to enhance the controller's functionality are embedded within the coolers. These include door switches, which enable the counting of cooler door openings. This can provide an insight into the commercial performance of a cooler as door counts may indicate the utilisation rate of the cooler. Temperature, humidity, and light sensors typically provide health information about the cooler and its operation. Motion sensors are often present in controllers. These can provide an indication of 'footfall' or traffic around the cooler by measuring and counting movement as people walk past the cooler. Data from motion sensors combined with door openings are reliable indicators of the commercial performance of a cooler. These are often measures used to determine the suitability of an outlet housing a cooler. For example, if the daily ‘footfall’

around a cooler is very minimal, this may indicate that the cooler is poorly situated in a store. It may also indicate that the store is a low performing outlet. Being armed with this data may assist a brand or bottler in making tactical decisions. For example, moving a cooler to another location within the store or even to another store. Coolers that have low activity levels are more likely to be underperforming in sales. Therefore, relocating the cooler to a 'better' location or a different store may resolve such an issue.

This data can also be used to identify stores that perform well and can be viewed as a benchmark for other stores. It can be used to optimise coolers and displays which will result in increased sales. Additionally, the data can be applied to inform marketing and promotional campaigns to ensure that the target market is being reached.

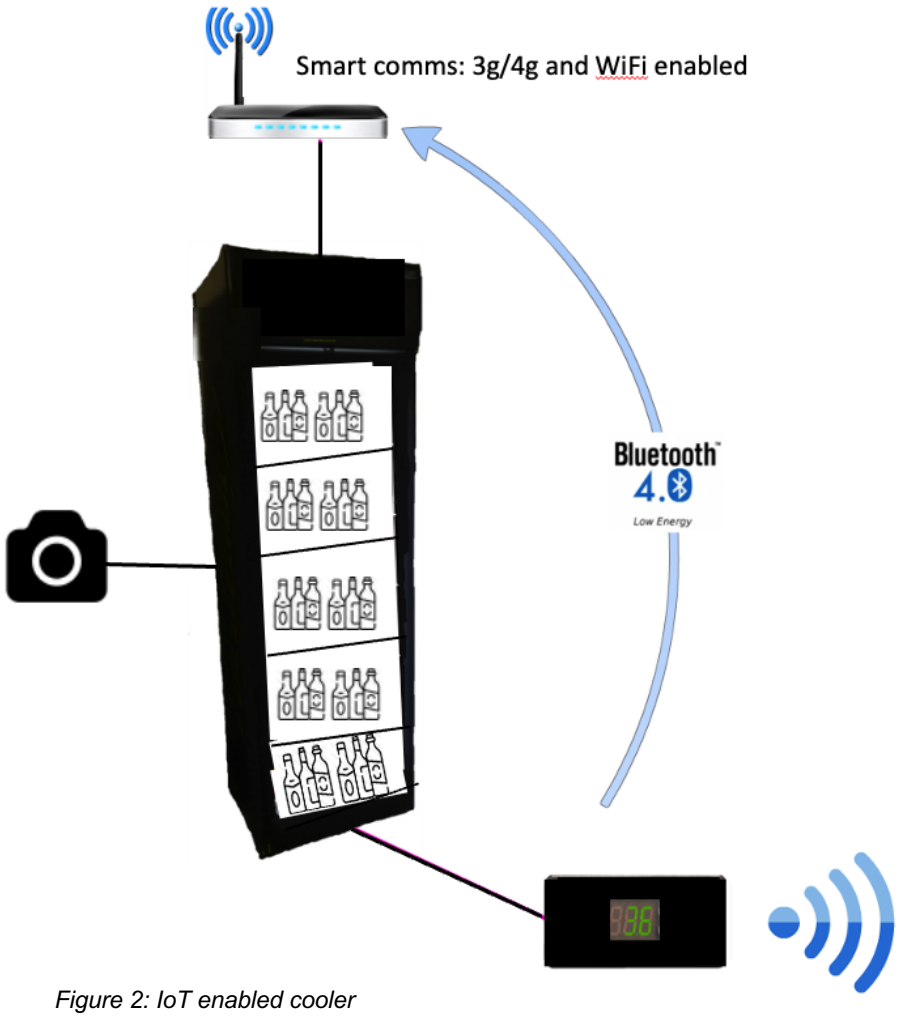

Figure 2: IoT enabled cooler

Figure 2 illustrates how IoT enabled controllers communicate. Essentially, sensor data is recorded regularly and stored in the controller's memory. This includes cooler temperature, door openings, footfall, humidity, light levels, and other sensors. The data from these sensors is transferred via Bluetooth LE to the smart comms device. In turn, this device transmits the data to a cloud platform where analytics and actionable insights are created. Controller parameters and settings are also transmitted in the same way. The smart comms devices often provide bi-directional communication, allowing for remote access for commands to be pushed directly to the controller from a remote location. This provides the means for users to remotely update controller parameters and settings, which is not possible to do with non-IoT enabled controllers.

An additional benefit of including smart comms devices as part of the IoT enablement of controllers is that these have cellular and WIFI capabilities. This is critical for the transmission of IoT sensor data and as just described remote control capabilities. However, a key benefit is the ability to utilise cellular and WIFI modules for geolocation data. The smart comms device is utilised to gather latitude and longitude references that are translated into address data, generally with an accuracy rate of a few meters. This essentially produces location data for the cooler, as registered geolocation reference data is uploaded to a cloud platform alongside sensor data. This is of importance, as bottlers own and place 100,000s of coolers in the field. Therefore, having daily updates as to the actual location of each cooler provides the bottler with asset location and management capabilities. Coolers are assets that can often go missing, so such capabilities are valuable to the bottler from many perspectives. This reduces wasted maintenance and sales visits where coolers, unbeknown to the bottler, are no longer at their expected or authorised location. In addition, an up-to-date asset register allows finance personnel to accurately depreciate traceable assets and write off lost assets.

It also helps the bottler track usage and determine when the cooler needs to be serviced or replaced. It provides visibility of where coolers are located so the bottler can better manage their inventory and identify opportunities for additional placement of coolers. Finally, it allows the bottler to better manage customer relationships, as they can quickly address customer complaints if they know exactly where the cooler is located.

1.2.2 TRANSITION FROM NON-IOT ENABLED TO IOT ENABLED COOLERS

Understanding the relationship between chilled beverages and IoT enabled coolers is imperative to understanding the driver of this research. This explanation provides insight into why the shift from non-IoT equipped coolers to IoT capable coolers may be significant to an organisation, its workforce and business practices. Prior to IoT enabled coolers, bottlers or organisations would have had limited interest and need to understand the operational data of a cooler. This is other than to troubleshoot maintenance related issues. Organisations would typically have been aware of cooler performance issues by notification from store owners, if they noticed a cooler was malfunctioning. Store owners would generally call a maintenance telephone support number, or an account manager assigned to them by the bottler. This prompts action from the bottler. A maintenance call is usually planned to investigate and resolve any issues. This would typically take the form of an onsite visit by the bottler's refrigeration engineer for diagnosis and repair. Very often spare parts are not in the possession of the engineer, necessitating a second or even third visit to complete reparatory works. Understandably, this is an inefficient and costly exercise, as the skillsets required for reparatory works are limited to a refrigeration engineer.

The introduction of IoT enabled coolers changes the landscape for bottlers and the skillsets required within their organisation. Firstly, an IoT enabled cooler regularly uploads operational, commercial and asset health data to a cloud platform for analysis and subsequent actions. For example, if the cooler temperature is too high, this will result in warm beverages in the cooler. This may indicate that the cooler compressor is faulty and not able to pull down the cooler temperature to keep beverages chilled. For the reasons mentioned earlier, this is not ideal for impulse products which are intended to be consumed at the point of purchase. This adversely affects the sale of products.

This can lead to customer dissatisfaction and decreased sales, as customers may not want to buy warm items, and may even leave the store altogether. Furthermore, this could

lead to complaints and negative reviews, which could damage the store's reputation and drive away potential customers.

An IoT enabled cooler can send an alarm signal to the cloud platform where the organisation is alerted to issues. Depending on processes, such an issue can be evaluated, monitored, and eventually actioned upon. Having remote access to the controller can result in resolution via a simple remote configuration change, eliminating the need for an onsite visit.

There is no doubt that sensor data, door openings, temperature, motion, humidity, light, and others contribute to the success of an organisation. For a bottler, embracing IoT enabled coolers suggests that its existing resources may not have the necessary competence, skills or capabilities to operate at this enhanced level. As an organisation adopts IoT technologies in this scenario, it will need updated skillsets, including, but not limited to, technical, software platform, and analytical skills. Management skillsets required include the capability to consume and understand the resultant analytics gathered from all IoT enabled coolers to plan and organise subsequent actions. New processes and workflows are required to effectively operate and respond to changing information and business intelligence. Developing or acquiring various and different skills is inevitable.

To effectively manage an IoT enabled cooler, managers must be able to interpret the data gathered from the cooler, plan out next steps and create new processes and workflows that can effectively respond to changing information. They will also need to develop or acquire new skills to be able to do this.

1.2.3 CAPABILITIES OF EXISTING ORGANISATION RESOURCES

The chilled beverages sector is huge considering there are more than 10 million chilled beverages coolers placed in stores globally. It has been established that the production and bottling of chilled beverages are in the domain of licensees. These organisations are usually responsible for the procurement of coolers from OEMs and subsequent placement of the same in retailers and other outlets. The bottler therefore requires a workforce which generally includes sales reps, merchandisers, and maintenance personnel. In respect of placing coolers in the field the sales rep's role is critical. They are responsible for sourcing opportunities and existing locations for coolers. In addition, they issue contracts for the free-on-loan coolers with retailers and finally ensuring that these coolers are merchandised appropriately on a continuous basis. Sales reps attempt to develop strong relationships with their retailer or customer accounts and provide a point of contact for processing orders for cooler replenishments. They are also primarily responsible for fielding customer issues with coolers, merchandise, and general customer service.

This helps to ensure that the coolers are always in excellent condition. In addition, the products are stocked properly, and that customers have a good experience when they interact with the cooler. It also allows the bottler to build relationships with retailers. This allows them to gain a better understanding of their needs so they can make sure they are providing a high-quality service.

As the main point of contact, the sales rep plays a vital role in ensuring their accounts continue to purchase and maintain stock of chilled beverages. Much of this communication is done face to face with regular visits by sales reps to their allocated customer accounts. This can entail visiting many outlets every day of the week. This is a valuable activity. It affords the sales rep the opportunity to maintain customer relations, visually inspect the coolers for merchandise and agree with and place orders directly with the store owner. This hands-on approach tends to be prevalent in markets where the cost of human resources is typically low. Added benefits of this model include the opportunity for the sales rep to check the cooler asset is in place and in proper condition. The products

in the cooler are the correct products and their respective planograms are adhered to. Observe whether competitor products are in the cooler and whether there are competitor coolers in the same outlet. Arguably, this is useful market intelligence that can be utilised for the benefit of the sales rep and bottler.

Knowing what competitors are selling in a particular store and how they are selling their products, can give insight into how to adjust the product offering and pricing strategy to gain a competitive edge. By employing a large sales force to manage retailer accounts, a bottler can ensure that bottler products are always in stock, that prices are competitive, and retailers are satisfied with the service.

Low resource costs are prevalent in locations such as Central and South America, Eastern Europe, and Asia. Therefore, employing a significant fleet of sales reps to manage customer accounts with regular weekly visits, or even several times a week, is a viable strategy.

Other methods of collecting orders from retailers can be achieved by utilising a telesales team or relying on store owners to phone in orders. Store visits by sales reps can be scheduled at a lower frequency where the cost of resources is high. This method is typically found in markets based in Western Europe, North America, and Australia.

The significance of describing the various business models is relevant in that these methods require skillsets that are no doubt valuable to the bottler and store owners. However, when introducing IoT enabled coolers, the status quo is somewhat challenged by emerging technological capabilities. The existing workforce, including management, sales reps or maintenance teams, may need the development of enhanced skills. In addition, they will need to understand a variety of concepts in relation to IoT data gathering, analysis and proposed actions. Much of which is likely to be unfamiliar and uncharted territory for existing resources. The workforce, including management, sales reps and engineers, requires development and understanding of the latest IoT concepts, hardware, software, mobile apps, communications devices, and cloud platforms. Much of which is conceptually challenging and potentially confusing (see Figure 1).

To keep up with the ever-evolving IoT technology, it is essential that the workforce is trained on the latest tools and platforms. This will ensure they are able to identify and solve problems quickly and accurately and make decisions that are both cost-effective and beneficial to the organisation.

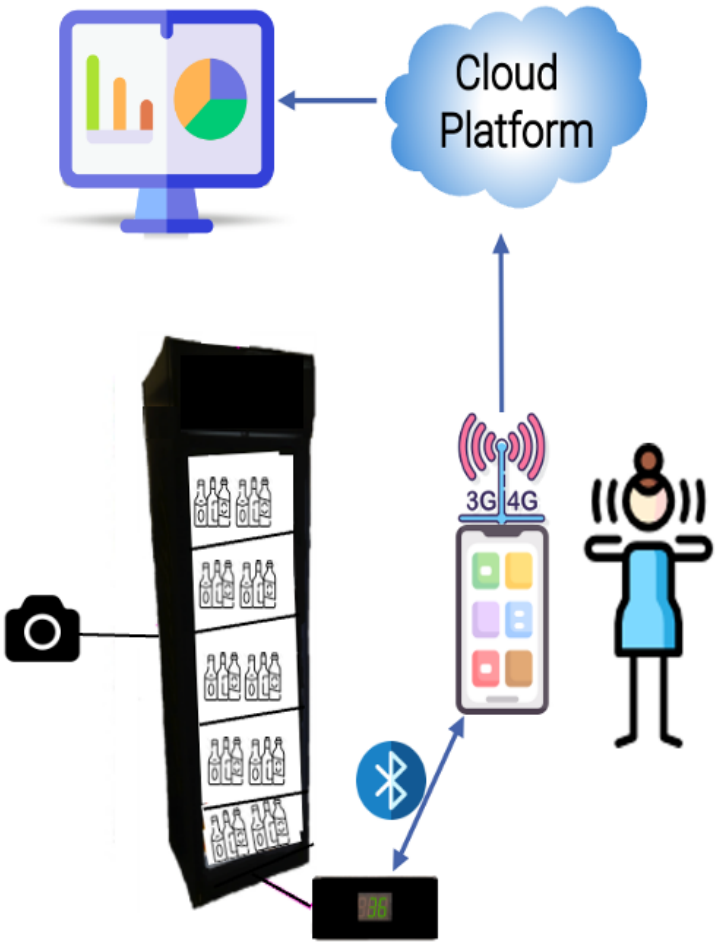

Figure 3: IoT enabled coolers, hardware, software, and platforms

In this section, a description of the roles of existing organisational resources is offered. In addition, an explanation of the capabilities of existing resources needs to be addressed in the context of IoT enabled coolers. These coolers begin to provide data and insights regarding the operational and commercial performance of these assets. Sensor data and

analysis provide new insights and actions that were previously unattainable. In this context it is hypothesised that gaps in an organisation's workforce and resource capabilities start to appear that require addressing. It is also expected that uncertainty and concerns about an organisation's workforce in terms of individual roles and responsibility will begin to surface. Even though new technology can be exciting and innovative, it can also lead to fear and confusion within an organisation.

Arguably, an organisation will be faced with challenges when transitioning from a traditional non-IoT enabled cooler to a fully IoT enabled cooler because of the array of new data and insights that are available and the introduction of tools and platforms to the organisation and its workforce. This suggests that an organisation may need to prepare appropriately to enhance the chances of successful adoption by all its stakeholders. This must include the organisation's workforce, from senior management through to operational personnel. It's partners, suppliers and customers may also be integral to the process. It may also be necessary to involve existing team members from other parts of the organisation or indeed new employees that have the skillsets necessary to support such an IoT focused initiative. For example, as never before, when sensor data is made available on a cloud platform, it is inevitable that technical resources will be required to generate meaning and present outputs and actions from sensor data. Dashboards, charts, key performance indicators (KPIs) and data mining are arguably required.

As such, it is important that the team has the necessary knowledge and expertise to be able to interpret the data, identify trends and patterns, and generate insights that can be used to make informed decisions. This may require a combination of technical and analytical skills, as well as problem-solving abilities, to be able to uncover hidden opportunities and generate solutions that are tailored to the organisation's needs.

1.2.4 PROBLEM STATEMENT

An appreciation of the chilled beverages sector is necessary to understand the context of this study. Working in the IoT industry often presents exciting and innovative opportunities and projects. However, it also presents significant technological challenges sometimes related to hardware such as IoT enabled controllers, cameras, beacons, and other devices. Issues with communication protocols can also occur, such as weak cellular, Bluetooth or Wi-Fi connectivity. IoT data collection, storage, and transmission fail without a good 'received signal strength indicator' (RSSI) connectivity or failed connections between devices.

This research is concerned with the challenges an organisation has with IoT adoption from a resource perspective. For example, failed IoT adoptions could stem not from technological issues, but from human issues. This could encompass any number of factors such as knowledge deficit, lack of appropriate skills, understanding, unwillingness, motivation, lack of belief or trust in IoT technology. In addition, there may be a general lack of support for IoT technology initiatives.

The driver for this research was based on experiencing a variety of these challenges presented by businesses involved in IoT adoption. The researcher perceived significant gaps in an organisation's 'readiness' to adopt IoT technology across various stages of the deployment process. Involved in many IoT adoption initiatives, the researcher observed challenges negatively affecting successful outcomes. There were both failures and successes. A few examples are shared highlighting factors that may have significant relevance to the success or failure of organisations adopting IoT technology.

In one example, a deployment in South America, a bottler wanting to deploy smart IoT enabled coolers throughout a major city's small independent retail sector (known as mom and pop stores) struggled to gain alignment with their own IT, marketing and sales teams and the store owners of these small retailers. Internally, there appeared to be resistance from the IT team and the sales team, whereas initiative and enthusiasm was the responsibility of the marketing team. It appeared on the one hand that IT were concerned

about technology robustness and viability, whereas the sales team may have been concerned about their roles. Retailers themselves, although they do not own the assets, seemed dubious about the motives for the introduction of IoT technology into their stores. Many may not have been overly keen on such an initiative. Argentina has a reputation for strong union activity, and this may play a role in the experienced organisational resistance. Store owners may operate in the 'grey' market. They may be suspicious of technology that may have the capability to measure or report on their sales activities without their knowledge. They may even suspect that trading data could be reported or shared with the tax authorities. These concerns are often driven by lack of knowledge or understanding but are none-the-less valid when taking into context the culture, national or local institutional values of a country. These are some of the reasons for this study to explore and understand the real factors affecting the IoT adoption of technology from an organisation's perspective. In addition, it will help to understand how these could be overcome.

To do this, in this study, interviews were conducted with organisations in the chilled beverages industry to better understand their concerns and attitudes towards IoT technology and adoption.

In another organisation, there were challenges experienced in a deployment where coolers are placed in the field. These coolers are equipped with IoT enabled controllers and cameras to analyse the operational performance of coolers and compliance with branded beverages within the cooler. In this case, the bottler does not have a distribution channel and relies on storeowners to replenish the bottler's branded cooler with the bottler's beverages direct from wholesalers. The purpose of the cameras is to enable the bottler to monitor compliance levels and address shortcomings with store owners.

The bottler contracts with a third party maintenance company to ensure the healthy operation and maintenance of the coolers. The introduction of IoT sensors permits the third party maintenance company to receive automated alerts where issues arise and monitor coolers remotely. These updated processes, although innovative and efficient may not have met with third party approval. Arguably, this promises efficiency gains which

may result in a reduction in chargeable fees and loss of business for the third party supplier. Within the bottler's organisation it was apparent that knowledge of IoT and understanding of technologies was limited. The ability of the leading members to promote the benefits and onboard the wider organisation was limited. Tactical plays to undermine this initiative between the third party and bottler may have contributed to the stunting of this initiative. Arguably, claiming robustness, trust and reliability issues can quickly undermine technology initiatives. Understanding the underlying issues and dynamics of an organisation struggling to adopt IoT technology is a driver for this research.

The lack of support from senior members of the organisation could have been due to a misunderstanding of the potential benefits of the initiative, or due to a fear of the unknown that comes with technological change. The presence of tactical plays from the third party and bottler could have also been a factor, as these entities may have felt that their own interests were threatened by the initiative.

Conversely, other organisations have successfully deployed IoT enabled coolers. These are the organisations where it was apparent that there was clear leadership at the top of the organisation. The benefits were well understood by key stakeholders, and clear processes and tools were available to enable both the organisation's resources and retailers. Understanding how and why such an organisation was able to deliver their IoT initiative successfully and identifying the key factors required for such success is an important driver of this research.

In summary, the chilled beverages sector is undergoing significant changes and the need to become more competitive and efficient is essential. It’s a changing marketplace, under pressure from declining chilled beverage sales (soft beverages and beer) in many countries.

1.3 MOTIVATION AND RESEARCH QUESTION

A literature review was conducted using academic databases such as Scopus, Emeralds, and IEEE Xplore, in search of articles related to this topic. 85 articles were reviewed in their entirety from a pool of 2,119 search results. The conducted literature review illustrates a clear lack of research on this topic, whilst there is abundant research on technically oriented IoT adoption (Brous *et al.*, 2017). Moreover, this literature review was mainly conducted pre-pandemic, therefore there is scant research available on the impact of the Covid-19 pandemic on organisations' IoT adoption and capabilities. This study seeks to bridge this gap.

In addition to this, and despite the pandemic, there is limited reference to how IoT impacts the capabilities of workers (Coombs *et al.*, 2016) and limited commentary on business processes (Del Giudice and Della Peruta, 2016), whilst research on IoT security, standards, technology, connectivity, and other technological challenges is plentiful (Brous *et al.*, 2017).

Furthermore, in Erfanmanesh and Abrizah (2018), the highest 15 ranked subject categories did not include any publication titles suggesting research on IoT and its impact on an organisation's capabilities. The top five subject categories include Computer Networks and Communications (5692 publications), Electrical and Electronic Engineering (2701 publications), Computer Science Applications (2496 publications), Software (2027 publications) and General Computer Science (1512 publications). This theme continues throughout all 15 top-ranked subject categories, none of which addresses the question of the impact of an organisation's capabilities on the adoption of IoT technologies.

1.3.1 RESEARCH GAP

The findings of this literature review support the assertion that this topic is understudied. This is because there is a gap in terms of IoT adoption and its organisation's capabilities,

prior to and during a global pandemic. This is evidenced in Tang, Huang and Wang (2018) who suggest in their research on the impact of IoT on a firm's performance, that first movers in IoT gain pioneering advantages. Whilst their study contributes to extant knowledge on IoT technology performance, they do not explore the organisations or workforce capabilities in respect of IoT adoption, which is arguably linked to a firm's performance.

This gap in knowledge is significant because it is important to understand the capabilities of an organisation to assess the full potential for IoT adoption. The lack of research into this area could be due to a lack of access to relevant data, or the complexity of the data itself. Consequently, without further research into the capabilities of organisations, it is difficult to predict the long-term implications of IoT adoption.

To illustrate further, it is suggested that manufacturers increase efficiency by 82% after implementing IoT (Tang, Huang and Wang, 2018). Notably, they do not address how employees of the organisation contributed to these efficiency gains. To address this gap, they could have extended their research to study the capabilities of the organisation. By doing so, the organisation could have gained valuable insight into how its resources contribute to efficiency gains. Such an exploration may uncover underlying positive, negative, or neutral influences, such as skills, behaviour, willingness to adopt, perception, trust, and competence. In addition, such findings may have provided valuable data to this thesis.

This is a qualitative study focusing on strategic level participants, such as senior managers, strategic leaders, directors, and chief executives. It aims to explore and understand what impact this participant group believes IoT has on their organisation. However, to further this study, the research included middle management for thematic analysis and validation. By involving middle management in the initial study, it was possible to gain insight into the impact that IoT has on the organisation from both the senior and mid management level. However, further research involving employees at the operational level may provide an even more in-depth understanding as these respondents

may be able to provide knowledge about the specific factors that are having an impact, and potentially identify any novel themes that have not yet been explored.

19 participants (see Table 3) were recruited from a list of 39 directly approached candidates (see Table 4) based in 19 different countries (see Table 5 and Table 6) on the following 5 continents: North America, South America, Europe, Asia and Australia. Acceptance from 19 of the 39 potential candidates resulted in a final participant list. Participants included senior managers, strategic leaders, directors, and chief executives. The 19 participants worked across 14 companies and were based in the following 13 countries. This included Australia, Argentina, Croatia, Denmark, India, Malaysia, Mexico, the Netherlands, Spain, Serbia, Thailand, United Kingdom, and USA. These companies operate in the chilled beverages industry, supplying cold drinks and chilled food products. 17 of these worked for companies in the chilled soft beverages, alcoholic beverages, and chilled foods sector, whilst 2 worked for companies providing IoT technologies to this sector.

1.3.1.1 **Existing studies on dynamic capabilities and technology adoption**

The existing research on dynamic capabilities and technology adoption tends to focus on specific topics not relevant to this thesis, such as decision making and external forces in high-velocity markets (Daniel and Wilson, 2003). Bottlers in the chilled beverages industry are not in these markets. However, this thesis does examine the external forces affecting the chilled beverages industry. According to Ancarani et al., 2020, there is a lack of IoT research across the business spectrum. They explore an organisation's readiness for technological IoT adoption based on a quantitative study of secondary data. Their research is focused on the type of projects firms undertake when adopting technology or IoT. This thesis differs significantly from their research. Based on a qualitative study, this thesis proposes an IoT adoption framework for organisations in the chilled beverages industry. Moreover, it provides an original contribution to the field as it offers a more comprehensive, holistic framework for IoT adoption specific to the chilled beverages industry.

Similarly, other studies on technology and dynamic capabilities focus on technological aspects (Khalil and Belitski, 2020; Marheine and Petrik, 2021; Shen, Zhang and Liu, 2022) which is somewhat unrelated to the purpose of this thesis. Several studies have focused on the role of technology and dynamic capabilities in business survival (Rashid and Ratten, 2020; Weaven *et al.*, 2021), big data analysis (Wamba *et al.*, 2017; Singh and Del Giudice, 2019; Bahrami and Shokouhyar, 2022) or knowledge management (Sher and Lee, 2004). These studies contribute valuable insights of technology within their specific topics, such studies do not answer the research questions of this thesis with regards to technology adoption and dynamic capabilities.

1.3.1.2 **Why existing studies cannot be applied to this thesis**

A relatively new concept, the Internet of Things was described for the first time in 1999 (Sayar and Er, 2018; Ancarani *et al.*, 2020). Dynamic capabilities were first introduced in 1997 by David Teece (Teece, Pisano and Shuen, 1997). Since then, a series of research studies have been conducted on dynamic capabilities. Some of which are related to the adoption of technology. The existing knowledge of dynamic capabilities and technology adoption cannot be applied in the same context as this thesis. Existing research focuses primarily on the technical aspects of technology adoption, and much research, as indicated above, is focused on specific applications of dynamic capabilities. As a support for this thesis, it is argued that there is a lack of research related to dynamic capabilities and digital transformations (Ellström *et al.*, 2022). It is important to note, however, that their valuable research is primarily focused on organisational reconfiguration, which does not effectively contribute to this thesis. Additionally, most studies in the literature review lack a longitudinal perspective, as they are primarily based on other literature reviews, which is further evidence of the gap in qualitative and case study based research on this topic (see Table 1).

The focus of this thesis is on bottlers in the chilled beverage industry. It is necessary to understand the challenges of the ‘lived’ experience when introducing IoT adoption as informed by dynamic capabilities. This thesis bridges that gap by contributing insight and

knowledge on how bottlers in the chilled beverages industry should approach IoT adoption in their organisation. By following the proposed IoT adoption framework, bottlers will be able to plan appropriately for IoT adoption in their organisation, particularly in respect of IoT enabled commercial coolers. This thesis differs by analysing primary qualitative data from leaders, senior executives, and management from the chilled beverages industry. This is done across many countries and in the context of environmental turbulence. It also contributes by analysing their existing experience of IoT technology. This is done by examining their perceptions, and understanding of the impact their IoT adoption strategy has on the organisation's workforce and their capabilities. As participants are from 14 companies across 13 countries, this may provide cultural and institutional insights.

This thesis specifically explores the way in which bottlers in the chilled beverages industry experience the sense, seize, and transform phases of IoT adoption. It also explores how organisational resources respond to an IoT adoption strategy. It is interested in the organisational adoption of IoT as opposed to the technical capabilities of IoT.

1.3.1.3 **The theoretical gap**

As discussed further in this thesis, this study identifies theoretical gaps in existing knowledge on the topic. It is noteworthy that bottlers within the chilled beverages industry are still relatively early adopters of IoT, particularly regarding IoT enabled coolers. This capability is relatively new, having been available since approximately 2016. Bottlers in the chilled beverages industry began exploratory projects at that time, however due to the Covid-19 global pandemic, they will have experienced a slowdown in progress from 2019 to 2022. This thesis is delivered in the context of a global pandemic, there is scant research on IoT adoption and dynamic capabilities within this context. Through addressing this gap, this thesis was able to establish direct experience from leaders, senior executives, and management regarding their IoT adoption strategies. The purpose of this was to develop a specific IoT adoption framework for the chilled beverage industry.

In this study, qualitative primary data and Gioia methodology are used to interpret the experiences of bottlers in the chilled beverages industry. Moreover, it provides a framework for other organisations in the industry to adopt IoT. In the chilled beverages industry, there is no literature that offers this level of specificity or framework to support bottlers.

1.3.2 MOTIVATION

1.3.2.1 **Motivation for this study of organisational IoT adoption**

The key motivation for this study is to understand organisational IoT adoption within the chilled beverages industry and to create an IoT adoption framework. This study is informed by dynamic capabilities, whilst utilising the Gioia methodology for analysis and interpretation. The COVID-19 modern-day phenomenon provides a context for examining how an organisation might have adapted its IoT adoption strategies. There is a lack of research in this area, and the focus of this thesis is to fill that gap.

The most relevant studies on this topic focus on the technological aspects of IoT technology adoption (Lee and Lee, 2015; Hsu and Yeh, 2017; Li, Xu and Zhao, 2018; Ben-Daya, Hassini and Bahroun, 2019; Akpan, Udoh and Adebisi, 2022). A similar outcome was obtained by extending searches to include technology adoption and organisation. These studies provide evidence of the importance of technology in IoT technology adoption. They suggest that organisations need to focus on understanding the technological aspects of IoT technology adoption to successfully adopt and implement it.

This study extended the literature review to include dynamic capabilities with IoT and technology adoption to understand the extant research of this topic. Similarly, the existing studies focus on factors not beneficial to this study, where the lens is focused on SME survival, dynamic capabilities and digital technology, IT governance and technology (Singh and Del Giudice, 2019; Ancarani *et al.*, 2020; Weaven *et al.*, 2021; Bahrami and Shokouhyar, 2022; Shen, Zhang and Liu, 2022). This illustrates a gap in respect of both

IoT adoption from an organisational resource perspective and through the lens of dynamic capabilities.

These studies have largely focused on the technical aspects of IoT, such as the hardware and software components, as well as the security aspects of IoT. They have not examined the role of organisational resources, such as the availability of skilled personnel, in facilitating the adoption of IoT. They have also not explored the potential of IoT to enable organisations to develop dynamic capabilities, such as the ability to quickly adapt to changing market conditions.

COVID-19 has resulted in strict international and governmental policies, hindering the ability of businesses and organisations to operate on a business-as-usual basis. During a pandemic, organisations must adapt the way in which they engage with their stakeholders, which may include customers, consumers, partners, suppliers, regulators, and their own workforce. With public health a high priority, organisations have had to change working practices and adopt effective strategies to survive during a pandemic, and consequently, in the post-pandemic era. Firms have had to transform their organisations to optimise their own efficiencies and maximise their competitiveness at a national and international level. Covid-19 has had a devastating impact on the world's economy, which is widely anticipated to reverberate in the post-pandemic era.

To be successful in this new business environment, organisations must not only be prepared to adjust to the realities of the post-pandemic landscape, but to also leverage the opportunities it presents. Therefore, this qualitative study explores the impact that the adoption of IoT technologies has on organisations within the chilled beverages industry during the Covid-19 pandemic.

1.3.2.2 **Why explore IoT adoption in chilled beverages industry**

Dynamic capabilities and technology adoption

There are several reasons why the chilled beverages industry and organisational IoT adoption should be explored further. There is currently no research on the IoT enablement of the chilled beverage coolers. This is because IoT adoption and its association with the chilled beverage industry are relatively young. In the world of commercial refrigeration, when it comes to the production of commercial coolers equipped with IoT capabilities, it has occurred in recent years. Further, the manufacturing industry or OEMs that support the bottlers in terms of cooler procurement requirements will also be exposed to new IoT enabled controllers that have recently become available. As such, IoT technology and its applications in the chilled beverage industry are just beginning to be explored and utilised. This offers opportunities for creative innovations, increased efficiency, and significant cost savings.

Arguably, exploring this with OEMs is worthy of, but subject to, a separate study. Further, this study addresses this phenomenon within the context of dynamic capabilities considering shock events such as the Covid-19 pandemic, which is discussed as part of this timely research. To summarise, the extant literature on dynamic capabilities and technology focuses primarily on the technological aspects of adoption (Ancarani *et al.*, 2020; Khalil and Belitski, 2020; Marheine and Petrik, 2021; Shen, Zhang and Liu, 2022). Specifically, this thesis explores IoT adoption from an organisational point of view, rather than from a technical standpoint, by gathering valuable insight from senior executives, managers, and leadership. Arguably, some of these participants may be relatively new to the idea of IoT enabled coolers, their benefits and in turn, how to manage the dynamic capabilities of their own organisations. Therefore, understanding how these stakeholders perceive IoT enabled coolers is essential in order to drive successful IoT adoption.

Dynamic capabilities and external and internal forces

In this thesis, it is argued that internal and external forces influence an organisation's IoT adoption strategy. It is important to note, however, that the types of forces and the extent to which they are applied depend largely on the circumstances of the environment. It was found that bottlers in the chilled beverage industry's IoT adoption strategies were affected by external forces from supplier networks, policy makers, consumers, and retailers. This is supported by extant literature on dynamic capabilities and the tension between internal and external forces (Daniel and Wilson, 2003; Sher and Lee, 2004), in which these forces can impact an organisation's ability to adapt quickly to changing markets. Furthermore, in this thesis, it was found that the influence of external and internal forces is somewhat intensified in the midst of a global pandemic such as Covid-19. However, further research is needed to understand the full impact of the pandemic on organisations' ability to respond and adapt (Hsiao and Tuan, 2022; Martins, 2023). This is needed to align with existing knowledge of the dynamic capabilities of organisations.

Dynamic capabilities and Covid-19

Understandably, a global pandemic such as Covid-19 will impact international and national businesses, most acutely between 2019 and 2022 (Hsiao and Tuan, 2022; Martins, 2023). In this thesis, it was found that this had a negative effect on bottlers in the chilled beverages industry. This had a negative effect on their capacity and pace for the adoption and IoT enablement of their fleet of coolers. This research is timely given that commercial coolers began to have IoT capabilities around 2016. Therefore, this research provides valuable insights as to how the pandemic has hindered the full implementation of IoT enabled coolers in the chilled beverages industry, and how businesses can plan for the impact of future pandemics on the industry.

In support of this thesis, it is suggested that financial support alone is not sufficient to support small and medium enterprises (SME) during a pandemic, and digitalisation or computerisation may play an important role for SME survival, particularly at the

transforming stage of dynamic capabilities (Hsiao and Tuan, 2022; Martins, 2023). However, these studies, one quantitative and the other qualitative were limited to SMEs in one country. The analysis of the dynamic resilience and performance of a firm during the Covid-19 pandemic (Dovbischuk, 2022) validates the findings of this thesis regarding the importance of knowledge sharing and effective training during the transform phase of dynamic capabilities. This suggests the need for further research on a global scale to investigate the impact of knowledge sharing, training, and other dynamic capabilities on business resilience and performance.

Another study on the impact of dynamic capabilities on SME performance during Covid-19 (Dejardin *et al.*, 2022), focused on SMEs sensing new opportunities before and after Covid-19. It was found that the focus shifted from the development of new products for the marketplace to putting existing products on the market after Covid-19. Research such as this is valuable because it explores the organisation's appetite for finding new opportunities. To further develop this thesis, their study would have been useful in examining the organisation's shifting strategies for already sensed opportunities. This would enable them to examine how they proceeded through the stages of seizing and transforming.

Finally, this section explored literature on dynamic capabilities and technology adoption, dynamic capabilities external and internal forces and dynamic capabilities and the impact of Covid-19. There can be no doubt that these valuable studies have contributed to existing knowledge in their respective topics, but they also contribute to the justification for this thesis. Furthermore, their studies provide insight into the SME market, which does not necessarily provide the same results and findings as those found in this thesis. This is because the study participants in this thesis work in mainly international or global organisations, the uniqueness of the bottlers and their interrelationship to other parts of the chilled beverage industry, the relatively newness of IoT enabled coolers, the perspective of leaders, senior executives and senior managers in this industry, and the focus on how organisations adopt IoT.

This underscores the relevance of this thesis. It provides valuable insight into the key components and factors that influence adoption of IoT in the context of the chilled beverage industry.

1.4 RESEARCH AIMS AND OBJECTIVES

The thesis aims to develop an IoT adoption framework and answer the following questions.

1. In what way can senior executives within the international chilled beverages industry prepare for effective organisational IoT adoption?
2. In what way is the chilled beverage industry organisation's IoT adoption strategy informed by dynamic capabilities?

This thesis contributes to existing knowledge by identifying a strategic approach to effective organisational IoT adoption and by delivering an IoT adoption framework. This study aims to explore and discuss the impact on an organisation’s capabilities in the adoption of Internet of Things (IoT) technologies within the chilled beverages industry, and within the context of a global pandemic.

Furthermore, this study produces an IoT adoption framework to assist organisations, practitioners, and academics to explore the dynamic capabilities of organisations (Teece, 2012, 2014, 2016) and their potential business models for the adoption of IoT technologies in the context of a global pandemic.

This research explores how the dynamic capabilities (Teece, 2018a, 2018b) of national and international businesses affect the organisational adoption of IoT during a global pandemic. Within this context, existing research is limited, and this thesis aims to bridge this gap by way of a qualitative study, interviewing key stakeholders within the chilled beverages industry. Selected participants were responsible for digital transformation

initiatives within their organisations. They were engaged specifically in IoT adoption initiatives, working in global enterprises and across multiple continents.

This study is important because it will provide insight into the processes and technologies that are driving digital transformation in the chilled beverages industry. It will also shed light on the challenges that organisations are facing in terms of implementing IoT solutions and the strategies they are using to overcome them.

In the context of this study, the focus is on the understudied topic of IoT adoption in the chilled beverages sector. Arguably, the dynamic capability of an organisation becomes ever more critical due to modern day unprecedented global events, such as the Covid-19 pandemic. Organisations and their employees must be able to identify, enable and deliver IoT transformation rapidly to survive. The nature of the chilled beverages industry lends itself specifically to IoT transformation due to the various operational practices described in this chapter. Existing knowledge in IoT transformation focuses on the capability of technology or digitalisation but does not take into consideration the role of an organisation's workforce capabilities in the successful adoption of IoT technology (Soluk and Kammerlander, 2021; Li *et al.*, 2022). There is a gap in research in this specific use case, and within the context of both a global pandemic and dynamic capabilities.

This gap in research is especially pertinent given the shift towards remote working. This is because it is the need for organisations to understand how to effectively leverage the capabilities of their workforce in the successful adoption of IoT technologies. As such, research is needed to understand how organisations can leverage their workforce capabilities to efficiently leverage IoT technologies during a pandemic.

The relationship between dynamic capabilities and new technology adoption is often focused on the firm's perception of technological capability to guide or determine an adoption decision (Graham and Moore, 2021). An extension to the existing state of the art research includes studies on adoptive management innovation technological decisions and the role of dynamic capabilities (Lin et al., 2016). This study utilises the theory of dynamic capabilities to specifically understand IoT adoption and the impact on an

organisation during a global pandemic. As a result, the creation of an IoT adoption framework contributes to the existing state of the art knowledge in this understudied topic.

Furthermore, this research includes international organisations where, arguably, results are enriched by cultural and institutional values at local and national levels.

Such values lead to greater diversity in the results, and the potential for more comprehensive and meaningful findings.

As discussed above, the overall aim of this research is the production of an IoT adoption framework within the context of dynamic capabilities and a global pandemic. To achieve this, the thesis will focus on and answer the following objectives.

1.4.1 Study objective 1: examine IoT adoption strategy of chilled beverages industry

To critically examine the IoT adoption strategy within the chilled beverages industry from the view of leaders, senior executives, and management, informed by dynamic capabilities, and within the context of environmental turbulence, such as the Covid-19 pandemic. This was completed by conducting online semi-structured interviews with 19 participants, from 14 companies across 13 countries, and subsequently transcribing, coding, analysing, and evaluating interview results. The interviews were held with those in executive, strategic or management roles.

The purpose of this objective is to identify suitable candidates within the chilled beverages sector at senior, executive and middle management level. These candidates participated in semi-structured interviews to explore their experience of IoT adoption. Participants were selected based on their involvement in IoT deployments within their business. 19 senior executive, strategic or management level candidates participated by attending remote (Zoom, MS Teams) video interviews, which were transcribed, coded, and analysed using computer assisted qualitative data analysis software (CAQDAS) and the Gioia methodology.

1.4.2 STUDY OBJECTIVE 2: DEVELOP AN IOT ADOPTION FRAMEWORK

To develop an IoT adoption framework to prepare organisations for effective IoT adoption informed by dynamic capabilities.

Driven by the literature review, methodological approach, research philosophy and resultant analysis of the semi-structured interviews, an IoT adoption framework was derived to support practitioners and researchers to further explore this topic.

1.5 METHODOLOGICAL DIRECTION

The purpose of this qualitative research is to explore, understand and expand knowledge of IoT technology adoption and its impact on an organisation's workforce and dynamic capabilities. This is in the context of a global pandemic. A particular focus is the inclusion of participants in senior executive and middle management positions holding responsibility for IoT technology adoption within their organisations. Furthermore, due to their seniority and ownership of strategic IoT initiatives, these participants have a vested interest in the successful execution of their organisations IoT strategy.

A multiple-case qualitative approach guided this research. Beginning with a qualitative study following the interpretative approach (Collis and Hussey, 2013), which included semi-structured interviews with strategic leaders, senior executives, and managers. It informed the development of an IoT adoption framework that reflects the theory of dynamic capabilities. An evaluation of research paradigms and genres was undertaken to identify an approach suitable for this study, resulting in the adoption of Gioia’s grounded theory.

Data gathering was drawn from 19 in-depth, online interviews (due to pandemic related social distancing policy), which were audio or video recorded, transcribed, coded, categorised, and analysed. Interviews were semi-structured in design and held with senior

management, strategic leaders, directors, chief executives, and middle managers actively involved in digital transformation, specifically focusing on the organisation's adoption of IoT. Participation in semi-structured interviews lasted between 40 and 60 minutes. For verification, saturation, and extension, interviews with middle managers supported the validation and robustness of the results and framework derived from this qualitative study. Furthermore, the adoption of the preferred Gioia methodology provided a clear process for the robustness of the interview analyses phase. The researcher developed prior knowledge and background of the participant organisations, to better understand the participants' role within their organisations and their views of the business.

This PhD research will be structured in several parts.

Part 1: Provide the research introduction, set the context of this thesis, including background, motivation, research gap, thesis aim and objectives, and thesis contribution.

Part 2: A qualitative study with literature reviews on IoT technology adoption, dynamic capabilities, associated theories, and competitiveness. Finally, describing the methodology and findings of this thesis.

Part 3: To describe the completed semi-structured qualitative interviews and analysis using CAQDAS and Gioia methodologies.

Part 4: To present the findings and conclusions of this research and the contribution of an IoT adoption framework. This approach requires the collection, coding, and analysis of qualitative data (Molina-Azorin *et al.*, 2017; Saunders, Lewis and Thornhill, 2019, p. 181). Qualitative content and thematic analysis ultimately informed this research for the creation of an IoT adoption framework.

1.6 SIGNIFICANCE OF THIS STUDY

The contribution of this research is primarily twofold: theoretical and practical.

The main contribution of this study is to produce an IoT adoption framework for businesses, practitioners, and academics to further expand knowledge on this understudied topic. This new model considers the extraordinary event of a global pandemic and its associated business challenges.

Theoretically, this research will help in the creation of relevant theoretical reference models to assist future researchers wishing to contribute to this subject matter. This will enable them to devise a theory of IoT technology adoption for organisations. The study should also provide valuable insight into the impact of adoption of IoT in organisations within the context of a pandemic. The results of this thesis offer a base for researchers and others to engage in further studies to extend the collective understanding of this topic.

Practically, this research will collect, record, and analyse the experiences of those charged with the strategic delivery and deployment of IoT technologies within their organisation. In doing so, this research will contribute empirical evidence to assist in the further understanding of this topic. Expected and unexpected contributions may be evidenced, in this multiple case study, due to the geographical spread of organisations and participant diversity. Participants are from many different countries with differing cultural and institutional values. Finally, this research will explore the impact of the Covid-19 pandemic on organisations' adoption of IoT.

Furthermore, the findings of this research may be useful to identify best practices for businesses to navigate the challenges associated with deploying IoT during uncertain times.

1.7 STRUCTURE OF THESIS

Chapter 1: The introduction of this thesis provides a background to this research and the reasons for undertaking this study, specifically in the chilled beverages sector. It identifies a lack of existing research on this topic and that there is a gap in research that this study will address. This chapter presents the motivation, aims, objectives, and specific research question addressed in this study. Specifically, the research question has two objectives. One is to explore IoT adoption and organisational capabilities from the perspective of participating strategic leaders and senior managers. Secondly, to develop an IoT adoption framework informed by dynamic capabilities in the context of a global pandemic. Finally, the methodological approach is described, followed by the contribution of this thesis to an understudied topic.

Chapter 2: This chapter is primarily focused on the literature reviews conducted in relation to this thesis. Since the term IoT was coined in 1999 by Keven Ashton (Sayar and Er, 2018; Ancarani *et al.*, 2020), it was not necessary to extend search dates before this with the terms IoT or Internet of Things. Literature reviews were extended to explore themes of this research including but not limited to dynamic capabilities, and other associated theories such as absorptive capacity, open innovation, long range planning, competitive advantage, innovation, collaboration, self-determination theory and change management. Material collection, review methods, tabulated literature for comparisons, and discussions about review results are offered to demonstrate the gap in literature in respect of this thesis topic. Various models are reviewed, discussed, and rejected with the exception of dynamic capabilities as this offers the preferred and appropriate framework to inform this research.

Chapter 3: This chapter describes the methodological approach adopted throughout this thesis. It offers a rationale for studying IoT adoption within the chilled beverages sector and how IoT technology adoption in these organisations is informed by dynamic capabilities theory. The researcher's philosophical assumption is based on a pragmatic approach, using techniques offered by following a qualitative content analysis or thematic

analysis strategy. To support this, an exploration of grounded theory was undertaken identifying suitable techniques, without the emphasis on new theory building but with a preference for the Gioia methodology. This method utilises an inductive or qualitative research method for this research. It describes the participant selection process, interview questions and designs. Finally, the ethical considerations that must be made are discussed in this chapter.

Chapter 4: In this chapter the findings, data analysis conducted, and research methodologies are presented, particularly the subsequent CAQDAS analysis. Concepts, themes, and dimensions are derived from the Gioia methodology. The key themes of capabilities, leadership, competitiveness, and awareness are derived from a coded analysis. Also, in this chapter, findings from interviews include participant responses to their intended IoT adoption strategy pre and post Covid-19. The case studies were tabulated, and interview comments were categorised into the dynamic capabilities' phases of sense, seize and transform.

