Exploration towards a Resilient Corporate Real Estate:

Re-conceptualisation and Operationalisation in Various Commercial Asset Classes

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Re-conceptualisation and Operationalisation in Various Commercial Asset Classes

P5 Report

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Abstract

Real estate is one of the highest expenditures in almost every business. External disruptions, such as the current COVID-19 pandemic, created a significant shift in business operations. This disruption accentuated the importance of resilience as a fundamental operational factor against uncertainties. Corporate real estate (CRE) industries need to be resilient in their processes to respond to the inevitable disruptions and anticipate future opportunities. Nevertheless, in recent years, resilience is becoming a rather broad and ambiguous concept that has been used repeatedly in different contexts. This research was aimed to address and advance resilience in various CRE asset classes to overcome external problems and increase preparedness during uncertainties. This study attempted to re-conceptualise resilience, by exploring the current definitions of resilience. The redefined concept of resilience was then reflected to different asset classes of CRE. A comprehensive literature review was conducted to provide the contextual definition and features of resilience, as well as to assess the value of resilient CRE to an organisation. Subsequently, a resilience framework was composed based on the findings from both theoretical and empirical studies. The framework was then utilised to assess resilience in within-class and across-class analyses. The within-class analysis evaluated the extent of resilient approaches in an asset class, whereas cross-class analysis attempted to explore how resilience can be achieved and optimised in a particular asset class. Furthermore, additional synthesis between theoretical and empirical findings was conducted to further maintain resilience in a longer time span. Here, continuous improvement was identified as a determining factor for the sustenance of resilience. The output of this research provided a theoretical basis for resilient CRE and applicable suggestions to improve and maintain resilience capability in an organisational CRE.

Keywords – *Corporate real estate, corporate real estate management, resilience, resilience framework, asset classes, office, retail, industrial, logistics, persistence, adaptability, transformability, continuous improvement.*

Preface

This master's thesis was conducted as a part of the Real Estate Management Graduation Lab of the MSc Program at Delft University of Technology, track Management in the Built Environment. This thesis elucidated resilient CRE, a concept that is rarely explored before. This research provided knowledge on resilient corporate real estate through its re-conceptualisation and operationalisation attempts.

This research was made possible through continuous support by numerous people. First and foremost, I would like to thank my thesis supervisors, Dr. Tuuli Jylhä and Dr. Aksel Ersoy for their spot-on feedbacks, guidance and support throughout the year. It has been quite a journey, and I enjoyed the process of creating this research with you.

I would also like to extend my gratitude to:

- The interviewees, for the valuable information you shared to a complete stranger. The information gathered was very crucial to my research.
- MBE family, for the inspiration, motivation, advice, study companion, and countless coffee breaks. Thank you for being the best support system.
- Mama, Papa, Karina, and the rest of the family, for your prayers and continuous support.
- Fukumori-sama, for believing in me. Your protégé did it. Rest easy.

To all the ones who dare to dream.

Delft, June 2021.
Danica Antonia Widarta.

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Executive Summary

1. Introduction

Resilience is a crucial element for corporate real estate industries. It is required to support business continuity during disruptions and to accommodate the changing demand of its actors. Nevertheless, studies are yet to fully explore the concept of resilience in the CRE context.

Despite the recent increase in popularity, the core concept of resilience is yet to be clearly defined (Meerow, Newell & Stults, 2016; Desouza & Flanery, 2013). To date, existing definitions of resilience tend to be rather vague (Meerow et al., 2016; Hassler & Kohler, 2014; Pizzo, 2014). Meerow et al. (2016) also argued on the instability of the existing definitions of resilience, which may lead to a situation where stakeholders agree with the general concept of resilience without having a shared understanding of its exact implication (Brand & Jax, 2007). This ambiguous and unaligned theoretical preconception of resilience made it difficult for resilience efforts to be practically implemented, especially in the core operational plan of a CRE.