Chapter 5: In this chapter a discussion on the theoretical and managerial implications is offered and an IoT adoption framework informed by dynamic capabilities and in the context of a shock event such as a global pandemic.

Chapter 6: This chapter provides a conclusion and implications of this research with suggested future research and identified limitations of this study.

2 LITERATURE REVIEW

2.1 INTRODUCTION TO CHAPTER 2

In the previous chapter, it was suggested that there are challenges for organisations in the adoption of IoT technologies. It is hypothesised that non-technical issues are under-considered, which may influence the success or failure of an organisation's IoT adoption strategy.

To explore existing knowledge of the capabilities of an organisation's workforce and the implementation of organisational IoT adoption, a literature review was undertaken. It explored several theoretical areas and explained them more fully in this thesis. It included adoption of IoT technology, flavours of dynamic capabilities, research on organisational competitiveness, and finally aspects related to motivation and change management. It was found that there is a lack of research supporting IoT adoption informed by dynamic capabilities theory.

This literature review is divided into several parts. The initial literature search focused on and thoroughly assesses IoT adoption, its impact on workers, and the organisation's dynamic capabilities. As the term IoT was first coined by Kevin Ashton in 1999 (Sayar and Er, 2018; Ancarani *et al.*, 2020), this was used as the starting year for searching terms relating to IoT adoption as it is unlikely peer reviewed research will exist before this date.

For completeness, an extended literature review was undertaken substituting the term, and variations of ‘IoT’ with the term ‘information systems’ (IS). This was completed to discover whether any technology related literature paired with the organisations workforce and capabilities was in existence. Searches dated as far back as 1990. Since the term IoT was coined in 1999, interchanging various terms for IoT with the term information systems was intended to unearth similar literature that could explain this studied phenomenon. A sample of journal articles and conference proceedings has been tabulated for reference (see Appendix I).

Furthermore, a literature review was conducted on IoT technology adoption, an organisation's dynamic capabilities and other related theories, and models of competitiveness. To explore further a review of popular models that may be beneficial to this study was undertaken, which critically examines dynamic capabilities, absorptive capacity, open innovation, and long range planning. Beyond this, an examination of popular theories on competitiveness, motivation, management, and technology acceptance was undertaken. A series of models were considered for inclusion in the outcomes of this thesis, including self-determination theory, change management and technology acceptance.

Finally, a description of the methods for material collection, analysis and findings is offered.

2.2 IoT ADOPTION

The purpose of this literature review is to rigorously examine the extant knowledge of IoT adoption and the role of an organisation's workforce and its capabilities. It is hypothesised that there is a lack of literature in this regard, and that most research is focused primarily on the technological aspects of IoT. In this chapter, the material collection and methodology for IoT adoption is described. For completeness, this literature review was extended to include a search for research utilising the term 'Information systems' to replace 'IoT' or 'internet of things'.

This literature review illustrates that there are many studies on IoT focusing on topics such as technological adoption, security, applications, trends, architecture, and the future of IoT. However, few studies have focused on IoT adoption and the role of an organisation's resource capabilities, or how this affects employee behaviour, adoption rate, perception, competence, and trust. Parts of this literature review will not have reference to the impact of Covid-19 on organisational adoption of IoT, as this research began prior to the Covid-19 pandemic. In this study, however, this topic will be explored as it relates to both the pre- and post-Covid-19 pandemic eras.

The result of this literature review finds that the extant Internet of Things (IoT) literature has been focused on the technology of IoT, suggesting a lack of studies on managerial issues (Lee and Lee, 2015; Hsu and Yeh, 2017; Li, Xu and Zhao, 2018). Illustrations of this shortfall are demonstrated throughout this literature review, with examples of how this thesis attempts to close this gap. These limitations collectively underscore the need for a more nuanced and balanced approach to studying the impact of organisational IoT adoption and dynamic capabilities. The research gap becomes ever more evident in the absence of studies that comprehensively explore this topic within the context of environmental turbulence.

The adoption of IoT technologies will arguably have a significant impact on an organisation's operational performance (Brous, Janssen and Herder, 2020) who completed a study on how the implementation of IoT impacts organisational workforces and the potential of IoT to address both staff shortages and in reducing costs and improving competitiveness. Similarly, Akpan, Udoh and Adebisi (2022) research focuses on the use of state-of-the-art technology to improve both operational and commercial performance. These studies focus on the technology of IoT and its technological benefits rather than questioning how IoT impacts an organisation's capabilities and workforce. In other words, they discuss the technology and its application, but do not share any insights into the workforce or organisational capabilities.

For IoT data to be accepted by asset managers, a variety of barriers such as trust and acceptance still need to be overcome (Brous *et al.*, 2017; Alraja, Farooque and Khashab, 2019). In this thesis, 'awareness' is observed and examined, which is derived from IoT robustness, trust, capability, and benefits, relating to human experiences rather than pure technological factors.

Establishing dynamic capabilities requires appropriate resourcing and upskilling resource capabilities which are essential in the seize and transform stages of the dynamic capabilities model. Participants contributing to this thesis were able to share where they believe transformation occurs due to efficiency gains and improved capabilities.

This is because the dynamic capabilities model seeks to create an environment conducive to the learning and development of resources, meaning that the individual capabilities of the resources need to be kept up to date, and the resources must have the right knowledge and know-how to be able to effectively execute the changes needed for the transformation.

Another study on IoT-based employee performance technology, resulted in improved employee satisfaction (Kaur and Sood, 2017). It is evident that effective leadership skills are essential to the adoption of IoT technology. This thesis thoroughly analyses the sense and seize stages of dynamic capabilities. These are where adoption of IoT technology is challenged due to lack of leadership, execution, and communication.

In another study, Tang, Huang and Wang (2018) closely inspect secondary data that explores enterprise adoption of IoT technology. Sengupta and Abdel-Hamid (1996) suggest that the introduction of unreliable information can have a negative effect on employees, denting trust and consequently delaying or faltering potential adoption rates. For these reasons, it was imperative that this thesis included primary qualitative data.

In a recent study, Brous, et al. (2017) discuss IoT and highlight that adoption remains low, despite the availability and enhancement of IoT technology. Arguably, there are underlying operational factors not explored in their study, which may have resulted in low IoT adoption rates.

In another study, it is suggested that operational gains are possible with the introduction of IoT (Ben-Daya, Hassini and Bahroun, 2019). However, these studies do not examine whether the organisation's workforce was required to adapt to changing processes and develop new skillsets or capabilities to deliver such gains. Although IoT contributes to operational gains, they emphasise its technological benefits. It is therefore unclear what impact the employees of the organisation may have had on adoption levels. It is suggested that extending these studies to explore the utilisation of primary data within the context of dynamic capabilities, would be beneficial to further understand an organisation's existing capabilities. If in their study, they had utilised primary data within the context of dynamic

capabilities, they may have recognised the organisations workforce impact on IoT adoption.

In a study it was found that IoT adopters have higher performance and market value than non-IoT adopters (Hitt and Brynjolfsson, 1996; Devaraj and Kohli, 2003). Furthermore, first movers have pioneering advantages, profitability, labour productivity advantages and the ability to allocate resources and labour (Tang, Huang and Wang, 2018). However, in these studies there is no evidence of research demonstrating a direct relationship between the adoption of IoT and workforce influence or capabilities. Furthermore, these studies were not conducted within the context of dynamic capabilities or impacted by a global pandemic. This thesis bridges this gap by thoughtfully examining the relationship between IoT adoption, dynamic capabilities, and the Covid-19 global pandemic.

As a result, this research provides an excellent opportunity to understand the impact of IoT on workforce capabilities and performance under conditions of environmental turbulence. Moreover, it may provide insight into how organisations can use IoT to enhance their workforce capabilities and performance, both in the short and long term.

Other studies include the impact of IoT on global trade (Sousa, 2018). Businesses that adapt to develop innovations in products and services to disrupt markets might resolve to change their own processes, capabilities, structure, and pace. Wortmann and Fluchter (2015) suggest that strategic level executives are now forced to evaluate the opportunities and threats that the emergence of IoT might present to their companies. With this in mind, a close examination of changes in workforce capability and roles is warranted, especially at the transformative stage of dynamic capabilities theory. Arguably, this assertion is even more significant during a global pandemic. Considering this, this thesis thoroughly explores the implications of these factors with senior executives, especially during a pandemic and considering the context of dynamic capabilities.

In a recent study, it was suggested that diversification of the supply chain (compute, storage, or delivery platforms) will ensure business continuity (Bremner, 2015). Bremner’s assertion implies companies are finding ways to become more competitive. This has implications for an organisation's processes, structure, and resources. An extension of

this thesis could explore competitiveness at a deeper level during this transition. This may result in valuable insights into how an organisation is impacted and responds to IoT technology adoption during a pandemic.

Conversely, a study investigating impediments blocking IoT adoption found hurdles such as cost, security, standards, and protocols, as well as human capital barriers. These include insufficient IoT-oriented training, education, lack of IoT specialists, and skill shortages to operate IoT applications (Brous and Janssen, 2015). In this thesis, a thorough analysis identified that a lack of knowledge and capabilities is due to insufficient IoT-oriented training, education, lack of IoT specialists, and skill shortages to operate these applications.

The importance of the role of capabilities on this topic is abundantly clear, as demonstrated in the following studies. Improving the performance of an organisation's resources via the introduction of technology is evidenced in a study that eliminates the procurement of expertise. This allows an organisation to reduce costs by improving the capabilities of its own resources. The right training and learning conditions accompanied by technological support can reduce the perception of complexity and insecurity for users (Chenthamarakshan *et al.*, 2010). It is suggested that studying the capabilities of the workforce, the 'new normal' due to disruptive technologies such as IoT (Kamal, 2020), and how this may be impacted by the introduction of IoT technologies would yield valuable insights.

Thus, the need for further research into the implications of IoT on the workforce is apparent. A deeper understanding of the changes brought by disruptive technologies is essential to ensure the success of the organisations. It is evident that workforce trust and capabilities are significant factors in this (Grant and Higgins, 1991; Hamidi and Fazeli, 2018). These studies indicate that workforce trust, competence and cooperation are likely to be impacted by the introduction of technology or IoT. To improve the adoption of IoT, it is necessary to improve expertise, training, and skills. Invariably, these will have an impact on an organisation's workforce and capabilities in one form or another, a further indication of the significance of research into this understudied topic.

Increasingly digital transformation technologies in industrial internet of things (IIoT) promise improved productivity but require the formulation of new competencies (Akpan, Udoh and Adebisi, 2022). However, there is limited research determining how competence profiles impact digital transformation and contribute to the success of firms. A study of IoT adoption during Covid-19 and through the lens of dynamic capabilities may yield insights into productivity and competence.

To better understand the relationship between IoT adoption, dynamic capabilities and productivity, further research is needed to explore how competence profiles affect digital transformation initiatives.

2.2.1 MATERIAL COLLECTION AND SELECTION

Journal Articles were collected from well-established academic databases including, Scopus, EBSCO, Science Direct, Emeralds and IEEE Xplore (see Table 25). Search terms used to seek suitable journal articles were as follows:

- IoT + employee impact
- IoT + employee performance
- IoT + workforce
- IoT + human resources

The selected search terms were chosen for their relevance to the research question, therefore combining terms relating specifically to the technology in question, IoT coupled with terms representing the human aspect, such as workforce, employees and human resources. These were deemed conducive to generating the most relevant journal articles list. To further enhance results, the search terms were widened by substituting the prefix search word ‘IoT’ with suitable alternatives to create new pairings. These terms included ‘Internet of Things’, ‘M2M’, ‘machine to machine’, ‘IIoT’, ‘Industrial Internet of Things’, ‘Web of Things’, ‘IoE’, ‘Internet of Everything’ and ‘Industry 4.0’. The term ‘IoT’ was first coined by Kevin Ashton in 1999 (Sayar and Er, 2018; Ancarani *et al.*, 2020). The search period was therefore limited to journal articles dating from 1999 onwards.

There were 2,119 journal articles returned from all IoT-related searches. Journals were eliminated from review where the resultant titles presented little evidence that the articles were suitably relevant to the research question. Papers were subsequently eliminated where the article title or abstract contained no evidence of research related to this topic. This included particular references to IoT with or without key words resultant from the combined searches. The remaining 85 journal articles were reviewed at title and abstract level for suitability, evidenced by the presence or indication that the research had some focus in relation to the research question, in particular terms such as 'performance' 'human resource', 'workforce' or a tenuous indication within the subject title that the human impact was considered within the research article. This filtering resulted in a total of 48 journal articles that were considered relevant, and ultimately referencing 32 as part of this literature review (see
Figure 4). The criteria for reducing the reviewed articles from 48 was based on a deeper review of the article abstract, introduction and conclusion for contextual evidence relevant to this topic. This resulted in 32 relevant papers for inclusion into the literature review.

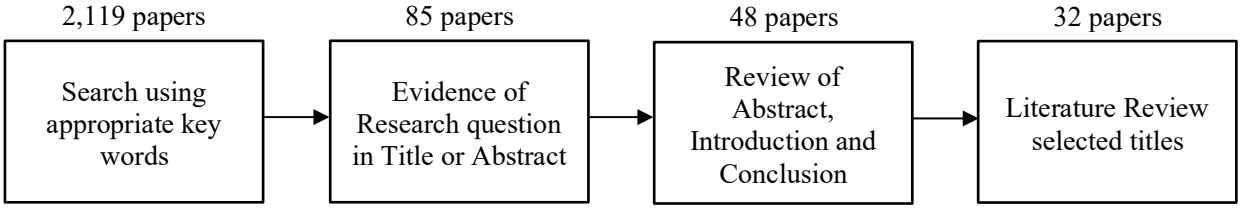

Figure 4: Literature Review Search: IoT 1999-2020

Most journal articles reviewed were published between 2015 and 2019 (see
Figure 5). The proposal for this study was conducted in January 2019, at the time of article selection. The most relevant papers will have been published during or before 2019. However, additional searches for relevant literature was conducted periodically, for journal articles up to the year 2023, findings of these are discussed further into this thesis.

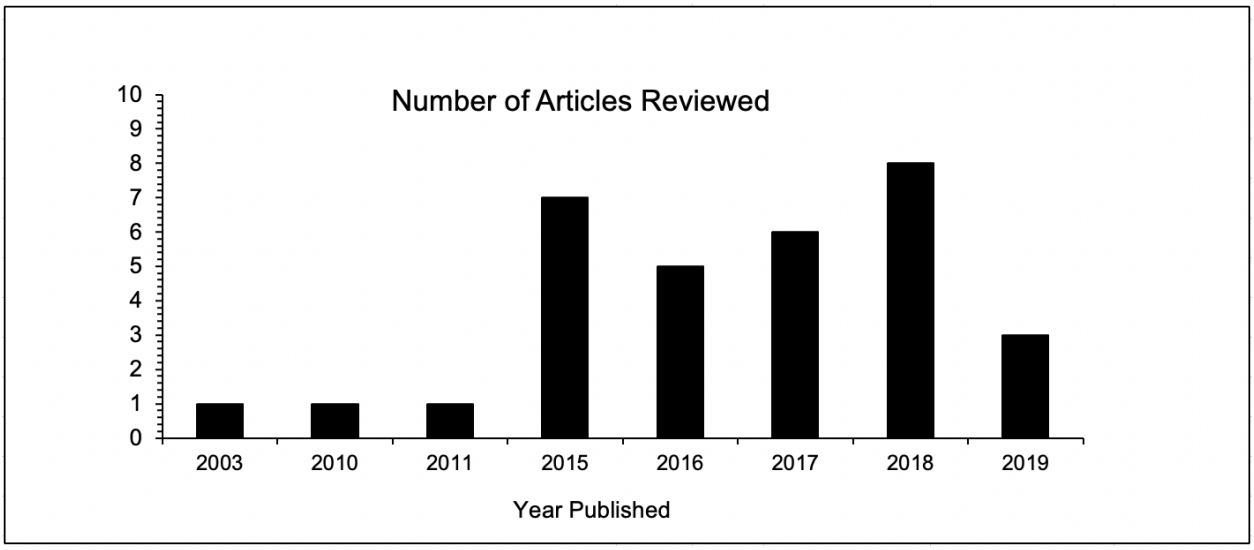

Figure 5: Literature review of IoT articles by year published

Due to the limited research articles related to IoT and this research, it was necessary to broaden the literature review search in technical terminology. The term Information Systems is widely used in the context of technology utilisation in a wide variety of organisations. The term 'information systems' was adopted in place of 'IoT' and paired with the previously used terms for consistency.

The extended search terms used to seek suitable journal articles were as follows:

- Information systems + employee impact
- Information systems + employee performance
- Information systems + workforce
- Information systems + human resources

There were 749 journal articles returned in all 'Information Systems' related searches dating from 1990 – 2019. These were found in well-established academic databases, already mentioned, such as Scopus and IEEE Xplore. Journals were eliminated from review where the resultant titles presented no evidence that the articles were suitably relevant to the research question. Using the same approach, a search for evidence of Information Systems technology adoption, combined with the aforementioned key words was conducted. 28 papers were selected based on content that could be related to this

topic, in the title or abstract. A subsequent deeper review of the abstract, introduction and conclusion, revealed 21 potential papers for inclusion, of which 10 were selected based on a final full review of these articles (see
Figure 6).

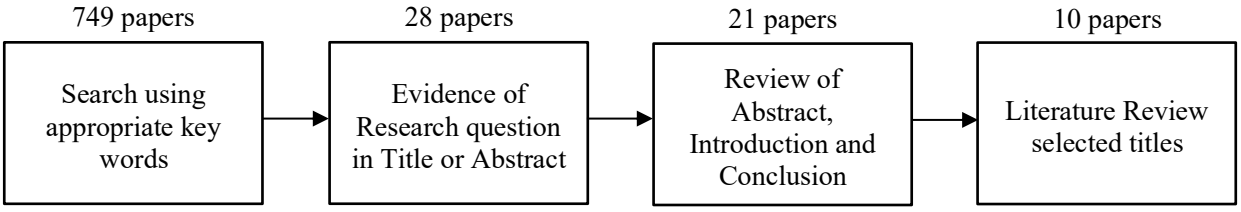

Figure 6: Literature review search: information systems from 1990 to 2020

Of the 10 selected journal articles based on 'Information Systems', 2 articles were published in 1991. The remainder published between 1992 and 2019 (see Figure 7).

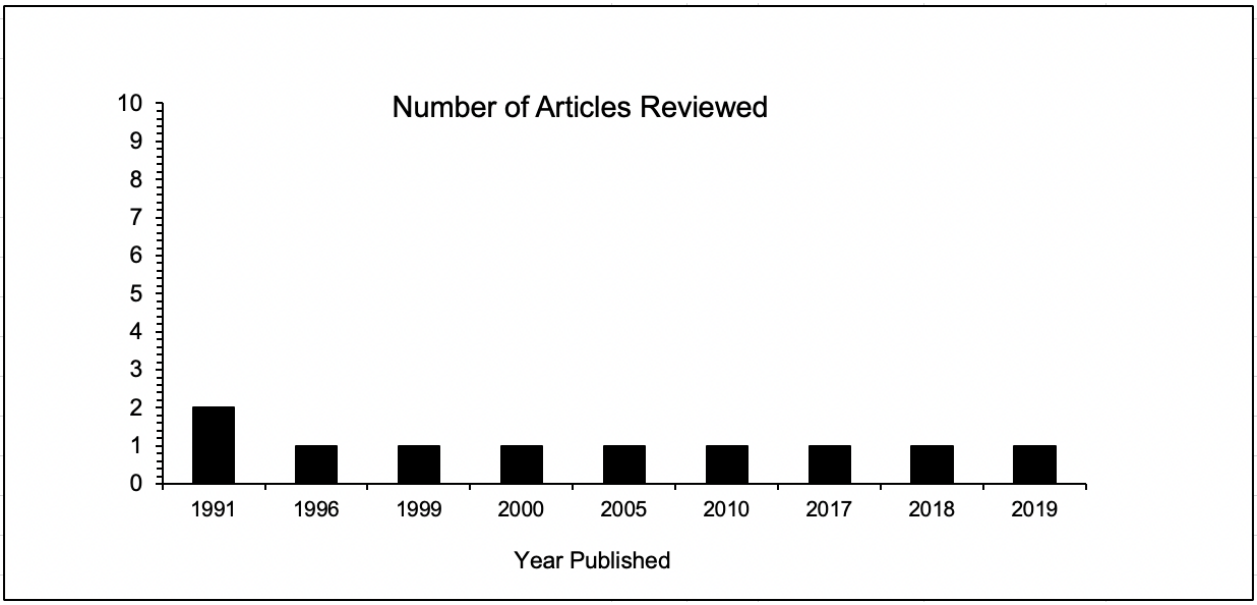

Figure 7: Literature review of information systems articles by year published

The purpose of extending this literature review search terms to Information systems was primarily to source published articles that are not limited in date range as is the case with search terms on IoT limited to 1999 as the earliest date. This is because the term internet of things was coined in 1999 by Kevin Ashton (Sayar and Er, 2018; Ancarani *et al.*, 2020).

This literature review resulted in studies on monitoring employee performance (Grant and Higgins, 1991), research on reward systems (Sankar *et al.*, 1991), or issues with information systems project costs and overruns (Sengupta and Abdel-Hamid, 1996).

2.2.2 ANALYSIS OF LITERATURE REVIEW

A list of journal articles was reviewed and categorised into a total of 4 variables (see Table 1). These are capabilities, leadership, competitiveness, and awareness. These variables were relevant as they offered insights into this topic where adoption of the Internet of Things occurs within an organisation. It is important to note that 'capabilities' refers to the capabilities of the organisation and the performance of its workers.

‘Leadership’ is a studied variable as the performance of an organisation and its workers inextricable link to the effective leadership of an organisation. Where it is expected to find successful IoT adoption, efficiency gains and process changes driven by strong leadership.

‘Awareness’ is a crucial variable to examine, as where the adoption of any technology is concerned, the organisation must be agile enough to not only identify opportunities but indicate the level of awareness an organisation has of IoT as a concept. The organisation's employees will be impacted by these opportunities, such as up-skilling or the identification and development of new skills and capabilities demanded by these opportunities.

The ‘Competitiveness’ variable is part of this study as it is anticipated that technology adoption must have an impact on an organisation's financial performance. This includes commercials, budgets, profitability, cost of adoption and return on investment. Variables studied will invariably result in an impact on the organisation's capabilities and its adoption of IoT technologies.

Arguably, capabilities is the focus on organisational related factors such as employee performance, skill sets, knowledge, motivation, perception, enthusiasm, communication, cooperation, and behaviour. Leadership refers to an organisation's ability to ensure vision, execution, operational efficiency, financial performance, work practices, processes, and procedures. Competitiveness relates to commercial aspects such as sales, revenue, competition, marketing, costs, innovation, and efficiency.

Arguably, competitiveness has a significant interest and focus from the executive management team, responsible for the strategic direction and financial performance of the organisation. It is anticipated that although this study is focused on organisational capabilities and adoption of IoT, executive level participants are likely to explore the commercial aspects of IoT adoption during semi-structured interviews. As in the earlier listing, ‘capabilities’ also refer to training, knowledge, qualifications, experience, and skills available within the organisation.

This is because executives need to ensure that the organisation has the resources available to implement the IoT, such as the technical and financial capabilities to purchase and install the required hardware and software. They also need to ensure that the organisation has the right personnel with the right skills, knowledge and qualifications to use IoT effectively.

As shown in Table 1, this study compares its proposed research with articles from the literature review. It explores this topic fully, across the 4 studied variables. This is followed by a further categorisation of articles by their strategic and operational importance.

The literature review, although relevant in places, does not cover the entire span of variables that were studied in this thesis (see Table 1).

For clarity, the column ‘Focus’ stipulates whether a research article was focused on either the Internet of Things/Industrial Internet of Things (IoT or IIoT) or Information Systems (IS). ‘Studied Variables’ signifies the key content within each article, and ‘Themes’ illustrates whether the article includes research at the strategic or operational levels of an organisation.

	Focus		Key Factors				Themes					Article Summary				
Article	**IoT**	**IS**	**Capabilities**	**Leadership**	**Competitiveness**	**Awareness**	**Strategic**	**Operational**	**Adoption**	**Environmental Turbulence**	**Dynamic Capabilities**	**Research Objective**	**Models used**	**Technology adoption factors and conclusion**	**Recommendation**	**Type of Study**
This Study	**X**		**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**					Qualitative
Ahlborn et al. (2010)	X		X	X	X		X	X								
Akpan, Udoh and Adebisi (2022)					X				X	X		SMEs in EMDEs challenges in adoption advanced tech and enhance comp advantage		Advance tech not readily available in EMDEs. SME non adoption due to pandemic and community lockdown. State of art tech imperative to maintain competitive advantage. Covid-19 encourage new generation of entrepreneurs to lead industrial revolution	Develop new business models	Literature review
Alraja, Farooque and Khashab (2019)	X		X	X		X		X	X			Attitudes towards using IoT technologies, security, privacy and trust in IoT	TAM, structural equation modelling (SEM)	Security, privacy and familiarity affects users trust in IoT. Level of risk perception affected users' attitudes	Improve sophistication of security and privacy embedded in IoT devices and applications, and/or design high quality awareness programmes	Quantitative
Amis and Greenwood (2021)				X					X	X		Implementing change in a covid context. exploring interests and values and organisation change in context of pandemic and impact of less well-off compared to wealthier counterparts	Change management models	Implementing change in a covid context is complexed.	Study links between values, interests, and dynamics of radical change	Literature review

Aono et al. (2016)	X			X				X									
Archetti, Giordani and Candelieri (2015)	X					X		X									
Belanger (1999)		X	X			X	X										
Ben-Daya, Hassini and Bahroun (2019)	X			X	X		X		X			Adoption of IoT in supply chain management	Business models	Security and privacy, interoperability are barriers interoperability	Modelling and optimisation in different application areas. Lack of models in supply chain IoT to be addressed	Literature review
Bremner (2015)	X						X					UK establishing leadership role in IoT adoption and sensor instrumentation		Imperative that UK take leading role and capitalise on IoT adoption	Phased modelling	
Brous and Janssen (2015)	X			X			X	X	X								
Brous et al. (2017)	X			X	X	X	X					Explore implementation factors for adoption in asset management organisations		Organisations experimenting with data sources, IoT adoption requires IT infrastructure, data management and sound data governance	Address dominant impediments, and address in concert	Systematic Literature review
Brous, Janssen and Herder 2020	X			X					X			Analyses IoT adoption by organisations and identifies IoT benefits and risks		IoT offers greater benefits than purely operational. Insights for pre-emptive actions. Identify risks, Org structure and conditions required.	Consider risks, trust, security, etc. Org conditions, IoT capabilities, governance, etc. make structural changes, business processes, new roles, comms, etc.	Systematic Literature review

Chenthamarakshan et al. (2010)		X	X		X	X	X					Deployment of IT practitioners in IT service organisations		Not always possible to make perfect matches	Cross training, rotation, etc to minimise skill gaps and underutilised resources	
Coombs et al. (2016)	X		X	X				X								
DeFranco, Kassab and Voas (2018)	X					X	X									
Del Giudice and Della Peruta (2016)	X		X			X	X									
Devaraj and Kohli (2003)	X			X	X		X					Relationship between investment and IT resources and technology		Actual usage of technology is driver of IT impact rather than investment	Develop comprehensive framework	Literature review
Diab-Bahman and Al-Enzi (2020)			X			X				X		Impact of Covid-19 on work practices		Workforce enjoy new flexibility of hybrid working, employee expectations changing, identifiable benefits of hybrid working	Suggest qualitative study for comprehensive approach and data integrity, answer limitation and experience bias	Survey
Erfanmanesh and Abrizah (2018)	X					X	X									
Grant and Higgins (1991)		X	X			X	X		X			Technology usage to monitor employee performance	Causal model	Employees not opposed to tech, but invasive electronic surveillance	Recommend series of appropriate strategies for acceptable monitoring	Quantitative and qualitative data
Hamidi and Fazeli (2018)	X		X				X					Ontology based design methodology for rehabilitation using intelligent systems in IoT	Fisher-pry model (prediction)	IoT can help rehabilitation using intelligent systems	Fisher-pry better than Gompertz model	Ontology
Harris, Wang and Wang (2015)	X			X		X	X	X								

Hentschel et al. (2016)	X					X	X									
Hitt and Brynjolfsson (1996)			X		X							Business value of IT, productivity, consumer value, profitability		IT may increase productivity and consumer surplus, but not necessarily business profits	Model to explore IT's effect on business profitability	Theoretical models
Hsu and Yeh (2017)	X				X	X	X		X			Identify key factors influencing IoT adoption	TOE/DEMATEL	IoT adoption is decision making problem with complex dependencies and interactions. Environment, organisation, and security dimensions.	Further study to include interviews or case studies	Literature review
Kamal (2020)	X								X	X		Impact of Covid-19 and use of advanced IS/IT to avoid disruption and loss of productivity		Academic literature lacking in context of pandemic its productive, disruptive, and destructive impact	Organisations and businesses need to develop robust tech and appropriate capabilities, conceptualise and take human centric approach to adoption	Literature review
Kaur and Sood (2017)	X		X			X	X		X			IoT based employee game-based performance evaluation	Decision making/game model	Correct evaluation of employees positively motivates	Game-based approach motivates and effectively evaluates employee performance	
Kiel et al. (2016)	X				X		X									
Lee and Lee (2015)	X			X		X	X		X			IoT technologies essential for successful IoT-based products and services	Conceptual model,	Scarcity in IoT studies on social, behavioural, economic and managerial aspects.	Challenging for companies to make informed decisions	
Li, Xu and Zhao (2018)	X						X		X			Review 5G IoT enabling technology, trends and challenges	Business models	5G-IoT integrated to emerging 5G techniques into future IoT		Literature review
Liao et al. (2017)	X			X		X		X								
Madakam et al. (2015)	X					X	X									
Metallo et al. (2018)	X			X	X		X									
Narayanamurthy and Tortorella (2021)			X						X	X		Covid-19 work implication on employee's performance, how I4.0 tech affects this relationship	Business models	Covid-19 work implications do impact employees performance	Performance can be improved through digitalisation of service	Survey

															organisations	
Nie et al. (2011)	X		X	X			X	X								
Pauget and Dammak (2019)	X			X		X		X				The impact of IoT on organisations,	Business models	IoT strengthens autonomy, perception, and bureaucratic aspects of organisation	Segment implementation of IoT into 4 segments	Case Studies
Pemberty et al. (2019)		X		X	X		X									
Saarikko, Westergren and Blomquist (2017)	X		X	X				X								
Sankar et al. (1991)		X	X		X		X									
Sayar and Er (2018)	X		X	X			X									
Sengupta et al. (1996)		X		X		X	X									
Sousa (2018)	X		X		X		X					Impact of IoT on global trade activities of multinational companies		IoT is changing manufacturing, energy, agriculture, transportation, and others through human-machine interactions	Develop, design and study new disruptive business and applications of IoT	Interviews and survey
Spottl (2018)	X		X			X		X								
Tang, Huang and Wang (2018)	X				X			X				Impact of IoT implementation on firms' performance	Tobin's q and financial performance	IoT has a positive impact on firms' performance. IoT adopters have higher performance and market value than non-IoT adopters		Secondary data
Tarable et al. (2017)		X		X			X					Investigation of performance gains from crowd work systems		Significantly imperfect characterization of the workers' reputation can be useful to improve the system performance		Systematic Literature review
Wang et al. (2005)		X	X			X	X									
Watson-Manheim, Piramuthu and Narasimhan (2000)		X	X	X			X									
Weber, Butschan and Heidenreich (2017)	X		X			X		X								
Wortmann and Flüchter (2015)	X			X			X		X							
Xu and Zhao (2018)	X					X			X							

Table 1: Literature review studied variables, themes, and existing knowledge

This literature review deliberately questions the extensive relationship between research focused on IoT technology and technical issues, whilst examining the lack of research between IoT technology and managerial issues (Kiel *et al.*, 2016). This is further illustrated by Lee and Lee (2015) who focus mainly on technical challenges, such as security, privacy, trust, data management and data mining. Similarly, Hsu and Yeh (2017) suggest that the biggest blockers to IoT include the organisation, environment, privacy, security, data authentication access control, and client privacy. Much IoT related research thoroughly assesses the impact on security, privacy, trust mechanisms and applications (Li, Xu and Zhao, 2018). Additional searches throughout this research was conducted for more recent journal articles from 1999 through to 2023. Studies on IoT adoption is still plentiful in respect of the technological aspects or future skills required in IoT (Gekara *et al.*, 2019; Tucker, Fixson and Brown, 2020; Li, 2022; Tamvada *et al.*, 2022). These studies are valuable within their topics but do not a contribute to the purpose of this thesis.

2.2.2.1 Capabilities

The adoption of IoT technologies will arguably have a significant impact on an organisation's capabilities and workforce. Pauget and Dammak (2019) completed a study on how the implementation of IoT impacts organisational workforces in the senior care sector. It critically examines the loss of knowledge workers, downgrade of health workers, and the potential of IoT to address both staff shortages and in reducing costs.

For IoT data to be accepted by asset managers, a variety of barriers such as trust and acceptance still need to be overcome (Brous *et al.*, 2017). In a study based on users' attitudes towards IoT-based healthcare, it was found that factors such as security, privacy, risk perception and familiarity had an impact on user trust (Alraja, Farooque and Khashab, 2019). These studies imply that there is a requirement to understand an organisation's capability and motivation to adopt IoT technologies.

Efficient resource allocation is essential for the optimisation of an organisation, as recognised in a study utilising technology that aids the allocation of the right resource to the right project (Chenthamarakshan *et al.*, 2010). Likewise, in a crowd work system, recording worker performance and reputation results in performance gains for the organisation by enabling the identification of the best resource for any given project (Tarable *et al.*, 2017). This further illustrates the impact technology can have on an organisation and the capabilities of its workforce. Conversely, reluctance to adopt the latest technology or to change are barriers (Harris, Wang and Wang, 2015).

Research on those working with technology or those that are ‘technologists’ recognised that they are more motivated by praise and recognition than money (Sankar *et al.*, 1991). Another study methodically examines the use of IoT based employee performance technology, to eliminate managerial bias, and the early identification and addressing of worker capability shortages, resulted in improved employee satisfaction (Kaur and Sood, 2017). These studies suggest that exploring the role of capabilities in the context of IoT adoption could provide valuable insights into this research, especially within the context of the Covid-19 pandemic era. It is evident that an understanding of an organisation's workforce capabilities and motivation is essential to understanding willingness to adopt technology. As an extension of this study, it may be possible to examine the technical acceptance model (TAM), with a focus on the employees' perspective (Ahmed, Qin and Martínez, 2019, p. 22). By doing so, it could provide critical insights into the relationship between employees and the successful implementation of IoT technology in an organisation.

2.2.2.2 Leadership

Leadership is arguably the driving force behind IoT adoption. Existing research suggests that IoT has the potential to have a significant impact on an organisation's workers and that there is limited academic research examining drivers for adoption (Coombs *et al.*, 2016). There is emerging managerial research exploring how IoT is changing business

process management (Del Giudice and Della Peruta, 2016). Many of these studies tentatively reference the impact on management and processes within organisations. However, they could have extended further to explore the direct impact of an organisation's leadership on the delivery of IoT adoption.

Other research conducted utilising IoT evaluated safety and the tracking of personnel location and physiological indicators (Nie *et al.*, 2011). This research suggests that the leadership team in these organisations may have direct involvement, due to the monitoring of safety behaviour of workers. In another study, Tang, Huang and Wang (Nie *et al.*, 2011) thoroughly assesses secondary data to explore enterprise adoption of IoT technology. Their research could have been beneficial to this thesis if they had included interviews with participants from the leadership team. As a result, they would have been able to better understand how they were involved in the adoption of IoT in their organisations. Sengupta and Abdel-Hamid (1996) suggest that the introduction of unreliable information can have a negative effect on employees, denting trust and consequently delaying or faltering potential adoption rates. It would have been beneficial for this thesis if they explored the leadership role in their study.

Research suggests that ‘virtual coolers’ (meeting areas) are created to connect remote workers with office-based members, to encourage frequent communications and positively impact the organisation's performance (Belanger, 1999). Supporting this, in a study of telecommuters, it was found that combining efforts and using communications channels were helpful to improve workforce productivity (Watson-Manheim, Piramuthu and Narasimhan, 2000). Extending their research to include the role of organisation leaders may have improved their study by identifying if improvements of processes and procedures, such as communications channels would have eased the organisations IoT adoption. It is expected that such processes pre and post Covid-19 will vary in effect.

Brous, et al. (2017) discuss IoT relative to asset management organisations, highlighting that adoption remains low, despite the availability and enhancement of IoT technology. It is argued that there are underlying leadership factors not explored in their study, which may have resulted in low IoT adoption rates. Exploring the role of leadership in this thesis

may lead to new insights, including improved costs (Archetti, Giordani and Candelieri, 2015; Aono *et al.*, 2016), time management (Aono *et al.*, 2016), efficiency of monitoring (Ahlborn *et al.*, 2010), and productivity (Hentschel *et al.*, 2016).

Based on two case studies in the following research, IoT devices were used for bridge inspection with a drone and road connectivity between two Dutch cities, both of which resulted in failed adoption of IoT (Brous *et al.*, 2017). Neither of these cases studied the role of leadership and whether poor leadership contributed to the overall failure to adopt. Exploring the relationship between leadership, the workforce and IoT adoption may highlight that other factors are at play, such as trust, capability, strong or poor leadership, and job security. In another study, it is suggested that operational gains are possible with the introduction of IoT (Ben-Daya, Hassini and Bahroun, 2019). However, this study does not explore how or who developed the necessary processes to achieve these gains.

This suggests that the relationship between leadership, the workforce and IoT adoption is complex and requires further investigation. For example, looking at how trust, capability, job security and leadership have an impact on the successful adoption of IoT. Additionally, understanding how processes were developed and implemented to achieve operational gains would be useful to better understand the relationship.

2.2.2.3 Competitiveness

An organisation's sales, marketing, competitiveness, and financial performance are arguably key to a successful business. Semi-structured interviews with those at the strategic level were intended to reflect on the competitiveness aspects of IoT adoption.

IoT adopters perform better and are more valuable than non-adopters (Hitt and Brynjolfsson, 1996; Devaraj and Kohli, 2003). Tang, Huang and Wang (2018) found that first movers benefit from various advantages, including being pioneers, profitable and productive (Tang, Huang and Wang 2018). It is therefore suggested that first movers or

IoT pioneers help an organisation to be more competitive. However, there is no evidence to link competitiveness with organisational factors, such as strong leadership or capabilities. Exploring this relationship may provide correlating links between an organisation’s workforce IoT adoption capabilities and its commercial performance.

Other studies include the impact of IoT on global trade (Sousa, 2018). Businesses that adapt to develop new products and services to disrupt markets might decide to change their own processes, capabilities, structure, and pace. Arguably, understanding an organisation's capabilities and competitive landscape is essential to understanding drivers of change, and thus warrants further study. Wortmann and Fluchter (2015) suggest that strategic level executives are now forced to evaluate the opportunities and threats that the emergence of the IoT might present to their companies. Fundamental managerial challenges are for instance likely to arise as rigorous hardware and agile software cultures start to clash not only within companies but even at early product development stages, and after-sales service processes may have to be modified to meet the requirements of connected products (Wortmann and Flüchter, 2015). Further research could have explored the impact of the after-sales process on an organisation's competitiveness.

In a recent study, it was suggested that diversification of the supply chain (compute, storage, or delivery platforms) will ensure business continuity (Bremner, 2015). Bremner’s assertion implies companies are finding ways to become more competitive. This has implications for an organisation's processes, structure, and resources. An extension of this study is to explore the capabilities of organisations during this transition. This is because it could result in valuable insights as to how an organisation adapts its capabilities for the adoption of IoT technology and this relationship to competitiveness.

Saarikko, Westergren and Blomquist (2016) examine the impact of IoT on organisations and highlight the need for close collaboration. According to Saarikko, Westergren and Blomquist (2017), a financially sustainable solution requires the full support of all participants. An extension to this research investigating the collaboration between an organisation and its business partners could provide useful insights into how this collaboration affects competitiveness.

Such a study could determine the extent to which successful collaboration between an organisation and its partners can lead to increased efficiency, cost savings, and improved customer service. It could also provide an understanding of the risks and rewards associated with such collaboration and the potential for increased competitive advantage.

2.2.2.4 Awareness

It is expected that improved awareness of IoT technologies via education, knowledge building and skills requirements is key to successful IoT adoption and business performance. Awareness of IoT technologies among an organisations employees should be explored in this research.

A critical study investigating impediments blocking IoT adoption by governments, found hurdles such as cost, security, standards, and protocols, as well as human capital barriers. These include insufficient IoT knowledge and skills (Brous and Janssen, 2015). Research on skilled and unskilled workers affected by the development of Industry 4.0 in manufacturing identified a requirement for personnel to adapt to evolving technology by retraining to onboard required knowledge skills (Spottl, 2018). Spottl (2018) identified that companies with high Industry 4.0 depth should increase their resources at the upper skill levels by between 20%-30% and substantially reduce the numbers of low-qualified workers. This indicates that IoT or other technology, the awareness and capability of lower skilled personnel results in a less efficient or performing organisation.

The importance of the role of ‘awareness’ on this topic is abundantly clear, as demonstrated in the following studies. Improving the performance of an organisation's resources via the introduction of technology is evidenced in a study introducing a system for developing ontologies, thus eliminating the procurement of expertise, and allowing an organisation to reduce costs by improving the capabilities of its own resources (Granados Pemberty *et al.*, 2019). Conversely, research identifying negative attitudes, thoughts and behaviours towards technology can negatively impact employees. However, appropriate training and learning conditions accompanied by technological support can reduce the

perception of complexity and insecurity for users (Wang, Shu and Tu, 2005). It is suggested that further study regarding the awareness and capabilities of an organisation's workers of IoT technologies would yield valuable insights.

Such insights could lead to the development of effective training programmes to improve the understanding of the technology and how to use it. The programmes may include hands-on experience with the technology, as well as educational courses that explain the potential benefits of the technology and how to use it safely and securely.

In an earlier study, employee performance measurement using technology highlighted trust issues (Grant and Higgins, 1991). More recently, the need for updated workforce skills was evidenced by the introduction of IoT for lower limb rehabilitation (Hamidi and Fazeli, 2018). Arguably, these studies indicate that a lack of awareness of IoT technologies and capabilities results in poor workforce trust, competence and cooperation when introducing IoT technology. To improve the adoption of IoT technologies, it is necessary to improve expertise, training and skills. Invariably, these will have an impact on an employee in one form or another, a further indication of the significance of research into this understudied topic.

In further support of this, in a study, it is recommended that college-level programmes to educate students to be skilled in building effective and safe IoT systems (DeFranco, Kassab and Voas, 2018), were based on the 18 knowledge areas (KA's) of Computer science, all of which are technical in content, with the exception of the 18th KA, 'Social issues and professional practice' (DeFranco, Kassab and Voas, 2018). Moreover, of the combined course recommendations, only one included the 18th KA. This suggests most courses are void of content related to increasing awareness of IoT technologies. Arguably, using the 18 KA's to formulate IoT based education programmes would be highly focused on the technological aspects. However, it would lack in content related to increasing awareness of IoT adoption within an organisation.

Without a more holistic approach that encompasses both technological and organisational aspects, the educational programmes may not adequately prepare students for the reality of working with IoT technologies. Moreover, without proper awareness of the potential

implications of deploying and using IoT technologies, organisations may not be able to adequately identify, mitigate, and manage the associated risks.

The latest digital transformation technologies in Industrial Internet of Things (IIoT) promise improved productivity but require the formulation of enhanced competencies. However, there is limited research determining how competence profiles impact digital transformation and contribute to the success of firms (Weber, Butschan and Heidenreich, 2017). The results of their quantitative study (from a sample of 284 data sets) of a German components company, revealed that highly developed cognitive and process efficient competencies provide support for the digital transformation of a firm, whilst suggesting social competencies have a minor influence. An individual with high processual competences is focused on the execution of tasks, so he or she does not have to be open-minded to new ideas. While persons with high cognitive competences adapt well to changing situations, as they tend to accept new technology more readily. It was observed that those 36 years and older were more process driven, whilst those that were under 36 years of age displayed cognitive competences (Weber, Butschan and Heidenreich, 2017).

The age group of 36 and younger have grown up in an environment where technology is constantly changing and evolving, so they are more accustomed to adapting quickly to new situations. On the other hand, those that are 36 and older may have more experience in executing tasks and processes, so they may be more comfortable sticking to what they know.

This suggests the adoption of IIoT or IoT can be positive in differing ways, and that age has an impact. An implication could be that lower cost resources, probably younger and less experienced, would be more effective. There is possibly a trade-off between cost and experience and faster adoption and familiarity with new technology. Young people mesh with each other and share knowledge through IT to solve problems within organisations (Pauget and Dammak, 2019). This thesis may contribute novel knowledge by exploring whether the age range of an organisation's workforce has an impact on IoT adoption.

Despite potential drawbacks, a younger workforce may provide organisations with increased agility and familiarity with technology, unlocking opportunities for faster adoption of IoT solutions.

2.2.2.5 Categorisation of literature review

Table 1 demonstrates that the existing knowledge on IoT adoption has been limited where qualitative research and the impact on an organisation's capabilities is concerned.

2.3 FACTORS INFLUENCING IOT

In the previous section literature reviews were conducted on IoT adoption and dynamic capabilities. Theoretical exploration was also undertaken on absorptive capacity, open innovation, long range planning and competitiveness. To further support this research relevant theories and models were reviewed such as self-determination, change management and the well-known Technology Acceptance Model (TAM) for consideration towards this research.

In doing so it was determined that there was a gap in research specifically on IoT technology adoption within the chilled beverages industry. This was through the lens of dynamic capabilities, and in the context of a global pandemic. This section discusses the impact of the global pandemic on international businesses, factors influencing IoT adoption and dynamic capabilities and international businesses. For comparison, this study categorises relevant literature to identify the purpose, approach, and relevance of this study.

2.3.1 IMPACT OF ENVIRONMENTAL TURBULENCE ON INTERNATIONAL BUSINESS

The impact of the Covid-19 global pandemic is significant. In the chilled beverages sector, the identification, enablement, and adoption of IoT technologies may lend itself to addressing challenges and creating opportunities. This is true both on a national and international level. Chilled beverages sales were significantly impacted when businesses were forced to cease trading during the pandemic. For example, sales of chilled beers and soft drinks in bars and restaurants will have essentially ceased, whereas sales of the same in businesses identified as essential to operate, such as supermarkets, local food stores, dark stores and petrol or gas stations will have presented both a challenge and opportunity to this sector.

This is because with the closure of bars and restaurants, the sale of chilled beverages in these outlets ceased. However, sales of chilled beverages in essential businesses, such as food retailers continued as these outlets were deemed essential for the purchase of food and drinks.

International organisations in the chilled beverages sector were faced with reduced demand from consumers and retailers, reduced production from suppliers, legislative constraints from policy makers and of course significant reductions in their own workforce availability. In this context, it is difficult for any organisation to maintain existing business plans and the need to restrategise is essential.

As a result, organisations must look for innovative solutions to navigate through this uncertain period, such as exploring new markets, adopting digital solutions, or seeking out alternative suppliers.

Reliance on an organisation's workforce to maintain business continuity can be critical. Organisations in the chilled beverages industry rely on their sales force to visit retailers, develop relationships, collect orders, and assess product stock levels in cooler assets in store. During the pandemic and due to workforce constraints, many essential retailers will not have had regular visits from sales reps, merchandisers, or distributers. Therefore,

planned, or opportunistic sales are lost. The utilisation of IoT technologies presents an opportunity to replace store visits by sales force with remotely gathered IoT business intelligence from in-store coolers. This will enable the identification of sales opportunities and potentially generate automated orders. However, research into how this impacts an organisation's workforce capability is limited.