This study aimed to advance and explore the applicability of resilience in CRE through its re-conceptualisation and operationalisation in various commercial CRE asset classes. This was done by redefining resilience and implementing the defined extended resilience concept in various asset classes of CRE. The current study analysed suitable features to distinguish the various extent of resilience and its value contribution to the core organisation. Additionally, approaches to advance and maintain resilience in CRE industries were explored. The measures to maintain resilience in CRE industries incorporated the concept of continuous improvement, which was defined as one of the key concepts of lean thinking (Jylhä, 2013; Jylhä, 2021). Through the efforts to maintain resilience, the analysis explored the idea of total CRE alignment in enabling businesses to continuously minimise waste generation while maintaining relevant value delivery.

Research Questions

Based on the previously defined problem statement and research goals, the main question of this research can be formulated as:

How can resilience be advanced in the context of corporate real estate?

The main research question can be further elaborated into two critical scopes: 1) the re-conceptualisation and 2) the operationalisation of resilience. Here, the re-conceptualisation of resilient CRE was performed to address the theoretical gap surrounding the terminology of resilience in the CRE context. The re-conceptualisation attempt was further elaborated into the following research sub-questions.

- What is the extended definition of resilience and its features that fits the context of CRE industries?
- Why should CRE industries enhance resilience from the value delivery perspective?

In contrast, the operationalisation of resilience was aimed to improve the applicability of resilient approaches. This was further expanded to the following research sub-questions.

- How can resilience be operationalised and optimised in various CRE asset classes?
- What are the potential measures that CRE industries may take to maintain their resilience?

2. Methodology

The research design consisted of two main methods, namely 1) theoretical study, and 2) empirical study, followed by the iteration between these findings (Figure i). The theoretical study attempted to reconceptualise resilience concept that fits in the context of CRE and investigate how resilience could be measured and assessed. The contribution of resilience to the value of organisations was then identified. At the end of the theoretical study, a literature-based resilience framework was formulated. The subsequent empirical study was aimed to advance the literature-based resilience framework and deliver resilient CRE management approaches in two forms: first, by addressing generic-applicable approaches, and second, focusing on the class-specific approaches suggested for each selected asset classes. The analytical scope of the current empirical study was limited to office, retail, and industrial/logistics sectors as the three representative asset classes.

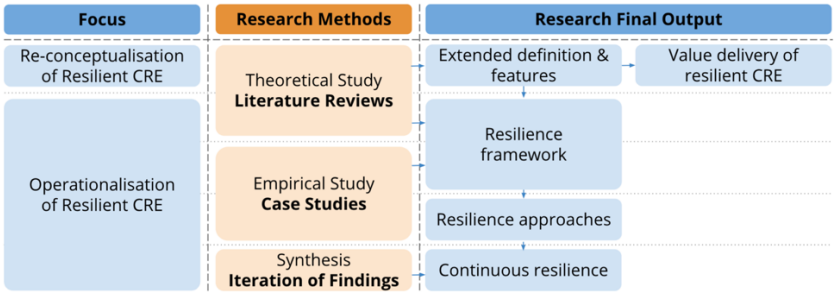

Figure i. Research methods and outputs (source: Author)

The empirical and theoretical studies were followed by a synthesis step to integrate and compare the results obtained during the preceding analyses. Here, the identified resilience approaches were compared to literature information to identify potential strategies to maintain the continuation of resilience capabilities.

3. Findings

This research explored, addressed, utilised, and maintained resilience in various CRE asset classes. The research provided the answer to the main research question by sequentially addressing its four research sub-questions.

Extended definition of resilience and its features in the CRE context

The extended definition of resilience was formulated through literature review on CRE management theories and by exploring the concept of resilience used in multi-disciplinary contexts. **Resilient CRE in this research was defined as the capability and preparedness to manage businesses' physical assets and CRE organisational processes to respond and immediately recover following external disruptions, thus allowing the maintenance of value delivery. This can be achieved by being 1) invulnerable, 2) resistant towards disruptions, 3) flexible in adapting the organisational sub-processes to maintain the same pathway, or 4) innovative in creating a more desirable pathway or state.** These four response methods should be utilised accordingly depending on the scale and the extent of disruptions to the receiving ends.