Therefore, utilising IoT technologies presents an opportunity to leverage in-store business intelligence for sales and order automation, ultimately replacing store visits by sales force. This shift in approach requires further research to understand the implications for an organisation's workforce capability.

2.3.2 THE CHILLED BEVERAGES SECTOR AND ENVIRONMENTAL TURBULENCE

The Covid-19 global pandemic has had a major impact on businesses in most industries, and the chilled beverages sector is not an exception. International chilled beverage companies, referred to as 'bottlers', produce, supply, and distribute products on behalf of well-known global and other brands (see Figure 1). Due to the pandemic, bottlers have been faced with reduced demand from consumers and retailers, reduced production from suppliers, legislative constraints from policy makers and of course a significant reduction in their own workforce availability (Chowdhury *et al.*, 2022). As businesses were forced to 'close shop' during the pandemic, sales of chilled beers and soft drinks in bars and restaurants will have experienced a significant drop in sales, possibly up to 80% (Chowdhury *et al.*, 2022; Fairlie and Fossen, 2022). Similarly, essential businesses such as supermarkets, local convenience stores, dark stores and petrol stations have also experienced a drop in sales (Nair *et al.*, 2021). In this context, it is difficult for companies to deliver on pre-existing business plans, and the need to restrategise becomes abundantly clear.

Bottlers usually provide coolers on loan, and as such, they are the owners of the coolers. These coolers are arguably valuable revenue generators and are a significant part of the bottlers' business model. They allow for close control and high levels of visibility of coolers

due to frequent visits for replenishment, merchandising and maintenance. In this context, a bottler's workforce plays a significant role in the successful operational and commercial performance of a cooler.

Retailers and bottlers often cooperate by providing free coolers to stores on loan. The cooler is used to display and sell bottler products. The bottler often uses its own sales team to merchandise, maintain and optimise these coolers. Reliance on an organisation's workers to maintain business continuity can be critical. This is because bottlers rely on their sales force to visit retailers, develop relationships, collect orders, assess product stock levels, and merchandise coolers.

Without their own sales team, the bottler would have to outsource these services to another organisation, which could be costly and time-consuming. Furthermore, as the sales team is familiar with the product and customer, they are in the best position to optimise the merchandising of the coolers.

This model is particularly prevalent in emerging markets (e.g. Central, South America and Asia) where the cost of resources is comparatively low and the frequency of sales visits is high, thus enabling strong store owner relations and excellence in the presentation and availability of merchandise in the bottlers' coolers. Due to the restrictions caused by the Covid-19 pandemic, regular sales visits to retailers were severely restricted, constrained or banned. Arguably, bottlers lost their influence and control over sales orders, availability of products, the presentational quality of their cooler and therefore, its commercial performance.

These restrictions on sales visits decreased the face-to-face contact between the bottlers and retailers, which in turn meant that the bottlers were unable to ensure the availability of the right products, or adjust the presentation of their coolers, in order to maximise their commercial performance.

On the other hand, in developed markets (e.g. North America and Europe), where resource costs are consistently higher, regular sales and maintenance visits for bottlers to retailers are less frequent. This context opens huge opportunities for Internet of Things

(IoT) technology adoption, by presenting the concept of an ‘IoT data driven’ sales force. With remotely gathered IoT data from coolers, it can be determined which locations should receive an infield visit based on both their commercial and operational performance. Ultimately, this utilisation of remote data, control and management of coolers provides new opportunities to optimise field resources and reduce costs.

Undoubtedly, the pandemic caused major disruptions in both scenarios. Due to workforce constraints, many retailers have experienced fewer to no visits from sales representatives, and thus planned or opportunistic sales have been lost. The identification, enablement, and adoption of IoT technologies is expected to overcome these challenges by presenting and creating the need for new organisational capabilities for businesses operating at a national and international level.

With the adoption of IoT technologies, businesses can benefit from real-time data analysis that can help them understand customer behaviour better, identify opportunities for optimisation, and create new strategies for better decision-making. Furthermore, IoT technologies can provide a more cost-efficient way of managing supply chain operations, minimising the need for manual labour and enabling more remote working.

2.3.3 Dynamic capabilities and organisation IoT adoption

Dynamic capabilities theory is introduced to this study to support the delivery of an IoT adoption framework. The participants in this study work for organisations within the chilled beverages industry, and the findings can be substantiated in accordance with dynamic capabilities theory. The key components of dynamic capabilities, sense, seize and transform can be utilised in a way to help shape this thesis and its outcomes. The data gathering, analysis and methodological findings of this research are therefore explained using the sense, seize and transform components of dynamic capabilities. Based on the translated data, analysis, and findings, this study suggests a framework for how to adopt IoT successfully in an organisation.

The utilisation of IoT technologies presents an opportunity to replace store visits by the workforce with remotely gathered IoT operational and commercial data, directly from in-store coolers. Data is typically transferred at regular intervals from the cooler via 3G/4G communications or WIFI to a cloud or SaaS environment for analysis, interpretation, and presentation.

Depending on the dynamic capabilities of an organisation, this can provide valuable business intelligence. This can help an organisation understand and improve the operational and commercial performance of a cooler.

The successful adoption of IoT technology by firms in the chilled beverages sector may depend on various factors, beyond the perceived technological benefits of IoT technology. This research utilises dynamic capabilities theory to explore international organisations' capabilities during a global pandemic.

During a global pandemic, organisations must adapt to new technology, such as IoT and new ways of working (Narayanamurthy and Tortorella, 2021) to maintain their competitiveness and commercial viability (Diab-Bahman and Al-Enzi, 2020; Amis and Greenwood, 2021). At the time of this study, no research has been conducted on the impact of Covid-19 within the chilled beverages industry on its adoption of IoT.

Delivering an IoT adoption framework within the context of a global pandemic may result in more innovative business models. Business leaders may choose to evaluate and utilise these new business models to maintain or enhance their own organisations. Researchers and practitioners may find this study useful and a basis for further research.

To this end, semi-structured interviews were conducted with participants, at senior and middle management level from international organisations and global brands.

This thesis differs from existing research in that it focuses on the chilled beverage sector, on an international level. It uses primary data from interviewing senior employees responsible for the adoption of IoT technologies, conducted during a global pandemic.

Furthermore, this study is strengthened using the Gioia methodology and dynamic capabilities theory.

Metallo et al, (2018) estimated that in 2020, there will be over 20 billion Internet of Things (IoT) devices connected, up from 5 billion in 2014, and the consumer market for connected devices is estimated to be valued at $1,534B. Similarly, in 2020, IoT connected devices in the enterprise market will be valued at $1,477B (Metallo *et al.*, 2018). Despite having a smaller market size than the consumer market, the predicted value of IoT usage in the enterprise market is comparable to that in the consumer market, suggesting momentum in Business to Business (B2B) IoT. It is suggested that the implications for organisations are significant as IoT continues to expand.

Erfanmanesh and Abrizah (2018) ran a study to map worldwide research on the IoT during 2011-2016. It found that the number of IoT-related publications, as covered by Scopus, increased nearly sevenfold from 747 in 2011 to 4,989 in 2016. However, the research topics in existing literature focus heavily on communications, electronic engineering, and computer science, whilst research on the impact of IoT adoption on organisations' capabilities remains scarce.

Erfanmanesh and Abrizah (2018) state that the economic impact of IoT will grow from $3.9tn to $11.1tn by 2025. The expected beneficiaries include security, energy, equipment optimisation, retail, health and fitness, health and safety, transportation, and connected cities. In their research, consideration towards understanding an organisation's capabilities in the adoption of IoT would have been beneficial. Furthermore, as indicated in other research, evidencing success of organisational IoT adoption is challenging and failures are plentiful (Brous *et al.*, 2017).

Considering the anticipated growth of both consumer and enterprise markets (Metallo *et al.*, 2018), further research on IoT adoption within the context of dynamic capabilities and a global pandemic is suggested. This should result in new knowledge and understanding about the impact the introduction and deployment of IoT has on an organisation, particularly considering a global pandemic.

There are many reasons why IoT adoption fails (Brous *et al.*, 2017), and in this thesis it is suggested that extending research to include IoT adoption and the organisations capabilities will contribute to the extant literature on this understudied topic. Utilising an IoT adoption framework may result in successful strategies for researchers, practitioners, and businesses.

Due to strict government policies, workers have had to change their work and life profiles, including working from home, video conferencing, limiting contact with customers and co-workers, self-isolating, dealing with personal or family illness, and managing mental and physical health issues.

On a global scale, the pandemic has changed the home and working lives of people, communities, businesses, and organisations, further accelerating the motivation and need to conduct this research. Therefore, it is argued that there is a strong case for conducting this study. This is further supported by a gap in research on organisational capabilities when adopting IoT technologies.

Furthermore, this thesis is strengthened by considering the impact of a global pandemic, whilst adopting computer-assisted qualitative data analysis software (CAQDAS) such as NVivo for data analysis of this thesis, as themed by the well-known Gioia methodology.

2.3.4 KEY THEMES OF EXTANT IOT LITERATURE

The current literature and factors influencing adoption of technology, such as IoT, is summarised in Table 1. Furthermore, it is suggested that during a global pandemic, organisations must adapt to new technology, such as IoT, and more innovative ways of working to maintain their competitiveness and commercial viability (Diab-Bahman and Al-Enzi, 2020; Amis and Greenwood, 2021).

This study differs from the literature review (see Table 1), by addressing the key themes affecting IoT technology adoption within the context of both a global pandemic and

dynamic capabilities. This research is informed by the dynamic capabilities model, illustrated in Table 1.

2.4 EVALUATING COMPARABLE FRAMEWORKS TO DYNAMIC CAPABILITIES

As previously stated this study has opted to use dynamic capabilities as the preferred framework to inform this research. A sample of these are reviewed further into this research. However, it was prudent to evaluate the available options for suitability to this study. These include but not limited to, long range planning, open innovation, absorptive capacity, resourced based view (RBV), ambidexterity, and strategic agility. Dynamic capabilities provide a unique perspective because it focuses on the ability of an organisation to actively shape, create, and reconfigure its resources and capabilities over time to capitalise on opportunities in an uncertain and ever-changing environment. This approach allows for an analysis of how an organisation can develop, maintain, and leverage its capabilities to gain a competitive edge.

However, there are some similarities between strategic agility with dynamic capabilities. As discussed, dynamic capabilities is focused on an organisation's ability to adapt and change its resources and capabilities in response to changing environmental conditions. Whereas strategic agility emphasises the need for quick responses to market changes. Therefore, the key difference between strategic agility and dynamic capabilities is that the former focuses on speed and the latter on the organisation's ability to change and adapt.

Strategic agility offers an excellent framework where a study is concerned with the rapid changes in the external business environment, such as a shock event like the Covid-19 global pandemic (Nijssen and Paauwe, 2012; Ahammad, Glaister and Gomes, 2020). Likewise, how an organisation’s CEO and management team can experiment with creative ways to make their business models evolve more rapidly (Doz and Kosonen, 2010).

However, although this research was partially conducted during Covid-19, and the context of a global pandemic is recognised throughout this thesis, it is not a key purpose of this study, rather a context in which to reflect on during the research. In a similar way, this thesis aims to examine how the leadership and senior management team may be able to spearhead a transformative process within the chilled beverages industry. This is based upon the existing IoT adoption opportunity as opposed to accelerating the business model of the organisation.

For these reasons strategic agility as a framework was rejected. While dynamic capabilities framework is most suitable due to its clear structure from opportunity identification at the sensing stage through to transformation. The resultant IoT adoption framework (see Figure 21) illustrates this clearly.

Ambidexterity is a framework that requires an organisation to balance existing strategic and operational competencies whilst developing new capabilities in order to remain competitive in a dynamic environment (Kimbrough, 2011; Prange and Verdier, 2011; Turner, Swart and Maylor, 2013). It is ambidextrous in nature, focusing on the ability to learn and innovate to gain a competitive advantage and maintain and grow existing markets and customer relationships. In this thesis, participants in the chilled beverages industry were interviewed about their IoT adoption strategy. This research did not seek to simultaneously explore or compare traditional business practices, and therefore, ambidexterity was not the most suitable method for this study.

Similarly, other frameworks were considered and rejected as it is suggested they are less suitable to this study compared with dynamic capabilities. These include resourced-based view, which primarily focuses on an organisation's unique resources (Barney, 1991; Lin and Wu, 2014; Kim, Song and Triche, 2015), which is not relevant in this study. Similarly, Absorptive Capacity relates to the ability to acquire, assimilate, and apply knowledge from outside sources. (Cohen and Levinthal, 1990; Lane and Luatkin, 1998; Easterby-Smith *et al.*, 2008).

2.5 DYNAMIC CAPABILITIES

In the previous section a literature review of existing research on organisation IoT technology adoption demonstrated that most knowledge is focused on technology capabilities. However, less so on the organisation, its resources and capabilities.
In this section, an extended literature review is conducted on exploring the existing knowledge of dynamic capabilities and technology adoption (see Table 25). Specific searches were conducted on the following terms:

- Dynamic capabilities + IoT adoption
- Dynamic capabilities + Internet of things
- Dynamic capabilities + technology adoption
- Dynamic capabilities + information systems

2.5.1 DYNAMIC CAPABILITIES AND TECHNOLOGY ADOPTION

Current literature on dynamic capabilities and IoT technology is scant in respect of peer reviewed journals. Therefore, searches were extended to other literature. This includes, to a small degree, conference proceedings. To explore further, an expanded search related to dynamic capabilities, technology adoption, information systems was undertaken. In a study on dynamic capabilities and e-business transformation across several industries (Daniel and Wilson, 2003), the tension between internal and external forces can impact an organisation's ability to adapt to rapidly changing markets. In high velocity markets, it was found that managers had little to rely on in respect of organisational structure and business routines. In this scenario, decision making must be rapid. In this thesis, it is suggested that decisions and actions must also be rapid. Arguably, bottlers in the chilled beverages industry are not within a high velocity market. However, comparisons can be drawn between this and the effects of a global pandemic on an organisation's dynamic capabilities. Similarly, it is argued in this thesis that significant business challenges, or external forces, arose due to the global pandemic.

This has led to a change in the speed of decision making and action taking, which is necessary for an organisation to remain competitive in a rapidly changing environment. This can be seen in the chilled beverages industry, where an organisation must be able to quickly adapt to customer demands, changing regulations, and the competition. By being able to rapidly adjust to these external forces, an organisation can stay ahead of the competition and remain successful.

In a recent study, it was observed that there is a lack of empirical evidence or research undertaken by organisations on the impact of their IoT projects (Ancarani *et al.*, 2020). In their study, it is suggested that further exploration of this phenomenon, namely, to understand what organisations are doing with IoT would add value to their research (Ancarani *et al.*, 2020). In this thesis, emphasis is placed on the chilled beverages industry, their purpose and description of utilising IoT technologies and explanation as to how this would improve their competitiveness. Arguably, this thesis adds value by answering this call, demonstrating a valuable contribution to this understudied topic. Notably, their study utilises secondary sources of information and thus misses the opportunity to gain qualitative empirical data typically achievable when following an inductive approach associated with qualitative research.

Although the study has made a valuable contribution, it is limited by its reliance on secondary sources of information. Qualitative research could provide a more comprehensive understanding of the topic by giving researchers the opportunity to collect empirical data and use inductive reasoning to reach conclusions.

In another study examining dynamic capabilities and SME survival during an economic downturn (Weaven *et al.*, 2021), direct parallels cannot be drawn between a downward market turn and the effects of a global pandemic. In their research it is recognised that a global pandemic such as Covid-19 represents far reaching health, economic, political, and social disasters (Weaven *et al.*, 2021), arguably significantly more complex than an economic downturn. Their study, a qualitative study, focuses on the dynamic capabilities of SMEs. This is because they understand their success or failure in a downturned

economy directly impacting the business owners, whilst not addressing the wider organisation. This does not answer the research question presented in this thesis.

In their study Shen, Zang and Liu (2022) carefully scrutinise how managers can make better decisions about their digital transformation initiatives. However, their research is technology focused as they explore the relationship between technology, capability and innovation thus contributing towards understanding the impact of digital technology on business performance. In other studies, research on big data, dynamic capabilities, and firms' performance (Singh and Del Giudice, 2019; Bahrami and Shokouhyar, 2022) is in light of risk management culture and does not investigate the impact of senior management, which would have been beneficial to this thesis. Similarly, a study on family owned businesses discusses business survival and the role of dynamic capabilities (Rashid and Ratten, 2020) does not address the phenomena of this thesis.

Using dynamic capabilities, knowledge management, and Information Technology (IT), Sher and Lee (2004) found that a firm's competitiveness depends on its internal and external knowledge. In this thesis knowledge sharing and development is recognised as a vital aspect of ensuring IoT technology adoption.

There are studies on dynamic capabilities linking IT governance to a firm's performance, presenting an IT governance framework (Khalil and Belitski, 2020), or the creation of IoT platforms through the lens of dynamic capabilities (Marheine and Petrik, 2021). These are focused on technological aspects and do not address the research question of this thesis.

Ljungquist (2014) rigorously examined the relationship between dynamic capabilities sense, seize, and transform. It was found that knowledge transfer could be negatively affected where top management demonstrated lack of vision. This could result in excessive autonomy for business units, suggesting a loss of control and information flow. Exploring this phenomenon further could have been beneficial to this study.

By doing so, this research could have provided insight into how dynamic capabilities could be more effectively utilised to create a better knowledge transfer environment for organisations.

Earlier in this chapter, the literature review on IoT adoption was structured into four variables: capabilities, leadership, competitiveness, and awareness. A theoretical literature review on dynamic capabilities, absorption capacity, open innovation, long-range planning, competitive advantage, resource-based and market-based views, and collaboration is provided further into this chapter. The rationale for this was to explore models that best support the findings of this study, considering available theories. To inform the outcome of this study, a critical evaluation of suitable theories was conducted and is explored further into this chapter.

However, to summarise, dynamic capabilities theory was chosen due to its ability to account for the complex interactions between the internal and external environments of an organisation that can lead to changes in strategy. The theory was seen as the best fit to illustrate the findings of the study and to explain how the organisation was able to achieve its goals.

Existing studies on dynamic capabilities and technology adoption do not address the phenomena of this thesis, hence the necessity of this study. This thesis will contribute to the existing knowledge on IoT adoption and dynamic capabilities within the context of environmental turbulence. Therefore, this thesis will provide an original perspective, as it explores IoT adoption and dynamic capabilities within the context of a global pandemic. This has not been addressed in existing studies.

2.5.2 DYNAMIC CAPABILITIES OF AN ORGANISATION

Dynamic capabilities refer to an organisation's ability to build, reconstruct and combine existing competencies from within and externally, adapting to emerging and rapidly developing challenges (Teece, Pisano and Shuen, 1997). It is argued that dynamic capabilities are interdependent on strategy and business models (Teece, 2018a). Moreover, due to the emergence of IoT, innovation in new business models is likely, as the communication of sensor data between devices, objects and platforms may facilitate various business opportunities (Teece, 2018a).

Arguably, organisations with strong dynamic capabilities typically are characterised by the ability to rapidly respond to market conditions and maintain or improve their competitiveness. They can do this because they have clear and strong practices for identifying and leveraging new opportunities. These practices ensure the organisation can identify and rapidly adapt its internal or external knowledge resources for success.

Moreover, organisations with strong dynamic capabilities tend to anticipate and embrace change, allowing them to remain agile and competitive in their respective markets.

Sense, seize and transform are key components that are interrelated in that an organisation must recognise new opportunities, be they technological, process oriented or new business related. An organisation with strong dynamic capabilities should have processes for continuous sensing to ensure opportunities are not missed, delayed, or lost to competitors. Seizing opportunities is crucial, and therefore an organisation must make sure that it has the tools and capability to act on opportunities. Finally, a key component is the ability to ensure the organisation has the right resources and skills to take advantage of and deliver on new opportunities.

Having the right resources and skills is essential for taking advantage of, and delivering on, new opportunities. Therefore, an organisation must ensure that they have processes in place to ensure they can continuously sense opportunities and possess the ability to swiftly act on them.

This thesis evaluates various dynamic capabilities frameworks in search of the most suitable framework to explore this research phenomenon.

The next section details dynamic capabilities and other theories and models considered for suitability in supporting the goals and outcomes of this thesis. Dynamic capabilities, absorptive capacity, open innovation, and long range planning may offer appropriate frameworks for this thesis (Cohen and Levinthal, 1990; Bruce and Zander, 1992; Stadler, Helfat and Verona, 2013; Teece, 2018b).

2.5.3 DYNAMIC CAPABILITIES AN INTERNATIONAL VIEW

It is important to note that the chilled beverage industry studied in this thesis consists of international or global bottlers. IoT technology has been used in chilled beverage commercial coolers relatively recently, probably since 2016 when IoT enabled controllers became available for these coolers. Therefore, IoT has revolutionised the chilled beverage industry, providing an innovative way for global bottlers to monitor, manage and maintain their coolers in real-time.

There are certain technological capabilities that are needed for a controller to be IoT enabled, such as WIFI, Bluetooth, cellular communications as well as an array of sensors and detectors. This is because they require the capability of collection and transmission of sensor and operational data from coolers to cloud platforms for further analysis and insights. Before this change, the controllers in coolers used to be non-connected, with the main functionality being to monitor the temperature of a cooler as well as to manage the compressor of the cooler. These non-connected controllers would have had some configurable features, but only manageable through the front panel menu, and without remote capabilities. Now, however, the controllers have been upgraded to be connected to the internet, enabling a range of advanced functionalities, such as remote control and monitoring, as well as more configurable features than ever before.

This backdrop suggests that knowledge, experience and understanding of IoT enabled coolers in this industry is relatively new. This is understandable as IoT will have been a somewhat novel concept for stakeholders in these bottler organisations. As such, stakeholders must remain open to exploring and embracing the potential of IoT to improve their competitiveness, operations, and customer experience.

Taking into consideration the fact that IoT enabled controllers are relatively new, from 2016 and the fact that in the early years of IoT adoption in the chilled beverages industry, they will have been impacted by the Covid-19 global pandemic most notably between 2019 and 2022, suggesting that progress will have been somewhat stunted. It is also prudent to explore dynamic capabilities and international organisations to further demonstrate the potential contribution of this study to existing research.

In a study of public organisations' dynamic capabilities and information, communications, and technology (ICT) utilisation, it was found that public organisations should build both resource and operational capabilities to interface effectively with businesses and individual citizens (Panagiotopoulos, Protogerou and Caloghirou, 2022). However, exploring ICT adoption processes within these public organisations would have been beneficial to this thesis.

Arguably, large organisations such as the bottlers in the chilled beverages industry require the capabilities of entrepreneurship management (Teece and Augier, 2008; Teece, 2016). As a result, it has been suggested that international organisations ought to behave in an entrepreneurial manner. This is because they need to be agile and flexible to gain sustainable competitiveness. In this and other research, it has been suggested that global organisations need to develop their dynamic capabilities to achieve a sustainable competitive advantage (Luo, 2000; Prange and Verdier, 2011; Teece, 2016; De Silva, Al-Tabbaa and Khan, 2021; Panagiotopoulos, Protogerou and Caloghirou, 2022). Therefore, they must cultivate the ability to rapidly assess and respond to changes in their environment.

A single case study of a large public construction company found that project managers' previous knowledge affected their ability to adjust to new organisational structures,

whereas the new employees to the organisation did not have a problem adapting to their new working environments as they were not affected by the same prior knowledge and subsequent way of working (Adam and Lindahl, 2017). This focus on organisational change and dynamic capabilities does not address the research question of this thesis. However, extending their research to leadership, senior executives and management may add valuable insights. This could be used to identify any underlying trends and develop effective strategies that can be implemented within an organisation.

According to a study conducted by Luo (2000) that involved multinational enterprises (MNE), it was suggested that technological advances and the globalisation of businesses require organisations to continually upgrade their critical capabilities, to positively impact their competitiveness in the future. As a result, this implies that organisations should obtain, share, and utilise employees' existing and newly acquired knowledge. This thesis may benefit from their research on dynamic capabilities in its exploration and application in the transformation phase for bottlers. Therefore, it is essential for organisations to leverage available knowledge to ensure effective transformation and ultimately a sustainable competitive advantage.

There are existing studies on dynamic capabilities from an international organisation's point of view. However, these studies do not address the aim of this thesis, which is to explore aspects of an organisation's adoption strategy. This is because the aim is to produce, in this case, an IoT adoption framework informed by dynamic capabilities. A nuance of this thesis is that the challenges of IoT adoption faced by bottlers in the chilled beverages industry are relatively new. They need to recognise that the many facets of IoT are somewhat different from traditional ICT or technology adoption. It is also recognised that the extant literature on technology adoption tends to be focused on the technological aspects rather than the organisational resource aspects. As a part of this thesis, this is explored in detail.

In summary, existing research on dynamic capabilities and international organisations provides valuable insights into their own topics, but do not answer this thesis' research

questions. However, some value can be drawn from these studies that may support this thesis.

2.5.4 Analysis of dynamic capabilities

Dynamic capabilities

Organisations with strong or sophisticated dynamic capabilities are flexible and are likely to adopt new and diverse business models, as they are engaged in more activities to develop existing resources (Stadler, Helfat and Verona, 2013; Teece, 2018a). Figure 8 illustrates the popular and frequently referenced dynamic capabilities model (Teece, Pisano and Shuen, 1997; Eisenhardt and Martin, 2000). This model may be a suitable model to adapt to a potentially new framework to inform this research.

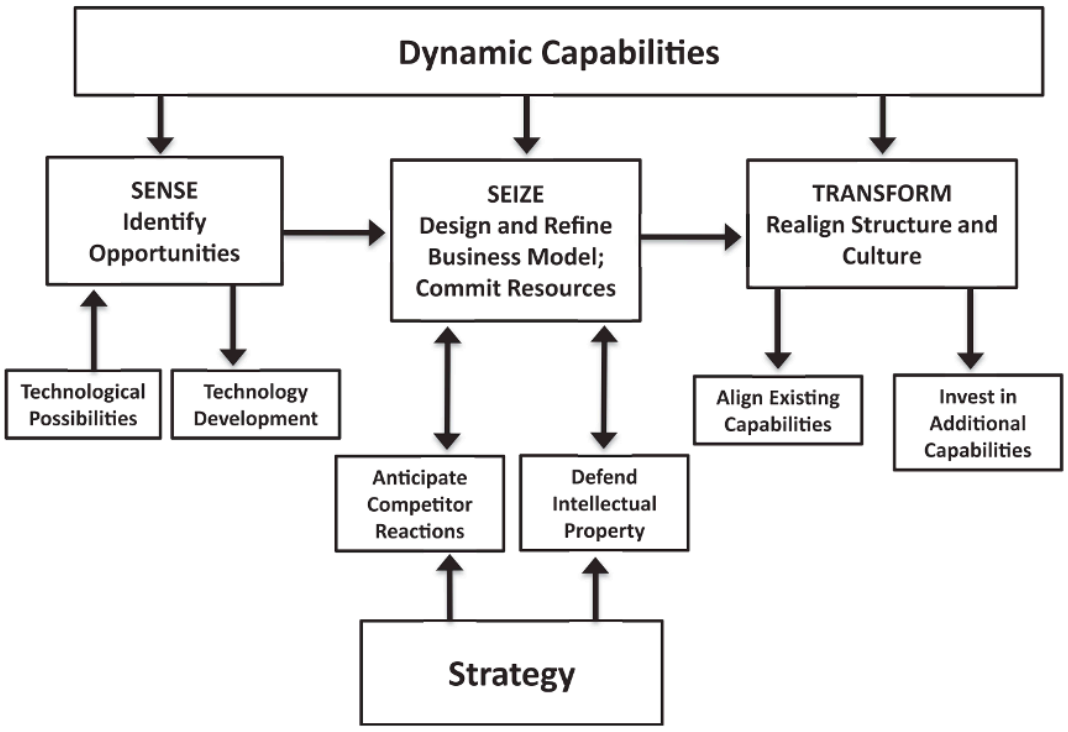

Figure 8: Simplified dynamic capabilities, business models and strategy (Teece, 2018a)

Strong dynamic capabilities enable firms that have complementary knowledge and assets to build new products and processes in a changing market (Helfat, 1997). A dynamic capabilities approach may assist in developing and continuously maintaining a competitive advantage (Augier and Teece, 2007). A dynamic capabilities framework will also consider resources, strategy, internal and external factors to gain a competitive advantage (Teece, 2007).

Absorptive capacity

Absorptive capacity is based on an organisation's ability to gather and embed new knowledge to gain a competitive advantage (Cohen and Levinthal, 1990). Strong absorptive capacity occurs where an organisation can build on its existing knowledge and experience or its ability to effectively utilise newly acquired knowledge (Bruce and Zander, 1992). A typical absorptive capacity model considers the effectiveness of an organisation's existing resources, structure, and knowledge to improve the organisation's competitiveness and ability to adapt and create more innovative products or services (see Figure 9). In this thesis, the objective extends beyond absorptive capacity, as this model focuses on technical capabilities which may partially address the study's requirements.

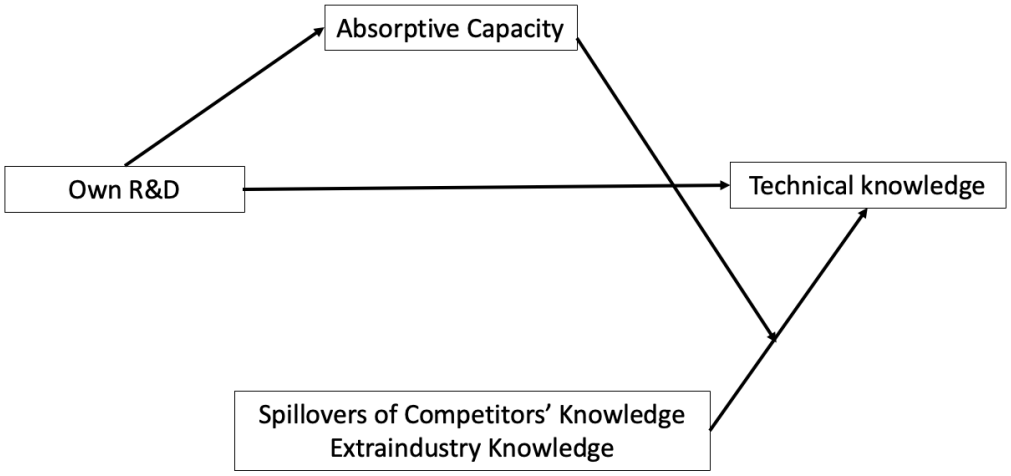

Figure 9: Model of sources of a firm's technical knowledge (Bruce and Zander, 1992)

Dynamic managerial capabilities

Dynamic managerial capabilities capture the effects over time of management decisions and the underlying factors that make up dynamic capabilities are managerial human capital, social capital and cognition. These suggest workforce upscaling is a significant factor when considering IoT adoption (Adner and Helfat, 2003). Moreover, it is argued that understanding the potential gains of IoT adoption and overcoming challenges including strategies to tackle knowledge, skills and social resistance due to job insecurity is essential (Xu, He and Li, 2014; Lee and Lee, 2015; Ryan and Watson, 2017). Therefore, organisations should explore ways to develop skilled workers who are comfortable with the changing technology landscape and capitalise on the opportunities that IoT presents.

Participants in this research are at executive and middle management levels and thus the dynamic managerial capabilities model (Adner and Helfat, 2003) may be considered as a model to inform this research (see Figure 10).

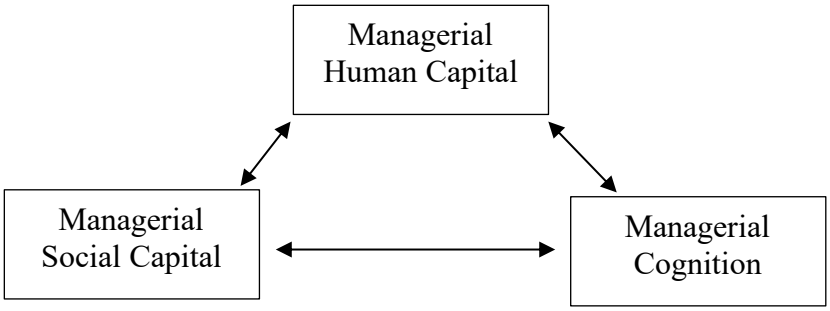

Figure 10: Dynamic managerial capabilities: underlying attributes (Adner and Helfat, 2003)

Dynamic managerial capabilities rely on the ability of an organisation's management to monitor and respond to both internal and external forces to be agile enough to respond to changes. Like absorptive capacity, knowledge management is a key component. However, a manager must have the capability to use knowledge and skills to adapt to new opportunities and enable the organisation to develop its competitiveness. Managers must consider several components in relation to dynamic managerial capabilities. These include responding rapidly to external changes that may affect the organisation's ability to execute organisational change to adapt to new market conditions. They also embrace a

culture of creativity and innovation within the organisation, ensuring that resource skills are continuously improved. A manager with these facets may be more likely to successfully navigate their organisation to maintain and grow its competitiveness.

Such a manager should be able to recognise the potential for disruption, identify opportunities for improvement and then devise and implement the necessary changes to ensure that the organisation remains competitive in the long-term.

The thesis examines several dynamic capability models, including dynamic capabilities, dynamic managerial capabilities, and absorption capabilities. The thesis continues to present revised versions of these models to reflect IoT adoption. This is to determine the most appropriate model for supporting the results of this study.

2.6 REVISED DYNAMIC CAPABILITIES MODELS

As already established, dynamic capabilities are based on an organisation's ability to sense, seize, and transform the organisation (Teece, Pisano and Shuen, 1997). In this research, organisations sense the potential opportunities for utilising IoT within their markets and explore these options within the context of a global pandemic.

The three key themes of dynamic capabilities include Sense, Seize and Transform (Teece and Pisano, 1994). At the Sense stage, an organisation may use external and internal factors to 'sense' an opportunity. This is followed by the Seize stage where an organisation looks to reorganise, design, and enable the execution of its proposed strategy. Finally, at transform, the organisation may realign or develop its internal and external resource capabilities to support new strategies.

By sensing opportunities in the market, organisations can identify and capitalise on them more effectively. By seizing the opportunity, organisations can create new strategies that can help them gain a competitive advantage. Finally, by transforming the organisation's resources, it can implement and sustain these new strategies in the long run.

Although dynamic capabilities research in relation to the international chilled beverages industry and the adoption of IoT, an innovative technology, within the context of a global pandemic is limited to this study, research on innovation related dynamic capabilities and international performance suggests innovation and adaptability are key drivers (Gölgeci *et al.*, 2019). Furthermore, emerging studies on new ventures in ever-changing environments suggest enhancing an organisation's innovation capability (Buccieri, Javalgi and Cavusgil, 2020).

Organisations with strong or sophisticated dynamic capabilities are flexible and are likely to adopt new and diverse business models, as they are engaged in more activities to develop existing resources (Stadler, Helfat and Verona, 2013; Teece, 2018a). This thesis investigates the organisational challenges in IoT adoption. In this research there were

mixed experiences of sensing opportunities due to 'Awareness'. This stemmed from varying levels of awareness and the perceived capabilities and benefits of IoT adoption during a pandemic. Internationally recognised IoT technology providers contributed to this research with their knowledge and experience of products specifically for this industry. Furthermore, for these organisations, the global pandemic resulted simultaneously in business growth and resource constraints. Demand for IoT technology increased for these entrepreneurs, whilst increased costs, reduced component availability and significant shipping delays were constraints.

Similarly, dynamic managerial capabilities capture the effects over time of management decisions. The underlying factors that make up dynamic capabilities are managerial human capital, social capital and cognition. These suggest workforce upscaling is a significant factor when considering IoT adoption (Adner and Helfat, 2003).

Revised dynamic managerial capabilities

This revised dynamic managerial capabilities model illustrates the external factors that may affect managerial decision making for the adoption of IoT technologies in response to this thesis (see Figure 11). Although this model encapsulates the role of external factors and the Covid-19 pandemic, its focus is on managerial decision making and does not capture the role of the wider organisation.

Therefore, it is important to understand the broader organisational context and the potential impact of external factors on managerial decision making for IoT adoption in the current environment.

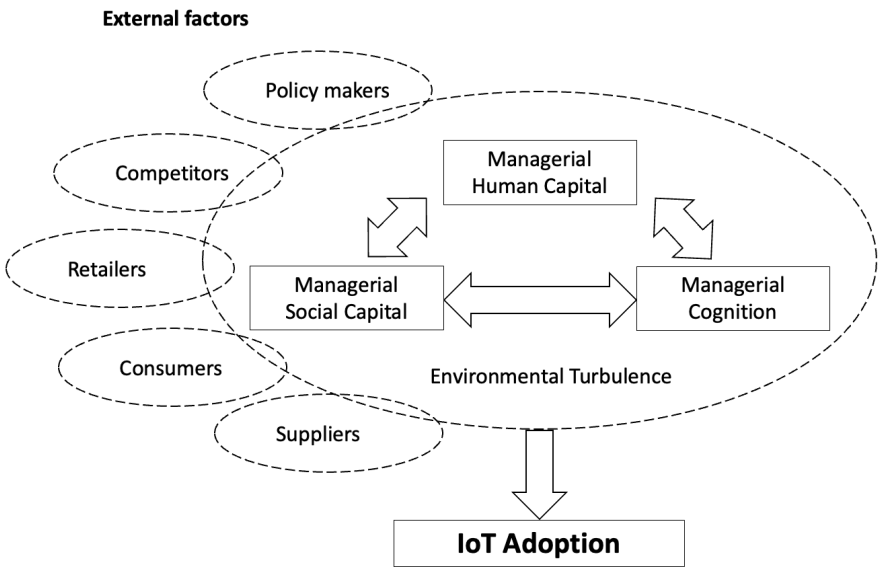

Figure 11: Revised dynamic managerial capabilities (Adner and Helfat, 2003)

Revised key elements of dynamic capabilities

The following Teece (2018) revised key elements of dynamic capabilities demonstrate how, based on the findings of this thesis, a suitable framework may be illustrated (see Figure 12). However, this model describes the role of external forces and a global pandemic such as Covid-19, but does illustrate the journey through sensing, seizing, and transforming an organisation for an IoT adoption.

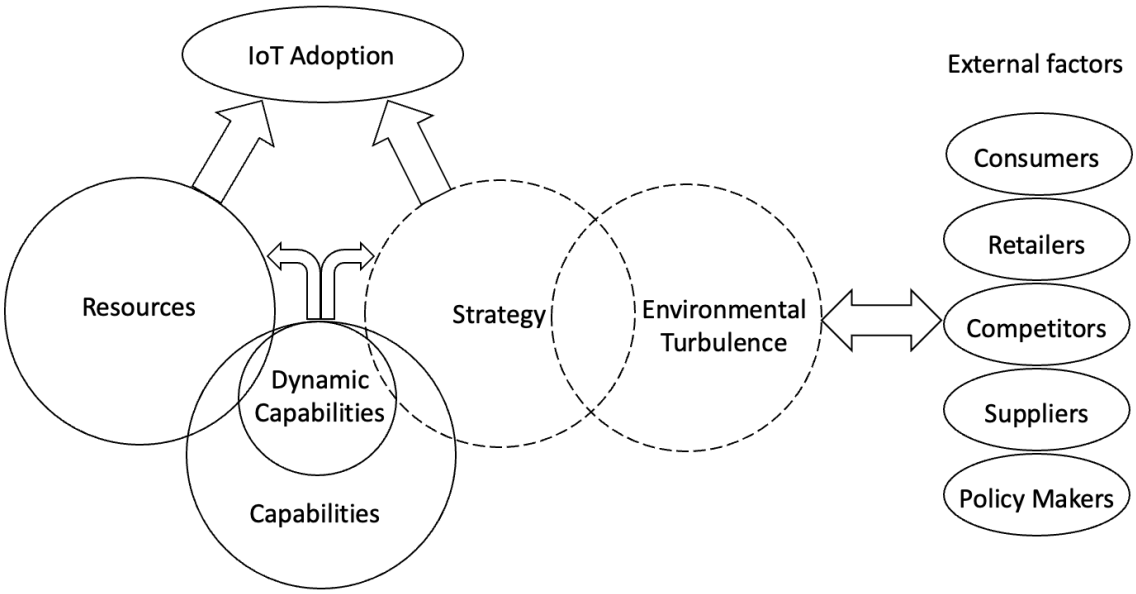

Figure 12: Revised key elements of dynamic capabilities (Teece, 2018b)

Moreover, it is argued that understanding the potential gains of IoT adoption and overcoming challenges including strategies to tackle knowledge, skills and social resistance due to job insecurity is essential (Xu, He and Li, 2014; Lee and Lee, 2015a). In addition, dynamic capabilities frameworks consider resources, strategy, internal and external factors to gain a competitive advantage (Teece, 2007, 2018b).

Strong Dynamic Capabilities enable firms that have complementary knowledge and assets to build new products and processes in a changing market (Helfat, 1997).

Further, a Dynamic Capabilities approach may assist in developing and continuously maintaining a competitive advantage (Augier and Teece, 2007).

The heart of the Dynamic Capabilities model is ‘Capabilities’ (Teece, 2018b). Covid-19 may influence an organisation's dynamic capabilities and strategy for IoT adoption. Below this study revises Teece’s dynamic capabilities model to illustrate the influence of external factors, competitors, and Covid-19 on an organisation’s dynamic capabilities for IoT adoption.

Revised dynamic capabilities

This revised dynamic capabilities' model shows the influence of external factors, including the Covid-19 global pandemic, that may impact an organisation's strategy and subsequent IoT adoption (see Figure 13).

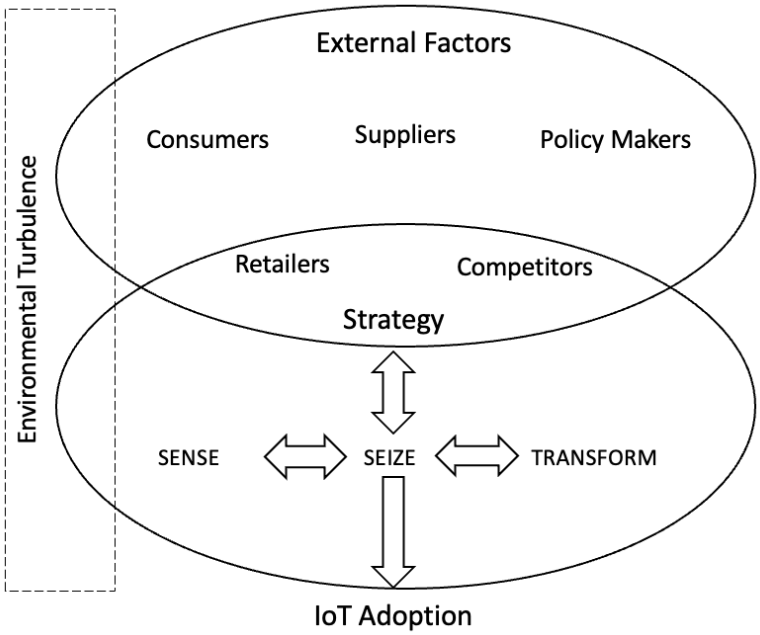

Figure 13: Revised dynamic capabilities model (Teece, 2018a)

2.7 ABSORPTIVE CAPACITY

In this section a brief overview of the literature on absorptive capacity is discussed (see Table 25).

2.7.1 ANALYSIS OF ABSORPTIVE CAPACITY

A firm's 'Absorptive Capacity' is its ability to maximise its innovative capabilities by absorbing and understanding new externally sourced information to enhance its commercial offerings (Cohen and Levinthal, 1990; Bruce and Zander, 1992; Fabrizio, 2002). In this research, participants at the strategic and management level may have a level of 'prior knowledge' of IoT technology that may lead to their ability to explore and exploit additional external knowledge (Cohen and Levinthal, 1990); in the case of this research, consulting with technology solution providers to pursue IoT adoption within their organisation.

Furthermore, organisations with direct R&D influence or manufacturing capabilities enhance a firm's absorptive capability (Cohen and Levinthal, 1990). Effective absorptive capacity in creating new knowledge for problem-solving, general knowledge or learning new skills requires intense effort above and beyond relying on brief access to prior knowledge (Cohen and Levinthal, 1990). An organisation's absorptive capacity relies on the interaction and knowledge exchange of its workforce, the external environment and the organisation's communications structure and the spread of expertise within the organisation (Cohen and Levinthal, 1990). Fabrizio (2002) argues that investing in capability building and other activities is fundamental to enhancing organisations' ability to identify, absorb and value external knowledge, exploited for the benefit of the organisation.

Consequently, the absorptive capacity of an organisation depends on the collective knowledge and capabilities of its employees and its ability to effectively tap into knowledge from external sources.

It is argued that knowledge may be held by individuals but is often passed on by groups within an organisation due to social and cooperative factors (Bruce and Zander, 1992). Moreover, accessing resources outside the organisation is indicative of a more cooperative nature between firms in the market (Lane and Luatkin, 1998).

As such, cooperation between individual and organisation can lead to an increase in knowledge and resources to benefit a business.

The absorptive capacity model was not selected as a preferred model for this study, as its focus on knowledge transfer informs only part of this thesis.

2.8 OPEN INNOVATION

This is followed by a short review of open innovation literature (see Table 25).

2.8.1 ANALYSIS OF OPEN INNOVATION

Open Innovation is a concept widely accepted in business and other sectors (Bogers, Chesbrough and Moedas, 2018). This paradigm involves adopting both internal and external paths and ideas to advance an organisation's technology and route to market (Chesbrough, 2003). Conversely, a closed innovation paradigm is when an organisation develops its innovation without external input (Chesbrough, 2003). Inside-out and outside-in innovation are represented by opening up internal innovation processes to outside contributors and allowing internally generated innovations to leave the organisation (inside-out), a typically known policy of Xerox's Palo Alto Research (Chesbrough, 2003; Bogers, Chesbrough and Moedas, 2018).

Beyond infrastructure and application development in the so-called first and second wave technologies, new opportunities to drive digital transformation include machine learning, blockchain and the Internet of Things (IoT) in the third wave (Bogers, Chesbrough and Moedas, 2018). As a result of COVID-19 and the technological and medical advancements to overcome a pandemic, both inside-out and outside-in openness became more prevalent. As an example of the 'inside-out' approach, Lego allowed teachers to modify Lego's Mindstorm product (Huston and Sakkab, 2006; Afari and Khine, 2017). This is further constrained by supply chain shortages of materials and components caused by

COVID-19, which is anticipated to extend supply limitations beyond the medical sector and into the commercial sector (Bhaskar *et al.*, 2020).

This example of an inside-out approach to product development highlights the importance of having resilient supply chains that are able to adjust in the face of unprecedented challenges, such as the Covid-19 pandemic.

The open innovation approach was rejected due to its focus on ideation and innovation, whereas the phenomenon of this thesis requires a broader approach.

2.9 LONG RANGE PLANNING

In this section an overview of long range planning (see Table 25).

2.9.1 ANALYSIS OF LONG RANGE PLANNING

The term "long range planning" refers to long-term strategy development including the setting of long-term goals and actions over a period of a few years. Essentially, it is a strategy for anticipating opportunities and challenges to come. An organisation must have the capability to monitor factors, usually external to the organisation, that may have an impact on the organisation. This will include anticipated economic changes, governmental and socio-political factors. Considering and planning for these factors requires clear and measurable goals, a timeframe, and action plans. Essentially, long-range planning is about achieving an organisation's future goals through future resources and organisational structure. The RBV and MBV views are considered in long-range planning (Varadarajan, 2020). For long term planning organisations must have a strong business model that embraces the organisations dynamic capabilities and leadership skills. Organisations not operating in such a planned way are susceptible to today’s volatile, uncertain, complex and ambiguous business environments (Schoemaker, Heaton and Teece, 2018).

To ensure successful long-term planning, it is vital for organisations to have a robust business model that considers RBV and MBV views, dynamic capabilities, and leadership skills. On evaluation, long-range planning as a model to adopt was rejected for this study.

2.10 COMPETITIVENESS THEORIES AND MODELS

Dynamic capabilities theories may identify the inimitable characteristics of a firm's capability, particularly in a resource-based organisation. Focusing efforts on achieving sustainable competitive advantage may require the use of models and processes to assist in developing a competitive strategy. Often utilised within other sectors, models for developing competitive strategies such as the resource based view (RBV) or the market based view (MBV), have proven to be successful. Organisational survival, growth and success are often dependent on an organisation's competitiveness.

RBV and MBV are two different approaches an organisation can adopt to identify and deliver on its distinct or unique capabilities, resulting in a competitive advantage. In the following section, the differences between these theories are explained, and their relevance is evaluated. These two approaches are widely studied, debated, and adopted by many organisations, typically within the private sector. They are particularly focused on the idea, understanding and definition of sustainable competitive advantage.

As such, the evaluation of these two approaches is essential for understanding the complexities of long-term business success.

2.10.1 RESOURCE BASED VIEW (RBV)

Barney (1991) argues that a firm achieves a 'competitive advantage' by creating a strategy that is unchallenged by its competitors; to extend this, Barney (1991) states that obtaining a position of 'sustained competitive advantage' occurs when its competitors are unable to replicate it.

As illustrated in Barney's conceptual model (see Figure 14), a sustained competitive advantage requires inimitable and non-substitutable elements (Barney, 1991).

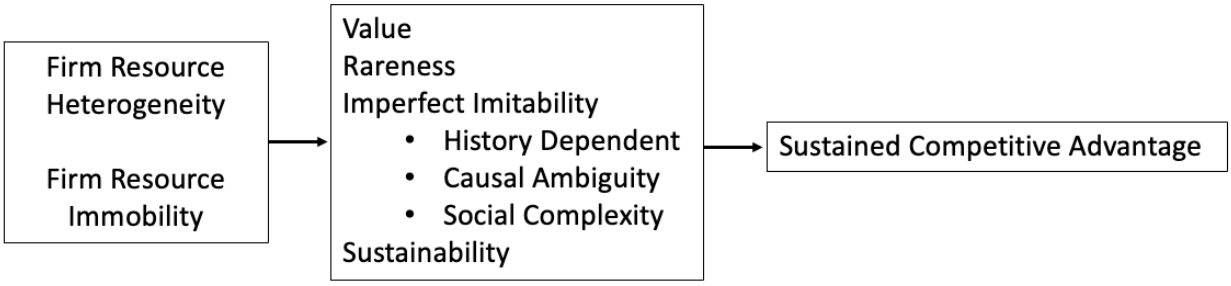

Figure 14: Relationship between VRIN and sustained competitive advantage (Barney, 1991)

RBV focuses on the resources and internal capabilities of an organisation as its source of competitive advantage, viewing the organisation as a 'bundle of resources' (Knecht, 2013). In simpler terms, the way in which an organisation achieves significant differentiation from its competitors, is by possessing resources and capabilities its competitors are unable to replicate.

2.10.2 MARKET BASED VIEW (MBV)

An organisation adopting a resource-based view (RBV) is said to have an 'inside-out' approach to its business strategy, whereas a market-based view (MBV), has an 'outside-in' approach to its business strategy (De Wit and Meyer, 2010).

The key difference is that an organisation with a RBV will look internally at its resources and capabilities to identify existing or potentially unique or distinctive qualities; to then package, promote and offer distinctive products or services. An organisation adopting MBV tends to look outward into the market to identify what is attractive and organises itself to meet what it perceives are market requirements (Porter, 1985).

To adopt an MBV, Porter suggests that organisations should analyse their competitive environment, choose strategies, acquire suitable resources, and then implement their strategy (Porter, 1980 cited in Barney, 1991:100).

Porter's five competitive forces (see Figure 15) is a strategic tool used by organisations to develop a MBV strategy. Organisations must identify the threats of new entrants, the bargaining power of buyers, the threat of substitute products or services, the bargaining power of suppliers, and rivalry among existing competitors (Porter, 1985). This examination assists the organisation in determining whether it is attractive to enter a particular market.

By understanding how these forces interact with each other, organisations can create a strategy that leverages their advantages. This will minimise the impact of any external threats or competitors on the market.

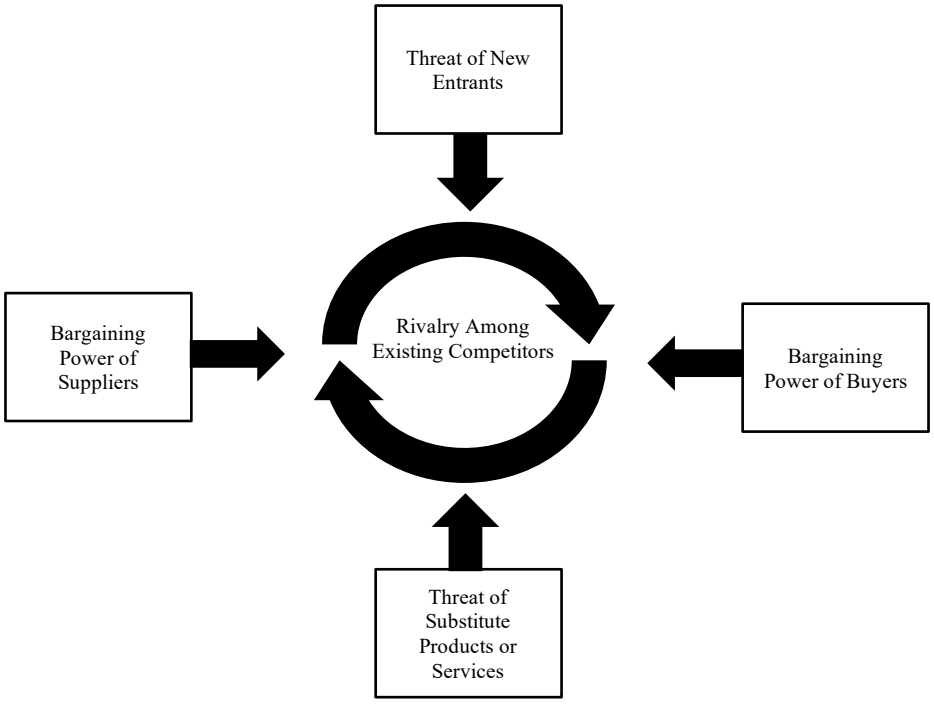

Figure 15: Porters five forces model (Porter, 2008)

Firms that believe they possess inimitable competencies are more likely to adopt an RBV model. This is where an organisation looks inwards, identifying its resources, knowledge, and skills across the organisation, with a view to maximising its potential and achieving a competitive advantage. However, allowing room for creativity (Amabile, 1998), innovation (Hansen and Birkinshaw, 2007) and collaboration (Ritala, 2012) are important factors to consider, because these activities assist organisations to identify ideas, create innovative solutions and develop mutually beneficial partnerships. All of which can result in a sustainable competitive advantage (Porter, 1985; Hansen and Birkinshaw, 2007; Ritala, 2012).

Therefore, it is essential to nurture an environment of creativity, innovation, and collaboration, which can collectively help organisations to build a sustainable competitive advantage and gain a competitive advantage.

2.11 OTHER SOCIAL SCIENCE THEORIES CONSIDERED

Exploring strategic management and organisational theories was a necessity in order to arrive at a suitable model to support the aims of this study. As demonstrated in this thesis there are several other theories that have similarity to dynamic capabilities theory and were duly considered for their appropriateness to this study. However, the dynamics of an organisation can be complex. Understanding theories available in social sciences is valuable to this study. In this section, an exploration of various theories is undertaken to determine if there are potential valuable contributions to this study. In this case, the following social science theories are explored: innovation and creativity, self-determination theory, Kurt Lewin's change management theory and the technology acceptance model (TAM). To understand the significance of these theories, their attributes are discussed, with the aim of determining which theories might offer the most useful insights to this study.

2.11.1 INNOVATION AND CREATIVITY

Amabile (1998) states that business objectives such as maximising productivity and control can unintentionally destroy innovation and creativity within an organisation. There are six general categories that help to foster creativity within an organisation: challenge, freedom, resources, work group features, supervisory encouragement, and organisational support (Amabile, 1998).

Hansen and Birkinshaw (2007), state that there are several components to innovation, which include idea generation, conversion, and diffusion. Idea generation is achieved by creating and engaging teams from internal cross-departmental resources and external resources. Conversion is the process of idea selection and development, while diffusion concerns the spreading of the selected idea.

If an organisation is having difficulty with idea generation, Hansen and Birkinshaw (2007) believe that organisations can fix this by building internal cross-unit networks and establishing links with external networks. For example, in 1999, Siemans created a fifteen person scouting team to cultivate relationships with scientists, doctoral students and venture capitalists; QuickBooks created a 'follow me home' development team to monitor how accounting was carried out, eventually leading to the launch of their Simple Start software. Interestingly, P&G Olay Daily Facials created an ongoing dialogue between people from different departments, thus combining the brain power of experts from skin care, paper towels and detergents. Bringing together experts from such a diverse group assists in the generation of creativity and innovation. To build on this, Amabile (1998) claims that when fostering creativity, it is imperative to match people's jobs to their expertise, provide challenging work, freedom to motivate, resources, support, genuine praise and positive encouragement.

By providing these key elements, teams are empowered to produce creative solutions, breaking down the barriers of traditional thinking and unlocking potential.

According to Reeves and Deimler (2011), achieving a sustainable competitive advantage is not dependent on position, scale and first-order capabilities. There are four organisational capabilities required for adaptability. Ability to read and act on signals, ability to experiment, ability to manage complex multi-company systems and the ability to mobilise. This suggests that an organisation can develop a sustainable competitive advantage despite its size and level of resources. This can be accomplished through fostering the ability to identify and develop ideas and keeping a flexible response to the needs of the market.

Through developing these four capabilities, an organisation can create an environment where it can stand out from its competitors, allowing it to stay ahead of the competition and remain successful despite changes in the market.

Arguably, components within Amabile's componential theory of creativity could be beneficial to organisations within the chilled beverages industry and their IoT adoption strategy. An individual's domain-relevant skills refer to their knowledge and expertise. For example, an individual with domain-relevant skills in mathematics may be able to easily solve complex equations, while someone with domain-relevant skills in writing may be able to craft engaging stories (Amabile, 1983).

It is important to note that creativity-relevant processes refer to the cognitive processes that are responsible for generating ideas that are new and useful (Amabile, 1998).

An individual's intrinsic motivation for a particular task or project is called task motivation. People who are intrinsically motivated to complete a task engage in behaviours that support creativity. Perseverance and exploration of multiple options are included in these behaviours (Emami *et al.*, 2023).

Creativity and innovation may not be the core focus of this study, however the three interrelated components of domain-relevant skills, creativity-relevant processes, and task motivation (Amabile, 1983; Emami *et al.*, 2023), may be useful to this study. The bottlers' IoT adoption strategy could be influenced by domain-specific skills and task motivation.

Organisations should focus on resources with domain expertise - either internally or externally. In addition, it is argued that creating the right environment to encourage and nurture task motivation within the workforce would prove beneficial.

Innovation and creativity could add value to this study; however, this will not be included in this study. Further investigation of its relationship with an organisation's dynamic capabilities should be considered in a future study.

2.11.2 COLLABORATION

Ritala (2012) conducted research on coopetition (collaboration between competing firms) by surveying 209 Finnish firms and found that under certain scenarios, a coopetition strategy is beneficial. It was found that during high market uncertainty, by sharing risks and costs, competitors can increase their innovation and their market performance (Ritala, 2012).

Research presented in this study suggests that collaboration, creativity and innovation can be interlinked. Collaboration may act as a stimulus for creativity and innovation, with the potential to induce inimitability or competitive advantage (Hurmelinna-Laukkanen and Ritala, 2010; Kähkönen *et al.*, 2017). While Ritali's theory on knowledge creation and transfer through collaboration is relevant to this study, especially at the transform stage of dynamic capabilities, it will not be explored further. However, the study of collaboration and innovation may be considered in a future study. This is because the intricate relationship and collaboration between bottlers in the chilled beverages industry and suppliers, such as OEMs, would be worth exploring. Particularly, in respect of the implementation of IoT enabled controllers.

2.11.3 SELF-DETERMINATION THEORY

This includes intrinsic and extrinsic motivation elements of Self-Determination theory. There are two levels of motivation, intrinsic and extrinsic (Levesque, C., Copeland, K. J., Pattie, M.D., Deci, 2010). Intrinsic motivations correlate with high levels of self-determination, whilst extrinsic motivations indicate a lower level of motivation (Baudier, Ammi and Lecouteux, 2019).

In Self-Determination Theory (Deci and Ryan, 1985), motivation is distinguished in two forms, intrinsic motivation and extrinsic motivation. Intrinsic relates to motivation based on interest or enjoyable activities whereas extrinsic motivation involves completing a task that leads to a particular or clear outcome. In some ways, extrinsic motivation is seen as a controlling factor. Understanding the drivers for IoT technology adoption and whether intrinsic or extrinsic motivation applies could be beneficial to this thesis.

The insight gained from exploring intrinsic and extrinsic motivation can help to identify the key drivers for an organisation's employee motivation towards IoT adoption, which is a crucial step for successful implementation. However, this theory on human behaviour will not be considered further for this study.

2.11.4 KURT LEWIN'S CHANGE MANAGEMENT THEORY

Kurt Lewin's simple three-step change management theory is encapsulated in three simple stages: Unfreeze, Change, Refreeze (see Figure 16). The stages entail analysing and undoing current practices (unfreeze), changing thoughts, feelings and behaviour (change) and establishing new habits or processes (refreezing) (Kaminski, 2011; Cummings, Bridgman and Brown, 2016). Studying whether an organisation's practices have been adapted, due to external pressures such as the Covid-19 global pandemic, and whether employee behaviour can be represented in the model would be beneficial.

To further investigate the efficacy of the model, it would be interesting to explore how the stages have been applied in practice, to analyse the impact on organisation resources.

Figure 16: Lewin's change theory (Cummings, Bridgman and Brown, 2016)

This model can be utilised by organisations in the chilled beverages industry to ensure all organisational resources feel part of the change process. This may result in a shared vision across the organisation. Change in any organisation is likely to be met with resistance from various factions, so addressing concerns should assist in the transitioning stage. This is a model that could be used within the context of dynamic capabilities across all three stages: sense, seize and transform. However, this theory will not be adopted for this study.

2.11.5 TECHNOLOGY ACCEPTANCE MODEL (TAM)

The TAM (see Figure 17) is primarily used to explain technology acceptance by users. In this study, it is expected that, at the strategic level, there will be challenges around senior management's knowledge of IoT technologies. In addition, there will be corporate and competitive pressure to adopt IoT technology to create a competitive advantage, improve efficiency or reduce costs. There is a lack of research into IoT adoption and dynamic capabilities. This may have a bearing on the organisation’s workforce perception, willingness, and capability to understand IoT adoption. The TAM is a model that can be used to explore an organisation's resource intention to use IoT technologies. It is

anticipated that this could yield value in a future extension of this research to incorporate operational resources.

As such, it is essential to further explore the effects of the TAM model on the adoption of IoT technologies. This is in order to better understand the potential impact on the organisation's resources and capability to use IoT technology.

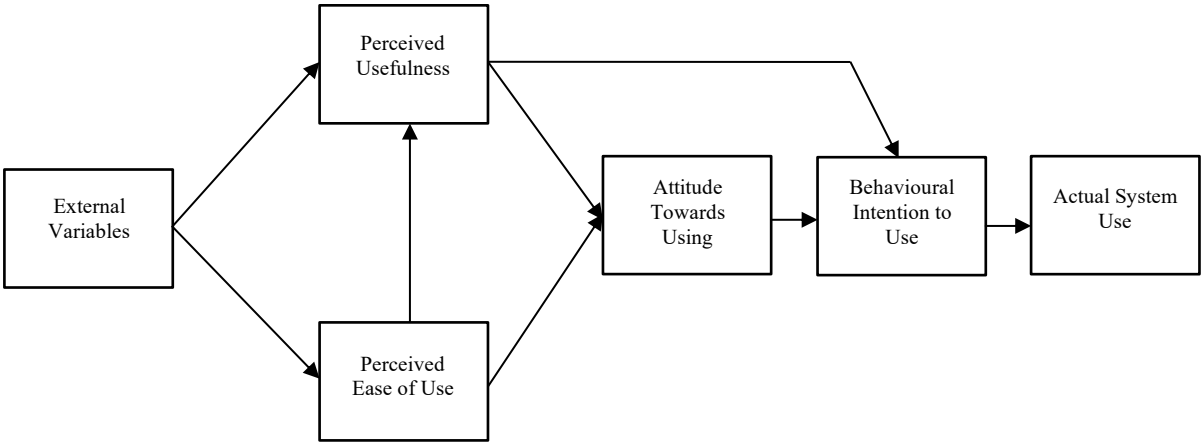

Figure 17: Technology acceptance model (Miller and Khera, 2010)

2.12 SUMMARY OF CHAPTER 2

The findings of this thesis suggest that there is a lack of research on organisational adoption of IoT and dynamic capabilities. The impact of IoT and information systems on organisations has been extensively studied from a technological perspective. Among the papers searched in this literature review, 2,119 were related to IoT technology and 749 to Information Systems. Following analysis, articles were organised into categories such as capabilities, leadership, competitiveness, and awareness, and further themed as strategic or operational. For completeness, extended literature reviews were conducted on dynamic capabilities and technology, absorptive capacity, dynamic managerial capabilities, open innovation, long range planning, RBV, MBV, innovations and creativity, self-determination

theory, Kurt Lewin's change management theory, and TAM. This thesis identifies gaps in existing research by categorising literature reviews (see Table 1) to identify the extent of existing studies. Extant knowledge is mostly based on technological outcomes.

In this chapter various theoretical models were explored. Of these, the dynamic capabilities theory was found to be the most appropriate lens to inform this research. This model helps strengthen research on IoT adoption by an organisation, its organisational capabilities and within the context of a global pandemic. A dynamic capabilities approach provides a clear understanding of how organisations sense, seize, and transform IoT technology adoption stages.

The findings of this thesis identify several factors regarding organisation readiness for IoT technology adoption (Kollmann, Kuckertz and Breugst, 2009). In this study, the themes of capabilities, IoT robustness, leadership, awareness, and competitiveness play a role in organisations' adoption of IoT technologies. In future research, this journey to explore various models warrants further consideration, especially if it involves operational resources. However, after reviewing the various theoretical models, it was decided that dynamic capabilities theory presents the most appropriate framework to follow in support of the outcome of this thesis.

3 METHODOLOGICAL APPROACH

3.1 INTRODUCTION TO CHAPTER 3

In the previous chapter a detailed literature review was conducted on IoT adoption. It was found that existing knowledge was primarily focused on the technological aspects of IoT. There was also a lack of research into an organisation's capabilities regarding IoT adoption. For detailed analysis, the literature review was evaluated and categorised into ‘capabilities’, ‘leadership’, ‘competitiveness’ and ‘awareness’, and further compared to the approach of this thesis. The literature review was summarised (see Table 1) to identify the context of each article. Dynamic capabilities and other associated theories were reviewed for their suitability in support of this research. Furthermore, it was established that there is a gap in research into organisational IoT adoption within the lens of dynamic capabilities and the context of environmental turbulence.

This provided an understanding of the literature, which was then applied to the aims and objectives of the research, to determine a suitable approach to exploring the organisational adoption of IoT in the era of the global pandemic.

In this chapter, a rationale for studying the chilled beverages industry is detailed, followed by a description of the chosen Gioia methodology approach, and philosophy towards conducting this research. For qualitative research, the HARP (Heightening Your Awareness of Your Research Philosophy) tool was chosen to better understand the researcher's most natural philosophy. Further, an assessment of grounded theory as a basis for qualitative content analysis and thematic analysis is presented in this chapter. After consideration, and as indicated earlier, the preferred approach to thematic analysis resulted in the selection of the Gioia methodology. This methodology involves several steps including data collection, coding, categorisation, interpretation, theme development, theory building and provides flexibility for continuous analysis refinements. As established in this study, data collection consisted of qualitative interviews, coding undertaken using

CAQDAS software in conjunction with a flexible coding strategy. Following this, the Gioia methodology suggests the researcher categorises coded data into meaningful sub themes and aggregate dimensions, before undertaking the interpretation of the said themes. Finally, following the Gioia methodology resulted in a conceptual framework that explains the findings of this research.

In summary, qualitative interviews were conducted in order to gain an in-depth understanding of the research question. This data was then coded and analysed. The Gioia methodology was then applied to the data in order to categorise the coded data into meaningful sub-themes and aggregate dimensions. Finally, these sub-themes and dimensions were used to create an IoT adoption framework that explains the research findings.

3.2 RESEARCHER PHILOSOPHY

A HARP (Heightening your Awareness of your Research Philosophy) is a reflexive tool (Saunders, Lewis and Thornhill, 2019, p. 161). It was used to help guide this research by identifying the researcher's philosophical preferences. The results suggest that the researcher's beliefs map closely with two research philosophies, Critical Realism and Pragmatism (see Table 2).

Pragmatism requires a focus on practical elements of knowledge that can be used towards resolving or addressing real life organisational problems. It is a paradigm that lends itself to bridging gaps between theory and practice and as suggested, takes a practical approach to research.

Critical realism emphasises research that is grounded in empirical evidence. It relies on the researcher's ability to interpret and understand evidence, whilst recognising the

researcher’s role as part of the study itself as informed by the researcher’s self-awareness. In essence, the researcher is involved beyond being a neutral observer.

Interpretivism considers other factors that shape human behaviour such as culture and institutional values. It also relies on the researcher’s self-awareness and suggests researchers should be open to a variety of viewpoints and explanations.

Postmodernism is most often used in research where direct observations of participation in their social environments are made. This requires the researcher to spend significant time immersed in the community as part of their research. This approach is not suitable for this study.

Positivism is a method most commonly adopted in quantitative research, which is not aligned with this research. Although arguably objective, using this approach may miss opportunities to capture the richness and complexity of responses that are often beneficial to qualitative research. Moreover, this research is not designed to gain new insights through hypothesis testing. The lowest score recorded as an approach to follow for the researcher was Positivism (-2).

Qualitative research is better suited to this type of research, as it focuses on understanding the context and meaning behind people's responses. Additionally, qualitative methods give researchers the opportunity to explore multiple perspectives and gain a better understanding of the nuances of the data. This research is not designed to test hypotheses, so a positivist approach is not the best choice.

The most appropriate approach for this research is pragmatism. Among its key outcomes are practical solutions to solving organisational problems, as well as a wide range of techniques and methods it uses.

Philosophy	**Score**
Positivism	-2
Critical Realism	10
Interpretivism	5
Postmodernism	5
Pragmatism	7

Table 2: The researchers HARP scores

The scores indicate that the researcher's preferred approach is most in line with 'Critical Realism' (score of 10) and 'Pragmatism' (score of 7). Nevertheless, this study was conducted in accordance with the pragmatist method. Pragmatism involves determining the most appropriate methodological choice, context, and expected consequences (Nastasi, Hitchcock and Brown, 2015; Saunders, Lewis and Thornhill, 2019, p. 181). This approach is preferred, as it enables the collection of credible, reliable, and relevant data for addressing the research question (Saunders, Lewis and Thornhill, 2019, p. 181) without the constraints of a single approach.

Although the HARP score for 'Critical Realism' was the highest (score of 10), this was rejected as a philosophical approach, primarily due to its explanatory focus on observable events, which was not best aligned with how data is gathered during semi-structured interviews. Pragmatists are interested in practical outcomes and will use multiple methods, including semi-structured interviews, that enable, credible, well-founded, reliable, and relevant data to be collected (Kelemen and Rumens, 2008; Saunders, Lewis and Thornhill, 2019, p. 151). It is for these reasons, and the expectation that the intended outcome of this research will influence organisational practice, that pragmatism is adopted. Therefore, this approach allows for the collection of data that will be both robust and relevant, ultimately leading to tangible and beneficial results.

Philosophical Assumptions

As indicated, it is appropriate to adopt pragmatism as a philosophical approach to this study. Undertaking an inductive study with in-depth interviews and analysis supports the exploration of the most relevant themes. Based on philosophical assumptions, this research was conducted as illustrated in a ‘research onion’ as seen in Figure 18. The research onion provides a visual representation of the chosen research methodology for this study. Various research paths exist within the six layers of the research onion. Figure 18 illustrates the specific research approach to this study. Starting with a pragmatic approach to qualitative research, conducting semi-structured interviews based on case studies, grounded theory methodology (GTM) and participant interviews carried out over the same period of time (cross-sectional).

This enabled this study to explore the participants’ perceptions and experiences in depth. In addition, the data was analysed from multiple dimensions to gain a comprehensive understanding of IoT adoption in the chilled beverages industry.

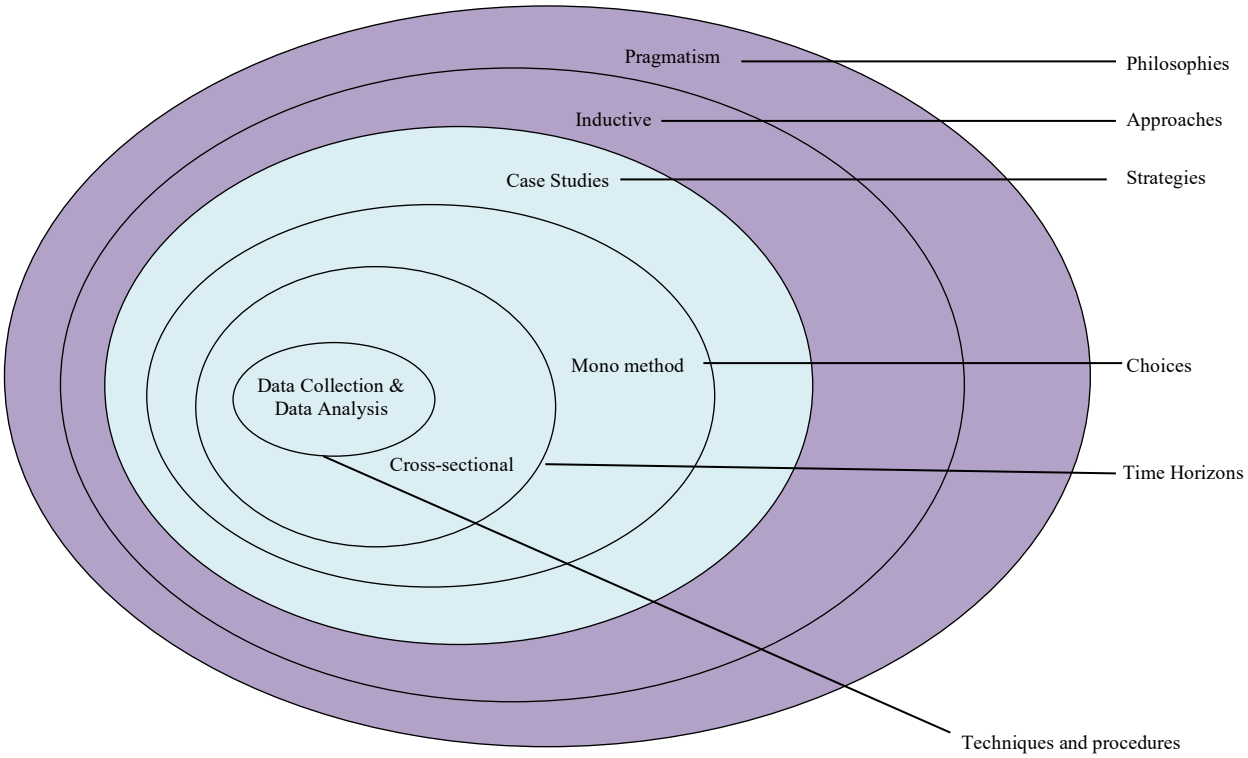

Figure 18: Saunders research onion

Access to participants to explore their experiences with existing IoT projects and their future IoT plans is key to this research. In this research a variety of international organisations were included, as a set of case studies. The available sample size of potential participants is rich in diversity, experience, and strategic focus. A qualitative study was the correct approach, combined with the preference for an inductive, pragmatic study.

A qualitative study does not require many participants, and utilises methods such as purposeful sampling, interviews, audio recordings, transcriptions, and secondary data analysis; all acceptable under the interpretivist paradigm (Collis and Hussey, 2013). An alternative, positivist approach, focuses on collecting and analysing quantitative numerical data. Methods include surveys, longitudinal studies, and experimental studies. Positivism

was therefore not chosen for this thesis. Rather, this study has opted for a qualitative approach, which allows for an in-depth exploration of experiences and views of participants.

This research was conducted within the pragmatist paradigm, based on an opportunistic set of case studies. As previously stated, access to high quality and relevant participants was available for this study. Semi-structured interviews were conducted with 19 participants within the drinks bottling or chilled food industries. These included chilled soft beverage bottlers, beer bottlers and chilled food companies. The research question warrants an approach that allows for deeper probing during interviews, with the aim of supporting the validity, robustness, and reliability of collected data. Semi-structured interviews were conducted, which unlike quantitative research, provide the opportunity to generate supporting notes, observations, and additional questions.

This approach was suitable for this study, as the research is specifically about the impact of IoT on an organisation's workforce capabilities. This would require flexibility for additional probing questions. It was anticipated that the participants would share their views, experience, and wider commercial and strategic goals. This is because many have senior strategic roles within their respective organisations, presenting an opportunity to collect high quality data. Therefore, face-to-face interviews provided the best opportunity to gain a comprehensive understanding of the subject matter and answer the research questions.

In support of this, and for possible thematic variance, 4 of the 19 semi-structured interviews were conducted with those with the role of middle manager within the organisation. Middle managers serve as a conduit between senior management and the operational team. Therefore, input from this group contributes to the overall reliability of this research. This may also provide possible insights that may suggest extending this research to include operational personnel, potentially leading to an additional qualitative or quantitative study.

By considering the valuable input of middle managers, this research can become more reliable and comprehensive. Additionally, this may suggest the need to further investigate the effects of operational personnel, leading to new opportunities for qualitative or quantitative studies.

3.3 METHODOLOGY

This research uses primary data and is informed by dynamic capabilities. For robustness the Gioia methodology is employed for data analysis. Concept and theme categorisation resulted in the identified aggregate dimensions of awareness, competitiveness, leadership, and capabilities. These themes are in accordance with the categorisation of the literature review conducted on the Internet of Things. Participants represent global organisations at senior and strategic levels working towards the digital transformation of their business units. Participants included 19 senior executive, strategic, and management level employees.

Using the interpretative approach, a case study-based qualitative study was conducted in order to answer the research question. This research included conducting a series of semi-structured interviews with strategic leaders and middle managers within the chilled beverages sector. Participants were asked to share their experience and planned approach to IoT adoption before and during a pandemic and how the organisation adapted its capabilities to ensure successful adoption and its competitiveness (Helfat *et al.*, 2009). Particular attention was placed on selecting participants from the chilled beverages industry, across multiple companies, countries and continents.

Questions were specifically posed to understand how the chilled beverages industry had adapted to the changing landscape of the pandemic, and the strategies they adopted to remain competitive.

This included following the Gioia methodology and Dynamic Capabilities model (Gioia, Corley and Hamilton, 2013; Teece, 2014, 2018a). In support of this approach, selected participants were based in 13 different countries, including Argentina, Australia, Croatia, Denmark, India, Malaysia, Mexico, Netherlands, Serbia, Spain, Thailand, UK, and USA. Making for a suitably diverse approach to this study. This allowed for the capture of a more holistic view. It presented a variety of experiences within the chilled beverages industry, whilst also offering potential insights into the differing cultural and institutional values of a diverse set of organisations. Interviews were conducted between 40 and 60 minutes.

The results were wide-ranging, offering an innovative perspective on the topic that was not available through any other research method. This allowed for a more comprehensive understanding of IoT adoption in the chilled beverages industry.

3.4 RESEARCH STRATEGY AND DESIGN

Initial contact was made with each potential participant from the selected companies. Candidates were approached with a view to securing participation, and eventually 19 candidates from an initial pool of 39 agreed to participation. It was sensible to target a large pool of candidates due to potential rejection or withdrawal. An ethical approval application was submitted via Brunel Research Ethics Online (BREO) and a Letter of Approval was received by the Research and Ethics Committee on 11th June 2020 (see Appendix D). Cover letters (see Appendix A) , consent forms (see Appendix C) and participant information sheets (see Appendix B) were issued to candidates, all of which were reviewed, accepted, signed, and returned. As this research is intended to be completed by participants from various countries around the world, it was expected that any in-country or employer-specific ethical approval would be obtained as required. There were no requests to apply for any additional ethical clearance beyond that which was supplied by the University of Brunel.

The approach of using purposeful sampling is relevant to this study. The criteria for this study was to explore the in-depth knowledge of those at a strategic level of an organisation, who have experienced the conception, implementation, and practice of IoT technology initiatives within their organisation.

As previous studies on the adoption of IoT have significantly focused on technological aspects, and in doing so, have not dealt with the impact of organisational IoT adoption on an organisation's workforce and its capabilities, it was critical to utilise methods that would strengthen the contribution of this research by adopting a robust, reliable, and validated methodology. Due to limited research on organisations' IoT adoption and workforce capabilities, it was decided to study these phenomena practically. This research was conducted inductively, employing a qualitative, interpretive approach. In doing so, semi-structured interviews were conducted with 19 participants in senior executive, strategic or management roles. These interviews were key to enhancing the quality of this study.

A purposeful sampling was conducted for this qualitative study since it was necessary to interview senior and strategic executives with relevant experience in IoT adoption. Through the researcher’s professional network, it was possible to identify and connect with highly suitable candidates to explain the nature of this research and to request their participation. Initial contact was possible with candidates via a historical professional working relationship or due to a mutual professional network. Various types of contact information were collected in these cases, including email, phone numbers, LinkedIn, and WhatsApp accounts. An introductory contact was made with candidates through two channels, email, and LinkedIn. In many cases, a single email or LinkedIn message was enough to elicit a response, and subsequent enquiries for further clarification or agreement to participate. The email contained a high-level explanation of the research goals and the request for participation. A typical email request and several responses were as follows:

RESEARCHER EMAIL:
Hi [name],

I hope you are well. I am conducting doctoral research on the adoption of IoT, supported by Brunel University in London, and wondered whether you would be available for a 45-60 minute zoom/team interview in the next couple of weeks.

If you are able to support this, please let me know and I'll send you the background information for your consideration.

Regardless, it would be good to catch up. ☺

Kind regards,

Niazy

CANDIDATE RESPONSES TO EMAIL:

SER-MG5430

'I'll be glad to help you and assist you in your research. We can schedule a Teams/Zoom meeting any day next week'.

AUS-AL6641

'That's fantastic – congratulations. I would certainly welcome the conversation with you and would love to learn more about your research'.

UK-AT4223

'Thanks for that invite for the interview. I would be glad to participate. Please only consider that this interview can take place after 23rd of September. Let me know if that works for you'.

In cases where email contact was not possible or no reply to an email was received, and if there was already a connection with the candidate via LinkedIn, then a simple LinkedIn message was sent to the candidate to establish whether they would be interested and able to participate. Where established LinkedIn connections did not assist, a request to connect was made by using the LinkedIn search feature for a particular candidate. A direct request to connect was made. Typical LinkedIn communication and responses were as follows:

RESEARCHER LINKEDIN MESSAGE:

'I hope you are well and know you have moved on, so please let's connect, as I would like to discuss IoT research I am conducting and would like for you to participate if possible'.

CRO-KS4721

'Great to hear from you, and, sure, let's connect. I will be happy to participate in your research. Kindest regards'.

RESEARCHER LINKEDIN MESSAGE:

'I hope you are well and keeping safe. I have a request regarding IoT adoption, if you can assist me. It is regarding my doctoral research. If you can participate, will take 45mins-60mins, let me know and I will send you some details'.

DEN-SA3152

'I'm well thanks - hope all's good with you too. Absolutely that sounds interesting, let me know how I can help'.

RESEARCHER LINKEDIN MESSAGE:

'Thanks for getting back to me. I am undertaking PhD research on IoT adoption and would like to ask you to partake in a short interview. Can I share details with you for your consideration?'.

CRO-DC6625

'Hi Niazy, I apologise I missed previous notification. Sure, I'll find time, just let me know when. Feel free to contact me via e-mail [email addressed removed]'.

From 39 initial candidates, 19 strategic level and middle management candidates agreed to participate. Of the remaining 20 candidates, 15 did not respond to emails, 2 bounced, 2 agreed to take part, but did not finalise interview dates. 1 was rejected due to expected unavailability. A decision was made to proceed with 19 candidates initially identified, with the possibility of revisiting the non-participating candidates if theoretical saturation did not occur during coding (Gioia, Corley and Hamilton, 2013; Birks, Hoare and Mills, 2019; Chun Tie, Birks and Francis, 2019).

It was essential to simplify the consent process once the participant's agreement to participate had been acknowledged. Most potential participants worked at senior or strategic levels in their organisations. As they usually work in high-demand roles, easing their acceptance and participation was imperative. The covering letter, participant information sheet, and consent form were combined into one electronic document using Adobe Acrobat. Designed to be filled in and signed electronically, the consent form portion can be filled out electronically.

As a result, every participant had the opportunity to read a covering letter, the full details in the participant information sheet, and finally agree or disagree with participation. After clicking the check boxes on the consent form and accepting their participation digitally, they completed the fillable consent form. As a result, a full copy of the completed and signed consent form was automatically emailed directly to the researcher and participant. A covering letter and participant information sheet were included. It was an efficient and effective way to ensure candidates had all the information they needed before deciding whether to participate, in combination with a simple consent process (see Appendix C).

Communication via tools such as Microsoft Teams (MS Teams) or Zoom is common practice. In light of the Covid-19 pandemic, the semi-structured interviews were conducted remotely, using Zoom Video, Zoom Audio, or MS Teams video depending on participant preference. Moreover, this study's participants were located in 13 different countries, making these communication tools appropriate. Time slots for interviews were set for 60 minutes, with the expectation that they would last between 40 and 60 minutes. For later transcription, participants agreed to conduct and record interviews. Participants were verbally informed when each recording began and ended, in addition to being informed that a backup digital recording device was also being used.

Four of the fifteen strategic level interviews were conducted via Zoom audio, four via Zoom video, and seven via MS Teams video. In addition, four middle management interviews were conducted using MS Teams video. Meetings were conducted according to the preferences of the participants. A verbal confirmation was requested of whether the

interview could be conducted with cameras enabled in advance of either video recording or audio recording when participants appeared with cameras enabled. In contrast, if the participant entered with video off, a check was made to confirm this was their preference, and if so, an audio-only interview was conducted. Having video enabled offered the prospect of a richer and more interactive face-to-face interview, allowing meaning to be derived from observations and behaviour (Berg, 2001).

Each of the four initial interviews was recorded using Zoom and transcribed in Word by playing back the Zoom recordings, listening to the interview, scrolling back and forth, and typing the entire interview verbatim. In addition, long and short pauses, laughter and other observations were noted in the transcription, which may provide accentuation and meaning to the participant's thoughts and mood. In this exercise, each interview was replayed multiple times, reinforcing each experience, and a transcript of each interview was produced. It was discovered during the 7 video interviews that MS Teams provides for its own textual translation of recordings, a feature that was unavailable in Zoom. MS Teams was used to schedule the remainder of the candidate interviews after realising this added benefit.

To produce a most efficient, accurate, and orderly transcription, MS Team's auto-transcribed documents required substantial data cleansing and reformatting, much of which was accomplished using MSWord's find and replace and wildcard features. When compared to transcribing directly from a Zoom video or audio recording, the time taken to cleanse, correct, and prepare the auto-transcription did not result in any time savings or quality improvements. Still, all transcripts had to be carefully read, video recordings had to be rewatched, and transcriptions had to be retyped or corrected. Even though there were no real efficiency gains, receiving an automated transcription file from MS Teams made this the preferred tool for the rest of the interviews. If for no other reason, but for the subjective belief that the available additional resource material of an auto-transcribed text file was in some way better to have, as it represents an independent output from each interview that supports the validity and integrity of each interview. While limited in success, trying to find ways to enhance MSWord's programmatic automation of data cleansing for

the auto-generated files was quite satisfying. Throughout all cases, scrubbing forwards and backwards, typing and retyping transcriptions were necessary. The transcription process was assessed as being similar in both instances in terms of the amount of time and effort required, as well as the perceived quality of knowledge gained.

The transcription methodology crosses Naturalism, in which every utterance is transcribed, and Denaturalism, in which the accuracy of the transcription is determined by the meaning, perception, and substance of the interview (Oliver, Serovich and Mason, 2005). As part of the absolute transcription, non-lexical fillers such as 'um' and 'ah' were ignored, while fillers like 'like' and 'you know' were included, since these illustrate nuances that may enhance key points made by the participant naturally. This was further supported by transcription of long or short pauses and laughter from participants to capture the essence of their interviews.

Interviews were conducted at the strategic and executive management levels between 18 September and 19 October 2020. Four additional middle management interviews were conducted between 15th December 2020 and 14th April 2021, using MSTeams video. To maintain continuity and familiarity of the recorded content, interviews were transcribed as soon as possible. For coding, categorisation, and analysis, each document was refined further and standardised into a format for import into NVivo, a computer-assisted qualitative data analysis software tool (CAQDAS). As a result of CAQDAS, researchers can gain a complete view of their data and maintain an audit of data and processes (Welsh, 2002). The interviews were coded, categorised, analysed, and visualised using NVivo. NVivo is a tool suited to supporting the qualitative research analysis process, but the task of identifying relationships, themes and meaning remains the responsibility of the researcher, who relies on recognised techniques, processes, skills, and capabilities to ensure the research is valid, reliable, and robust.

NVivo provided a platform to structure and organise the qualitative data collected during the interviews. It allowed for quick and efficient analysis of the data, identify patterns and relationships, and draw conclusions from the data. Additionally, NVivo enabled the

researcher to create visualisations of the data, such as charts and graphs, to better understand the data.

Using the Gioia methodology, interview analysis enabled the identification and emergence of 1st order concepts, which were then revised into 2nd order themes and finally aggregate dimensions (Gioia, Corley and Hamilton, 2013).

3.5 QUALITATIVE ANALYSIS

In selecting a research genre, novice researchers need to understand their philosophical position to support their selection of an approach to data collection and analysis (Chun Tie, Birks and Francis, 2019). As previously indicated, a HARP evaluation was conducted with high scores for Critical Realism (10) and Pragmatism (7). In light of the exploratory nature of this research and the fact that it was conducted via semi-structured interviews, a pragmatic philosophical approach was chosen for this study. Critical Realism tends to be observational and explanatory in nature, which is not suitable in this research context. To this end, an attempt to understand better the various approaches was undertaken before settling on Pragmatism.

In Qualitative Data Analysis, there are several procedures, including Interpretive Approaches, Social Anthropological Approaches and Collaborative Social Research Approaches (Miles and Huberman, 1994; Berg, 2001, p. 338). The Interpretative Approach seeks meaning from human action, including interviews, observations, and behaviour, all of which can be transcribed into written text for analysis (Berg, 2001). Social Anthropological Approaches require the researcher to spend time within the community, participating and interacting with the study population. Collaborative Social Research Approaches require the researcher to work with their study subjects in a given setting (Berg, 2001). Both Social Anthropological and Collaborative Social Research Approaches were rejected. This is because both involve close interaction with the study group, which is neither practical nor necessary, due to the social distancing rules of a global pandemic.

For similar reasons of inappropriateness, phenomenology (Husserl, 1999) and ethnography were also rejected.

Collis and Hussey (2013) describe a ‘general analytical procedure’, as a procedure that employs the practice of reducing data, displaying data, drawing, verifying and validating conclusions. This analytical method is systematic and does not rely on any particular data collection method (Collis and Hussey, 2013, p. 157). The analytical procedure includes coding words, phrases and paragraphs, adding research comments, identifying similar phrases, patterns and themes; using patterns and themes to focus on further data collection, and developing generalisations to cover the consistency found in the data (Miles and Huberman, 1994).

The process of content analysis (Berg, 2001), in which researchers examine artifacts of social communication, could be applicable to this research. Although open and inviting, the ‘general analytical procedure’ supports this research as does ‘grounded theory’, a widely used and popular research method, particularly among doctoral researchers (Bryant and Charmaz, 2007). Grounded theory (GTM) is the preferred research methodology as it consists of techniques suitable for qualitative content analysis and thematic analysis, so a variety of genres of grounded theory were evaluated.

The primary goal of grounded theory is to generate new theories that explain and explore phenomena based on the data. However, this research is not focused on such an outcome. It is primarily concerned with identifying patterns and potentially recurring themes within the data, hence the emphasis on categorisation and thematic analysis, which are techniques that can be found within grounded theory strategies.

An interpretative approach was preferred in answering the research question, as this requires conducting inductive research, entailing iterative, concurrent data capture, coding and analysis of semi-structured interviews. This approach does not require prior interaction, work with, or getting to know the study group. Semi-structured interviews were conducted, transcribed and analysed in a methodical way. The research was supported

by the use of CAQDAS, as interview transcripts were imported into NVivo, iteratively coded, categorised and analysed.

Using CAQDAS and NVivo, this study was able to be conducted in a thorough and methodical way.

3.6 GROUNDED THEORY, QUALITATIVE CONTENT ANALYSIS AND THEMATIC ANALYSIS

Grounded theory has several methodological genres. Among them are traditional grounded theory (GT) founded by Glaser, evolved grounded theory (GT) by Strauss and Corbin, constructivist grounded theory (Chun Tie, Birks and Francis, 2019), or Gioia's Methodology (Gioia, 2019), which is an organisation-focused, inductive, systematic approach. Therefore, it makes sense for a novice researcher to evaluate and adopt one of these methodologies, although new theory development is not the primary outcome of this research. Congruency is recommended when choosing a genre.

Congruency occurs when the philosophical position of the researcher is congruent with the research question and chosen methodology (Birks and Mills, 2015). This has been described by Birks and Mills (2015) as methodological congruence. It is suggested that novice theorists should not mix methods and should minimise adaptations. This is arguably good practice, as it is noted that researchers following grounded theory must develop specific qualities, most likely achieved through experience (Kenealy, 2012). For these reasons, this research follows a single genre of grounded theory, such as Gioia’s Methodology. However, it has the flexibility to incorporate common techniques, such as Strauss and Corbin’s conceptual coding and analysis.

There are inconsistencies in the grounded theory methods literature (Kenealy, 2012). For the purpose of this study, consideration of methods developed by Glaser and Strauss, Strauss and Corbin, Charmaz and Bryant, Eisenhardt, and Gioia and Corley was

evaluated. The purpose of this evaluation was to develop an understanding of the varied philosophical approaches and techniques. It was also important to determine which approach would most align with this thesis. This approach would be one that considers the previously mentioned HARP score and a preference for pragmatism.

Thus, the ultimate goal was to find a practical, evidence-based approach which would yield the best outcomes for the research.

Glaser and Strauss are the founders of the grounded theory method, subsequently diverging from each other, with theories by Strauss and Corbin becoming popular among researchers (Bryant and Charmaz, 2007). Glaser is synonymous with Traditional or Classical GT, an objectivist approach with open, selective, and theoretical coding (Charmaz and Bryant, 2011), as it is suggested that separating the researcher from the participant is achievable when writing an account from the researchers' perspective (Birks and Mills, 2015). Glaser's GT approach is rejected as in this study, 19 strategic and mid management level semi-structured interviews were conducted using MSTeams or Zoom, resulting in both audio and video recordings.