The **features used** to advance resilience in CRE industries can be categorised into **(a) persistence, (b) adaptable, and (c) transformable resilient features**, as adapted from Davoudi, et al. (2013). In his theory of evolutionary resilience, Davoudi, et al. (2013) proposed the fourth component of

preparedness, even though its implementation was restricted in the current research as an indispensable factor for the maintenance of resilience capability, which was discussed on the fourth research question.

The importance of resilience in CRE industries from the value delivery perspective

Real estate decisions impact to the core business (Gibler & Lindholm, 2012). As such, real estate decision may provide added value and generate income for the organisation (de Jonge, 1994; de Jonge et al., 2009). Krumm, Dewulf & de Jonge (1998) conferred that organisations can provide added value by awareness of its capability, resources, and the changing markets. Hence, creating resilient CRE may deliver value to the CRE management and to the core organisation. A resilient real estate can be one of the determinants that decides whether a disruption would hinder business activities. Therefore, the possession of resilient capabilities in its CRE would help businesses to maintain a stable output, especially during disturbances.

Operationalisation and optimisation of resilience in various CRE asset classes

Two main deliverables were provided to answer this research question. The first deliverable was the resilience framework (Figure ii), which may be used to assist organisations to assess their resilience capability. The resilience framework provided a basis for analysing the important criterion of a resilient industry. Additionally, the resilience framework can also be used to analyse asset classes beyond the currently observed asset classes.

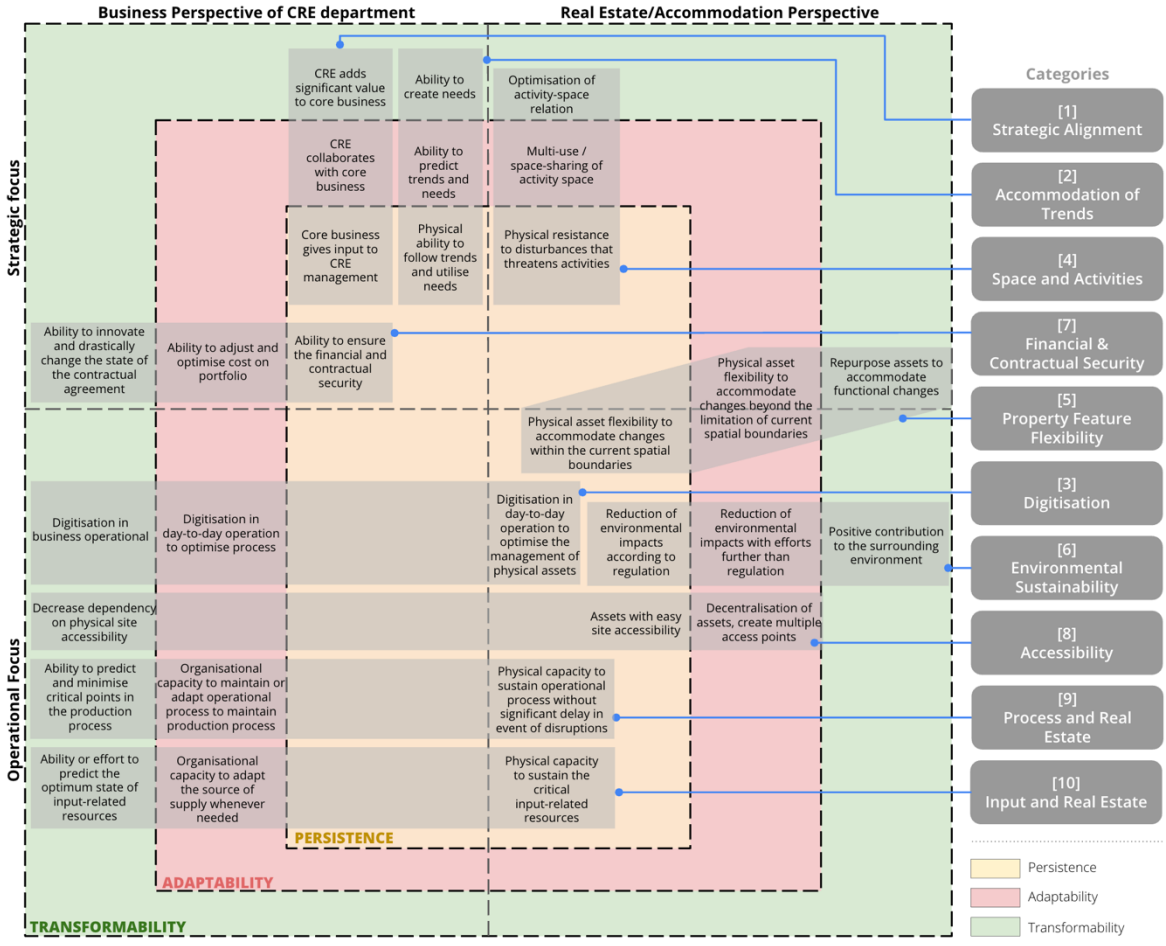

Figure ii. Final resilience framework (source: Author, replicated from Figure 4.02).

The second deliverable consisted of **a set of suggested approaches for the operationalisation of resilience in CRE**. The sets of approaches could help organisations to implement resilience in their real estate management. The approaches were derived from information obtained from theoretical and empirical studies. During the empirical study, it became clear how many of the identified resilient approaches were originally targeted to achieve other institutional aims. In such cases, the current research showed how these approaches may also contribute to CRE resilience. Our analysis identified **categories 1, 4, and 6, which represented** 'Strategic Alignment', 'Space and Activities', and 'Environmental Sustainability', respectively**, as approaches that possessed sequential characteristics in its persistence, adaptable, and transformable (P, A, T) features.** In other words, for these categories, persistence needs to be possessed before reaching adaptable efforts, and acquiring transformability requires the possession of both lesser features (Figure iii).

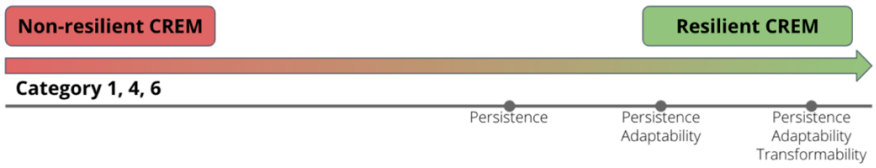

Figure iii. Sequential characteristics of Category 1, 4, and 6 (source: Author).

Here, four sets of approaches were introduced to help CRE industries operationalise and optimise their resilience. These four sets of resilience approaches consisted of one set of generic approaches, which was applicable for a larger scope of commercial real estate, and three class-specific approaches for the office, retail, and industrial/logistics classes. Each set of approaches consisted of suggested operationalisation efforts through the lens of 10 categories and 3 features of the resilience framework (Figure ii).

The **generic approaches** consisted of general ideas on how CRE industries could better operationalise and optimise resilience. The generic approaches were detected in 8 out of 10 categories from the resilience framework. The first category of strategic alignment showed generic characteristics in all of its P, A, T features. The CRE of commercial real estate industries was thus suggested to receive input from (P), to align strategies with (A), and to contribute significantly to (T) to their respective core business organisation. These may be achievable by translating core organisational strategy to real estate strategy (P), forming collaboration between the real estate and other departments in the core business (A), and adopting a dynamic CRE strategy to continually assess added value to the core business (T). Other generic approaches included the responsiveness and prediction to market trends and demands, hybrid working capability as well as space optimisations to save costs.