Strauss and Corbin evolved Glaser's approach to what is known as 'evolved GT', a pragmatist approach. Strauss & Corbin have continuously revised their approach providing user friendly, flexible techniques and guidelines for data coding and analysis. The three stages of Strauss & Corbin's data coding include Open coding, Axial coding and Selective coding. In more recent writings, Strauss and Corbin have reduced the emphasis on distinctions between open, axial, and selective coding (Strauss and Corbin, 1998; Bryman, 2016). Strauss & Corbin's pragmatist view is aligned to the philosophical approach for this study, and they suggest a flexible approach for student researchers:

> *'Sometimes, one has to use common sense and not get caught up in worrying about what is the right or wrong way. The important thing is to trust oneself and the process. Students should stay within the general guidelines outlined in this book*

> *and use the procedures and techniques flexibly according to their abilities and the realities of their studies'* (Strauss and Corbin, 1998).

Straussian grounded theory is deliberate as it is flexible and allows for data collection and production of concepts through open coding (Bryman, 2016, p. 575). Focus is on understanding meanings rather than describing them. Supporting this approach further, it is suggested that substantive coding directs the researcher to work with the data directly through open coding resulting in new properties for recoding, and the emergence of categories (Bryant and Charmaz, 2007). Strauss and Corbin's approach is suitable for this study. Combining or adopting other research methods applied within the context of organisational studies, such as Gioia's systematic approach and methodology (Gioia, 2019), may strengthen the results of this study.

Charmaz, a student of Glaser and Strauss objectivist approach, established Constructive Grounded Theory Method (Constructive GTM). Subsequently devising a data coding convention of Initial, Focused and Theoretical coding. Considerable discussion on what exactly is grounded theory has been debated (Charmaz, 2000). Charmaz suggests grounded theory methods should utilise constructivism within its method, where the researcher proactively uses their background and knowledge to co-construct meaning and experience with participants to construct theory (Charmaz and Bryant, 2011; Birks, Hoare and Mills, 2019). Charmaz argues that Strauss and Corbin's approach has contemporary alignment with constructivism (Charmaz, 2000). Charmaz, and as indicated earlier, Strauss and Corbin provide suitable approaches for this study, and are arguably focused on social contexts. It is relevant for this study to evaluate genres that focus research within an organisational context, and the writings of Eisenhardt or Gioia are relevant in this respect.

Eisenhardt believes that theory building, and theory testing is closely related. Theory building goes from data to theory, and theory testing, from theory to data (Gehman *et al.*, 2018). Eisenhardt's 'Building Theories from Case Study Research' (Eisenhardt, 1989)

was ground-breaking and according to Google Scholar has been cited more than 41,000 times (Gehman *et al.*, 2018). At the time of writing, the citations exceeded 61,000. Eisenhardt suggests research should begin with a research question, even if it is not the question that will be addressed at the end of the study. She believes in theory building from multiple cases by exploring multiple cases (Gehman *et al.*, 2018). Eisenhardt's view on multiple cases is relevant to this study, as qualitative semi-structured interviews were conducted with 19 strategic leaders, senior executives, and middle management from 14 different companies based in 13 different countries. A multiple case study approach with a common thread of operating within the chilled beverages industry. These organisations focus on supplying cold drinks, chilled food products, or alternatively supplying IoT technology within the sector. In contrast, Eisenhardt recommends using ethnography or archival surveys wherever relevant, rather than just interviews and notes that Gioia prefers (Gehman *et al.*, 2018).

The organisations chosen for the multiple case study approach may have different focuses and strategies for success. This will enable an insightful comparison of the various methods employed by each to achieve success.

For many years, Gioia has been developing grounded theory for interpretive research and finding ways of ensuring 'qualitative rigour', that is to enable inductive researchers to follow systematic conceptual and analytical discipline that can result in credible, plausible and defensible interpretations of data (Gioia, Corley and Hamilton, 2013). Gioia devises an approach allowing for the systematic presentation of first-order analysis, the coding of 'facts' from participants, and second-order analysis of concepts, themes and dimensions explaining these facts (Maanen, 1979; Gehman *et al.*, 2018). This then leads to a data structure which is the basis for translating the analysis of data. As Gioia argues, semi-structured interviews are the heart of a study, while not excluding other data sources (Gioia, Corley and Hamilton, 2013). Simplicity in the design process suggests Gioia's approach is a strong candidate for this study. Gioia assumes the organisational world is socially constructed by 'knowledgeable agents', allowing the researcher to merely account

for the informants' experience, much like a reporter, and thus rejecting priori knowledge whilst encouraging the discovery of new concepts (Gioia, Corley and Hamilton, 2013).

Gioia (2019) also refers to people working in organisations as knowledgeable agents (Giddens, 1982), suggesting people understand well what they are planning or trying to accomplish and are clear on how to explain themselves. During this study, this sentiment was overwhelmingly represented during the semi-structured interviews with strategic and senior executive level participants (informants). Gioia begins to structure his research in terms of first-order accounts, which are meanings from the participant and second-order accounts, which are the researcher's meanings (Gioia, 2019). Preparing data in this structured way is suggested to begin interpreting research findings in a systematic way. Gioia believes representing the way knowledgeable people accomplish their goals may yield better results, if done systematically (Gioia, 2019).

Gioia argues that before undertaking qualitative research, there needs to be a well-defined, if general, research question (Gioia, Corley and Hamilton, 2013). Gioia's systematic approach, combined with Strauss and Corbin's conceptual coding techniques (Strauss and Corbin, 1998), should result in confidence in its quality and rigour. There may be a theory, content for a conceptual framework, or proposition for further research, exploration, validation, and verification as a result of this thesis.

It is worth noting that Birks and Mills explain GT in simple terms, bypassing philosophical debate to present a framework for research design that is applicable to all genres (Chun Tie, Birks and Francis, 2019). They offer a simplified coding terminology of Initial coding (fracturing data), Intermediate coding (abstract concepts emerging from data) and Advanced coding (storyline technique) and demonstrate how these interplay between grounded theory methods and processes (Chun Tie, Birks and Francis, 2019). Birks and Mills' design framework helped reinforce an understanding of what is common among the various GT genres by demystifying GT.

It is also suggested novice researchers should not blend methodologies (Morse, 1991), hence this thesis is based solely on a qualitative study and mono method.

The flexible nature of Gioia made it the preferred approach out of all the grounded theory genres. Gioia's systematic, inductive, pragmatic approach to organisational research was chosen despite the intention to not mix philosophies from different genres. Strauss and Corbin's coding and analysis methods supported this research. Although, the goal of this research is not intended to develop new theory, the Gioia methodology is a concise and clear methodology that allows for the organised gathering, categorisation and thematic analysis of data.

It is suggested that the results of this thesis should be subject to extended research using different methodologies and techniques, such as a quantitative study at the operational level of the organisation cases in this research. Participants must have experience with IoT technologies on an operational, supervisory, or hands-on basis. Their organisations will have introduced them to IoT technology, and they will be responsible for implementation. It is likely that this group will have been involved with data gathered from IoT enabled coolers using smart devices.

Using a snowball technique (Corley and Gioia, 2004), participants could recommend potential operational level candidates to participate in extended research. This study would benefit from selecting participants from existing case studies, maintaining a link with organisations already involved. In conjunction with the qualitative data analysis conducted in this thesis, the data collected and analysed from operational level participants should enhance research outcomes.

3.7 PARTICIPANT SELECTION AND PURPOSEFUL SAMPLING

Participants were selected from a purposefully selected list of companies to participate in semi-structured interviews scheduled for 40 to 60 minutes. Due to social distancing rules, each interview was conducted via remote session using Zoom or Microsoft Teams and a backup digital recording device. An average of 47 minutes was spent on each interview.

For analysis, voice recordings were transcribed and analysed. In accordance with Collis and Hussey (2013), participants were selected based on a judgmental or purposeful sampling approach. Several types of participants were identified, selected, and included based on their roles and experience related to this topic, including senior management, strategic leaders, directors, and Chief Executives (see Table 3). According to Cassell and Symon (2004), qualitative interviews provide insights into the research topic from the participant's perspective. A predefined set of questions is used to explore themes, with flexibility to adapt questions and probe further during the interview.

The interviews allowed the researcher to understand the perspectives of each participant, while also providing a deeper understanding of the research topic.

In a literature review, articles were reviewed including on organisational IoT adoption, COVID-19 and dynamic capabilities. A total of 19 in-depth, online interviews were held with participants in the chilled beverages industry (due to Covid-19's social distance policy). Audio and video recordings were transcribed, coded, categorised, and analysed. Among the 19 interviews, 15 were conducted with senior management, strategic leaders, directors, and chief executives. These individuals were actively engaged in digital transformation initiatives, with an emphasis on IoT technologies. 4 of the 19 semi-structured interviews were conducted with Middle Managers (see Table 4).

All interviews were conducted in a similar format, with a focus on understanding the strategies and motivations for the adoption of IoT technology.

Participant	Gender	Title	Country	Length at company
IND-SB4053	Male	Associate Director, Strategy	India	4 years, 4 months
IND-VA4053	Male	Senior Manager Sales and Strategy	India	4 years, 3 months
AUS-AL6641	Female	General Manager Asset Management & Innovations	Australia	2 years, 11 months
AUS-AS5001	Male	General Manager Technical Services	Australia	21 years, 1 month
MAL-ER3100	Male	Head of Services Southeast Asia	Malaysia	15 years
CRO-DC6625	Male	Commercial Value Director	Croatia	14 years, 6 months
DEN-SA3152	Female	Strategy and Performance Director	Denmark	6 years, 9 months
GBR-AT4123	Female	Associate Director Cold Drink Equipment Technology & Innov.	UK	5 years, 8 months
SER-MG5430	Male	Head of IT Department	Serbia	5 years, 3 months
USA-DJ4556	Male	Chief Technology Officer	USA	6 years, 6 months
USA-RM2916	Male	Chief Executive Officer	USA	6 years, 6 months
SPA-EF5508	Male	Commercial strategy & execution	Spain	9 years, 9 months
ARG-CA3701	Male	Head of Trade Marketing Commercial Assets	Argentina	22 years, 10 months
MEX-AT5754	Male	General Manager Sales	Mexico	23 years, 11 months
THA-MK4300	Female	Commercial Execution Director	Thailand	8 years, 11 months
IND-DM4327	Male	Business Analyst	India	1 year, 1 month
IND-AK5952	Male	General Manager Marketing	India	5 years, 1 month
CRO-KS4721	Male	Business Development Director	Croatia	6 years, 7 months
NED-CG5412	Male	Global Category Manager	Netherlands	3 years, 11 months

Table 3: Profiles of strategic and senior management level participants

Position	Interviews	Roles & Responsibilities
Chief Executive Officer	1	Strategy & Business Development
Chief Technical Officer	1	Strategy & Technology
Associate Director	2	Strategy, Technology & Innovation
Director	2	Business Development, Commercial Execution
General Manager	5	Commercial Strategy & Execution, Sales, Trade Marketing, Asset Management & Innovations, Technical Services
Senior Manager	4	Strategy & Performance Management, Sales & Strategy, Commercial Value, Services SE Asia, Information Technology
Middle Manager	4	Business Development, Marketing and Brand management, Business analysis, supply team management, Procurement management

Table 4: Roles and responsibility details of participants

Purposeful sampling is based on the strategic nature of the research question, which warrants access to people with roles corresponding to it. It is the responsibility of senior managers, strategic leaders, directors, and chief executives to guide and execute IoT strategies within their organisations. These individuals are naturally interested in ensuring progress, unblocking bottlenecks, interpreting the results of these initiatives, and achieving expected results. Those in this group are most likely to be exposed to factors affecting IoT initiatives, workforce capabilities, and business, which makes them ideal candidates for this study. The semi-structured interviews were conducted in English, as all participants are fluent English speakers. In-country and company-specific ethical approvals were not a problem.

As a result, a successful data collection process was implemented for this study, allowing for accurate and valuable insights to be gained.

In this study, organisations were at different stages in their adoption of IoT technology. Identifying where each organisation is in the IoT adoption process was necessary. To do this a cross-industry standard process for data mining (CRISP-DM) has been used in this thesis (see Figure 19). This methodology provides a structure for planning a project for data mining.

The CRISP-DM methodology was specifically chosen due to its ability to visually present organisations at their different stages of IoT adoption.

Organisational challenges can be better understood by identifying where an organisation is in the IoT adoption process. Every organisation and phase are mapped according to the CRISP-DM. In this methodology, several phases are involved, starting with business understanding, which is equivalent to an organisation understanding the business case for IoT adoption. In the following stages, organisations develop an understanding of the data they have gathered. They analyse the data, create explanation models based on this data, and then evaluate them against the organisation's objectives.

CRISP-DM shows at what stage each participating country is regarding IoT adoption. A total of 12 organisations from 12 different countries are represented in this model (Argentina, Australia, Croatia, Denmark, India, Malaysia, Mexico, Spain, Serbia, Thailand, UK and USA). 16 of the 19 participants (strategic leaders, senior executives, and middle managers) are from these 12 countries, at least one from each country except for Australia, Croatia, India and the USA.

As shown in Table 5, organisations are grouped by the stage they are at with regards to IoT adoption and deployment. There are a number of ways to do this, including early adoption (immature/mature), collecting IoT data (understanding/collecting), analysing IoT data (preparation/analysis), generating insights from IoT data (evaluation/actionable insights), or integrating into their own systems (deployment/integration).

The 'Deployment' phase suggests that its IoT adoption process is mature, and the insights are integrating with other business-related data to enhance business performance.

Country	City	Ref.	Immature	Mature	Business Case	Data Understanding (data gathering)	Data Preparation (data analytics)	Evaluation (actionable insights)	Deployment (integration)
Argentina	Buenos Aires	C2		✓		✓	✗	✗	✗
Australia	Melbourne	C17	✓		✓	✗	✗	✗	✗
Croatia	Zagreb	C7		✓		✓	✓	✓	✗
Denmark	Copenhagen	C29	✓			✓	✗	✗	✗
India	Bangalore	C8		✓		✓	✓	✗	✗
India	New Delhi	C16	✓		✓	✗	✗	✗	✗
Malaysia	Kuala Lumpur	C9	✓		✓	✗	✗	✗	✗
Mexico	Mexico City	C31	✓			✓	✓	✗	✗
Mexico	Monterrey	C10		✓		✓	✓	✓	✓
Serbia	Belgrade	C26		✓		✓	✓	✓	✓
Spain	Barcelona	C28		✓		✓	✓	✓	✓
Thailand	Bangkok	C30	✓			✓	✗	✗	✗
UK	Uxbridge	C27		✓		✓	✓	✓	✓

Table 5: Details of participating countries

Candidates from the following 8 additional countries (see Table 6) were invited to participate in this study without success. Initial attempts to connect with candidates on this list were consistently unsuccessful. However, it was intended to revisit this, subject to

saturation, should additional participants be required. The original 39 targeted candidates were based in companies across the combined countries in Table 5 and Table 6.

Country	City	Ref:	Immature	Mature	Business Case	Data Understanding (data gathering)	Data Preparation (data analytics)	Evaluation (actionable insights)	Deployment (integration)
Algeria	Algiers	C1	✓		✓	✗	✗	✗	✗
Brazil	Sao Paolo	C3	✓			✓	✗	✗	✗
Chile	Santiago	C5		✓		✓	✓	✓	✗
Morocco	Marrakesh	C12	✓		✓	✗	✗	✗	✗
Poland	Poznan	C13	✓		✓	✗	✗	✗	✗
Turkey	Istanbul	C14	✓		✓	✗	✗	✗	✗
Bolivia	La Paz	C19		✓		✓	✓	✓	✗
France	Lille	C24		✓		✓	✓	✗	✗

Table 6: Details of non-participating cities and countries

The data mining methodology, cross-industry process for data mining (CRISP-DM) is presented in

Figure 19, to outline the stage of IoT adoption that each company (see Table 5) has reached. Participants were questioned during their semi-structured interviews about their experience or perception regarding the phases of IoT adoption their respective organisations had completed.

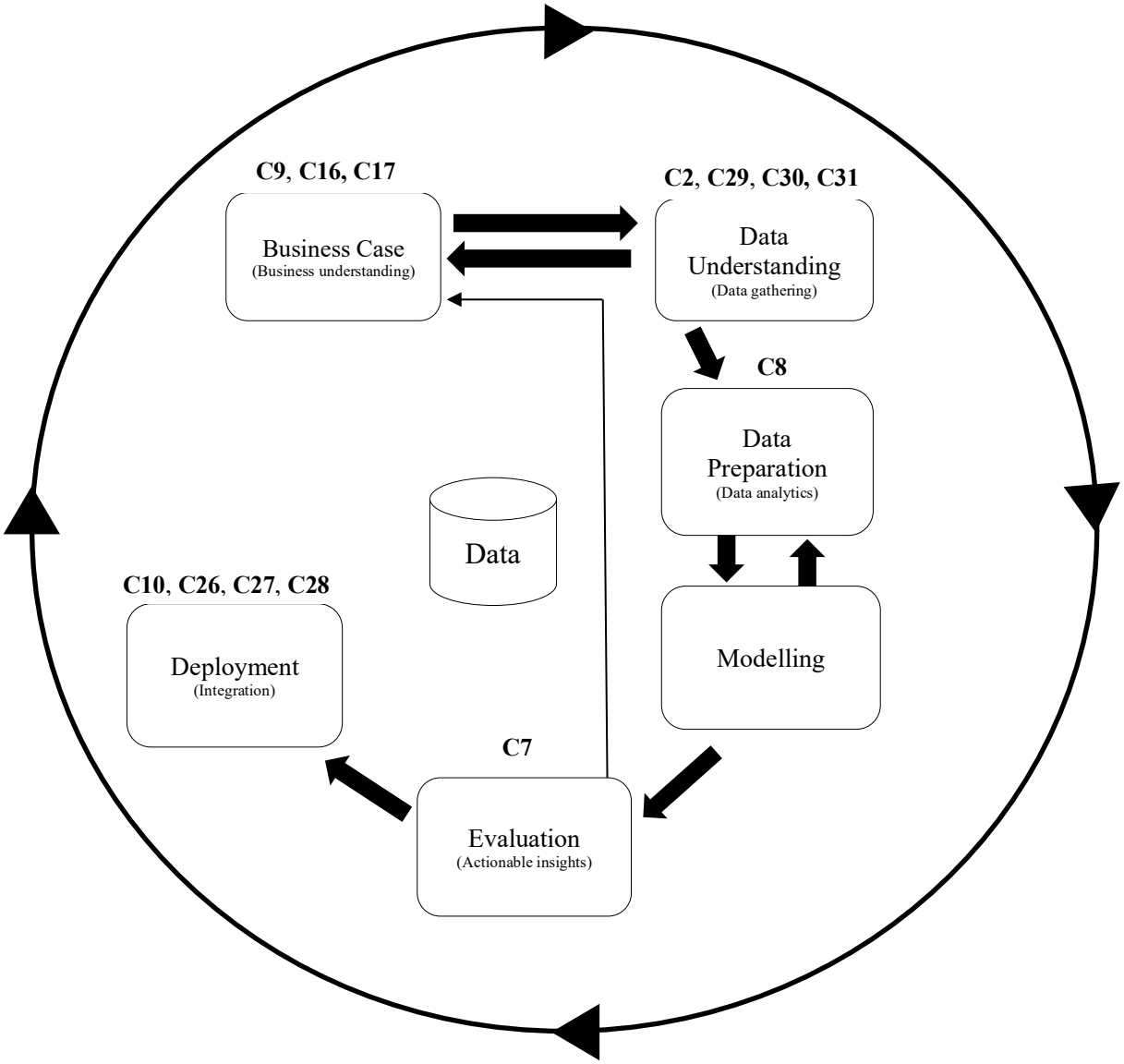

Figure 19: CRISP-DM methodology representing participating companies

Candidates from different countries presented the opportunity to record a variety of experiences, from those who have completed the process and can share their lessons learned, to those who are at the planning stage or in the implementation phase. Participant responses may be influenced by cultural and institutional factors due to the large number of international locations. It is understood that some adaptation may be warranted, depending on the IoT adoption progress of each company.

Organisational adoption stages of IoT vary; an example is Spain (C28), where an organisation has reached the deployment stage of their adoption. This international bottling company plans to connect 100% of its coolers to the cloud with IoT. This will allow them to analyse the operations and commercial performance of their coolers, as well as manage their assets by monitoring geolocation and asset tracking data. In general, OEMs configure IoT enabled devices into coolers during manufacturing for subsequent delivery and placement in outlets. However, C28 already has thousands of coolers that don't have IoT capabilities in retail outlets. A maintenance visit is needed to retrofit IoT devices in these outlets. Coolers can be retrofitted with IoT devices that sync location, operational, and commercial performance data.

Retrofitting IoT devices has significant implications for an organisation's capabilities and workforce, as well as their experiences with IoT adoption. In these cases, workers will be charged with installing IoT devices onto field assets as a one-time exercise, exposing them to IoT technology. By using a purpose-built app on their smartphones, they configure, activate and add additional metadata to the retrofit IoT device. Directly from the factory, IoT enabled assets would require less interaction since their IoT capabilities will have been installed and configured. Considering this, it is interesting to explore whether IoT adoption differs depending on the capabilities of the organisation and its interaction with IoT technologies.

At C10, a supplier of chilled beverages and dairy products, IoT is being implemented solely through new coolers. Data from C10's IoT enabled assets is actively collected and analysed for business intelligence. Through semi-structured interviews, this study can explore with the interviewee the capabilities, development, and experiences of IoT adoption from conception to completion.

In a future study, it will be interesting to explore how data from C10's and other organisations' IoT enabled coolers were used to gain business intelligence and whether IoT adoption impacted the organisations' overall commercial and operational performance.

Conversely, participants from organisations at the immature stages, C9, C16, C17, C29 and C30 are particularly interesting since they are still in the early stages of adoption. It should allow participants to discuss their experiences with IoT adoption in the early days, including expectations, perceived benefits, and concerns.

These organisations may provide invaluable insight into the challenges associated with IoT adoption, such as cost, complexity, and organisational inertia. Additionally, since these organisations are in the early stages of adoption, they may be able to provide an in-depth view of the potential benefits that they expect to gain from IoT adoption.

3.8 INTERVIEW DESIGN AND DATA SAMPLE

An empirical qualitative approach is used in this study. Participants in this research are identified as having a strategic, senior executive or management role in delivering IoT adoption within their respective organisations. As part of this research, details of participants' companies, countries, locations, ages, ethnicities, and qualifications were recorded. Validating that the participants and their roles and responsibilities were appropriate for this research is the purpose of this step.

It was expected that interviews would last an hour. Interviews took an average of 47 minutes to conduct. The study recruited 19 strategic, senior executive, and middle management participants (see Table 4) with responsibility for IoT strategic planning, implementation, or decision making. Participants came from 14 different companies based in 13 different countries. 94 % were graduate educated, 40 % held double master's degrees, and 40 % completed an MBA (see Table 7 and Table 8). As defined by the Office of National Statistics (ONS), participants came from four ethnic backgrounds and 88% were multilingual. There were four females and fifteen males between the ages of 25 and 54. Several sources of demographic information were used: prior research, knowledge of participant profiles, interviews, and LinkedIn profiles. Participants' qualifications and experience indicate a high level of educational and professional achievement. There are 14 participants with master's degrees (one with a PhD), 6 with double master's degrees, and 6 with MBAs. This indicates high level academic studies and business training. A total of 18 participants speak more than one language. Professional and academic achievements, work experience, and role within their respective organisations make them suitable participants for this study.

This diverse and highly qualified group of participants displays a great level of competency and understanding in both the academic and business spheres, making them an invaluable asset to the study.

Participant	Gender	Age	Title	Country	Length at company	Length in role	Highest Qualification	Double Masters	MBA	Nationality	Ethnicity (ONS)	Spoken Languages
IND-SB4053	Male	25-34	Associate Director, Strategy	India	4 years, 4 months	2 years, 9 months	Masters	Yes	Yes	Indian	Indian	English, French, Hindi, Marathi
IND-VA4053	Male	25-34	Senior Manager Sales and Strategy	India	4 years, 3 months	2 years, 4 months	Masters	No	Yes	Indian	Indian	English, Bengali, Hindi, Marathi
AUS-AL6641	Female	35-44	General Manager Asset Management & Innovations	Australia	2 years, 11 months	1 years, 1 month	Masters	Yes	Yes	Australian	Any other Asian background	English
AUS-AS5001	Male	45-54	General Manager Technical Services	Australia	21 years, 1 month	9 years, 11 months	Bachelors	No	No	Australian	Any other White background	English
MAL-ER3100	Male	45-54	Head of Services Southeast Asia	Malaysia	15 years	8 years	Bachelors	No	No	Indonesian	Any other Asian background	Indonesian, Malay, English
CRO-DC6625	Male	25-34	Commercial Value Director	Croatia	14 years, 6 months	4 years, 4 months	High School	No	No	Croatian	Any other White background	Croatian, English
DEN-SA3152	Female	25-34	Strategy and Performance Director	Denmark	6 years, 9 months	3 years, 1 months	Masters	No	No	Danish	Any other White background	Danish, English
GBR-AT4123	Female	45-54	Associate Director Cold Drink Equipment Technology & Innovation	UK	5 years, 8 months	4 years, 5 months	Doctoral	Yes	Yes	Greek	Any other White background	English, German, Greek
SER-MG5430	Male	25-34	Head of IT Department	Serbia	5 years, 3 months	5 years, 3 months	Bachelors	No	No	Serbian	Any other White background	Serbian, Russian, English
USA-DJ4556	Male	35-44	Chief Technology Officer	USA	6 years, 6 months	6 years, 6 months	Bachelors	No	No	Indian	Indian	Hindi, English
USA-RM2916	Male	25-34	Chief Executive Officer	USA	6 years, 6 months	6 years, 6 months	Masters	No	No	American	Indian	Hindi, English
SPA-EF5508	Male	35-44	Commercial strategy & execution	Spain	9 years, 9 months	4 years, 11 months	Masters	Yes	Yes	Spanish	Any other White background	Spanish, English
ARG-CA3701	Male	35-44	Head of Trade Marketing Commercial Assets	Argentina	22 years, 10 months	18 years, 11 months	Masters	Yes	No	Argentinian	Any other White background	Spanish, English
MEX-AT5754	Male	35-44	General Manager Sales	Mexico	23 years, 11 months	5 years, 10 months	Masters	Yes	Yes	Mexican	Any other Ethnic group	Spanish, English
THA-MK4300	Female	35-44	Commercial Execution Director	Thailand	8 years, 11 months	2 years, 11 months	Masters	No	No	Thai	Any other Asian background	Thai, English

Table 7: Profiles of strategic and senior executive level participants

Participant	Gender	Age	Title	Country	Length at company	Length in role	Highest Qualification	Double Masters	MBA	Nationality	Ethnicity (ONS)	Spoken Languages
IND-DM4327	Male	25-34	Business Analyst	India	1 year, 1 month	1 year, 1 month	Masters	No	Yes	Indian	Indian	Hindi, Punjabi, English
IND-AK5952	Male	25-34	General Manager Marketing	India	5 years, 1 month	2 years, 8 months	Masters	No	Yes	Indian	Indian	Hindi, Punjabi, English
CRO-KS4721	Male	35-44	Business Development Director	Croatia	6 years, 7 months	4 years, 1 months	Masters	No	No	Russian	Any other White background	Russian, English, German, Croatian
NED-CG5412	Male	35-44	Global Category Manager	Netherlands	3 years, 11 months	3 years, 11 months	Masters	No	Yes	Spanish	Any other White background	Spanish, English, 'Street Hindi'

Table 8: Profiles of management level participants

3.9 RESEARCH QUESTIONS

Interview Length: 40 to 60 minutes

Data collection was conducted using semi-structured interview questions designed to explore participants' IoT adoption strategies and capabilities. Participants were asked 13 questions regarding their experiences pre and post Covid-19 pandemic. The pandemic may have affected organisations' IoT adoption strategies.

Intro.	Thank you for taking part in this research, which is about how the adoption of IoT impacts an organisation's workforce performance. The contents of this interview will be treated as confidential and anonymous. Your responses to questions will be analysed along with others, interpreted and presented in a final report without reference to your name or any other personal information. I would like to capture accurate data of your responses and opinions, and therefore would like your permission to allow for an audio recording of this interview, which will be transcribed and used to facilitate in the analysis of this research. You can at any time opt to end the interview or stop/start the audio recording.				
Stage	Question	Related Variables	Source	Rationale	Probe/Sub Q's
Pre-interview	Observe and engage in casual discussion via Zoom or MS Teams	N/A	Surroundings and participant	Ease the participant	Any relevant common observations
Intro.	Cover introduction text	N/A	Standard introduction	Assurance of confidentiality and anonymity.	
Q0	Could you start by telling me your name, role and what you do for your organisation?	Human Resource, Operations	Participant	Gather profile information	Ask about organisation
Q1	What is your understanding of the term IoT?	Capabilities	Participant	Simple question to ease the participant	Participant validate understanding of IoT
Q2	What were the drivers for the introduction of IoT in	Operations, Finance	Participant	To gauge whether participants are synonymous in	Business benefit, market share, profitability,

	your organisation pre COVID-19?			respect of this question.	efficiency, innovation?
Q3	How has the adoption of IoT changed due to COVID-19?	Human Resource, Operations, Finance, Capabilities	Participant	Understand how or whether Covid-19 has impacted company drivers for adoption of IoT	Changes in strategy, workforce behaviour, safety, performance, income?
Q4	Prior to COVID-19, and in your opinion, how was the introduction of IoT been perceived by the workforce?	Human Resource, Operations	Participant	To appreciate how participants believe the workforce responds to the introduction of IoT.	Positive/negative workforce sentiments?
Q5	Since COVID-19, how has this perception changed for the workforce?	Human Resource, Operations, Capabilities	Participant	To understand whether the current pandemic has changed workforce perceptions and willingness to adopt IoT technology	How has workforce changed working behaviour? What has been their concerns?
Q6	What stage of IoT adoption is your organisation at, and if given the opportunity, would you do anything differently?	Operations, Capabilities	Participant	To understand participants view on current state of IoT adoption and whether this has progressed as they expected. Identify what they would do differently.	Why would participant make changes? What went well? What went wrong? How would you make changes? How did workforce respond?
Q7	Prior to COVID-19, what were the expected gains from the adoption of IoT?	Human Resource, Operations, Finance, Capabilities	Participant	Understand strategic goals and ambitions of company and participant.	What other gains, technical/commercial/strategic?
Q8	How have these expectations changed since the impact of COVID-19?	Human Resource, Operations, Finance, Capabilities	Participant	To identify strategic shift or reprioritisation in the business. Identify behavioural changes required. Identify organisational	Can you give examples? Explain why?

				flexibility and challenges.	
Q9	Prior to COVID-19 what challenges or problems did you experience with the workforce when introducing IoT?	Human Resource, Operations, Capabilities	Participant	To identify workforce concerns, challenges, vulnerabilities, flexibility, motivation, development requirements	Can you give examples? Security? Trust? Knowledge? Skills? Explain why?
Q10	Since COVID-19, how have these challenges changed?	Human Resource, Operations, Capabilities	Participant	Understand the impact of Covid-19 on workforce concerns, challenges, vulnerabilities, flexibility, motivation, development requirements	Explain in more details on specific points.
Q11	What impact did the introduction or adoption of IoT have on the motivation of the workforce?	Human Resource, Capabilities	Participant	To identify how new technology and change impacts the workforce and their motivation	Can you give examples? Explain further?
Q12	How has motivation to adopt IoT by the workforce been impacted by COVID-19?	Human Resource, Capabilities	Participant	Identify how or if Covid-19 has impacted the workforce's behaviour and motivation to adopt IoT	Can you give examples? Explain why?
Q13	Is there anything else you can think of that is relevant to the adoption of IoT by your organisation and workforce that you want share?	All	Participant	To identify any other factors participants would like to share and to explore in more detail existing factors	Can you give examples? Explain why?
Closure	Well that concludes my questions for today, thank you for your participation and patience. However, before we close this interview, is there anything that we may have not covered that you feel you would like to share? As discussed earlier, your participation will be treated confidentially and anonymously. The final report will be available on completion of this research of which you are welcome to a full copy.				

Table 9: Interview questions

3.10 Ethical Consideration

Participants did not include vulnerable persons, people with mental or physical health issues, or those with other complications. This research focuses on commercial organisations with highly experienced and academically qualified senior executives. Participant informed consent was therefore all that was required. The research participants come from many different countries, including Argentina, Brazil, Chile, Mexico, Croatia, India, Mexico, and the UK, so it was necessary to determine if ethical clearances are needed at the organisational level or whether in-country ethical applications are necessary. No such requirement existed.

In the absence of additional requirements, it was anticipated that ethical clearance via the Brunel Research Ethics Online application process (BREO) would be sufficient to cover all proposed regions.

The following considerations are important: obtaining informed and voluntary consent, providing clear and concise information about the proposed research, ensuring confidentiality and security of interviews and data gathered, and ensuring anonymity throughout all publications (see Table 10).

A Brunel research ethics online BREO application was submitted, and the approval letter was received on the 11th of June 2020 (see Appendix D).

The following files were submitted for approval: Fieldwork risk assessment, Off-campus risk assessment, Letter to participants (see Appendix A), Draft interview questions, participant information sheet (PIS) (see Appendix B), and research planned schedule (see Appendix E).

The following courses were completed by the researcher:

Title	**Date completed**
Ethics 1: Good research Practice	06/05/19
Ethics 2: Research with Humans in the Health and Sciences	06/05/19
Integrity: Social and Behavioural Sciences	21/04/19
Introduction to Research Skills Master Programme	06/05/19
Managing Your Research Project	06/05/19
Research Methods: Social and Behavioural Sciences	21/04/19

Table 10: Researcher personal development

3.11 SUMMARY OF CHAPTER 3

HARP revealed that the researcher is most naturally aligned with pragmatism and critical realism as philosophical approaches. As a result, pragmatism was selected as the approach for this study due to its significant suitability. This is because it allows the researcher to interpret the problem from multiple points of view. Qualitative research was then used to gain insight into the study and provide a more in-depth understanding of the topic. This allowed for the creation of an IoT adoption framework.

This chapter establishes the researcher's philosophical preferences. The purpose of this study was to provide knowledge of this understudied topic through a pragmatic approach. As a result, a new or revised reference model or framework was developed. In addition to providing a detailed explanation of the methodology chosen for this study, a rationale for focusing on the chilled beverages industry was provided. A pragmatic approach based on grounded theory and inductive research was followed. A detailed description of participant profiles, the originating research questions, and the stage of IoT adoption by participant organisations was shared.

Furthermore, the results of this research study have provided valuable insights that can be used to inform decision-making in the chilled beverages industry, enabling organisations to not only better understand the context of their IoT adoption, but also to optimise their investments in IoT applications.

In order to support the rationale for choosing the chilled beverages sector for this study, a description of the methodology, philosophy, and design elements of the study was presented. To analyse data, several methodologies were evaluated, with the Gioia methodology selected and NVivo used as the analysis tool. It is common to use Gioia's methodology (Gioia, Corley and Hamilton, 2013) in research within a business context. Also, previous chapters confirmed that the research outcomes would be guided by the dynamic capabilities model (Teece and Pisano, 1994; Teece, Pisano and Shuen, 1997).

As a final step, the participant selection process, the quality of participants, and the base questions of this study were discussed in detail.

This research is based on international organisations. Chapter 7 makes recommendations for further studies to investigate the findings of this thesis.

4 FINDINGS

4.1 INTRODUCTION TO CHAPTER 4

A description of the chosen methodology, research philosophy, and design was provided in the previous chapter. An evaluation of the results and themes derived from the Gioia methodology, pre- and post-Covid-19, is presented in this chapter. An introduction to a new IoT adoption framework based on the analysis and interpretation of this research using the Gioia methodology.

From the perspective of executive leadership and middle management, this study explores factors contributing to organisational IoT adoption and dynamic capabilities. The adoption of IoT is influenced by significant positive factors; on the other hand, there are significant negative factors that can adversely impact the progress of organisational IoT adoption (see Table 11). Aggregate counts of themes were reviewed as generated from the analysis stage of this thesis (see Appendix F).

Further, in this chapter a listing and review of sample quotations from participant interviews represents some key findings of this research. Relevant subheadings within this chapter are divided into the sections sense, seize and transform. Quotations from participants are listed with commentary on their meaning and context within this research. In some cases the analysis of a quotation is relevant to one or more of these subheadings. In addition, the findings of this study are supported by the interview quotes categorised into awareness, competitiveness, leadership, and capabilities. Sample quotes from these themes are found in the respective subsections.

Theme	No. of Participants	Positive Responses	Negative Responses
Factors that influence the organisation adoption of IoT	16	194	78
Factors that impact the organisations resource willingness to adopt IoT	16	38	152
Factors that impact the organisations workforce perception on adopting IoT technologies	14	33	40
Factors that impact the organisations resource capability to adopt IoT technologies	13	16	43

Table 11: Count of participant responses and sample various themes

There were overwhelmingly positive responses (194) from senior executives in regard to the adoption of IoT technology in their organisation, but there were also negative responses (78). Conversely, responses regarding the willingness of workers were overwhelmingly negative at 152 responses vs 38. A series of aggregate counts from research questions were created and reviewed as part of this study (see Appendix H).

The reasons for this are explained further in the next chapter where the findings are discussed. Participants who are senior executives also mentioned that their own organisation's workforce lacks the knowledge and capability to adopt IoT.

Pre- and post-pandemic thematic analysis was conducted using Gioia's methodology. Participants were interviewed about their pre-Covid-19 plans for IoT adoption and their post-Covid-19 (during Covid-19) strategies for IoT adoption. An organisation's adoption of IoT is influenced by factors such as its resource capabilities, leadership, trust in technology robustness, and competitiveness.

4.2 GIOIA METHODOLOGY

A data structure was created to represent the voice of the participants based on the Gioia methodology (Gioia, Corley and Hamilton, 2013). The structure provides a visual representation of the resulting concepts and themes. The first order concept, the second order themes, and finally the aggregated dimensions.

As shown (see Table 12), the concepts are based on participant responses related to IoT adoption before the Covid-19 pandemic. It was designed to explore how an organisation approached IoT adoption under relatively normal environmental conditions. Furthermore, the views of respondents were within the context of a global pandemic. The comparative number of responses can be seen in Table 18.

In this study the following process was followed to inform the Gioia methodology structure and derive at final aggregate dimensions for contribution to the IoT adoption framework.

Data collection. As part of the first step of the process, data was gathered from participants across all case studies, using interviews and a predefined set of questions that were used to gather the data. For consistency each participant was presented with the same set of questions. Based on participants' responses, further probing questions were allowed during the interview.

Data reduction. After the data had been collected from the semi-structured interviews, it was reduced to a manageable size at the earliest opportunity, for the next stage of analysis. The various steps involved in this process included identifying the most relevant data and excluding any information that was irrelevant to this study. By reducing the data, the analysis phase was focused on the most important aspects of this study. As a result, the analysis was carried out in an efficient and streamlined manner, facilitating a more comprehensive understanding of the data.

Data presentation. This stage presents and organises the data so it can be analysed easily. There are many ways to do this. In this study the preferred option was to utilise tables to represent aggregate data to assist in exploring patterns and relationships in the data.

Conclusions and interpretations. At this stage of the research conclusions were drawn from the analysed data. Finally, interpretation of the data is completed to achieve deeper insights. Identifying themes, patterns, and relationships is a key outcome.

This finalised data structure represents the results of the first order concepts gathered in order to provide a representation of the emerging themes from the first order concepts. The process was somewhat challenging due to the large volume of quotes which contributed to a significant number of conceptual ideas. The process of aggregating, thinking, and formulating the various concepts was supported by Strauss and Corbin's open coding method of coding (Strauss and Corbin, 1998; Bryman, 2016). This method was chosen because of its clear structure and flexibility. CAQDAS software (NVivo) was used to analyse the data and identify key concepts that emerged from the open coding phase. As a result of iteratively working through the data, the number of first order concepts was reduced to a manageable level (see Table 12). Further, axial and selective coding of the data formulated relationships based on the data.

After theoretical saturation of 1st order concepts, 2nd order themes and aggregated dimensions followed. It should be noted that although there is no need to have a direct relationship between each of these stages, within this study, emerging patterns and relationships resulted in a number of novel themes and aggregate dimensions that are clearly associated with one another. The final outcome of this exercise was the generation of aggregate dimensions. The Gioia methodology was then used to organise the concepts, themes and dimensions into a structure based on the relationship between them. In doing so, a clear visual representation was created depicting the journey from data to concepts, themes and dimensions. It was imperative to do this in order to demonstrate the rigour of the process followed in this qualitative study. The aggregate

dimensions of capabilities, awareness, leadership, and competitiveness are shown in the data structure (see Table 12). The Gioia methodology represents an excellent presentation of the analysis in this study.

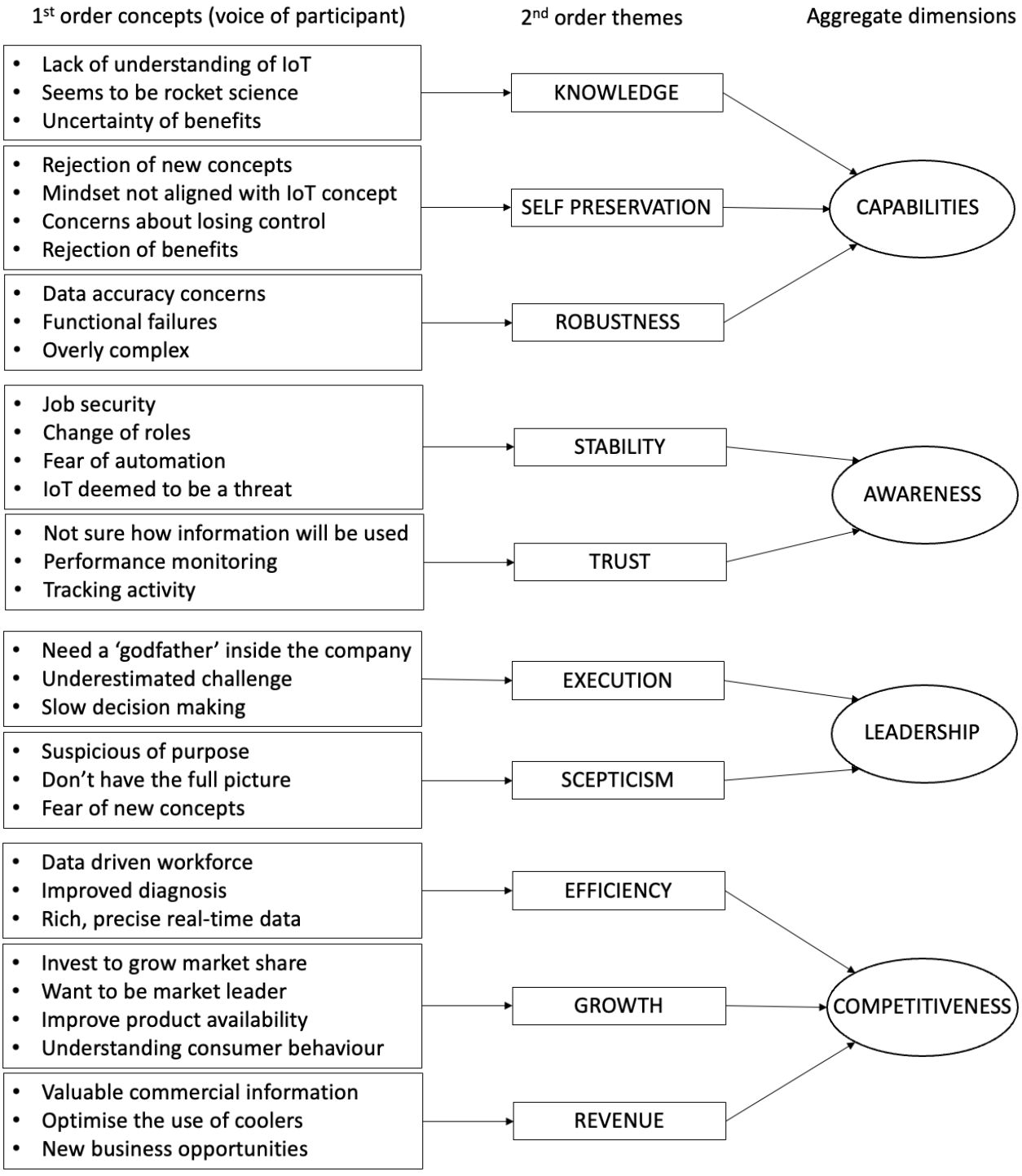

Table 12: Gioia Methodology Data structure

As a result, the aggregate dimensions contribute to the development of an adoption framework of IoT as illustrated in Figure 20. In the framework presented here, the aggregate dimensions represent the phases that need to be considered in each of the three stages of understanding, capturing and transforming dynamic capabilities. As part of this framework, there are other factors that need to be considered by an organisation within the chilled beverages industry. These factors support the need to develop a successful IoT adoption strategy. Among these factors is the relationship between the organisational IoT adoption strategy and the company's business challenges. This is significant because they are an effective illustration of what is expected to be external influences on an organisation's IoT strategy in the chilled beverages industry. There is a more detailed discussion of this in chapter 6 of this thesis.

Therefore, it is essential for companies to create a well-thought-out IoT adoption strategy that considers the relationship between organisational strategy and their business challenges. Doing so may help ensure that their strategy is robust and provides a competitive edge in the marketplace.

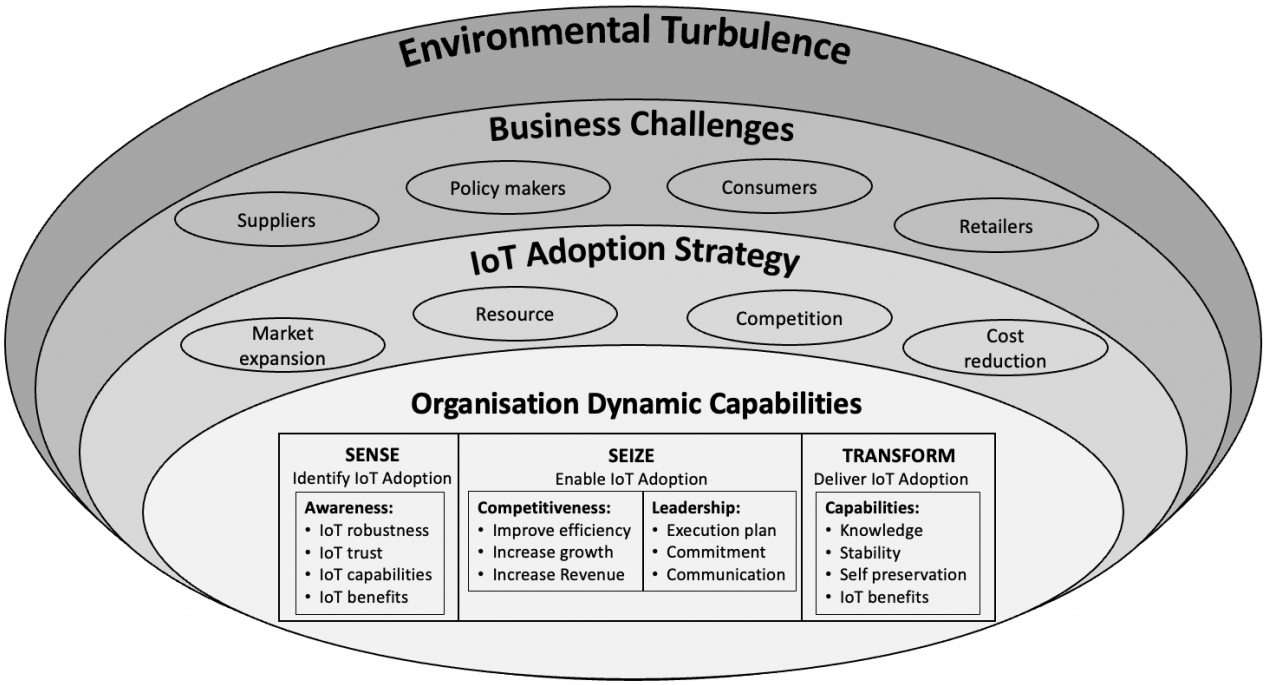

Figure 20: A chilled beverages industry IoT adoption framework

This research explored key themes from resultant semi-structured interviews to drive theory development to aid the creation of an IoT adoption framework (see Figure 20).

Interviews with strategic, senior executive, and management level participants were categorised (see Table 13) based on their responses and themes. Leadership and competitiveness are the most mentioned topics, while capabilities and awareness are less frequently mentioned. With 203 and 171 references, leadership and competitiveness are the most prominent themes. There are 120 references to awareness and 97 references to capabilities.

Cases	Awareness	Capabilities	Competitiveness	Leadership	Total
ARG-CA3701	9	4	12	8	**33**
AUS-AL6641	16	4	17	28	**65**
AUS-AS5001	11	9	22	7	**49**
CRO-DC6625	4	2	5	5	**16**
CRO-KS4721	5	2	11	8	**26**
DEN-SA3152	6	5	12	8	**31**
GBR-AT4123	10	7	9	26	**52**
IND-SB4053	5	8	5	9	**27**
IND-VA4053	7	8	12	8	**35**
MAL-ER3100	0	0	1	4	**5**
MEX-AT5754	17	3	20	14	**54**
SER-MG5430	12	18	14	11	**55**
SPA-EF5508	12	16	7	35	**70**
THI-MK4300	2	4	5	13	**24**
USA-DJ4556	2	4	10	13	**29**
USA-RM2916	2	3	9	6	**20**
Total	**120**	**97**	**171**	**203**	**591**

Table 13: Counts of top level themes by participant

In this next section a count of responses by 2nd order themes is presented showing the most common response types with interpretations.

Capabilities:

Several references are included in this study that discuss organisational challenges and resource capabilities. Due to these challenges, organisations struggled with IoT adoption and infrastructure capabilities, indicating knowledge gaps and awareness issues.

Capabilities	No. references
Organisational challenges	32
Resource capabilities	28
Technological issues	26
Training	11

Table 14: Capabilities score

Competitiveness:

Participants overwhelmingly referenced the benefits of IoT adoption, indicating positivity towards sensing and embracing new IoT opportunities and the competitive advantages this could achieve. References to consumer behaviour and costs identify that both can improve the organisation's competitiveness, leading to a reduction in organisation costs. This will ensure high availability of bottler products for consumers. Therefore, it is important for organisations to understand and embrace the competitive advantages offered by IoT adoption.

Competitiveness	No. references
Business benefits of IoT	82
Business insights	18
Consumer behaviour	22
Costs	25
Customer satisfaction	16
Fraud and deception	9

Table 15: Competitiveness score

Leadership:

Challenges from workers and motivation issues among workers are two key references here. As a result of participating in the survey, participants discovered that challenges from workers were mainly related to job-related concerns, followed by comments about motivational issues. Communication improvements were identified as areas for improvement, including raising awareness and improving leadership commitment.

Leadership	No. references
Challenges from workers	71
Communications	10
Investment	14
Motivation issues with workers	64
Resourcing challenges	20
Leadership issues	25

Table 16: Leadership score

Awareness:

There was a significant increase in references related to the perception of IoT. As a result, there may be a lack of awareness about IoT generally, particularly regarding its benefits, component parts, platforms, and associated capabilities. Since IoT is a relatively new concept, exposure and understanding in the chilled beverages industry may be low compared to other technologies. It has been mentioned previously that references to fear are connected to the stability of roles in an organisation that are involved in IoT adoption.

Therefore, it is essential to increase IoT awareness in the chilled beverages industry by highlighting its potential benefits and capabilities, as well as providing education and training on its platforms and component parts. This will help to reduce any fear associated with its adoption and enable a smooth transition for those whose roles may be impacted by it.

Awareness	No. references
Fear and concerns of workers	24
IoT understanding or awareness	31
Perception of IoT	66

Table 17: Awareness score

4.3 ENVIRONMENTAL TURBULENCE

Interview questions were constructed to gauge an understanding of organisational capabilities and the adoption of IoT technologies. These questions were further refined to take into consideration the context of a global pandemic, by requesting participants to consider their responses in light of Covid-19. It was important for them to share their experiences in relation to the primary question. Since the interviews were undertaken between October 2020 and December 2020, the questions were designed to capture whether the pandemic had an impact on organisational capabilities and practices. Organisations will have embarked on an IoT adoption strategy prior to Covid-19 and will have progressed to various stages of implementation. Participants were asked to discuss each key question in depth prior to Covid-19 and they were asked to elaborate on whether changes in their organisational strategy or practice had occurred as a result of the Covid-19 pandemic.

Many organisations had not only adopted an IoT strategy prior to the pandemic but had already made strides in its implementation. The discussion was then further deepened as participants shared how Covid-19 had altered their plans and objectives.

Participants shared their views regarding the impact of the Covid-19 pandemic (see Appendix H). Participants from Argentina, Australia, Croatia, Denmark, Mexico, Serbia and the UK referenced the impact of Covid-19 more frequently than those from other countries. These participants worked for companies in countries that were among the most mature in their IoT adoption roll out.

Where there are ‘0’ references under the post-Covid-19 column, this is due to participants changing companies ahead of the pandemic. Note the number of responses from both Australian participants is identical, which is a pure coincidence and not a counting error. Significantly, approximately 38% of the coded references relate to comments made post covid-19. General feedback suggest that original drivers for IoT adoption have remained the same or have become even more significant. This is synthesised in some of the comments.

Consequently, strategic leaders, senior executives and managers in organisations are more motivated to invest in IoT technology as a result of the pandemic. They are looking to benefit from the advancements it offers.

> *IND-VA4053: ‘Now, [pause] rather than a good to have, it has become a must have, because our dependency on humans to collect data have of course gone down’.*
>
> *CRO-DC6625: ‘Yes, so that made the data from XXXX controllers even more, let's say, important’.*
>
> *GBR-AT4123: ‘I don't think that it changed things, so however Covid-19 may be enforced need for more applications, let's say, within the area of IoT. Which was, anyway a matter of time in my opinion to come, but it came faster because of Covid-19’.*

The number of responses regarding various themes was higher when discussing IoT adoption strategy pre Covid-19, than post Covid-19. Significantly, there was a drop in the number of responses for the stated themes, when discussions turned to post Covid-19 across all the sampled themes, as shown in Table 18.

Theme	Pre Covid-19	Post Covid-19
Drivers for adopting IoT	47	24
Perception of IoT	45	11
Expected gains from IoT adoption	42	16
Challenges from the workforce	52	13
Organisation workers willingness to adopt IoT	47	24

Table 18: Count of participant comments on IoT adoption

Participants felt validated in their decision to move forward with IoT adoption initiatives. The IoT adoption goals did not change as a result of the differences between views before and after Covid-19. Rather, it was realised that accelerating the IoT adoption and deployment process would help gain the expected benefits sooner. It plays into the knowledge that external pressures on the competitiveness of the organisation have made it more important for the organisation to deliver on its IoT adoption initiative more rapidly. The onset of a pandemic did not derail IoT adoption strategies, but rather slowed progress due to constraints. Covid-19 responses were fewer than pre-Covid-19 partly because participants had fewer opportunities to interact with other team members due to strict social distance and work policies, increased remote activities, and fewer resources.

4.4 CASE STUDIES AND DYNAMIC CAPABILITIES

Across five continents, semi-structured interviews were conducted with key individuals involved in IoT adoption projects from senior management level at various stages of their deployment. They were primarily involved in strategic, executive, and management functions in their organisations and were highly educated and skilled. The Gioia Methodology was then applied to the transcription, analysis, and interpretation of these interviews. As a result, 1st order concepts, 2nd order themes, and aggregate dimensions were generated. Four dimensions emerged: capabilities, awareness, leadership, and competitiveness. Further, sample participant comments were divided into sense, seize, and transform components for validation (see Table 19).

Case Study	SENSE	SEIZE	TRANSFORM
India #01	the major problem was understanding of IoT. It seemed to be rocket science, they didn't know how it worked, so there was a lot of [pause] oh, how should I put it? People were not ready for that change yet. So, it seemed to be rocket science, it was, it seemed to be very expensive. And also, in a country like India a way faced… why don't we deploy, say, a person for that, or why don't we just use manual efforts and they might be cheaper. And in some case, it did make sense, because labour here is a lot cheaper than in the western countries	And then, since we were going to get real time data and understanding the performance of everyone. There was also [pause] a bit of uncertainty in the workforce, like what if … says that we are not working properly? So, there all this answered coupled with resistance to change, which I experienced while implementing IoT.	Yes, so what I would actually do differently is try and work more on changing the mindset, because that is, I feel, the most important barrier that we have faced, while pushing this through. Probably, I would try and see how the entire workforce have a learning session about all the benefits of IoT, so that they can understand the solution better.
Australia #02	Yes, so they were I think the three main drivers. So in summary it would be preventative maintenance, achieving better customer experience, and also optimising the placement of our equipment to optimise sales for our customers. So, I think, yes, people are still, they sort of get the connection bit, but maybe, [pause] struggling to see the bigger picture.	Without senior leadership support and that focus, all our KPIs are around something else. You know the more people they know and then they connect you to other people in the organisation. Yes, so I guess, I could have done that more differently. That's how I could of done that differently, more networking	In fact, they don't want it, because for them it's a new thing to learn. It's probably because of the business. The business doesn't invest in the right, the business doesn't provide enough resources to give them the proper training of the new tech.
Croatia #03	There was some changes during the covid, when it's all started because there is a lot of lockdown then what we saw is the moving of consumers from on-trade to off trade a lot. Yes, so that made the data from IoT controllers even more, let's say, important. Well of course there were, as always, there's always a reluctance to change and human, let's say, human reluctance to change and to add additional things. So, I would say the challenges, were maybe, let's say, additional workload. More time spent getting familiar with the new technologies and the new way of working and new application. So yes, that would be the challenges that we had.	I was more or less support of this implementation, but I would say that reason why we try to, why we went that way, is because we want, let's say, to have a better understanding of what is happening with our coolers. And to try to get the, let's say, the consumer data from the coolers and to try to understand consumer behaviour better. So, it was really necessary to invest into the equipment to be able to grow market share.	I mean, it all comes down to training and to, let's say, enforcing it and follow through. So basically, after some time, people just got used to it and started using it. Perseverance! So, you need to accept that people don't grasp your explanation and your instructions, however clear there are. It's always like this. I cannot explain why, but it just always happens, maybe not 50/50, maybe 60/40, but you can always expect a certain part of the people won't get it from the first time. So, plan time, plan additional follow up, plan additional explanation. People appreciate that and they will always be happy if you try to help them.
Denmark #04	They perceive it to be [pause] a bit fluffy and a bit over the top, and	I think that, it is really, really important [pause] that the	The most motivation isn't really that high, because it

	because, every one of our sales reps [pause] think that they know best, so there's no need to put technology into the fridges. They already know what they sell from the fridge, and that it is productive and so on, so yes. So, they couldn't really see the bigger picture	expectations. I think [pause] the expectations that we had when we did the test, in regards of the data quality that we will get out of, was a bit higher than what we actually got.	would likely, well it would be changed ways of working, and that is, for some people, that can be scary, not knowing what will hit you. And, I think that they saw it more or less as extra work. So, instead of just answering a phone when the fridge has breakdown, they would now need to be more proactive too, as technicians. And that's a whole other way of working for them
UK #05	And of course, there is another aspect, mainly related with infrastructure. So, enabling, let's say, remote access to our equipment. For example, allow us for faster response and avoiding of a lot of costs. For driving efficiency, I would I say it's the major force why we want to use IoT Well, I think, Covid-19 enhanced the need of doing things remotely. So, in a way, it has positively contributed in the IoT evolution within the organisation.	It's important of course, that understanding, and leadership is much more in favour of getting into that. However, as a big organisation, you know the processes, changing the way of working is the most difficult and the bottleneck in every change.	There were negative and positive reactions depending on where somebody works. So, there were people that for sure, could see how much help they can get in their own area of responsibility, so there were positive reactions from these people. While there were also people that were afraid of losing jobs and being obsolete after some period
Serbia #06	But the real gain is that we want to make our life a lot easier, the life of our technicians, because they will know, as I said before, the faults before they go there. We are trying to predict faults. You know you can predict some faults	It was terrible, because our business is closely connected with pubs and brewery, but luckily only have of the business, the other half is coolers and freezers. So, the markets were working and, you know, ice creams were sold and I think it was increased the alcohol selling the from the bottle coolers in the market. I think I have data from one of our breweries, during the covid, ok, draft beer selling was down 95% of course, because almost everything was closed. But they were increased in bottle beer was 120% increase, because everybody stayed home	And, of course, I would prepare the people much better with, you know, the, let's say, error training so they can recognise what is wrong with device, we also didn't do that properly as well. If we had to lay of some people during the Covid-19. Well, it is hard question, because the perception of everybody has changed
Spain #07	Why we are Internet of Things? Because the goals that we set ourselves, our ambition, in terms of doing whatever, we can discuss it later. But, our business goals in the area of cold drink equipments, the best way to achieve them, was by elaborating on technology. That was a reality. We knew at	And here is where it comes with two other things. Is because that will enable us to do better job in the market, to execute better in the market. So, in other words, to sell more Coke and on the other hand will help us to give a better customer service. That would means, that we expect, that our	but there is a particular people, which is the second, that they are against it, super against it. And this is, my particular, my particular position, OK, or my particular opinion, that I would not say in the middle of a senior management in my company. Because I cannot prove it, but that is my flavour,

	that time, that without a proper technology, we would not be able to get those calls. Both in scope and also in the quality, let's say. So, we decided that technology was a 'must' within our journey and then when we took a look into that technology, knocking on the door of the system or benchmarking with other business like us, we understood that one of the key solutions or the key technologies that suits into our, at that time requirements, was Internet of Things. So, this is why we got into in the Internet of things world, because that technology was capable to enable us to reach our initial goals or business requirements for the future	customer satisfaction will increase. So, that technology will pull out two key benefits. One is selling more or execute better rather than selling, OK. And the other is increase our customer satisfaction, because today in this challenging environment where we are living in, not for the covid for the competition	OK. I have the feeling that there is, certain bunch of people that they use this Internet of Things, or whatever, any new thing, OK, to play it in their advantage to force a negotiation, for getting more money, OK
Argentina #08	Well, maybe, it's more the other way. Something that innovation, we don't really know what it is. We don't like to implement. Big companies are always open to implement new things, new technologies, new ideas. But, that doesn't mean that they really understand what it is … that they have.	So, there is no chance of concepts, it was something very hard to implement. Implement the idea for the business, because in the case of beverage, these are company with more than 100 years. A way of thinking or how they manage the business, and in this case, it's not a technology company, so they don't have the concept either. So, to implement these words or concept, or whatever, it was an issue.	To adapt this new technology is not that easy. Especially, when it's something that is not 'downloaded' from the top of the company, saying 'we want to implement this'. I think, in general, new technologies, the big challenge is to change the culture or the mindsets of the people to implement this.
Mexico #09	So, the resistance is broken, nowadays it's about finding the correct IoT, because in my opinion, it isn't about IoT, it's about to find the correct IoT.	Most of the people think that having the data, having the numbers in front of you is enough. An that's the easiest part. The toughest part is to translate the data into actions into people that take decisions on that. And that's very tough. So, the way I will do it, let's see the proof of concept, let's understand what's going on. Let's do some trials and some decisions that we have to take. In the time, if it looks good, in the time that I am doing the investment, I began to do the trainings on the decisions of the data.	At the beginning it's like, wow, that's amazing. And, after that, they began to realise that it's like a spy on the point of sale and they are then OK, but it's not so nice. So, it was nicer when they explain to me, but now that I understand that it's a spy like that, I don't like it so much.

Table 19: Drivers for IoT adoption and the role of dynamic capabilities

4.5 IoT ADOPTION CHALLENGES AND SUCCESSES OF ORGANISATIONS

By identifying the impediments, organisations can identify strategies to overcome them, leading to increased efficiency, greater competitiveness, and ultimately higher sales. A sample overview of the challenges and successes in different organisations from different countries is outlined in Table 20.

Case Study	Background	Challenges	Success
Croatia #03	▪ 3,000 connected coolers ▪ Engineers to manage maintenance ▪ Salesforce to collect data with mobile App ▪ Management to analyse data and define strategy	▪ Inconsistent data collection from sales force ▪ Incentivising and adoption issues ▪ Changing work practices	▪ Managed to act on cooler analytics ▪ Asset register regularly updated ▪ Relocated underperforming coolers ▪ Established that 'Can' only results in 30% less sales ▪ Increased revenue and reduced costs ▪ Improved store owner satisfaction
Argentina #08	▪ 120,000 connected coolers ▪ Significant investment ahead of execution ▪ Salesforce to collect data with mobile App ▪ Required the use of their existing App	▪ Marketing and Sales team vs Info. Systems team ▪ Adoption of sales reps who visit 60-80 stores a day ▪ Significant lack of data collection ▪ Lack of data analysis ▪ Cultural, institutional, political issues ▪ Struggle to integrate into own App	▪ Managed to deploy beta bespoke application ▪ Managed to collect data for client ▪ Proven business case
Mexico #09	▪ 65,000 connected coolers ▪ Chilled foods and beverages ▪ Strong leadership and commitment to IoT ▪ Required the use of their existing App	▪ Technical issues ▪ Regular onboarding and training ▪ Changing work practices ▪ Many coolers in dangerous locations	▪ Excellent execution and sales force adoption ▪ Asset register regularly updated ▪ Integration into ERP system ▪ Integration of functionality into own App ▪ Near 100% coverage by City
UK #05	▪ 4,500 coolers ▪ Must use smart modems to collect data ▪ Must use smart camera for planogram and purity data ▪ Maintenance outsourced to third party ▪ No distribution channel for products	▪ Technical issues with image technology ▪ Technical issue with smart modems ▪ Support of third party maintenance supplier	▪ Data capture directly via smart modem ▪ Remote access and updates of software ▪ Purity issues immediately spotted in coolers ▪ Automated updates on status of each cooler ▪ Actionable insights

Table 20: Sample organisation IoT adoption cases

4.6 IMPACT OF A GLOBAL PANDEMIC

Table 21 illustrates comparison of participant views of their organisation response to IoT adoption prior to the onset of a global pandemic and subsequently after the global pandemic. Additionally, comments are added on whether there was a perceived change of behaviour within the organisation from the leadership, senior executive, and management view.

Themes	Pre Covid-19	Post Covid-19	Comments
Knowledge	▪ I honestly believe their understanding of IoT is very limited ▪ It seemed to be rocket science, they didn't know how it worked ▪ At the beginning they are always sceptical, because they don't really understand this new thing ▪ Understanding of IoT and the impact of IoT was something that the workforce was not convinced or aware about	▪ They are not educated well and they are not trained to work with electronics at all and the whole concept of IoT ▪ 50% of people do everything as you explain, they understand everything 100% and 50% struggle ▪ I believe that in the beginning there were negative reaction, because of lack of awareness ▪ Some of them felt a little bit insecure, because they know they're bad in electronics, and they are now scared if they cannot do this job	It is suggested that the perceive knowledge levels were low irrespective of Covid-19. It may have caused more uncertainty among the organisation workforce.
Preservation	▪ In fact, they don't want it, because for them it's a new thing to learn ▪ This is the most difficult part where we're pretty slow in adapting to the new ways of working ▪ So what I would do differently is try and work more on changing the mindset, because that is, I feel, the most important barrier that we have faced ▪ I think every company that implements IoT will be with problems with workforce, because IoT is usually controlling something ▪ First they were demotivated because they have additional tasks ▪ Most of these people always were under the impression that they are overworked ▪ So, I would say the challenges were maybe, let's say, additional workload	▪ Younger guys, since covid they've actually that jobs have becoming more scarce. So, a way to stay valuable to an employer, is to start learning more skills ▪ Ok, to keep our jobs, we'll do whatever it takes, you know, just to be a good employee, so that we still have a job ▪ The younger people are now changing their attitude, post-covid. The attitude I'm starting to now see is, 'Ok, to keep our jobs, we'll do whatever it takes' ▪ I have the feeling that there is, certain bunch of people that they use this IoT, or whatever, any new thing, OK, to play it in their advantage to force a negotiation, for getting more money, ok. ▪ I would say that Covid-19 has accelerated this motivation, much more	Managing expectations was prevalent pre Covid-19. It is suggested here that post Covid-19, a heightened sense among the younger employees to embrace IoT adoption to increase their value to the organisation.

Robustness	▪ So, we've had, like an app on a device, you know for pairing, at a local level, hasn't always worked as seamlessly as you might hope ▪ I'm talking the guy in the field, if they find that if it's not easy to use, well they tend to stop using it. ▪ This is challenge was the battery of the telephone. They were very aware because the sales rep, they can't run out of battery in the middle of the day ▪ More time spent getting familiar with the new technologies and the new way of working and new application.	▪ Covid-19 maybe enforced need for more applications ▪ Now they are more in the, not in the resistance of using, more in the learning of how to take advantage of it ▪ I would rather say that COVID-19 has really put even more focus on optimising, because, yes, budget has been cut ▪ Now, rather than a good to have, it has become a must have, because our dependency on humans to collect data have of course gone down ▪ Yes, so that made the data from 'the asset' even more, let's say, important ▪ But the early adopters, they are knocking on the door and say 'hey, hey hey', can we move faster in here?	Responses shifting attitudes from challenges of suitability of IoT technology and its robustness to focus on finding ways to utilise better due to advent of Covid-19
Stability	▪ They are stressed out, because maybe sometimes…even though we explain them, they will not get sacked ▪ The psychological fear of losing the job, and you know, not doing the job properly was stronger than that ▪ The first part is everybody thinks they're going to lose their jobs because they think it's automation ▪ While there were also people that were afraid of losing jobs and being obsolete after some period ▪ They first of all see IoT is a threat to their work now, right? Because, now it can reduce the amount of times they have to visit	▪ The fear of change, scared of, fear of lack of support ▪ So, you have in front a new thing, that looks like you can show me the things that I don't want to show to you. So, they could be scared ▪ So, when I started introducing this concept of IoT to them. A lot of them were scared that they might lose their jobs ▪ I know it's in people's minds that if he's not doing the job right, he will get sacked	Stability was a concern for the organisation both before and after Covid-19.
Trust	▪ I think that, there were some concerns of how accurate this data can be ▪ So, we've had, like an app on a device, you know for pairing, at a local level, hasn't always worked as seamlessly as you might hope ▪ So, I think, yes, the maturity of the technology impact the adoption rate of the workforce ▪ They just need like, ok, a simpler way. Sometimes that makes difficult the adoption of that, because too complex	▪ When they see the tech does not work and they stop using it ▪ Well, one of the largest problems, that they had to get used to it, because, they simply are not used to dealing with electronics ▪ When they cannot understand the benefits of the information, they look for examples, in order to discard the information ▪ People still have misconceptions of Bluetooth communications	The study found that trust issues were not adequately managed by the organisation's leadership.

Execution	▪ The other is to have a 'godfather' inside the company. Someone in big management to help you to implement this ▪ I underestimated the difficulty or the challenge of this journey, in terms of resources, in terms of timings, in terms of everything ▪ I believe the speed of decision making could have been better, is something I would have changed in the adoption of IoT in the last one year ▪ Without senior leadership support and that focus, all our KPIs are around something else	▪ It's just that we need to work in a more efficient way and allocate our resources in different directions that can bring more benefits, let's say, in our business ▪ Supervisors and managers need solutions that help them to have a bigger perspective or have a deeper analysis ▪ The toughest part is to translate the data into actions into people that take decision on that, and that's very tough ▪ It was the availability of rich, precise and real time data, available at a lower cost versus human resources that lead to the option of IoT	Support from leadership to ensure execution was a key theme that needed to be addressed. This also was an issue post Covid-19 for organisation team members. Execution was a challenge throughout.
Scepticism	▪ So, in the beginning is not comfortable for them, knowing that 'Oh my God, now IoT will start telling people on the headquarter or the planning team' ▪ There was also a bit of uncertainty in the workforce, like 'What if it says that we are not working properly?' ▪ They saw it as a way to control them and the work they do ▪ Most of them think 'Oh, are they trying to track our movement? Are they trying to track how many jobs we are doing? How long we're taking?' That sort of feeling ▪ Well, for the sales reps, the motivation was really low, because they think of it more as a controlling device, than something that would help them in their work ▪ At the beginning they are always sceptical, because they don't really understand this new thing.	▪ So, I would say that in our case innovation was the reason to have data, the maintenance to have all the data ▪ For me it's been, you know, like a lot of excitement, this feels like, this is really exciting technology and it can bring a lot to the organisation ▪ So, for sure there were a lot of people that became very much motivated, because of the IoT projects that are run within the company ▪ I can be proud of that and I can share with my client that we have the most intelligent fridge ▪ And the real important was the early adopters' motivation, because we they are showing us the potential of this IoT ▪ Due to Covid-19 a lot of people's eyes have now opened to try and see about how we can do that work by using digital transformation	Heightened sense of scepticism at the early stages of IoT adoption. In some cases, it is suggested, because of the Covid-19 pandemic the benefits of IoT adoption were shared and scepticism declined
Efficiency	▪ It's just that we need to work in a more efficient way and allocate our resources in different directions that can bring more benefits, let's say, in our business ▪ Supervisors and managers need solutions that help them to have a bigger perspective or have a deeper analysis ▪ But the real gain is that we want to make our life a lot easier, the life of our technicians, because they will know the faults before they go there	▪ I would rather say that COVID-19 has really put even more focus on optimising, because, yes, budget has been cut and so on ▪ Now, [pause] rather than a good to have, it has become a must have, because our dependency on humans to collect data have of course gone down ▪ Which was anyway a matter of time in my opinion to come, but it came faster because of COVID-19. ▪ So, the resistance in the top level is going down, and that's very	It is suggested the focus on efficiency benefits was more acute after Covid-19, however, efficiency was recognised as an important factor throughout.

	▪ It was the availability of rich, precise and real time data, available at a lower cost versus human resources that lead to the option of IoT	useful, because they beginning to understand that [pause] it's data that helps them to have a deeper understanding of what's going on in the point of sale.	
Growth	▪ The driver was just to see if we could optimise the use of our coolers and start getting some insights on the actual behaviour in store ▪ We want to be the front runner in that field and gain market share versus our competitors, based on better technology ▪ So, it was really necessary to invest in to the equipment to be able to grow market share	▪ I think everybody understands the data is valuable, but everybody is being much more revenue and operations driven now ▪ So, I think, you know, Covid may change some of the consumer buying habits ▪ To be honest, who knows, different buying patterns [pause] that information might become even more critical.	Growth is a key component IoT adoption prior to the pandemic. Challenges to this post pandemic was based on uncertainty in the market and consumer demand or behaviour. Understanding this using IoT adoption was recognised as an important benefit.
Revenue	▪ So, the expectation was to make sure that, OK, the product stays on shelf and they can supply just in time, and they can make sure that they can sell more stuff ▪ So, it was a very useful tool, in order to understand what was the pattern of the consumer, if it was changed or not, and we discovered it was a huge impact ▪ So, everything that helps you understand in this case, mass consumption, what is going on in the stores, in the market is gold	▪ It was terrible, because our business is closely connected with pubs and brewery, but luckily only have of the business, the other half is coolers and freezers. ▪ The main focus is still return on investment and revenue of the fridge, of the cooler ▪ yes, it was terrible, Covid had a great impact on our business	It is suggested that gaining intelligence to improve revenue opportunities was key, however post pandemic, this resulted in some uncertainty due to market conditions.

Table 21: Responses pre and post covid-19

4.7 DYNAMIC CAPABILITIES AND CHILLED BEVERAGES INDUSTRY

Based on Gioia methodology (Gioia, Corley and Hamilton, 2013), the analysis of interviews generated four aggregate dimensions: Awareness, Competitiveness, Leadership, and Capabilities. Based on the well-known Dynamic Capabilities model (Teece, 2018a), the responses were then categorised into sense, seize, and transform.

The findings of this research are substantiated by evidence collected from interviews with participants from organisations in the chilled beverages industry. In this chapter, interview quotes are categorised into the sense, seize, and transform stages of the dynamic capabilities model. Participants' responses reveal many valuable aspects, including the need for improved resource capability, operations, knowledge, leadership, and competitiveness.

Furthermore, the results of the research indicate that organisations require a holistic approach to IoT adoption and their dynamic capabilities in order to achieve a successful transformation in the chilled beverages industry.

4.7.1 SENSE

This is an investigation into the role of dynamic capabilities in fostering organisational IoT adoption and resilience during a pandemic. In this study, sense aligns with Gioia's aggregate dimension 'Awareness' (Gioia, Corley and Hamilton, 2013). During a pandemic, it is argued that organisations should explore technological adoption opportunities in order to maximise their performance (Amis and Greenwood, 2021).

The research suggests that adoption is influenced by trust in IoT technology and its robustness. Scepticism and organisational awareness of IoT technology play crucial roles in the consideration of potential technological adoption. Workers in the chilled beverage industry exhibit varying levels of awareness, knowledge, and scepticism. This may

negatively impact an organisation's ability to sense appropriate business or technological opportunities. The diverse nature of participants and countries suggests that there are differences in economic, cultural, or institutional values that may influence an organisation's ability to sense new business opportunities.

To further investigate this phenomenon, organisations should seek to understand the values and attitudes of their employees, as well as the economic and cultural climate in which they operate. This is in order to identify and capitalise on the opportunities presented to them.

To this end, in commenting on the viability of using IoT technology, participant #01 states:

> "*So, it seemed to be rocket science, it was, it seemed to be very expensive. And also, in a country like India a way faced… why don't we deploy, say, a person for that, or why don't we just use manual efforts and they might be cheaper. And in some case, it did make sense, because labour here is a lot cheaper than in the western countries."*

This participant appears to make a case for not adopting IoT in their environment. However, the participant does sense an opportunity for IoT adoption, and merely provides an example of the type of resistance faced within the organisation. Things are done differently in different countries, possibly influenced by a variety of cultural and institutional values. It is suggested that a further study of cultural and institutional phenomena may add value to this study. This may impact the way in which organisations from different countries sense, consider and respond to IoT opportunities.

Furthermore, the statement from participant #01, indicates an underlying feeling of scepticism towards technological change, a lack of appreciation of potential benefits and resistance to change. This is interpreted in different ways by participants in different countries. There may be significant challenges to IoT adoption (Umair *et al.*, 2021) due to reluctance to change, increased workload and new capability requirements from the organisation's workforce.

However, there are also many benefits to IoT adoption, such as increased efficiency and productivity, cost savings, and improved customer satisfaction. With the right training and support, organisations can overcome the challenges and realise the full potential of IoT.

Participant #03 stated:

> *"Well of course there were, as always, there's always a reluctance to change and human, let's say, human reluctance to change and to add additional things. So, I would say the challenges, were maybe, let's say, additional workload. More time spent getting familiar with the new technologies and the new way of working and new application."*

This response highlights challenges that may be addressed with better awareness when sensing IoT adoption opportunities. The objections identified indicate concerns, valid or otherwise, with trust and robustness of IoT technologies, perceived lack of capability to work with new technology and concerns about benefits due to the suggestion of increased workloads.

Lack of IoT awareness and benefits are illustrated in the following comments:

Participant #04:

> *"They perceive it to be [pause] a bit fluffy and a bit over the top, and because, every one of our sales reps [pause] think that they know best, so there's no need to put technology into the fridges."*

This responded suggests some workers in the organisation do not appreciate the benefits of the organisations IoT strategy and that a form of resistance is offered by the sales reps due to their implicit knowledge of their customer base.

Participant #02:

> *"So, I think, yes, people are still, they sort of get the connection bit, but maybe, [pause] struggling to see the bigger picture."*

Participant #08 stated:

> *"Something that innovation, we don't really know what it is. We don't like to implement. Big companies are always open to implement new things, new technologies, new ideas. But, that doesn't mean that they really understand what it is … that they have."*

These two statements illustrate that sensing opportunities may not be straightforward for an organisation and its workforce and that there may be a gap in understanding the benefits of implementing IoT technology during the sensing stage.

Participant #09 intimates lack of awareness of IoT Technology and fear job losses:

> *"The people on the ground sometimes they are scared. And not scared because of they …, but because they have families, and they have the rest of the teams. It's a tough position."*

This statement suggests that sensing the benefits of IoT technology adoption might lead to potential gains in resource efficiency. In turn, this may instil concern among the organisation's existing workers regarding their roles.

At sense, some participants clearly understood the benefits of IoT adoption as it moved from sense to seize. As a result of coding and interpreting interview quotes, this study demonstrates that an organisation might benefit from structuring their IoT adoption practices according to the various stages of the dynamic capabilities model.

The following statements illustrate how the organisation's leadership believes in sensing. It is evident from these statements that the participants are aware of the business or technological opportunities available to them. Efficiency gains, assisting in the achievement of planned business goals, and improving customer satisfaction are some of these benefits.

Due to this research being undertaken during a global pandemic, it is suggested that in some cases employee performance would improve. This is because younger members of the organisation recognise the potential job loss consequences of a pandemic and so embrace new technology to demonstrate their value to the organisation. Additionally, organisations perceived that their competitiveness and market share could be improved through the adoption of IoT technologies, and this perception was reinforced by the Covid-19 pandemic.

Participant #06 predicts technology will introduce overall efficiencies:

> *"But the real gain is that we want to make our life a lot easier, the life of our technicians, because they will know, as I said before, the faults before they go there. We are trying to predict faults. You know you can predict some faults."*

Participant #07 suggests the opportunity to meet business goals:

> *"So, this is why we got into the Internet of things world, because that technology was capable to enable us to reach our initial goals or business requirements for the future."*

Participant #02 stated:

> *"Yes, so they were I think the three main drivers. So in summary it would be preventative maintenance, achieving better customer experience, and also optimising the placement of our equipment to optimise sales for our customers."*

Participant #07 stated:

> *"Why we are Internet of Things? Because the goals that we set ourselves, our ambition, in terms of doing whatever, we can discuss it later. But, our business goals in the area of cold drink equipments, the best way to achieve them, was by elaborating on technology."*

Participant #10 recognises job security opportunity impact by external factors such as a global pandemic:

> *"The younger people are now changing their attitude, post-covid. So, the attitude I'm starting to now see is, 'Ok, to keep our jobs, we'll do whatever it takes, you know, just to be a good employee, so that we still have a job."*

Participant #11 identifies the need to reduce costs:

> *"They want more efficient insight from the field. So, during the Covid-19 we made a special wide angle camera with night vision, so that we can take a picture of refrigerator and all kinds of stuff inside and save them the time for the sales representatives to go there and check, how it's like, you know, the planogram and everything. They already see it over the years. And they just want more of it, especially now, after Covid they want to cut expenses."*

Participant #13 : demonstrates the urgency required to be more competitive

> *"So, we also wanted to be ahead of the curve, because we believe that technology is the future and the more we ride the curve, on top of it, the better we are placed… to our competitors in the future."*

> *"We want to be the front runner in that field, and gain market share versus to our competitors, based on better technology."*

Participant #07 suggests early adopters are keen to onboard IoT Technology:

> *"OK. But the early adopters, they are knocking on the door and say 'hey, hey hey', can we move faster in here? 'Hey, hey, hey, do you have it?' 'Hey, hey, hey', because, they really see the potentials, OK. So, I would say that Covid-19 has accelerated this motivation, much more, in this particular segment."*

Overall, these interview quotes express a sense, view, or vision of how IoT adoption could enable businesses to gain competitive advantage through efficiency, optimisation, and increased sales. Organisations perceive IoT opportunities with mixed responses. This is potentially due to cultural or institutional differences. There was some scepticism towards IoT robustness, and low awareness of IoT. This contributed to a negative perception from participants from organisations in some countries and may have contributed to a sense of reluctance towards change. Conversely, participants from other countries demonstrated an appreciation of the benefits and articulated how these align with organisational goals.

To explore this further, an in-depth study of how local and national institutional values influence adoption of IoT could be beneficial to this study. Theorists argue that firms are influenced by both institutional pressures and cultural factors. Institutional theory focuses on the 'taken-for-granted' aspects of social institution, including politics, the family, work, and religion (Brewster *et al.*, 2011; Berger and Luckmann, 2016).

4.7.2 SEIZE

Participants in this research identified appropriate IoT technology adoption for the chilled beverages industry. As a result, they aimed to improve their organisation's performance, including its competitiveness and operational efficiency. Drivers for this were impacted by the organisations' need to improve on their competitiveness, efficiency, and growth potential within the context of a global pandemic. A pandemic may have global constraints

on a company's business model, requiring it to change. This includes maximising efficiencies during a period where fewer personnel were available, operating with a smaller workforce due to thurlough schemes or planned redundancies. In response to sensing IoT adoption opportunities, participants responded by emphasising the need to leverage or enable IoT adoption within their organisations. In order to accomplish this, a variety of goals were pursued, including maximising sales and market share growth. Therefore, novel strategies were developed to evolve business models in challenging market environments.

To capture these opportunities and stay competitive, organisations had to develop novel strategies for evolving their business models to maximise sales and market share growth in the face of changing market conditions.

Competitiveness and leadership are the overarching aggregate dimensions of this research. ‘Competitiveness’ was found to be essential at the seize stage of an IoT adoption framework. Likewise, 'leadership' also played an important role at the same stage (Hussain *et al.*, 2018). According to this study, senior management needs to demonstrate strong leadership and commitment to a clear strategy to resource and deliver new business models (Schoemaker, Heaton and Teece, 2018).

Moreover, the research indicated that leadership should be continually demonstrated in order to provide direction and inspire IoT adoption within the organisation.

As a result of this research, competitiveness and leadership have been identified as aggregate dimensions. Subthemes identified within competitiveness included improving efficiency, generating growth, and increasing revenue. Leadership subthemes included execution, commitment, and effective communication, which are crucial attributes required by an organisation's leadership. During the interviews, participants indicated that poor execution, unclear leadership, and poor communication contributed to a negative impact on IoT adoption within their organisation.

Therefore, it is evident that execution, commitment and communication are key components of successful organisational competitiveness and leadership, with any lack thereof potentially hindering IoT adoption.

Participant #02 stated the importance of clear leadership:

> *"Without senior leadership support and that focus, all our KPIs are around something else."*

This participant found that members of the leadership team did not demonstrate the commitment, guidance and execution required to effectively seize the IoT technology adoption.

Participant #10 raises leadership issues:

> *"I believe [pause] the speed of decision making could have been better, is something I would have changed in the adoption of IoT in the last one year."*
> *"And in all my KPIs there is nothing around equipment innovation. But, in [name] key deliverables, he has equipment innovation under him, but his manager will 'talk to it' but will never give him the resources or the funding to explore what's out there."*

There is a lack of leadership, decision making, and execution demonstrated here. According to the quotation, the second statement implies that although a key leader promotes IoT adoption, as indicated by the meaning of the word 'talk to it', the organisation lacks commitment to funding and resources to implement. It was also noted by this participant that the same leader was not fully understanding the benefits IoT technology might bring to the business and was somewhat at arm's length during the sense and seize phases of IoT adoption.

As a result, it can be said that the organisation needs greater commitment throughout the organisational leadership. This is to ensure that the necessary resources and funding are in place for the successful implementation of IoT technology

An example of a common finding regarding an organisation's ability to take advantage of these opportunities can be found in the quotation below. Lack of leadership communication, commitment, and execution contributes to workforce incapacity and unwillingness to accept new opportunities. If these factors are addressed, including sharing commercial and other organisational benefits, outcomes should improve.

To ensure success, an organisation must ensure that leadership actively communicates and commits to new opportunities and executes them to ensure that the workforce is willing and able to accept them.

Participant #07:

> *"I underestimate the difficulty or the challenge of this journey, in terms of resources, in terms of timings, in terms of everything."*

In summary, these participants identified the need for leadership to clearly communicate, support and commit to seize the IoT opportunity. Without that, some employees did not support these opportunities, focusing on their existing and unchanged Key Performance Indicators (KPIs) which were often not aligned with these new IoT adoption initiatives.

Participant #01 states that communication and execution is essential:

> *"And then since we were going to get real time data and understanding the performance of everyone. There was also [pause] a bit of uncertainty in the workforce, like what if … says that we are not working properly?"*

This participant states that several members of the workforce are suspicious of the adoption of new IoT technologies. This statement implies that a feature of new technology may be used for employee monitoring. A negative connotation may be associated with this from an individual's perspective. As with the previous quotation, this quotation indicates a lack of trust among workers and an unclear understanding of IoT technology's

purpose and capabilities. In this study, poor communication and execution are found to contribute to this sentiment.

This statement could lead to a sense of insecurity and suspicion among employees as it implies that they are being tracked and monitored. In addition, these findings suggest that inadequate communication and implementation of IoT technologies can also lead to a lack of trust and misunderstanding.

It was suggested by this participant that employees are hesitant to use IoT technology since they believe the data gathered may provide a measure of their performance. With better communication and an effective execution plan, the organisation's workforce may understand the real benefits of IoT technologies and may allay individual concerns or fears.

In further support of communication and execution challenges:

Participant #05 stated:

> *"However, as a big organisation, you know the processes, changing the way of working is the most difficult and the bottleneck in every change."*

Participant #08 comments on execution, communication, and challenge to change people's perceptions:

> *"So, there is no chance of concepts, it was something very hard to implement. Implement the idea for the business, because in the case of beverage, these are company with more than 100 years. A way of thinking or how they manage the business, and in this case, it's not a technology company, so they don't have the concept either."*

Participant #09 stated execution as a challenge:

> *"Most of the people think that having the data, having the numbers in front of you is enough. An that's the easiest part. The toughest part is to translate the data into actions into people that take decisions on that."*

Competitiveness in relation to efficiency, growth, market share and consumer awareness were drivers for seizing the IoT technology opportunity.

Participant #03 states market share and understanding consumer behaviour as essential:

> *"So, it was really necessary to invest into the equipment to be able to grow market share."*
>
> *"We want, let's say, to have a better understanding of what is happening with our coolers. And to try to get the, let's say, the consumer data from the coolers and to try to understand consumer behaviour better."*

Participant #06 stated the clear impact of Covid-19 on revenue numbers in different market sectors.

> *"I think I have data from one of our breweries, during the covid, ok, draft beer selling was down 95% of course, because almost everything was closed. But they were increased in bottle beer was 120% increase, because everybody stayed home."*

Participant #07 identifies key benefits to enable the organisation to be more competitive.

> *"So, that technology will pull out two key benefits. One is selling more or execute better rather than selling."*
>
> *"Is because that will enable us to do better job in the market, to execute better in the market."*

4.7.3 TRANSFORM

A significant outcome of this research found that capabilities were a major component for consideration if an organisation is to restructure for success. It is imperative to address workforce knowledge across the organisation to ensure appropriate capabilities during a transformation. This feeds into the findings from the Gioia methodology of the aggregate dimension 'Capabilities' (Eisenhardt and Martin, 2000; Helfat *et al.*, 2009; Teece, 2014; Schoemaker, Heaton and Teece, 2018). For an organisation to adopt IoT, it is important to address knowledge, self-preservation, stability concerns, and the wider organisation's understanding of IoT benefits. Based on the dynamic capabilities model, these findings fall within the transform stage. In order to achieve successful transformations and

ultimately IoT adoption in the chilled beverages sector, it is imperative to align with and invest in existing and additional capabilities.

In summary, to ensure a successful transformation in the chilled beverages sector, organisations must address knowledge, self-preservation, stability concerns, and invest in capabilities that will bring the full value of IoT to the organisation.

The key sub themes of knowledge, stability and preservation are illustrated in the responses from participants. In this study, it was found that lack of knowledge has an impact on the sense of stability and self-preservation of an organisation's workforce. It is hypothesised that addressing knowledge deficits is essential for a successful transformation stage. Leaders must be clear on the intended IoT technology adoption goals and its business benefits for the organisation and its workforce. To do this, early and regular communication, training, materials, workshops on IoT technology, will result in a successful transformation stage. Conversely, the opposite approach is likely to have a significant de-stabilising effect. Therefore, investing in the necessary resources to ensure successful communication and training of IoT technology is essential for the successful adoption of IoT technology for the organisation.

A further study to explore the relationship between knowledge, stability and preservation may result in new findings.

Participant #01 recognises that communication and training may have improved the organisations understanding.

> *"I would actually do differently is try and work more on changing the mindset, because that is, I feel, the most important barrier that we have faced, while pushing this through. Probably, I would try and see how the entire workforce have a learning session about all the benefits of IoT, so that they can understand the solution better."*

As a result of this research, participants often used this type of quote in their interviews. The importance of communicating the business benefits to employees and improving their knowledge is evidence that knowledge gaps must be addressed. There are several barriers raised by workers that may hinder a successful transformation, including issues

of stability (mindset), and self-preservation caused by a lack of understanding and knowledge. It is important that organisations address these concerns early on in IoT adoption initiatives. To further ensure a successful transformation, organisations should not only maintain regular communications, but also implement a knowledge development program to help workers gain better understanding, hence alleviating their fears of instability and self-preservation.

Participant #02 suggest that lack of commitment in knowledge transfer has a negative impact.

> *"The business doesn't invest in the right, the business doesn't provide enough resources to give them the proper training of the new tech."*

Likewise, there is a lack of commitment to ensuring knowledge is transferred and developed appropriately to ensure successful transformation. If the existing teams are not deemed capable for whatever reason, new or external resources may be needed. As suggested elsewhere in this research age may have a role to play in successful IoT adoption (Pauget and Dammak, 2019).

Participant #03 states that organisations workers find grasping new technology very difficult.

> *"So, you need to accept that people don't grasp your explanation and your instructions, however clear there are. It's always like this. I cannot explain why, but it just always happens, maybe not 50/50, maybe 60/40, but you can always expect a certain part of the people won't get it from the first time. So, plan time, plan additional follow up, plan additional explanation. People appreciate that and they will always be happy if you try to help them."*

This quote stresses the need for knowledge transfer for a successful transformation. In this statement the participant implicated that through good training and knowledge transfer, stability is improved, and feelings of self-preservation may not be significant.

Participant #06 stated that they could have prepared their team better with training.

> *"And, of course, I would prepare the people much better with, you know, the, let's say, error training so they can recognise what is wrong with device, we also didn't do that properly as well."*

As suggested, preparing for knowledge development may result in improving stability and self-preservation of the workforce. The statements below illustrate there may be a link between lack of knowledge and reduced sense of stability.

Participant #04 states fear in the workforce of change that may negatively impact their work profile.

> *"The most motivation isn't really that high, because it would likely, well it would be changed ways of working, and that is, for some people, that can be scary, not knowing what will hit you. And, I think that they saw it more or less as extra work. So, instead of just answering a phone when the fridge has breakdown, they would now need to be more proactive too, as technicians. And that's a whole other way of working for them."*

Participant #07 states that some workers resist in principle for better working conditions and pay. This is indicative of how organisations institutional values differ from country to country.

> *"OK, or my particular opinion, that I would not say in the middle of a senior management in my company. Because I cannot prove it, but that is my flavour, OK. I have the feeling that there is, certain bunch of people that they use this Internet of Things, or whatever, any new thing, OK, to play it in their advantage to force a negotiation, for getting more money, OK."*

Participants said that there will be challenges to transformation due to the fact that some employees will take advantage of the opportunity for change to gain financial benefit for themselves. There is a high degree of union influence in this country, and workers may demand compensation if their working conditions change. As a result, there are challenges to transformation from the perspective of self-preservation and stability. In this quote, concerns are expressed about addressing such matters in an open forum. Therefore, it is important to consider the impact of change on employees and approach the matter in an empathetic and understanding manner.

Participant #08 suggests that workforce preservation may impact the ability for an organisation to implement change. Again based on the countries of participant #07 and #08, there may be cultural and institutional factors in play.