Office-specific approaches was centered on the fourth category, "Accommodation of Activities". The approach in this specific category included:

- (A) Flexibility of working space and the composition of office spaces
- (T) Optimisation of asset level through continuous desk-to-person ratio assessment, and in portfolio level through assessment of assets' performance for future-proof businesses
- (T) Hybrid working capability

In the retail sector, the class-specific priority approaches consisted of the extent of organisational responses to the ongoing market trends and demands (Category 2). The approaches available for this category included:

- (P) Creation of customer-friendly retail spaces, accommodation of regional or context specific demands, selection of retail location that follow the targeted consumers demands, and decent quality of the site's surroundings.
- (A) Prediction and accommodation of future trends through the prediction of future footfall of a specific area and the assessment of the balance between online and physical markets
- (T) Showcasing at retail spaces as the holistic way to create needs (although not defined as priority approaches).

During the data analysis, the industrial and logistics sectors were further sub-categorised into three subsets of suggestions. This categorisation was based our empirical results, which revealed the distinct characteristics of the industrial and logistics sectors. The suggestions for the industrial and logistics sector was thus separated into those applicable to both logistics and non-logistics sector, and those applicable only to the industrial or logistics sectors. In comparison to the office and retail sectors, the industrial and logistics sectors showed a dominance of approaches in process-related CRE interventions (Category 9). The approaches applicable for both logistics and non-logistics sector in this process category (on transformability level) were emphasised on the development of sustainable processes to minimise environmental hazards and the possession of contingency plans.

Overall, CRE industries showed the ability to implement the operationalisation of resilience. As CRE industries often belongs to the larger core organisations, approaches taken in industries should also account for the balance between cost of resilience effort implementation in relation to its value delivery. Hence, to optimise resilience efforts, a priority of approaches had to be applied on the provided approaches. CRE management may benefit more from prioritising some of the approaches. Additionally, the current resilience framework may be utilised for further exploration and identification of novel resilience efforts.

Potential measures to maintain their resilience in CRE industries

Actors involved in the management of CRE spaces should be aware of the ever-changing demands and needs of the real estate's occupiers. Therefore, real estate industries should be prepared to accommodate the constantly shifting context of its built environment. The preparedness capacity of CRE industries can be achieved through continuous evaluations, exploration, and improvement to the current real estate decisions. This included having a dynamic and active real estate strategy to avoid irrelevant value delivery and to continuously provide relevant values to their core organisations. It should also be noted that the currently identified transformable approaches may one day be a standard practice in the related sector(s). Therefore, the maintenance of CRE may be require the preparedness feature, which is achievable through continuous evaluation and improvement on the organisation's real estate decisions.

4. Conclusion

How can resilience be advanced in the context of corporate real estate?

The four sub-research questions created building blocks to provide an answer to the main question on the advancement of resilience in the context of CRE. The first building block reconceptualised resilience in the context of real estate. This created the extended definition of resilience in CRE and identified the three resilient features of persistence, adaptability, and transformability. The second component delivered in this research served as the justification of resilient CRE contributions to core organisation. This confirmed the necessity of resilience capability in CRE. Through the two building blocks, the current study established a foundation to perceive resilience in CRE.

The two primary building blocks also served as a basis for the utilisation of resilient CRE in a practical setting. Through the defined resilient CRE features, a general resilience framework could be constructed. The current resilience framework may act as a starting point for the subsequent operationalisation of resilience. Additionally, by using the resilience framework, the current study derived a number of approaches that may be performed to improve resilience in various CRE asset classes. The sets of approaches, along with its identified priorities, may facilitate the decision-making processes to implement resilience capability in organisations. Lastly, the research was further assured its applicability, through the utilisation of preparedness feature. This can be achieved through continuous improvement of real estate decisions. This constant evaluation and improvement capabilities help CRE industries to maintain resilience over a longer period of time, thus protecting the continuation of relevant value delivery to their respective organisations. These components provided the contributions to the practical side of CRE.