> *"I think, in general, new technologies, the big challenge is to change the culture or the mindsets of the people to implement this."*

This quote indicates that the participant is aware of potential cultural challenges within their organisation. In addition, the participant is aware that addressing a change in 'mindset' is essential to ensuring the successful transformation of IoT adoption. Again, ensuring knowledge is appropriately managed at this stage may be crucial to an organisation's IoT adoption success.

Participant #09 states that the workforce was suspicious of the technology's ability to 'monitor' their performance.

> *"At the beginning it's like, wow, that's amazing. And, after that, they began to realise that it's like a spy on the point of sale and they are then OK, but it's not so nice."*

During this study, it was found that some employees were initially enthusiastic about the concept of IoT adoption. As workers became more familiar with the capabilities of IoT, sentiment shifted to one of suspicion. Among the specific concerns raised were IoT technology acts as a 'spy' for the organisation's management. It is implied by the nature of the data gathered from devices that are capable of assessing the performance of sales representatives. This raises questions concerning the motivation of management and the use of gathered information. There are many concerns regarding the IoT benefits, knowledge sharing, and education required to succeed. This shows the importance of not only effective communication and leadership, but also clear and transparent explanations of the IoT benefits.

With this in mind, it is important for organisations to carefully consider the implications of the IoT and to be aware of the potential challenges which may arise from its use.

To overcome these challenges, an organisation should invest in improving awareness and gain early support from team members that are advocates for IoT adoption.

Participant #07 supports utilising advocates within their organisation:

> *"For the salesforce? [pause] There is then the strategy, but it's very implementing, which is starting with the best people you have, with the most aligned, with the most engaged, and then you prove that is a success within our organisation in a particular area, and then is easier for you to sell across other Salesforce."*

This participant found that it is beneficial to drive an organisation's IoT adoption strategy by ensuring advocates of the initiative are utilised at the early stages of implementation. This will improve positive outcomes. By sharing success stories and positive feedback from their peers, sceptics may be persuaded. Thus, the capabilities of the organisation are enhanced by ensuring that advocates have the necessary knowledge to be successful. Therefore, the advocates' successes can be transferred more fluidly to other members of the organisation. As a result of a strategy such as this, knowledge will increase, but stability and self-preservation issues may be reduced. In addition, this may result in a greater understanding of the benefits of IoT.

Consequently, not only can the organisation benefit from increased knowledge and understanding of the advantages of IoT, but it can also be better equipped to tackle objections from sceptics.

Participant #12 suggests efficiency benefits are recognised within the organisation:

> *"So, yes, due to Covid-19 a lot of people's eyes have now opened to try and see about how we can do that work by using digital transformation. So, if there is any way in which I can reduce my efforts and still get the same work done. People are more willing to accept that, so there is less resistance to change and we are already started seeing that."*

In this instance, it was found that onset of a global pandemic resulted in a more cooperative approach from workers within their organisation. An appreciation of the

constraints a pandemic has on an organisation resulted in less resistance and workers understand their organisation is faced with challenging times.

Participant #13 suggests conceptual adoption of IoT improves with exposure:

> *"So, the overall perception towards digital business and digital data working has improved. Which is why I believe when covid is behind us, the mindset towards adopting IoT in general will improve, because people are getting more accustomed and more used to technology and internet in general."*

According to this quote, the pandemic led to a wider acceptance of digital initiatives, like IoT technology. This is due to exposure to these initiatives because of a pandemic. It is suggested that there was a shift in mindsets towards accepting IoT technology. This shift occurred as organisations pivot during the pandemic as IoT technology became more widely understood and subsequently accepted within the organisation.

A lack of knowledge may result in a destabilising effect on an organisation's resources and may drive sentiments towards self-preservation during the transformation stage of dynamic capabilities. An organisation that is highly knowledgeable about IoT technology is likely to have a more positive attitude from its employees.

4.7.4 DRIVERS FOR IOT ADOPTION

In this study, environmental factors have played a key role in influencing the results of semi-structured interviews. Participants shared their perspectives on the impact of a pandemic on their organisations' adoption of IoT during the Covid-19 pandemic. It is possible that IoT adoption strategies were accelerated in some cases, and that they were influenced by pressures on the organisation's business requirements in others. In the interview responses, strategies for adopting IoT technologies focused on an organisation's key requirements. As a result of the pandemic, several areas felt under pressure. Most industries, including chilled beverages, suffered significant losses in trade,

so cost reduction was essential. To offset revenue losses, organisations had to find cost savings. Businesses can gain remotely gathered and regular business insights using IoT technologies, likely at a lower cost than using human resources. Using IoT technology to gather data overcomes constraints on the mobility of workers.

There are also instances where such conditions result in a reduction in resources by way of policies such as thurloughs or planned redundancies. Many organisations recognise the opportunity to bring IoT technologies into their business. This would enable them to have some sort of continued access to information about the performance of their coolers in the field. This is because workers were either restricted in their movement or were no longer available for the organisation. The adoption of IoT technologies by organisations is aimed at providing them with an advantage over their competitors by using IoT data intelligently to optimise the operational performance of coolers in the field, reduce maintenance costs, and develop strategies to increase commercial performance through the use of IoT data. The use of IoT technologies to gain an edge over competitors was also an objective. Many of these strategies were designed with the ultimate purpose of ensuring the survival of the organisation, but also gaining market share at the same time.

Several key factors such as market expansion, the availability of resources, competition, and cost reduction were considered factors that would drive organisations towards realising the business opportunities that IoT technology adoption could provide.

In the wake of the Covid-19 global pandemic, a wide range of stakeholders have been impacted, including suppliers, policy makers, consumers, and retailers, which in turn puts pressure on the chilled beverages industry. A significant decrease in consumer activity has resulted in a decrease in trade within the retail sector. As a result, there has been a decrease in the sales of chilled beverages. A similar drop in trade will be experienced in other sectors, including leisure and hospitality. All of these cases have seen a decline in the sales of chilled beverages. Aside from these declines, the chilled beverage industry is also negatively impacted by lockdown laws, which are implemented by policy makers and other government bodies, as well as other legislation that has an impact on the chilled

beverage industry. Suppliers to the chilled beverages industry also experienced reduced activity including the distribution capacity of chilled beverages and the manufacture of new coolers.

Finally, business challenges and the resulting IoT adoption strategies were influenced by the Covid-19 global pandemic.

4.8 SUMMARY OF CHAPTER 4

In this chapter, the rationale for utilising the Gioia methodology is described. The findings of this analysis, resulted in the aggregate dimensions of capabilities, awareness, leadership and competitiveness. For the purpose of reference, sample responses from participants were tabulated and categorised within the dynamic capabilities model into either the sense, seize or transform stages, according to their responses. The impact of the Covid-19 pandemic is evaluated by providing a quantitative count of participant quotes. The dynamic capabilities model was developed by tabulating case study quotations as they were related to the sense, seize and transform phases of the research. As part of this research, several case studies were presented in order to provide background details, a glimpse of their challenges, and success stories. As a final note, participants in this study shared evidence of the impact of Covid-19 on their IoT adoption strategy.

The findings of the semi-structured interviews are presented in this chapter along with supporting commentary. Regarding the adoption of IoT technologies within the chilled beverage industry, quotations were found to be thematically relevant to awareness, competitiveness, leadership, and capabilities. The key challenges and requirements of organisations are interpreted within these themes (see Figure 21). A more acute need for development of IoT technology adoption strategies was also found to be influenced by environmental factors associated with the Covid-19 outbreak.

Based on this study's qualitative evidence, results, and findings, there is a case for developing an IoT adoption framework.

In this study, the aggregate dimensions of awareness, competitiveness, leadership, and capabilities are considered. Analysis of participant interviews suggests that organisational IoT adoption challenges may be effectively addressed by utilising dynamic capabilities to develop an IoT adoption framework.

By understanding the importance of dynamic capabilities in addressing organisational IoT adoption challenges, organisations and practitioners can leverage this framework to assist in planning their own initiatives for successful adoption. Further, this framework provides academics with a valuable resource for engaging in further research in this field (see Figure 21).

5 DISCUSSION

5.1 INTRODUCTION TO CHAPTER 5

This study sets out on a journey to explore the challenges and capabilities of organisations in the adoption of IoT technologies within the chilled beverages industry. It explores the experiences and views of strategic and senior level management responsible for the successful implementation of their organisations' IoT initiatives primarily from a non-technical angle. This study found that there is a lack of existing literature and scrutiny from this perspective. Conversely, there is ample literature on the technological aspects of IoT adoption with the technology challenges and benefits of the same well researched. However, there is a gap in respect of an organisation or firm's IoT adoption strategy. This gap is within the senior executive view of the organisational challenges faced by stakeholders including an organisations workforce and their role in such initiatives.

Therefore, it is imperative for senior executives and stakeholders to understand the organisational challenges associated with IoT adoption, in order to develop an effective strategy.

Furthermore, the study found external and internal factors that influenced the identification or sensing of IoT opportunities, and the organisations' capability to successfully adopt IoT technology. An organisation's IoT adoption strategy was influenced by acute business challenges posed by the Covid-19 global pandemic. Organisations operating in the chilled beverages industry became more aware of the impact of a global downturn in market activity, legislative restrictions, and the overall negative impact of a pandemic.

The Qualitative empirical findings highlight organisations' positive and negative experiences with IoT technologies, as well as their desire and ability to improve their competitiveness and leadership. In order to adopt IoT, organisations must ensure they have the necessary resources. To represent the findings of this study appropriately, the dynamic capabilities model was utilised. The primary purpose of this study is the

production of an IoT adoption framework. It is also the aim of this study to provide clarity on the drivers for IoT technology adoption within the chilled beverages industry, within the context of a shock event such as a pandemic. This research distinguishes itself from other studies in that it contributes knowledge and insights from a managerial perspective to this understudied phenomenon. An IoT adoption framework offers practitioners and academics a vehicle for the further enhancement of knowledge on this topic. Future studies on this and other related topics may benefit from such a framework. Thus, this framework has the potential to not only provide a meaningful tool to guide and facilitate the adoption of IoT in organisations, but also to inform future research in this domain.

In reviewing the literature it was recognised that research relating to the adoption of IoT was primarily focused on technology capabilities, such as communications, security and networks. It was also established that since the inception of the term ‘internet of things’ back in 1999 (Sayar and Er, 2018; Ancarani *et al.*, 2020), there is a gap in research on IoT technology adoption and the impact on an organisation and its workers.

Further, the extant literature on dynamic capabilities and adoption of technologies does not support this thesis on IoT adoption. As previously discussed, these studies do not take into consideration the senior executive perspective on their organisations' resource capabilities, including dynamic capabilities and workers. Nor did any of these studies take into consideration the context of a global pandemic.

Techniques from qualitative content analysis and a thematic analysis within grounded theory inform the research design. This was accomplished using the preferred Gioia methodology. It can be explained primarily using pragmatism as an approach to knowledge derived from and relevant to this study. Since pragmatism focuses on practicality, it is a suitable philosophical approach to understand the phenomena under investigation.

This study clearly outlined the empirical context of the study and the relevance of the participants, their organisations, and the industry in which it was conducted. There was a discussion of the approach to data analysis and the subsequent interpretation of the

results. The researcher has completed profile testing using the HARP tool in order to determine the most suitable philosophical approach to be used in this study. This considered the results of the testing and suggested preferences. It became apparent that pragmatism was the preferred approach.

Based on the findings of this study, which are supported by empirical research data, an IoT adoption framework has been developed. The framework incorporates the aggregate dimensions derived from empirical, qualitatively collected, and analysed data.

According to the study, organisations in the chilled beverages industry and their ambitions to adopt IoT technologies as part of their operations face significant challenges both externally and within the organisation itself when they try to adopt IoT technologies. Organisations in the chilled beverages industry need to take into account and address their ability to manage issues within the aggregate dimensions of awareness, competitiveness, leadership, and capability. They must consider and understand the forces that impact their IoT adoption strategy. It includes a wide range of business challenges that can cause obstacles to the adoption of IoT technology. In addition, a global pandemic can introduce new and acute challenges. As such, organisations must ensure that they have the resources, strategies, and techniques to effectively navigate the changing landscape of the industry, while also ensuring they remain resilient in the face of unforeseen disruptions.

During this qualitative research, a number of aggregate dimensions were identified, namely awareness, competitiveness, leadership, and capabilities. It was apparent that each of these pillars would play a part in the adoption of IoT technologies within the context of a global pandemic, and as informed by the dynamic capabilities model. Business challenges and adoption strategies for IoT are likely to be affected by a global pandemic.

As such, organisations must be aware of the implications of the four aggregate dimensions noted, and proactively adjust their strategies and business plans to take advantage of the opportunities which IoT could bring.

The proposed IoT adoption framework expands upon existing theories of technological adoption and resilience by emphasising the interplay between an organisation's awareness, competitiveness, leadership, and capability in the context of IoT adoption. It posits that successful IoT adoption goes beyond the mere integration of technology; it requires a multifaceted approach that considers an organisation in the chilled beverages industry's ability to proactively sense and respond to external forces.

5.2 THEORETICAL AND MANAGERIAL IMPLICATIONS

In Figure 21, an IoT adoption framework is presented based on this study of the chilled beverages industry. The framework identifies the interactions of stakeholders faced with the challenges presented by the Covid-19 pandemic. These interactions require an organisation to develop strategies for new opportunities (Eriksson, Nummela and Sarcenet, 2014), for successful IoT adoption. This research argues that developing new business models may depend on the foresight, resilience, and strength of an organisation's dynamic capabilities. To this end, organisations must be able to anticipate disruption and adapt their strategies in response to the changing environment.

This research explored and developed an IoT adoption framework to enable organisations to more effectively complete organisational IoT adoption**.** Organisations are constantly faced with a multitude of challenges, technical advancements, and market forces. It is intended that the derived framework should be utilised by industry practitioners and academics to model successful IoT adoption in the context of a shock event such as a global pandemic. Furthermore, it is intended for academics to reference this framework, to enhance, develop and improve their shared understanding of this research topic. To ensure that this framework is of practical use, industry practitioners and academics should collaborate to ensure its applicability to different contexts and its potential for informing future research.

The IoT adoption framework introduced in this study, focusing on the chilled beverages industry, contributes to the theoretical understanding of how organisations can navigate environmental turbulence, such as the Covid-19 pandemic, and harness the potential of IoT technologies. This research, supported by the findings, extends existing theories by combining the concept of IoT adoption and dynamic capabilities as a theoretical framework.

It was decided to use a methodology that is most suitable for collecting and analysing data with a high level of quality in this study. This research follows both a qualitative approach, using NVivo to assist in the analysis and interpretation of research data collected. Candidates for this research were invited to participate, based on their profile suitability. Participants were engaged in the deployment of IoT within their organisations. Strategic level participants are invested in managing challenges, improving processes, and enabling their teams to maximise their performance. They are curious and determined in their pursuit of suitable solutions and willing to learn from their experiences. Moreover, the theoretical framework highlights the critical role played by strategic level participants in managing challenges, optimising processes, and enabling their organisational resources to perform well in the context of IoT adoption.

These are primarily senior managers, directors, strategic leaders, and chief executives. Future research should include extending qualitative interviews or quantitative surveys to participants at the operational level of an organisation. Therefore, these strategic, senior executives and management level participants need to be supported by operational level personnel who are responsible for implementing solutions. Thus, understanding the perspectives of such personnel could be beneficial for improving the organisation's performance.

It is posited that there is a lack of empirical qualitative data, research and understanding of this understudied topic, and therefore this study aims to address this gap. Furthermore, the effects of environmental turbulence, such as the onset of a global pandemic, has an

impact on organisational adoption of IoT in a way that demonstrates differences in an organisations approach pre and post Covid-19.

This research may be subject to limitations due to its sample size. The introduction of bias is possible due to previous professional relationships with some of the participants. Different countries and locations involved may introduce cultural and institutional values to this study. It was not necessary to apply for in-country ethical clearance, in addition to submitting an ethical research application via the BREO system.

5.2.1 SPECIFIC IMPLICATIONS

This thesis presents specific and practical implications for senior executives considering business opportunities for the adoption of IoT technologies within their organisation. There are five key considerations for organisations in the adoption of IoT technologies.

First, the context of environmental turbulence, such as a global pandemic must be considered. It affects organisations' ability to adjust and perform under exceptional, constrained, and difficult circumstances. In this environment, organisations must be able to adapt in order to detect new opportunities more quickly. It is their responsibility to enable these opportunities and ensure their organisation and infrastructure are ready to deliver on them.

In this study, the journey from sensing to delivery of IoT technology adoption opportunities presented challenges. In the absence of good awareness and clear understanding of IoT benefits, organisations were delayed in their journey to full IoT adoption and the realisation of associated business benefits. As suggested by Chowdhury et al. (2022) the beverage and food industry expected to experience a reduction in the workers due to the pandemic. In this study, the failure to anticipate or address these expectations resulted in uncertainty and fear amongst the workers regarding job losses (Singh, Bhatia and Nigam, 2021) and their future within the organisation. Interrelated to this is the reality that beverages sales

were likely to be negatively impacted (Fairlie and Fossen, 2022). To address the fear and uncertainty amongst the workforce, it is essential for organisations within the chilled beverages industry to have a strategic plan that not only anticipates any potential losses but also provides workers with a sense of security and future opportunities in the organisation.

Conversely, in this study, the younger employees were driven to learn about the proposed IoT technologies. This was done by adopting and developing their knowledge and skills to demonstrate their value to the organisation. This resulted in enthusiasm and advocacy for IoT technologies. This context increased participants' awareness of acute challenges and their views on IoT strategy, which is discussed in more detail in this thesis. This enthusiasm and advocacy for IoT technologies may provide organisations with an excellent opportunity to develop successful IoT strategies, which could help them to remain competitive and relevant in an ever-changing environment.

Second, and somewhat related to the first point, an organisation must be quick in the identification of IoT technology business opportunities. Awareness regarding actual opportunities and the facets surrounding IoT technology, its benefits, capabilities, and constraints. A lack of awareness results in delays in seizing opportunities and the ability for stakeholders throughout the organisation to grasp the ‘big picture’. It subsequently led to suspicions about the motive for IoT adoption with claims such as 'spying'. As a result, it is essential to spread awareness of the different opportunities and aspects of IoT technology. By doing this, delays can be avoided, and stakeholders can understand the technology's full potential.

Third, in this study the rationale for seizing IoT technology adoption was arguably driven by the need to be competitive in the ‘new normal'. Again, competitiveness is interrelated with both awareness and the context of environmental turbulence. In light of a global pandemic and rapidly evolving business challenges, the chilled beverages industry must find new and efficient ways to improve their commercial performance. Understanding and sharing how IoT adoption would improve efficiency and increase growth and revenues is

essential to provide the wider organisation with the 'big picture'. In order for IoT adoption to be successful for the organisation and its workers, the benefits of IoT adoption must be clearly demonstrated. It is therefore vitally important to communicate the tangible benefits that a company can gain from IoT adoption, both in terms of increased efficiency and revenue growth.

Fourth, it is imperative for leaders to share their strategy, goals, and the benefits of IoT adoption with the wider organisation. Leadership must ensure clarity of their own understanding of the benefits of IoT adoption and how these would result in the desired performance improvements. For IoT adoption strategies to be successful, leadership commitment, execution, and good communication are essential. This study found that leaders need to make faster decisions, improve messaging, provide appropriate funding, and demonstrate a transparent commitment to the execution of IoT technology adoption. Further, leaders should demonstrate transparency and willingness to be held accountable for their IoT adoption strategy and decisions.

Fifth. This study found that organisations had difficulty adopting IoT technologies. The four preceding points may determine the success of this effort. To achieve successful transformation, organisations must create an environment where organisational capabilities can be developed. According to this study, knowledge sharing, training, and clarity on the benefits of IoT technology adoption are needed. There was a lack of attention in this regard, causing destabilisation within the organisation and causing some employees to take self-preservation measures. Ultimately, this resulted in challenges for organisational transformation. In addition, it is recommended that a comprehensive programme be developed to ensure the successful adoption of IoT technology. As a result, the organisation should be able to maximise its potential.

5.2.2 AN IOT ADOPTION FRAMEWORK

Using the IoT adoption framework (see Figure 21) is highly beneficial. This applies both to theoretical models of dynamic capabilities and to practitioners working within chilled beverages companies and other organisations. When environmental turbulence events occur, such as a global pandemic, new business models are needed just as quickly. An organisation's capabilities and competitiveness will be strengthened as a result.

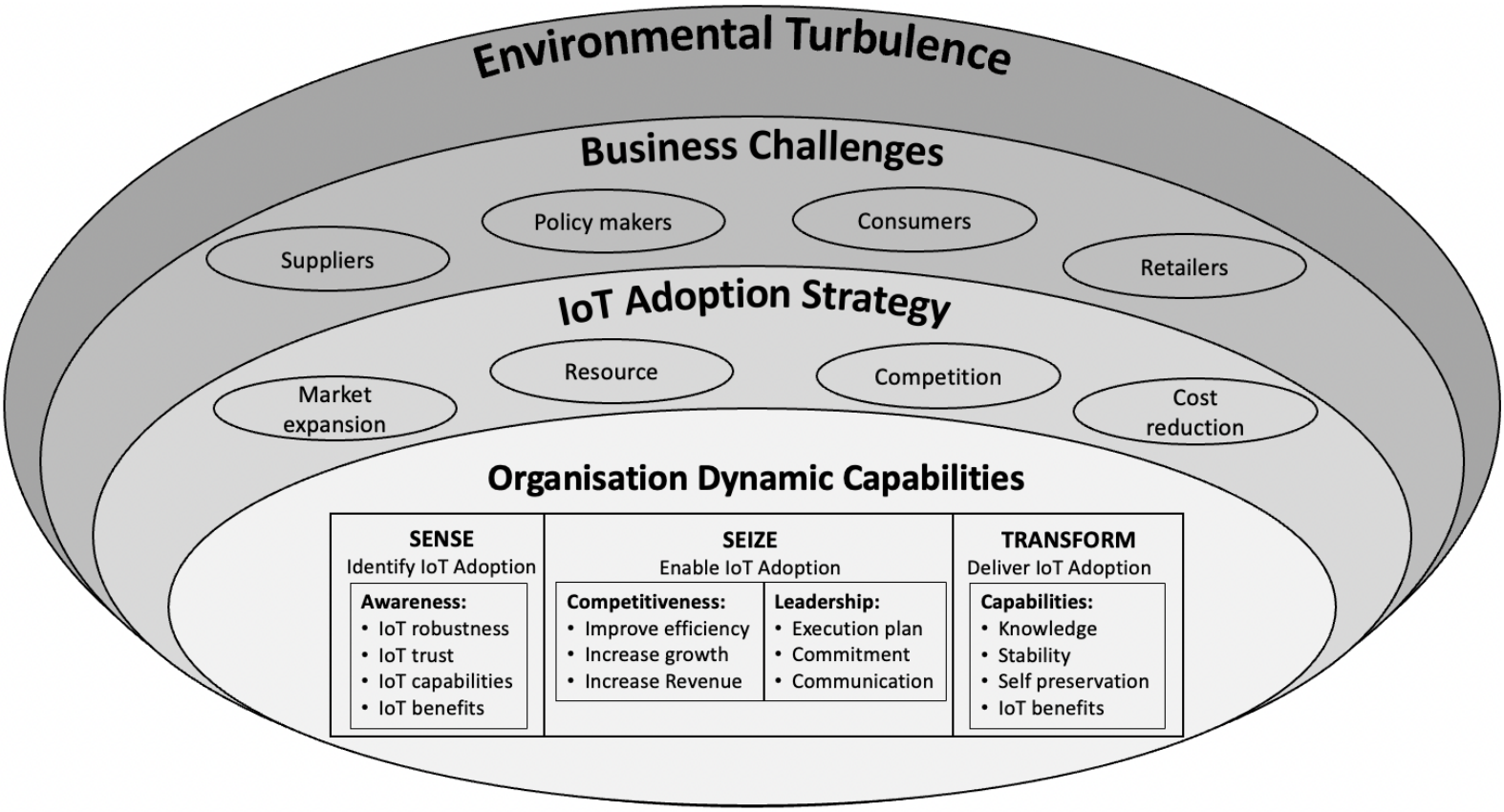

Figure 21: A chilled beverages industry IoT adoption framework informed by dynamic capabilities

As an evolution of traditional management theories, this IoT adoption framework contributes to dynamic capabilities theory. This framework takes into consideration key themes acknowledged in the international chilled beverages industry and the economic disruption of a global pandemic.

The proposed IoT adoption framework (see Figure 21) presents four overarching factors which are described in more detail.

A criticism of dynamic capabilities theory is based on the fact that the exact nature of dynamic capabilities is still unclear, and the concept is somewhat vague (Winter, 2003) and that identifying dynamic capabilities in an organisation requires observation over a period of time (Priem and Butler, 2001; Winter, 2003). This thesis addresses this issue by providing organisations in the chilled beverages industry with a framework for proactively implementing IoT (see Figure 21). A clear strategy for identifying and addressing issues, opportunities, and risks associated with IoT adoption is emphasised in the framework.

IoT adoption framework practical and theoretical contribution

In addition to providing a practical contribution to the chilled beverages industry, an IoT adoption framework also provides a theoretical contribution. There are several practical contributions. This study informs the IoT adoption framework based on dynamic capabilities.

Bottlers in the chilled beverages industry have little experience with IoT enabled coolers or an understanding of the benefits they offer. Specifically, the findings are aggregated to represent the key considerations for IoT adoption in the chilled beverages industry. In an IoT adoption strategy, suppliers, policy makers, consumers, and retailers play a critical role as external forces, for example. The framework presents these in the business challenges segment as forces that will influence an organisation's IoT adoption strategy.

In this study, market expansion, resource competition, and cost reduction were identified as part of a bottler's IoT adoption strategy.

Business challenges were influenced by environmental turbulence. It is likely that Covid-19 will have impacted each of the business challenges to varying degrees. There is no doubt this influenced policy makers to implement lockdown rules, thurlough, and other social distancing measures. According to the findings of this study, business challenges will have impacted the bottlers IoT strategy regarding market expansion, resources, competition, and cost reduction. Taking into consideration a shock event such as the Covid-19 global pandemic, one can observe the relationship between business challenges and IoT adoption strategy from the IoT adoption framework. This event has highlighted the importance of understanding the impact of business challenges on chilled beverage industry IoT adoption strategies.

These have practical implications for the dynamic capabilities of bottlers in the chilled beverages industry. This study contributes to four aggregate dimensions, namely awareness, competitiveness, leadership, and capabilities. Gioia methodology was used to code, theme, and analyse the semi-structured interviews. In sensing IoT adoption opportunities, organisations must consider the themes at the awareness stage. It is crucial for an organisation to grasp these concepts to quickly recognise and appreciate IoT adoption capabilities and benefits. Ignoring this during the sensing stage will result in missed opportunities, confusion, and potential delays. Organisations must therefore understand the four aggregate dimensions identified by the Gioia methodology. By doing this, they can take advantage of the potential benefits of IoT adoption.

Under seizing, the IoT adoption framework offers dimensions of competitiveness and leadership. These are somewhat connected, in that the organisation must understand its competitive goals, to ensure that the opportunity is worthy of seizing. Without a clear understanding of these goals, it will be difficult for an organisation to recognise whether an IoT adoption opportunity is needed to improve its competitiveness. To seize the opportunity of IoT adoption, strong leadership is essential if the bottler realises it will result

in a more competitive organisation. Without effective leadership, IoT opportunities will be compromised or delayed. To effectively capitalise on IoT opportunities, leadership must have a comprehensive understanding of the organisation's goals

Finally, the IoT adoption framework outlines clearly what bottlers need to address to make sure organisational transformation is achieved. The capabilities dimension requires the bottler to tackle key challenges found in this study. These include ensuring the organisation's resources are aware of all the benefits of IoT adoption, which requires early communication from leadership as identified at the seize stage. This is essential to ensure stability and support from other stakeholders in the organisation, especially if these stakeholders are directly affected by IoT adoption, such as operational employees. Other stakeholders in this study include sales reps, merchandisers, and maintenance personnel. To guarantee that these stakeholders are on board with the process, it is vital to provide them with necessary education and training on the concept of IoT and its applications.

A theoretical contribution of this thesis includes the combination of the dynamic capabilities model with IoT adoption, within the context of environmental turbulence. A scant amount of research has been conducted in this area, and none has been conducted in the chilled beverage industry. Furthermore, the study participants were leaders, senior executives, and management from 14 companies in 13 countries. This was valuable on several fronts, notwithstanding the high quality of participants responsible for the IoT strategies of their organisations. Also, cultural, and institutional differences may have been influenced by diverse backgrounds. In different circumstances, the chilled beverages industry may not have faced such acute pressures as they did in the context of environmental turbulence.

This study extends beyond the practical contribution offered by the IoT adoption framework. It offers a theoretical contribution by advancing academic literature in dynamic capabilities theory. This will enrich knowledge of industry practices. It is possible that future government policies can be informed by the findings of this study.

Finally, and in summary, the purpose of this study is addressed. This IoT adoption framework will help senior executives prepare for effective IoT adoption in the chilled beverages industry.

5.2.3 IoT ADOPTION FRAMEWORK COMPONENTS

5.2.3.1 **Environmental turbulence**

Covid-19 is a global pandemic discussed in this thesis. It has nevertheless been essential to remind the reader of this context as well as its impact on the chilled beverage industry. Throughout the course of this study, it has been found that that organisations at various stages (see Figure 19) in their adoption of IoT technology have been acutely aware of the business challenges faced in their IoT adoption initiatives. Despite the challenges posed by the pandemic, the research for this thesis has revealed that organisations have displayed resilience in the adoption of IoT technology.

5.2.3.2 **Business challenges**

There is no doubt that in a highly competitive market, there are always going to be challenges. As a result of this study in the chilled beverage industry, it was discovered that addressing challenges is essential for a successful IoT adoption strategy. These include external challenges from suppliers, policy makers, consumers, and retailers. In many cases these factors overlapped and have a significant influence on an organisation's IoT adoption strategy, as explained further in this thesis. It is therefore clear that any IoT adoption strategy within the chilled beverages industry must consider all of these external factors and their potential impact. This is in order to have the best chance of success.

Suppliers

A bottler's ability to acquire new business is hindered by a reduction in chilled beverage production and the manufacture of new coolers (see Figure 1). In other words, a bottler's ability to acquire new business depends on the ability of the bottler to place new coolers with retailers or by efficiently and effectively distributing chilled beverages through production and distribution channels. However, the participants in this study, while acknowledging these constraints, were primarily concerned with the existing customer base, and finding ways to maximise their commercial potential, hence the IoT adoption strategy followed by the participants in this study. Therefore, they saw the potential of the Internet of Things to drive growth in their customer base, and hence, its implementation was essential for business success.

Policy Makers

There is no doubt that policy makers such as international, national, and local governments, as well as regulations and industry guidelines play a significant and sometimes constricting role affecting bottlers in the chilled beverages industry. This study found that organisations were impacted in several ways as a result of lockdowns, travel restrictions, business closures, restrictions on working hours, and rules that govern social distancing. Since many bottlers are dependent on in-field sales reps, merchandisers, and maintenance engineers for their day-to-day business operations, this severely restricted the ability of organisations to continue to grow commercially as well as support retailers or outlets that were still operating.

As a result of government regulations, these bottlers were restricted in their operation in certain sectors, such as retail, leisure, and hospitality. Participants were clear about the pressure that this applied to their IoT adoption strategy. In particular, strict regulations meant that companies had to find more innovative ways to remain competitive. In addition,

they had to strategically plan their IoT adoption to minimise the negative impact on their business operations.

Consumers

Business challenges related to consumers are multifaceted. It was the primary concern of the bottlers to better understand the buying habits of consumers and to compare these habits by category such as channels and regions. This is related to increasing their market share. To achieve this, bottlers must ensure that their products are consistently available in all coolers. However, maintaining this was difficult due to lockdown policies. Consequently, consumer traffic in stores was significantly reduced. Therefore, bottlers needed to develop innovative methods to understand consumer buying habits. This included utilising IoT technologies, to maintain their competitiveness despite the restrictions of the lockdown.

Retailers

It has been quite challenging for the retail sector in recent years. Similarly, this is also the case for the leisure and hospitality sectors. It has been described previously that many bottlers may have dedicated sales, merchandising, and maintenance teams, depending on which distribution channel they employ and which country they operate in. The work of this group is to ensure that coolers in retail outlets perform well in terms of both their commercial and operational performance. To achieve this goal, it is necessary to visit retailers frequently and build relationships with them. Moreover, these bottlers strive to create a long-term partnership with their retailers, by providing high availability of their products, excellent service, and technical support, thus enhancing the overall customer experience.

There were three purposes behind this activity. The first was to ensure that products were available in the coolers, the second was to sell and take orders from retailers, and the third was to make sure that customer satisfaction was maintained. There are several efficiency benefits that can be gained from the adoption of IoT, including the ability to gather commercial and operational data remotely from coolers. This may allow for a reduced workforce, while also enabling data-driven sales, merchandising, and maintenance resources. In this way, an organisation will be able to reorganise their workforce in a more efficient way. As a result, businesses leveraging the power of IoT can gain a competitive edge by extracting valuable insights from their data, driving value, and increasing profitability.

5.2.3.3 **IoT adoption strategy**

Bottlers in the chilled beverages industry have identified the following business challenges: market expansion, resource allocation, competition, and cost reduction as being their most significant challenges. Overcoming these challenges proved to be important in order to maintain their competitive advantage. To ensure success, bottlers must develop strategies that address these business challenges and ensure their readiness for the implementation of IoT solutions.

Market Expansion

For the participants in this study, expanding their market share was part of the reason for adopting IoT. It is important for bottlers to consider how to increase their market share and improve their overall competitiveness. There was consensus among participants that the adoption of IoT could provide actionable insights to assist with the development of strategies that could further expand their market share. The purpose of this was to gather information about consumer behaviour related to cooler commercial behaviour, product availability, and consumer preferences. As a means of testing what is known as

planogram compliance, participants discussed the ways in which IoT technology might be used to achieve this. This involves careful management of merchandising.

A bottler is expected to create merchandising strategies that are tailored to different channels and geographic regions, depending on consumer preferences. As an example, in some cases, it was argued that it was possible to justify different planograms for different times of the day. For example, cold beverages based on dairy products and juices can be heavily merchandised in the mornings, with more carbonated beverages being heavily merchandised in the afternoons. As another example, it was found that in a local community a particular product may be extremely popular. However, it was not as popular elsewhere in the country. If these consumer-related questions are addressed, there is a possibility that sales and market share could increase.

Resource

In terms of the resource dimension, the focus is mainly on the workforce of the organisation. This includes, but is not limited to, sales representatives, merchandisers, and maintenance engineers. The results of this study suggest that the workforce plays a significant role in determining the success of the organisations IoT adoption strategy. The study found that one of the challenges that organisations and employees face is trust. To ensure a successful IoT adoption strategy, organisations must build trust with their employees and provide them with the support and resources needed to effectively work with IoT technology.

It was clear from this study that there was a perceived lack of confidence in the capabilities and trust in IoT technology by some employees within the organisation. Arguably, this was due to a lack of understanding of IoT technology. In this section, it is discussed how IoT adoption differs from other technological initiatives that employees may be more familiar with. Where a lack of understanding results in concern or fear regarding job roles, the focus tends to be on suspicious motives for IoT adoption aimed at management, rather

than understanding the benefits. This is due to mistrust among workers that IoT technology is being used to track and report on employee performance. To combat this fear, organisations should focus on creating a culture of trust and transparency, ensuring employees are aware of the benefits that come with IoT adoption and that it is not being used to replace jobs or spy on employees.

It is of note that most of those who were positive about IoT adoption were younger in age, who also advocated its benefits for the organisation. However, IoT adoption was feared by all ages, regardless of the organisation. Younger members of an organisation used this fear constructively, as they rationalised that embracing IoT may lead to them becoming more valuable to the organisation in the long run. There was a balance between the responses that were positive and those that were negative. Nevertheless, the overall sentiment was that the younger generation was more open to the idea of IoT adoption, believing that the potential of this technology far outweighed any of the perceived risks.

Competition

Competition is a key factor in bottlers' IoT adoption. By gaining an understanding of the potential benefits of IoT adoption in their organisations, participants anticipated that they would benefit from a competitive advantage. It was suggested that by embracing IoT adoption, the organisation would be perceived as forward-thinking, innovative, and an industry leader. Additionally, harnessing the power of IoT could provide the organisation with a wealth of data to extract insights and make informed decisions, setting it on the path to success.

As a result of IoT adoption, bottlers are provided with a novel method of reconfiguring their business structures. It was possible to gain remote and regular access to the operational and commercial performance data of coolers in the field. It would then be possible to take actions that could improve the organisation's competitiveness. This enabled businesses to make data-driven decisions that could influence their success and agility in the market.

A key component of this strategy is the ability to leverage insights that, in the past, have not been available to the competition. These insights are likely to remain unavailable in the short to medium term, therefore, bottlers are expected to benefit from first mover advantage. This allows Bottlers to proactively capitalise on opportunities, giving them a competitive edge that will help them remain ahead of their rivals. For bottlers to maximise benefits from IoT adoption, it would be necessary for all coolers in their fleet to be IoT enabled.

Cost reduction

As organisations strive to maximise the potential cost savings associated with the adoption of IoT, the reduction of costs is a critical factor. To improve their overall competitiveness, bottlers are striving to reduce costs and reconfigure their organisational resources. Participants expect IoT adoption to assist in the reconfiguration of workforce resources. IoT adoption will result in a data-driven sales, merchandising, and maintenance teams. By decreasing the number of physical visits, bottlers can help reduce their costs and optimise their resources, allowing them to remain competitive and strive to maximise the potential cost savings associated with the adoption of IoT.

For instance, bottlers rationalised that by gathering commercial data directly from the cooler daily, they would be able to synthesise this information into business insights. Depending on the type of commercial insights, an organisation could determine which retailers and outlets require a physical visit from a sales rep, merchandiser, or maintenance technician. Additionally, this data could provide valuable insights into consumer trends, allowing organisations to identify and adjust their strategies to meet the evolving needs of the marketplace.

For some organisations, in-field store visits can be as frequent as two or three times per week, potentially resulting in unprofitable visits. Using business intelligence from IoT technology, an organisation can be selective about the stores and retailers it visits. This

means that it can plan visits to those stores where it is absolutely required. The same can be said for cases when it is evident that a retailer needs a visit from a sales representative to be able to create an order for the retailer. This can help cut down on unnecessary costs and make the entire process more efficient, enabling the organisation to make better use of its resources.

Additionally, it was expected that cooler maintenance visits would be able to be more targeted and driven by the operational data that was collected by IoT technology. It is possible to use this data to determine whether a maintenance visit to the cooler is necessary based upon the health data received from the cooler. This is another example of a bottler's expectation that a team of data-driven resources would reduce costs. This reduction in costs could be further enabled using predictive analytics, wherein patterns within the operational data could signal when a maintenance visit may be needed in the future before any issues arise.

Furthermore, by freeing up resources such as a sales rep's time, the bottler will be able to redirect the sales rep's attention to acquiring new business. As a result, the organisation may be able to improve its use of resources, improve its competitiveness, and increase its market share by utilising its resources more effectively. This improved use of resources can lead to an increase in the efficiency of operations, creating a potential for greater profits and greater success in the marketplace.

The four dimensions of an organisation's IoT adoption strategy are interconnected in that one dimension will invariably affect the others. All these dimensions need to be addressed in an IoT adoption strategy to maximise its potential.

5.2.3.4 **Organisations dynamic capabilities**

In this study, participant interviews with bottlers in the chilled beverages industry were recorded, transcribed, analysed, and a visually presented. These interviews led to the

creation of aggregate dimensions, awareness, competitiveness, leadership, and capabilities. In the data analysis phase, these were generated from 2nd order themes.

Awareness

In the chilled beverage industry, it was found that awareness of the IoT was a challenge. There was a mixed level of awareness among senior executives and managers inside the organisation. Although, those responsible for IoT adoption strategies had a comprehensive understanding and knowledge of the benefits of IoT. To bridge this gap in understanding, senior executives and managers should be provided with the necessary information and resources to equip them with the knowledge and benefits of IoT adoption.

Despite this, it was evident that many of the workforce were unaware of the benefits that IoT can provide for their organisations. There were cases of senior executives who were unaware of the IoT strategy, even if they had budgetary control. This affected sales reps, merchandisers, and maintenance engineers at the operational level. This lack of knowledge across the entire organisation highlights the importance of raising awareness and developing an IoT strategy that is communicated and understood by everyone.

There was a general understanding of this perspective among the study participants, who demonstrated good IoT knowledge. Due to lack of awareness, questions and challenges arose about technology robustness, trust, and the true capabilities of IoT. Several of these objections were also linked to a fear regarding the roles that some employees may have. As a result, there should be clarification of employee roles and responsibilities as well as the provision of clear information and direction about the organisation's IoT adoption strategy.

Competitiveness

Competitiveness as described in the findings, is a theme that is a significant driver from the perspective of senior executives. Improving the organisation's competitiveness by

increasing sales, market share and introducing efficiency was key. A high response rate (82) on the use of IoT for business benefits indicated a clear ambition and motivation. Reducing organisation costs and questions around the cost of IoT ranked lower in mentions (25), followed by understanding consumer behaviour (22) and utilising business insights (18). This response demonstrates an eagerness to explore the advantages of IoT, rather than a focus on any associated costs or challenges.

In interviews, competitiveness was discussed frequently from a senior executive or management point of view. The suggestion that IoT adoption would lead to an increase in the competitiveness of the organisation was considered significant. Poor leadership was recognised by the same senior executive level participants as a challenge. This implies the leadership team must address their roles in IoT adoption. This topic is covered in the next section, but it is relevant here since leadership influences competitiveness. Considering this, it is vital for senior executive level participants to not only recognise poor leadership as a challenge, but to take active steps to address it in order to facilitate successful IoT adoption, and thus increase the organisation's competitiveness.

Leadership

Leadership, from the viewpoint of senior executives, is essential to the success of IoT adoption. Where there was a lack of effective leadership, there was poor communication, commitment, and execution. Leadership that lacked the ability to communicate clearly and effectively about IoT adoption, resulted in lack of knowledge development and an increased workforce sense of instability. As such, effective leadership is paramount to creating successful and sustainable IoT adoption, as it provides direction, understanding, and commitment from the organisation.

Capabilities

In a nutshell, capabilities are what participants see in the organisation's resources or employees. There were significant challenges experienced in this regard, where prior communication, commitment, execution, and IoT benefits were not strong or evident to key stakeholders. There was distrust of the purpose of IoT adoption and uncertainty of its benefits in these scenarios. Some employees acted in an unfavourable manner based on concerns about IoT technology reliability, claims of additional responsibilities, and challenges related to benefits. As a result, there is a need to build credibility and trust in the IoT adoption strategy with all key stakeholders. This is in addition to education on the benefits of adoption.

A global pandemic further heightened participants' awareness of the benefits of IoT adoption. It provided further validation of the opportunity for organisations to take advantage of IoT adoption. As mentioned previously, those at the beginning of the process recognised the need to start as early as possible. However, those at the end of the process expressed the need to address challenges early in the process, regardless of where they were on their journey.

5.2.4 A PROPOSED IOT ADOPTION FRAMEWORK AND DYNAMIC CAPABILITIES

When sensing opportunities for IoT adoption, organisations in the chilled beverages industry should carefully consider the dynamic capabilities of their organisation and have a clear process to follow. The proposed IoT adoption framework provides future organisations with a way of working that will smooth the transition to IoT adoption across the organisation.

A shock event such as a global pandemic can pose significant challenges when it comes to delivering on IoT adoption. However, despite the more acute business challenges, organisations were still intent on IoT adoption. This increased the speed at which

organisations wanted to move forward. There was a suggestion from those who were in the early stages of IoT adoption that starting sooner would have been beneficial. Organisations that were in the delivery phase of their projects suggested that their choices had been vindicated. They also emphasised the validity of IoT adoption in the wake of significant difficulties in the trading environment. This resulted in an urgency to act quickly, with those who had already begun IoT adoption, citing its benefits and recognising that they made a positive decision.

In the proposed IoT adoption framework, organisations must be clear on their understanding of the business challenges that they face. Furthermore, they should develop an IoT adoption strategy that increases their market share, reduces costs, and enhances their competitiveness.

An organisation's IoT adoption strategy should consider and address the four dimensions of awareness, competitiveness, leadership, and capabilities. As part of the adoption of IoT, these dimensions should not be addressed independently, but continuously evaluated throughout the entire IoT adoption process.

Leadership should clearly communicate their intention and the benefits of IoT adoption when sensing new business opportunities. This should be done not only with peers in the senior executive team, but to the whole organisation. This initiates knowledge transfer and should result in an organisation that is ready to adapt and deliver throughout the transformation process. Furthermore, the emphasis on communication should also be extended to customers (retail, leisure, and hospitality sectors), in order to ensure they understand the value of the adoption of IoT and the potential it holds for their businesses.

The process of enabling IoT adoption occurs during the 'seize' stage of dynamic capabilities, when an organisation's objectives for improving its competitiveness need to be clearly outlined. In some ways, this is intertwined with the role of leadership and the creation of a communication and execution strategy. It is very important to share a clear statement of intent and visible commitment throughout the organisation. In doing so, an organisation's transformation into IoT adoption should be smooth. To ensure this, strong

leadership is essential in driving the conversation and outlining a strategy for both communication and execution. Additionally, the leadership must make it clear that the organisation is committed to the adoption of IoT, and that everyone in the organisation must be educated on the benefits of such adoption. By doing so, this should ease transition, and any potential resistance or challenges should be kept to a minimum.

There is no doubt that other forms of technology adoption within the chilled beverages industry is not comparable to IoT adoption. As a result, there are various factors which affect this industry that may not be obvious in other scenarios. A bottler, for example, plays a unique role in the production of chilled beverages, the supply of coolers, and the management of distribution and retailers (see Figure 1).

In addition, the Internet of Things is a relatively new concept (Sayar and Er, 2018). To sense the opportunity, it is essential to understand the benefits of IoT and its operational capabilities.

As part of the Internet of Things (IoT) experience, hardware, software, platforms, analytics, mobile and web apps, sensors, communications channels, artificial intelligence (AI) and machine learning (ML) are all inextricably linked (see Figure 22). Unlike other more traditional technologies, such as networking, e-commerce, enterprise relationship management (ERP), desktop applications, and databases, this is somewhat different. Considering the factors mentioned above, these technologies may not offer the same level of conceptual challenges as IoT. It is suggested that the aforementioned IoT factors are considered and recognised as knowledge development opportunities across the organisation to ease the potential for IoT adoption. As such, IoT adoption presents a new set of challenges that must be tackled holistically to ensure successful implementation.

Understanding the relationship between the various components mentioned, the collection of new types of data, and the potential outputs and insights available is important to consider.

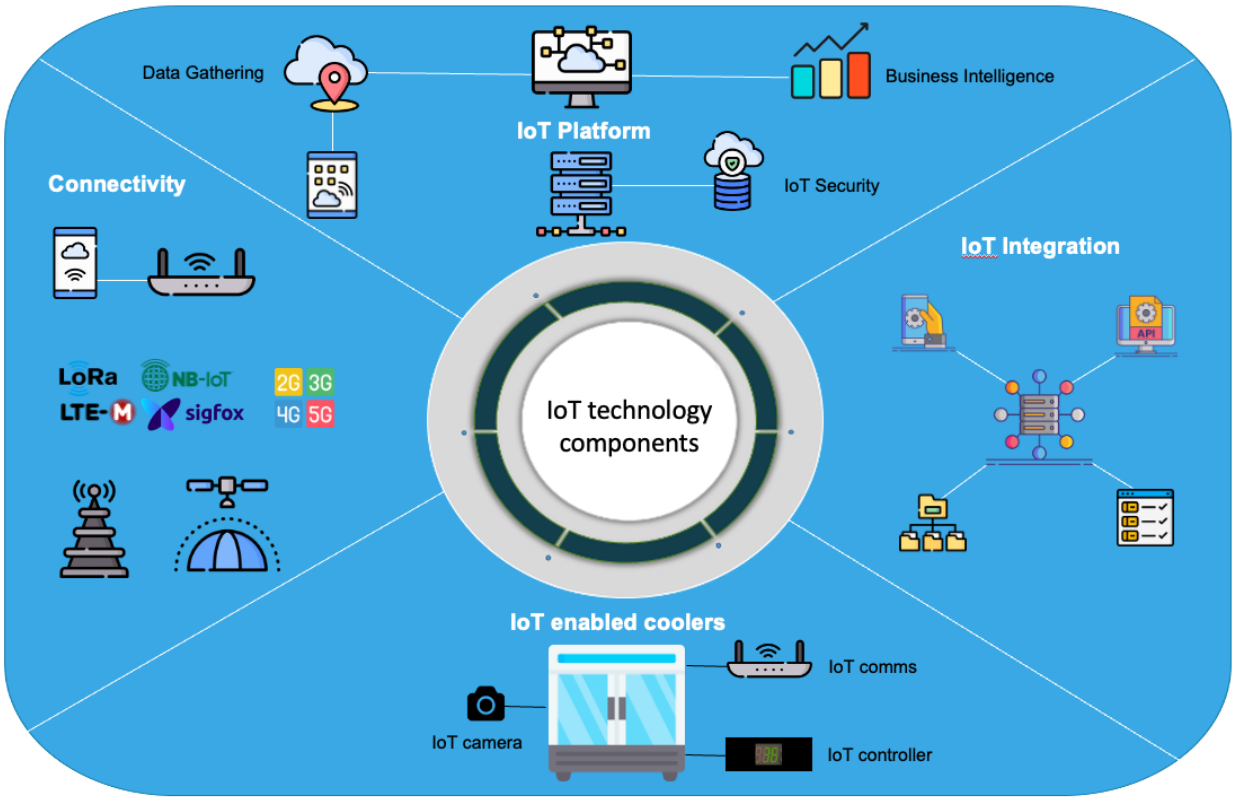

Figure 22: Typical relationships and components of IoT technology

5.2.5 THE IMPACT OF ENVIRONMENTAL TURBULENCE

Environmental turbulence, such as the Covid-19 pandemic, has been referenced throughout this thesis. The reason for this is because this study began in 2019, before the widespread awareness of the Covid-19 pandemic. In the initial literature review, the focus was on the adoption of IoT in the workplace and the impact it has on employees and the workforce. Consequently, the Covid-19 outbreak provided an opportunity to frame this research. It enabled participants to discuss how Covid-19 may have impacted their IoT strategy and the dynamic capabilities of their organisation. Covid-19 is not the main purpose of this research, but it is important to understand how environmental turbulence may impact organisations. It is especially important to examine how this may have affected the IoT adoption strategy from a leadership, senior executive, and management

perspective. Covid-19, as an external force, affected the chilled beverages industry in several ways. Suppliers, policy makers, consumers and retailers all had a bearing on the organisations in this study and their IoT adoption strategies. By doing so, it highlights the complex ecosystem of stakeholders that must be considered to make the best decisions for successful IoT adoption.

However, the key finding of this research was that the participants quoted more about IoT adoption when reflecting on the expectations of their organisations than when reflecting after Covid-19. The participants shared a variety of views, perceptions, and knowledge about the organisation and its approach to IoT adoption. The participants, however, had less access to the workforce because of lockdowns, social distancing, and work from home directives due to Covid-19, thus having fewer opportunities to collect feedback. There were more quotations pre Covid-19 (233) than post Covid-19 (88) (see Table 23).

Pre Covid-19, IoT adoption resulted in improvements in sales and efficiency. Post Covid-19, access to IoT data became more significant. The lack of understanding, knowledge, and confidence in IoT adoption was significant before the onset of Covid-19.

5.3 SUMMARY OF CHAPTER 5

In this chapter, an IoT adoption framework is presented with justifications based on the findings of this research. The proposed framework outlines a number of business challenges, IoT adoption strategies, and the core dimensions that need to be considered for successful IoT adoption. In support of the proposed IoT adoption framework, a justification was provided to support the application of dynamic capabilities theory. The methodological approach to this research was described and discussed. A detailed account of the various factors involved in the IoT adoption framework was provided. This was based on the experience of senior executives and managers within the chilled

beverages industry. Therefore, the proposed framework provides a useful tool for organisations to consider when implementing their IoT adoption strategies.

Using the Gioia methodology, various themes emerged from the analysis of this study. The key themes were awareness, competitiveness, leadership, and capabilities. An extension of this study to other identified themes could be beneficial. These themes could be further explored to develop an overall picture of the state of the industry and gain further insight into the challenges and opportunities that it faces.

In this study, the IoT adoption framework informed by dynamic capabilities is described in this chapter. As part of this study, a literature review was conducted on IoT adoption, dynamic capabilities, and organisational competitiveness. The impact of environmental turbulence such as a global pandemic on international businesses and factors influencing IoT adoption was also explored. The findings of this study suggest that the application of dynamic capabilities can aid organisations in achieving a competitive advantage. Furthermore, this study reveals that the combination of dynamic capabilities and IoT adoption can be a powerful tool for organisations to remain resilient in the face of environmental turbulence and other external challenges.

6 CONCLUSION AND IMPLICATIONS

6.1 INTRODUCTION TO CHAPTER 6

In the previous chapter an IoT adoption framework based on this study's findings was presented. The framework included the findings from the Gioia methodology such as awareness, competitiveness, leadership, and capabilities. It concluded that the combination of dynamic capabilities and IoT adoption was beneficial to organisations developing an IoT adoption strategy. This chapter discusses the conclusions, implications and future direction of this topic.

6.2 CONCLUSION

This thesis has contributed an IoT adoption framework for the chilled beverages industry, informed by dynamic capabilities. The IoT adoption framework provides a visualisation of the key components that are required for the chilled beverages industry to adopt IoT technology. This framework illustrates the external forces organisations must consider when developing their IoT adoption strategy. Furthermore, it outlines the core dimensions to be addressed across the organisation during the sense, seize, and transform phases of dynamic capabilities. In addition to this, the framework also provides a clear direction for organisations to create an effective IoT adoption strategy, enabling them to make informed decisions and successfully move through the three phases.

The aim of this study was also to understand organisational IoT adoption within the context of environmental turbulence, such as Covid-19. Consequently, it was found that this had some impact on business challenges and an organisation's IoT strategy, but it did not deter organisations from adopting IoT. It did, however, create a sense of urgency and validate the benefits of IoT adoption. There was evidence of uncertainty and concern about roles, responsibilities, and employment among organisational resources. However, organisations were still motivated to embrace IoT. Senior leaders should recognise the

need to consider the workforce and that changes to roles and responsibilities should be managed sensitively and effectively.

Existing literature on IoT adoption focuses primarily on technology, but little research considers organisational dynamics and managers' perspectives on IoT adoption. Additional to this, consideration must be given for the impact of environmental turbulence, such as a global pandemic. A framework for IoT adoption within this context contributes to existing knowledge of dynamic capabilities and technology. This bridges a gap, as existing dynamic capabilities and technology adoption studies do not address the aims of this research. This study explores the intersection of dynamic capabilities, IoT technology adoption, and environmental turbulence to understand how organisations in the chilled beverages industry successfully adopt IoT.

The chilled beverages industry (see Figure 1) has a somewhat complex relationship between brands, IoT providers, suppliers, production, OEMs, and distribution. In addition, IoT, a relatively new concept, has complexities because it requires an understanding of its benefits, some of which are unfamiliar to organisations, and its interrelatedness with different components (see Figure 22). This may require new learnings for an organisation. This concept is novel compared to traditional or familiar technology concepts. To gain a better understanding of IoT and its complexities, organisations must be open to new learnings and recognise the interrelatedness of components. This concept may be challenging, but the potential benefits are considerable.

By exploring the extant literature on dynamic capabilities and international organisations, this thesis was able to identify gaps for bottlers in the chilled beverages industry. Dynamic capabilities theory is not without its critics. For example, it is suggested that an organisation's dynamic capability cannot be known until after the organisation has been observed over a period. This thesis aims to present an IoT adoption framework for organisations in the chilled beverages industry. Therefore, organisations in the chilled beverages industry should use this framework as a tool to proactively assess their dynamic capabilities and gain insights into their potential for successful IoT adoption.

As discussed, existing literature on IoT adoption focuses on the technological aspects of IoT, rather than an organisational resource approach towards IoT adoption. This thesis concluded that there was a gap in the study of organisational IoT adoption based on dynamic capabilities and therefore, a need for further research. Existing studies do not address the factors that influence the capabilities of an organisation's workforce or how this contributes to the success of IoT adoption. To understand the success of IoT adoption, it is essential to examine the dynamic capabilities of the organisation, its workforce, and the potential impact on the organisation. This research contributes valuable insights for organisations considering their approach to IoT adoption in the chilled beverages industry.

Through qualitative semi-structured interviews at the strategic and middle management levels, this study explored organisations in the chilled beverages industry and IoT adoption. Further, the study considered the impact of a pandemic on chilled beverage industry IoT adoption strategies. The findings of this study provide valuable insights into the current state of the chilled beverages industry and IoT adoption.

The contribution of an IoT adoption framework based on dynamic capabilities is presented for the chilled beverages industry. The IoT adoption framework identifies dimensions to address at sense, seize and transform stages. As part of this study, environmental turbulence was considered for its impact on IoT adoption.

As previously stated, there is a gap in the existing literature on IoT adoption within the chilled beverages industry. In addition, this study considers the impact of the Covid-19 global pandemic on an organisation's approach to adopting innovative technology, such as IoT. The identification and consideration of the key dimensions of awareness, competitiveness, leadership, and capabilities was established. In this qualitative study, these dimensions were addressed through the lens of dynamic capabilities. This was done by considering the organisations ability to sense, seize and transform as part of their overall strategy. This strategic view emphasised the importance of organisations being able to respond quickly and effectively to the ever-changing environment and customer needs.

The chilled beverage industry was severely affected by Covid-19 on a national and international level. Its ability to maintain its competitiveness was tested. This study utilises dynamic capabilities and contributes an IoT adoption framework to support this industry in consideration of future IoT adoption initiatives. It takes considerable effort for an organisation to execute an IoT strategy. In this study, this was somewhat compounded by environmental turbulence, such as a global pandemic. There is a need to ensure the workforce, management and customers are aligned in terms of the overall benefits of such transformative initiatives. Pressure for rapid adoption may impact the quality of execution, level of awareness, stakeholder trust and commitment to IoT adoption.

Utilising the Gioia methodology and Dynamic Capabilities, in this study of the chilled beverages industry, has helped visualise an organisation's IoT adoption journey. This was achieved whilst considering both an organisation’s dynamic capabilities and the impact of environmental turbulence. It is understood that during a pandemic the challenges posed for IoT adoption run throughout the sensing, seizing and transform stages of dynamic capabilities. An additional point to note is how a pandemic impacts an organisation's resources in terms of levels of resistance, enthusiasm, awareness, and knowledge. This further highlights the need for organisations to be resilient in their approach to adopting IoT, ensuring they are well equipped to respond to changes in the external environment and remain agile in responding to stakeholder needs.

Finally, the context of the Covid-19 global pandemic was considered and found to have intensified business challenges faced by the chilled beverages industry, which ultimately, had an impact on an organisations IoT adoption strategy.

6.3 IMPLICATIONS, FUTURE DIRECTION AND LIMITATIONS

6.3.1 IMPLICATIONS

When conducting qualitative research, it is often argued that issues of reliability and validity arise due to the size of the study sample. It was recognised, however, that the contributing participants were highly suitable, relevant, and significant due to their high-level positions, relevant experience, qualifications, roles, diversity, and quality. This research is based on a multiple case study of companies around the world. The results of this study may have been influenced by cultural and institutional factors that differ from one country to another. Since this research is based on multiple case studies, it provides a diverse and varied set of perspectives, which in turn enriches the study. This would not have been possible if conducting research on a single case study, such as one company in one country.

Furthermore, research outcomes were enhanced by involving highly relevant participants from international organisations in the chilled beverages industry. Participants' decision making about their IoT adoption strategy may have been influenced by environmental turbulence, such as the Covid-19 pandemic. Qualitative research is prone to interviewer and interviewee bias, so efforts were made to maintain objectivity during the interview process. Finally, the interviewer was previously an employee of an international company providing IoT solutions, thus risking the introduction of bias into the study.

This research found that adoption and execution of IoT adoption by organisations during the pandemic was important. As a result, it is possible to achieve a condensed timeframe between the dynamic capabilities stages of sense, seize and transform. There is some evidence to suggest that scepticism regarding the technological robustness of IoT and other objections hamper the ability of an organisation to deliver its IoT adoption strategy. This is because there is a lack of general awareness of the benefits of IoT adoption. To address this issue, organisations must ensure that their teams have the necessary

knowledge and resources to properly implement their IoT adoption strategy. This will enable them to understand and deliver on the full potential of IoT.

Furthermore, the potential benefits and capabilities of IoT were recognised by organisational leaders. This motivated them to seize the opportunity to adopt IoT in order to become competitive and overcome external pressures. There are many areas in which the adoption of IoT could be of assistance, especially those where human resources are in short supply. In this regard, the provision of market performance intelligence from coolers and the ability to remotely access this intelligence, may reduce infield activity required from existing resources. The impact of Covid-19 was significant; therefore an organisation's IoT adoption strategy must be dynamic in order to adapt and deal with environmental turbulence.

The effect of Covid-19 provided justification for IoT adoption. Furthermore, challenges in organisational transformation were experienced due to poor leadership, commitment, inadequate investment, inadequate knowledge development, and workforce challenges.

6.3.2 FUTURE DIRECTIONS

As a result of this research, it is recommended that several further studies be conducted to extend on the findings of this thesis.

This study has produced an adoption framework that will help to facilitate the organisational adoption of IoT. This research was conducted to gain a better understanding of how to prepare an organisation in the chilled beverages industry to adopt IoT effectively. There are, however, several issues raised in this study that will benefit from further research. Approaches could include further qualitative research, single or multiple case studies, quantitative surveys based on the results of this study, or a study incorporating secondary data. Furthermore, investigating whether OEMs are using technology to IoT enable their coolers during manufacturing. Another approach may be to

explore the viewpoints and experiences of technology companies that specialise in IoT software and hardware, in the industries within which they operate.

As is evident, there are several possible studies that can extend the scope of this thesis and provide new and valuable insights that may enhance its impact. It is also suggested that the resultant IoT adoption framework, as informed by dynamic capabilities, is generalisable and can therefore be applied to other industries.

A quantitative study to extend this research to operational personnel based in organisations involved in this study.

First, the existing study can be extended to include quantitative methods in order to enhance its validity. A qualitative research method was used in the conduct of this study. As part of a quantitative study, participants at the operational level of all the organisations presented as cases in this study could complete offline or online questionnaires. These individuals are typically involved in the day-to-day operations in the chilled beverages industry. This should include, but is not limited to, supervisors, sales reps, merchandisers, and maintenance engineers. To help inform future research questions and provide an opportunity for further understanding of this topic, findings from this study should be used as a basis for future quantitative research. Typically, the operational workforce is lower qualified, more mobile in their day-to-day routines, less likely to speak a second language, and unlikely to have attended university. To support this, online surveys can be translated into multiple languages considering the international theme of this study. This approach is likely to reach a wider candidate pool.

A study of this type would be beneficial as it would allow the opportunity to analyse the viewpoint of operational workers. Candidates should be from the chilled beverages industry that are already involved in this study. There is a possibility that the involvement of operational personnel will enhance the overall diversity, validity, reliability, and robustness of this study. In many cases, these resources are on the front line when it comes to activities related to IoT technology and its adoption. By selecting candidates from organisations that have already been involved in this study and who have operational

roles and responsibilities, it is possible that they will be able to offer a deeper understanding of IoT adoption from a hands-on experience. They may be able to provide a more nuanced perspective on the potential opportunities and risks associated with IoT adoption, in addition to providing new insights that may be valuable.

A deeper exploration into the national and local institutional and cultural values of organisations in the study and its direct relationship with IoT adoption.

Second, an important extension of this study could be to examine how the cultural and institutional values of the various organisations in various countries differ from one another. This study suggests that there is a difference in behaviour between organisations and the progress of their IoT adoption. There is a likelihood that organisational cultural and institutional values (Brewster *et al.*, 2011; Berger and Luckmann, 2016) may have contributed to this outcome. For example, a company based in South America may appear to have a workforce that is less cooperative with management or more resistant to change. This may be in contrast with a company based in Europe. Arguably, organisations in countries with strong union participation may have dynamics that are more resistant to change than similar organisations in countries with weaker or no unions. This would be a worthwhile research topic to investigate within the chilled beverage industry, as it may add new insights to the overall understanding of this topic.

A cross-cultural study of the chilled beverages industry's workforce motivation and IoT adoption

An in-depth exploration of organisational behaviour, workforce motivation, and IoT adoption. Understanding the critical role that the operational workforce plays in the success or otherwise of IoT adoption within an organisation. Explore how organisations can develop effective strategies that will positively improve the motivation of their operational personnel for IoT adoption. Using a cross-cultural study may help researchers gain a better understanding of how companies in the chilled beverage industry motivate their employees. Moreover, to find novel ways to learn by comparing the different cultures of the different organisations and countries in this study. To this end, organisations should

strive to create strategies that recognise and reward their personnel who demonstrate a commitment to innovation and a willingness to embrace IoT technologies.

Dynamic capabilities of OEMs incorporating IoT technology into coolers in production.

There are many original equipment manufacturers (OEMs) in the refrigeration industry, which in most cases are large white goods manufacturers who produce coolers and freezers for the consumer markets as well as business to business markets. In general, these companies produce high volumes of coolers and may have in-depth knowledge or experience of IoT technology. OEMs tend not to have a presence in the market for IoT software, hardware, or platforms. Considering the findings of this study, it would be interesting to explore whether OEM integration of IoT technology on the production line is of interest. It would be interesting to explore how these organisations might adapt their production line resources and other capabilities to support this. This could potentially help OEMs diversify their product offerings and open up new opportunities or collaborations with other organisations to develop more advanced IoT solutions.

Environmental turbulence such as a pandemic and the commercial viability of the chilled beverages industry.

To explore whether there are any differences in relative commercial performance between organisations in the chilled beverages industry based on the use of secondary data, it may be possible to compare organisations into two categories, those who have fully adopted IoT and those who have not.

6.3.3 RESEARCH LIMITATIONS

Critics of qualitative research suggest the possibility that interviewer and interviewee bias may be introduced into the study. In addition to bias, other criticisms include the impact of the study on objectivity, reliability, and generalisability (Kvale, 1994). The reliability and validity of qualitative research can be questioned based on a fewer number of participants. In qualitative research, it has been argued that there can never be a 'relationship free' interview in the sense that the relationship between the interviewer and the interviewee is an integral part of the research process (Cassell and Symon, 2004). A strength of this study is evident in the quality of the participants, who were highly qualified and experienced professionals engaged in IoT adoption. These included senior managers, directors, strategic leaders, chief executives, and middle managers.

6.4 SUMMARY OF CHAPTER 6

This chapter concluded with the production of a generalisable IoT adoption framework for the chilled beverages industry and others. This includes academics, businesses, and practitioners. It was found that the extant literature does not answer this topic, whilst discussing the implications and limitations of this study. To support the findings of this study, a list of potential research topics was provided.
themes. In addition, academics can make use of the chilled beverages industry's IoT adoption framework to explore this topic more broadly.

6.5 FINAL NOTE

Several factors can make organisational IoT adoption challenging in the chilled beverages industry. The Internet of Things, or IoT, is a relatively new concept, and organisations in this industry have not had as much experience or exposure to IoT technologies. It is very

likely that the opportunities presented by IoT adoption will have been the first time those opportunities have been experienced.

As a result, the leadership of an organisation needs to grasp the benefits and challenges that IoT adoption will bring to their organisation. The reason for this is that, unlike many other traditional technologies, the Internet of Things may involve several component parts that are interconnected in a way that requires strong messaging, knowledge, and understanding throughout the organisation. Although understanding the actual technicalities of the Internet of Things may not be necessary for all stakeholders, grasping the concepts, their benefits, communication, execution, and knowledge are some key components that must be taken into consideration for the successful IoT adoption by organisations or bottlers in the chilled beverages industry.

The literature review was conducted based on a 'snapshot in time'. It is therefore worthwhile to continue to source academic research articles in this area. This qualitative study should inform future research, particularly through the lens of dynamic capabilities and environmental turbulence. An extension of this research, such as exploring cultural and institutional factors affecting organisational decision making on IoT adoption would be of interest and may enhance the findings. This may also lead to the emergence of some additional themes. It is recommended to extend this study beyond senior executives and management to include operational personnel for validation and new insights.

Finally, combining literature reviews with empirical data was crucial to generating valuable research conclusions. The result was the development of an IoT adoption framework, a potentially valuable resource for organisations, practitioners, and academics.

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APPENDICES

APPENDIX A (TO CHAPTER 3)

A.1 PARTICIPANT COVER LETTER (VERSION 1)

LETTER TO PARTICIPANTS

I would like to invite you to partake in my PhD Research entitled ***'A Change Management Framework for the Organisational Adoption of IoT (Internet of Things) Technologies'***. The purpose of this research is to interview appropriate candidates about their experiences related to IoT adoption, with the ultimate aim of developing a change management framework for the organisational adoption of IoT technologies.

The study has **ethical approval** from Brunel University London. **Participation in the study is entirely voluntary**; you can withdraw from the interview at any point in time without giving reason and without implications for you. Please be assured that the **information you provide will remain strictly confidential and anonymous**. Answers will only be reported in aggregate so that no individual or organisation will be identifiable from any publication presenting the results of the research.

By participating in an interview, your consent to take part in the study is assumed. Transcribed interviews will be sent to you for your approval. If you would like to have further information about the project, you can contact me via email niazy.kioufi@brunel.ac.uk.

Thank you for considering an invitation to contribute to this research.

Yours sincerely,

Niazy Kioufi

A.2 PARTICIPANT COVER LETTER (VERSION 2)

LETTER TO PARTICIPANTS

I would like to invite you to partake in my PhD Research entitled ***'A Change Management Framework for the Organisational Adoption of IoT (Internet of Things) Technologies'***. The purpose of this research is to interview appropriate candidates about their experiences related to IoT adoption, with the ultimate aim of developing a change management framework for the organisational adoption of IoT technologies.

The study has **ethical approval** from Brunel University London. **Participation in the study is entirely voluntary**; you can withdraw from the interview at any point in time without giving reason and without implications for you. Please be assured that the **information you provide will remain strictly confidential and anonymous**. Answers will only be reported in aggregate so that no individual or organisation will be identifiable from any publication presenting the results of the research.

By participating in an interview, your consent to take part in the study is assumed. If you would like to have further information about the project, you can contact me via email niazy.kioufi@brunel.ac.uk.

Thank you for considering an invitation to contribute to this research.

Yours sincerely,

Niazy Kioufi

APPENDIX B (TO CHAPTER 3)

B.1 PARTICIPANT INFORMATION SHEET

PARTICIPANT INFORMATION SHEET

1. Study title:

   A Change Management Framework for the Organisational Adoption of IOT Technologies

2. Invitation:

   You are being asked to take part in a research study for my PhD Research dissertation.

   Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

3. What is the purpose of the study?

   The study is about how the adoption of IoT (Internet of Things) in the workplace is undertaken and how it impacts workers and their performance. The aim is to develop an understanding and recommend a way to achieve adoption that can help others to do the same.

   - This study will require approximately 60 minutes of your time if you are invited to be interviewed

4. Why have I been invited to participate?

   CEO's, Directors, Senior Management and Strategic leaders:

You have been invited to participate because, as a CEO/Director/Leader you have a strategic role to play within the organisation and have all or some responsibility for the adoption of IoT. You will be invited to attend a remotely scheduled interview that should last approximately 60 minutes.

5. Do I have to take part?

As participation is entirely voluntary, it is up to you to decide whether or not to take part. If you do decide to take part, you will be given this information sheet to keep and you may be asked to sign a consent form. If you decided to take part you are still free to withdraw at any time up until 30th October 2020, and without having to give a reason.
Your participation will be completely anonymous and after your participation, you can withdraw your data up until the point of anonymisation which will be on 30th December 2020.
Your right to decline or withdraw from this research will no way influence or adversely affect you in any way.

6. What will happen to me if I take part?

- Your participation will require approximately 60 minutes of your time in an online interview
- I will ask you a series of approximately 8 interview questions related to the research question, however, your responses may induce additional questions
- With your consent, I will audio record the interview for later transcription and analysis
- You should ensure that the time set aside for participation should be dedicated and clear of any potential interruptions
- The interview should be undertaken in a meeting room, or if online, in a quiet location

7. Are there any lifestyle restrictions?

There are no lifestyle restrictions required prior to participation.

8. What are the possible disadvantages and risks of taking part?

   There are no anticipated disadvantages or risks associated with taking part in this study.

9. What are the possible benefits of taking part?

   There are no intended personal benefits for taking part in this study. However, on successful completion of the PhD research, a copy will be made available to you.

10. What if something goes wrong?

    Should you wish to raise any concerns or complaints about your participation you can raise this by contacting:
    Brunel University, College of Business, Arts and Social Sciences Research Ethics Committee Chair – Professor David Gallear (david.gallear@brunel.ac.uk)

11. Will my taking part in this study be kept confidential?

    All information which is collected about you during the course of the research will be kept strictly confidential and held up until 1st June 2023. Any information about you which leaves the University will have all your identifying information removed. With your permission, anonymised data will be stored and may be used in future research.

12. Will I be recorded, and how will the recording be used?

    With your permission our interview will be audio recorded for later transcription and analysis. I will utilise a digital recording device or mobile phone for the recording. The recording will be stored confidentially and securely destroyed once fully transcribed.

13. What will happen to the results of the research study?

The results of the research will be submitted to Brunel University as a PhD Research dissertation for a PhD qualification. If successful, the dissertation will be published by the University and accessible to other academic institutions from 1st June 2023. You can access a copy directly from the University.

14. Who is organising and funding the research?

This research is not funded by any organisation and is being organised by myself, Niazy Kioufi, in conjunction with Brunel University London.

15. What are the indemnity arrangements?

Brunel University London provides appropriate insurance cover for research which has received ethical approval.

16. Who has reviewed the study?

College of Business, Arts and Social Sciences Research Ethics Committee
Chair – Professor David Gallear (david.gallear@brunel.ac.uk)

17. Research Integrity

Brunel University London is committed to compliance with the Universities UK Research Integrity Concordat. You are entitled to expect the highest level of integrity from our researchers during the course of their research.

18. Contact for further information and complaints

PhD Research Student:
Niazy Kioufi niazy.kioufi@brunel.ac.uk
College of Business, Arts and Social Sciences Research Ethics Committee
Chair – Professor David Gallear (david.gallear@brunel.ac.uk)

Principal Supervisor: Dr Truong Van Nguyen (truongvan.nguyen@brunel.ac.uk)
Supervisor: Professor Habin Lee (habin.lee@brunel.ac.uk)
Research Development Advisor: Dr Weifeng Chen (Weifeng.chen@brunel.ac.uk)

Thank you for reading these guidance notes.

APPENDIX C (TO CHAPTER 3)

C.1 Participant consent form

CONSENT FORM

Brunel University London

A CHANGE MANAGEMENT FRAMEWORK FOR THE ORGANISATIONAL ADOPTION OF IOT TECHNOLOGIES

NIAZY KIOUFI

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 01/07/2020 AND 31/03/2022

The participant should complete the whole of this sheet.		
	YES	NO
Have you read the Participant Information Sheet?	☑	☐
Have you had an opportunity to ask questions and discuss this study? (via email/phone for electronic surveys)	☑	☐
Have you received satisfactory answers to all your questions? (via email/phone for electronic surveys)	☑	☐
Do you understand that you will not be referred to by name in any report concerning this study?	☑	☐
Do you understand that:		
• You are free to withdraw from this study at any time	☑	☐
• You don't have to give any reason for withdrawing	☑	☐
• Choosing not to participate or withdrawing will not affect your rights	☑	☐
• You can withdraw your data any time up to 30/12/2020	☑	☐
I agree to my interview being audio recorded.	☑	☐
I agree to the use of non-attributable quotes when the study is written up or published.	☑	☐
The procedures regarding confidentiality have been explained to me.	☑	☐
I agree that my anonymised data can be stored and shared with other researchers for use in future projects.	☑	☐
I agree to take part in this study.	☑	☐

Signature of research participant:

Signature: [redacted]

Email: [redacted]

Print name: [redacted] Date: Dec 12, 2020

APPENDIX D (TO CHAPTER 3)

D.1 RESEARCH ETHICS LETTER OF APPROVAL

College of Business, Arts and Social Sciences Research Ethics Committee
Brunel University London
Kingston Lane
Uxbridge
UB8 3PH
United Kingdom

www.brunel.ac.uk

11 June 2020

LETTER OF APPROVAL

APPROVAL HAS BEEN GRANTED FOR THIS STUDY TO BE CARRIED OUT BETWEEN 29/06/2020 AND 01/06/2023 01/06/2023

Applicant (s): Mr Niazy Kioufi

Project Title: A Change Management Framework for Organisational Adoption of IOT Technologies

Reference: 22371-LR-Jun/2020- 25810-2

Dear Mr Niazy Kioufi

The Research Ethics Committee has considered the above application recently submitted by you.

The Chair, acting under delegated authority has agreed that there is no objection on ethical grounds to the proposed study. Approval is given on the understanding that the conditions of approval set out below are followed:

- You put the 'On-line Consent Form' at the beginning of your Survey/Questionnaire (I.e. not at the beginning of your Interview questions - you use the full Consent Form for the Interviews).
- **Please ensure that you monitor and adhere to all up-to-date Government health advice for the duration of your project.**
- The agreed protocol must be followed. Any changes to the protocol will require prior approval from the Committee by way of an application for an amendment.

Please note that:

- Research Participant Information Sheets and (where relevant) flyers, posters, and consent forms should include a clear statement that research ethics approval has been obtained from the relevant Research Ethics Committee.
- The Research Participant Information Sheets should include a clear statement that queries should be directed, in the first instance, to the Supervisor (where relevant), or the researcher. Complaints, on the other hand, should be directed, in the first instance, to the Chair of the relevant Research Ethics Committee.
- Approval to proceed with the study is granted subject to receipt by the Committee of satisfactory responses to any conditions that may appear above, in addition to any subsequent changes to the protocol.
- The Research Ethics Committee reserves the right to sample and review documentation, including raw data, relevant to the study.
- You may not undertake any research activity if you are not a registered student of Brunel University or if you cease to become registered, including abeyance or temporary withdrawal. As a deregistered student you would not be insured to undertake research activity. Research activity includes the recruitment of participants, undertaking consent procedures and collection of data. Breach of this requirement constitutes research misconduct and is a disciplinary offence.

Professor David Gallear

Chair of the College of Business, Arts and Social Sciences Research Ethics Committee

Brunel University London

APPENDIX E (TO CHAPTER 3)

E.1 RESEARCH PLANNED SCHEDULE

To further support this research, the following schedule will be followed:

Milestone	Action	Outcome
Jan 2020 – June 2020	Extended Literature Review Ethical clearance	Validate lack of empirical evidence Improve understanding of international research on IoT
July 2020 – Dec 2020	Interview questions Invite senior management participants Schedule 60-minute interviews Invite research participants to	Complete interviews Transcribe interviews
July 2020 – Dec 2020	Invite middle management participants Schedule 60-minute interviews	Complete interviews Transcribe interviews
Jan 2021 – June 2021	Interview Analysis Survey Analysis Draft thesis chapters	Interpretative software results Survey results, Validate results Draft thesis chapters
July 2021 – Dec 2021	Draft thesis Revisions, Final submission Prepare for Viva Voce	Review thesis progress Mock Viva Voce
Jan 2022 – March 2022	Complete thesis Mock Viva Voce	Final thesis submission Draft chapters
April 2022 – June 2022	Viva Voce	Vice Voce Research completion

Table 22: Delivery milestones

APPENDIX F (TO CHAPTER 4)

F.1 IMPACT OF COVID-19 QUANTITATIVE SUB THEME SUMMARY COUNTS

F1.1 Theme: Drivers for adopting IoT

Pre Covid-19		Post Covid-19	
Sub Theme	**Ref**	**Sub Theme**	**Ref**
Improve workforce efficiency	14	Adoption became more important	9
Improve sales performance	11	Consumer behaviour changed	5
Drive to innovate	8	Adoption to increase revenue	4

F1.2 Theme: Perception of IoT

Pre Covid-19		Post Covid-19	
Sub Theme	**Ref**	**Sub Theme**	**Ref**
Lack understanding of IoT	20	Not right time due to pandemic	8
Positive perception of IoT	16	More important due to pandemic	3
Fear of job losses	7		

F1.3 Theme: Expected gains from IoT adoption

Pre Covid-19		Post Covid-19	
Sub Theme	**Ref**	**Sub Theme**	**Ref**
Improve sales performance	23	IoT data becomes more important	13
Improve workforce efficiency	19	No change in expectation	3

F1.4 Theme: Challenges from the workers

Pre Covid-19		Post Covid-19	
Sub Theme	**Ref**	**Sub Theme**	**Ref**
Lack of confidence in tech	22	Fear of job losses	5
Resistance to org change	16		
Lack of clarity of benefits	5		

F1.5 Theme: Organisational motivation to adopt IoT

Pre Covid-19		Post Covid-19	
Sub Theme	**Ref**	**Sub Theme**	**Ref**
Motivated due to potential benefits	16	Motivated due to making job a lot easier	8
Demotivated due to lack of understanding of IoT	16		
Demotivated due to fear of job losses	5		

APPENDIX H (TO CHAPTER 4)

H.1 IMPACT OF COVID-19 SUMMARY COUNTS BY PARTICIPANT

Cases	Pre Covid 19	Post Covid 19	Total
ARG-CA3701	14	0	**14**
AUS-AL6641	27	10	**37**
AUS-AS5001	27	10	**37**
CRO-DC6625	10	3	**13**
CRO-KS4721	16	0	**16**
DEN-SA3152	16	3	**19**
IND-SB4053	10	2	**12**
IND-VA4053	8	7	**15**
MAL-ER3100	7	1	**8**
MEX-AT5754	22	15	**37**
SER-MG5430	20	9	**29**
SPA-EF5508	11	8	**19**
THI-MK4300	7	0	**7**
GBR-AT4123	20	12	**32**
USA-DJ4556	11	3	**14**
USA-RM2916	7	5	**12**
Total	**233**	**88**	**321**

Table 23: Pre and post covid-19 reference count by country

H.2 Impact of Covid-19 key sub theme counts by participant

H2.1 - Q2 Drive to introduce IoT – pre Covid-19

Cases	drive to improve efficiency of workforce	drive to improve sales	drive to reduce costs	Total
Australia - AL	4	1	0	**5**
Australia - AS	6	0	0	**6**
Croatia - DC	0	1	0	**1**
Croatia - KS	0	3	0	**3**
Denmark - SA	0	2	1	**3**
India - SB	0	1	0	**1**
India - VA	0	0	1	**1**
Serbia - MG	1	0	2	**3**
Spain - EF	0	1	0	**1**
Thailand - MK	0	1	0	**1**
UK - AS	2	0	0	**2**
USA - DJ	0	0	1	**1**
USA - RM	1	1	0	**2**
Total	**14**	**11**	**5**	**30**

Table 24: Pre covid-19 drivers for IoT adoption key themes

H2.2 - Q3 Changes to IoT adoption rate post Covid-19

Cases	adoption focused on increasing revenue	adoption of IoT became more important due to covid 19	consumer behaviour changed due to covid 19	Total
Australia - AS	0	0	2	**2**
Croatia - DC	0	1	0	**1**
Denmark - SA	1	1	0	**2**
India - SB	0	0	1	**1**
India - VA	0	1	0	**1**
Mexico - AT	0	3	0	**3**
Serbia - MG	2	0	0	**2**
UK - AS	0	2	0	**2**
USA - DJ	0	1	0	**1**
USA - RM	1	0	2	**3**
Total	**4**	**9**	**5**	**18**

H2.3 - Q11 Motivation to adopt IoT – pre Covid-19

Cases	motivated due to potential benefits	demotivated due to lack of understanding	demotivated due fear of job losses	Total
ARG-CA3701	1	0	0	**1**
AUS-AL6641	0	1	1	**2**
AUS-AS5001	1	1	0	**2**
CRO-DC6625	0	0	0	**0**
DEN-SA3152	0	3	0	**3**
IND-SB4053	2	0	0	**2**
MAL-ER3100	1	4	0	**5**
MEX-AT5754	1	2	0	**3**
SER-MG5430	0	1	2	**3**
SPA-EF5508	2	0	0	**2**
GBR-AT4123	3	3	0	**6**
USA-DJ4556	2	0	1	**3**
USA-RM2916	1	0	1	**2**
Total	**14**	**15**	**5**	**34**

H2.4 - Q12: Motivation to adopt IoT post Covid-19

Cases	motivated due to making job easier	Total
India - SB	1	**1**
Malaysia - ER	1	**1**
Spain - EF	1	**1**
UK - AS	5	**5**
Total	**8**	**8**

H2.5 - Q09 Organisational challenges to adoption of IoT – pre Covid-19

Cases	due to lack of confidence in technology	due to resistance to organisational change	Total
Argentina - CA	3	0	**3**
Australia - AL	3	2	**5**
Australia - AS	8	0	**8**
Croatia - DC	1	3	**4**
Croatia - KS	0	4	**4**
India - SB	0	2	**2**
Mexico - AT	2	3	**5**
Serbia - MG	3	0	**3**
Thailand - MK	1	0	**1**
UK - AS	1	0	**1**
USA - DJ	0	1	**1**
USA - RM	0	1	**1**
Total	**22**	**16**	**38**

H2.6 - Q10 Organisational challenges to adoption of IoT – post Covid-19

Cases	motivated due to fear of job losses	due to other workforce challenges	Total
AUS-AL6641	3	0	**3**
IND-SB4053	0	0	**0**
IND-VA4053	0	1	**1**
MEX-AT5754	0	2	**2**
SER-MG5430	0	1	**1**
USA-DJ4556	1	0	**1**
USA-RM2916	1	0	**1**
Total	**5**	**4**	**9**

H2.7 - Q07 Expected gains from IoT adoption pre Covid-19

Cases	improve sales performance of the business	improve effeciency of the workforce	Total
ARG-CA3701	2	1	**3**
AUS-AL6641	2	1	**3**
AUS-AS5001	3	3	**6**
CRO-KS4721	3	0	**3**
DEN-SA3152	2	2	**4**
IND-SB4053	0	2	**2**
IND-VA4053	2	0	**2**
MAL-ER3100	0	2	**2**
MEX-AT5754	2	1	**3**
SER-MG5430	2	4	**6**
SPA-EF5508	0	1	**1**
THI-MK4300	2	0	**2**
GBR-AT4123	2	2	**4**
USA-DJ4556	1	0	**1**
Total	**23**	**19**	**42**

H2.8 - Q08 Expected gains from IoT adoption – post Covid-19

Cases	the data is even more important	Total
AUS-AS5001	2	2
IND-VA4053	1	1
MEX-AT5754	4	4
SER-MG5430	2	2
SPA-EF5508	2	2
GBR-AT4123	2	2
Total	**13**	**13**

H2.9 - Q04 Perception of IoT – pre covid

Cases	percieved the workforce to be positive about IoT	perceived workforce lacked understanding of IoT	perceived workforce feared for their jobs	Total
ARG-CA3701	2	4	0	6
AUS-AL6641	3	3	0	6
AUS-AS5001	0	4	0	4
CRO-DC6625	3	0	0	3
CRO-KS4721	1	1	0	2
DEN-SA3152	0	2	0	2
IND-SB4053	0	1	0	1
IND-VA4053	1	2	0	3
MEX-AT5754	3	1	1	5
SER-MG5430	0	1	1	2
THI-MK4300	0	1	0	1
GBR-AT4123	1	0	3	4
USA-DJ4556	2	0	0	2
USA-RM2916	0	0	2	2
Total	**16**	**20**	**7**	**43**

H2.10 - Q05 Perception of IoT – post covid

Cases	not the right time due to pandemic	more important due to the pandemic	Total
AUS-AL6641	1	1	**2**
AUS-AS5001	2	0	**2**
IND-VA4053	0	1	**1**
SER-MG5430	1	0	**1**
SPA-EF5508	3	0	**3**
GBR-AT4123	0	1	**1**
USA-DJ4556	1	0	**1**
Total	**8**	**3**	**11**

H2.11 - Drivers for IoT adoption

Cases	Competitiveness	drive to improve efficiency of workforce	drive to improve sales	drive to reduce costs	Total
AUS-AL6641	36	4	1	0	**41**
AUS-AS5001	30	6	0	0	**36**
CRO-DC6625	6	0	1	0	**7**
CRO-KS4721	12	0	3	0	**15**
DEN-SA3152	19	0	2	1	**22**
IND-SB4053	9	0	1	0	**10**
IND-VA4053	21	0	0	1	**22**
SER-MG5430	19	1	0	2	**22**
SPA-EF5508	20	0	1	0	**21**
THI-MK4300	10	0	1	0	**11**
GBR-AT4123	19	2	0	0	**21**
USA-DJ4556	15	0	0	1	**16**
USA-RM2916	11	1	1	0	**13**
Total	**227**	**14**	**11**	**5**	**257**

H2.12 - IoT understanding vs IoT perception

Cases	Good IoT understanding	Poor IoT understanding	Negative Workforce Perception	Positive Workforce Perception	Total
ARG-CA3701	0	3	4	2	**9**
AUS-AL6641	3	2	4	2	**11**
AUS-AS5001	0	5	5	0	**10**
CRO-DC6625	0	1	1	1	**3**
CRO-KS4721	0	2	2	1	**5**
DEN-SA3152	0	0	3	0	**3**
IND-SB4053	0	2	1	1	**4**
IND-VA4053	0	2	2	3	**7**
MAL-ER3100	0	0	0	0	**0**
MEX-AT5754	2	1	7	5	**15**
SER-MG5430	0	3	1	0	**4**
SPA-EF5508	0	1	8	1	**10**
THI-MK4300	0	1	0	0	**1**
GBR-AT4123	0	3	2	1	**6**
USA-DJ4556	0	0	0	1	**1**
USA-RM2916	0	0	0	0	**0**
Total	**5**	**26**	**40**	**18**	**89**

H2.13 - Motivation vs perception by country

Cases	Demotivated workforce	Motivated workforce	Negative Workforce Perception	Positive Workforce Perception	Total
ARG-CA3701	1	0	4	2	**7**
AUS-AL6641	4	0	4	2	**10**
AUS-AS5001	2	0	5	0	**7**
CRO-DC6625	0	1	1	1	**3**
CRO-KS4721	2	2	2	1	**7**
DEN-SA3152	3	0	3	0	**6**
GBR-AT4123	2	4	2	1	**9**
IND-SB4053	0	3	1	1	**5**
IND-VA4053	1	2	2	3	**8**
MAL-ER3100	2	2	0	0	**4**
MEX-AT5754	1	2	7	5	**15**
SER-MG5430	3	4	1	0	**8**
SPA-EF5508	2	4	8	1	**15**
THI-MK4300	5	1	0	0	**6**
USA-DJ4556	0	1	0	1	**2**
USA-RM2916	0	1	0	0	**1**
Total	**28**	**27**	**40**	**18**	**113**

H2.14 - All themes by participant

Cases	Awareness	Capabilities	Competitiveness	Leadership	Total
ARG-CA3701	9	4	12	8	**33**
AUS-AL6641	16	4	17	28	**65**
AUS-AS5001	11	9	22	7	**49**
CRO-DC6625	4	2	5	5	**16**
CRO-KS4721	5	2	11	8	**26**
DEN-SA3152	6	5	12	8	**31**
GBR-AT4123	10	7	9	26	**52**
IND-SB4053	5	8	5	9	**27**
IND-VA4053	7	8	12	8	**35**
MAL-ER3100	0	0	1	4	**5**
MEX-AT5754	17	3	20	14	**54**
SER-MG5430	12	18	14	11	**55**
SPA-EF5508	12	16	7	35	**70**
THI-MK4300	2	4	5	13	**24**
USA-DJ4556	2	4	10	13	**29**
USA-RM2916	2	3	9	6	**20**
Total	**120**	**97**	**171**	**203**	**591**

APPENDIX I (TO CHAPTER 2)

Sample list of journal articles and conference papers are listed. This represents a sample and in many cases there are several articles reviewed per journal listed.

Journal Title	**AJG Rank**
Academy of Management	AJG 4*
Academy of Management Review	AJG 4*
Administrative Science Quarterly	AJG 4*
Management Science	AJG 4*
Organization Science	AJG 4*
Strategic Management Journal	AJG 4*
Academy of Management Perspectives	AJG 4
Academy of Management Review	AJG 4
British Journal of Management	AJG 4
European Journal of Information Systems	AJG 4
International Journal of Operations and Production Management	AJG 4
Journal of Product Innovation Management	AJG 4
Organization Studies	AJG 4
Research Policy	AJG 4
Review Journal of World Business	AJG 4
Business & Information Systems Engineering	AJG 3
Business Strategy and the Environment	AJG 3
California Management Review	AJG 3
European Economic Review	AJG 3
Harvard Business Review	AJG 3
Harvard Business School Publishing	AJG 3
Human Resource Management Review	AJG 3
IEEE Transactions on Engineering Management	AJG 3
IEEE Transactions on Systems, Man, and Cybernetics	AJG 3
Industrial and Corporate Change	AJG 3
Industrial Marketing Management	AJG 3
Information and Management	AJG 3
Information Systems Frontiers	AJG 3
Information Technology and People	AJG 3
International Journal of Human Resource Management	AJG 3
International Journal of Management Reviews	AJG 3
International Journal of Production Economics	AJG 3
International Journal of Production Research	AJG 3
Journal of Business Research	AJG 3
Journal of Economic History	AJG 3
Long Range Planning	AJG 3
Management International	AJG 3

Management Learning	AJG 3
Technological Forecasting and Social Change	AJG 3
Business Horizons	AJG 2
Construction Management and Economics	AJG 2
European Business Review	AJG 2
International Journal of Information Management	AJG 2
Journal of Knowledge Management	AJG 2
Journal of Management and organization	AJG 2
Management decision	AJG 2
Managerial and Decision Economics	AJG 2
Review of Managerial Science	AJG 2
Technology Analysis and Strategic Management	AJG 2
Asia-Pacific Journal of Business Administration	AJG 1
International Journal of Logistics Management	AJG 1
Journal of Family Business Management	AJG 1
Journal of International Entrepreneurship	AJG 1
Journal of Outdoor Recreation and Tourism	AJG 1
Transnational Corporations Review	AJG 1
Vikalpa	AJG 1
Digital Manufacturing & Automation	
Emerald Insight	
Environmental Engineering and Management Journal	
IBM Journal of Research and Development	
IEEE Access	
IEEE Systems Journal	
IEEE Technology & Engineering Management Conference	
IEEE Transactions on Engineering Management	
IEEE Transactions on Parallel and Distributed Systems	
IEEE Transactions on Professional Communication	
Information Systems Frontier	
International Association for Management of Technology	
International Journal of Design	
International Journal of Information and Education Technology	
International Journal of Production Research	
IT Professional	
Journal of Computer and Communications	
Michigan Tech	
NOBO Onderzoekdag	
Open and Big Data Management and Innovation	
Report	
Technological Forecasting and Social Change	
Telematics and Informatics	
The Institution of Engineering and Technology	

Transfer Network	
Tsinghua Science and Technology	
World Engineering Education Forum, (WEEF)	

Table 25: Sample list of journal article and conference papers