These building blocks could be applied to other asset classes of the commercial real estate and to the larger CRE context. In the end, this study delivered a series of outcomes that would help CRE industries to implement resilience in their practices. At the same time, the findings of this research provided a basis for future studies to further explore the operationalisation of resilience in an even larger scope of CRE.

5. Contributions of the Research

This research contributed to the corporate real estate management field by expanding our knowledge on resilient real estate. Specifically, this research re-conceptualised resilient CRE management through the determination of its extended definition, identification of its features, development of its framework, and the identification of its added value to the core organisations. This research also contributed to the operationalisation of resilient CRE by providing a set of suggested approaches that were expected to be widely applicable to different scopes of real estate management. Furthermore, the framework and the three resilience features could be widely implemented for the assessment of resilience in a different field of research.

In conclusion, this research contributed to both the academic and practical communities. First, by filling the literature gap in the scientific literature by connecting the previously exclusive resilience and corporate real estate topics. This bridging of information may further promote the exploration

of novel strategies to create a better, more prepared, and agile real estate industries. Secondly, the approaches can be utilised directly by CRE management that operates in (but not limited to) The Netherlands. The implementation of these approaches may further enhance preparedness of their real estate management and subsequently safeguard their core businesses. Resilient real estate is hoped to better equip organisations to protect business continuity, especially during the times of unprecedented crisis.

6. Recommendations for Future Research

This study opened up other research opportunities for further resilient CRE exploration. First, the next studies could analyse other asset classes such as healthcare institutions, educational campus, data centres, and other classes in commercial real estate industries that are yet to be observed in the current study. This can be done by replicating the currently used methodology and by adding modifications to fit the future studies' specific goals and conditions. Furthermore, future research could scope down the research to sub-classes of each class, therefore increases the applicability of the approaches.

The findings of the current study also revealed the existence of an optimal state for classes to utilise resilience. Interestingly, none of the classes showed a tendency towards transformable approaches as its optimal state. This finding thus elucidated how excessive resilience efforts may be less profitable to the total business case. This was probably because transformable approaches, which were identified as the innovation of new pathways, may require a significant number of investments. Therefore, future study may further analyse the cost-benefit trade-offs of transformable efforts within an organisation.

Glossary

Focus: Re-conceptualisation of Resilience

Resilient CRE

The capability and preparedness to manage businesses' physical assets and CRE organisational processes to respond and immediately recover following external disruptions, thus allowing the maintenance of value delivery. This can be achieved by being 1) invulnerable, 2) resistant towards disruptions, 3) flexible in adapting the organisational sub-processes to maintain the same pathway, or 4) innovative in creating a more desirable pathway or state.

Features

Evaluations used to distinguish the extent of resilience efforts, which in this research consists of persistence, adaptability, transformability, and preparedness. The first three features (persistence, adaptability, and transformability) are used to operationalise and optimise resilience in organisations, and the fourth feature (preparedness) is used as measure to maintain resilience over the course of time.

Persistence

Physical ability to resist external disturbances, which requires physical robustness and rigidity.

Adaptability

Flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway.

Transformability

Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Resilience Framework, Categories, and Sub-Categories

Derived from both theoretical and empirical study, this framework is used as a basis to analyse important criterion of a resilient industry. Additionally, the resilience framework can also be used to analyse asset classes beyond the observed three sectors.

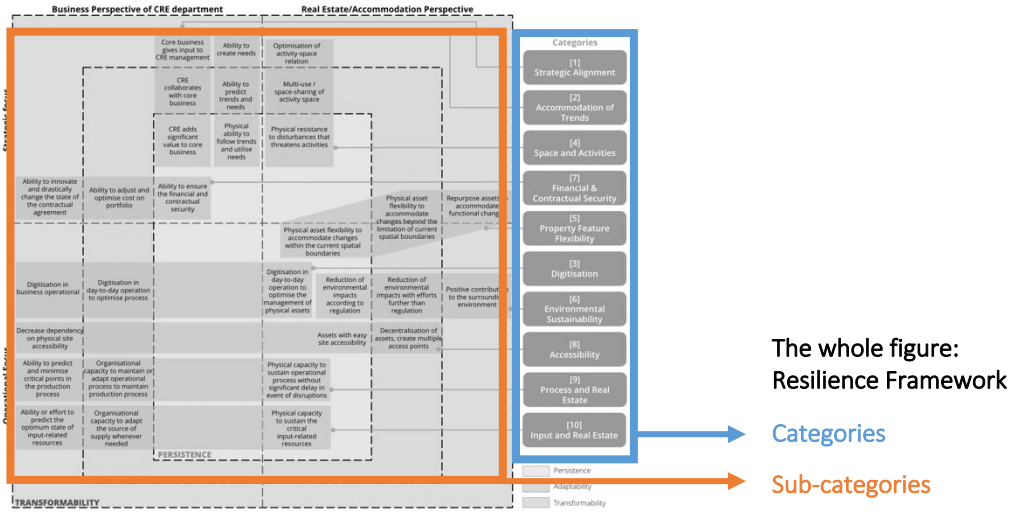

Figure iv. Resilience Framework, Categories, and Sub-categories(source: Author).

Focus: Operationalisation and Optimisation of Resilience

Case class

Asset classes in commercial real estate. During the empirical study, the case class selected are office, retails, and industrial/logistics sector.

Case organisations

Organisations that were interviewed to obtain empirical data. In this research, the respondents belong to one of the three selected classes.

Expert studies

Experts that were interviewed to obtain empirical data. In this research, the respondents belong to one of the three selected classes.

Within-class analysis and cross-class analysis

Within-class analysis analyses asset classes separately. The cross-class analysis dissected each of the category from the resilience framework and compare it across case classes.

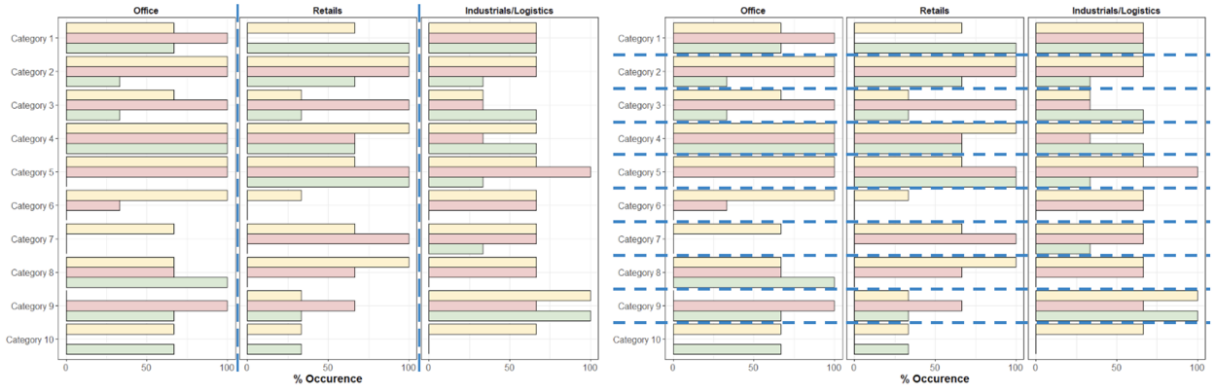

Figure v. Analyses used for operationalisation and optimisation of resilience (source: Author).

Resilience approaches

One of the research outputs, which focuses on feasible real approaches that organisations could implement, to increase each feature level of each category. This research delivered sets of approaches (generic and specific), in each feature per category, whenever possible.

Priority of approaches

The detected approaches were further assessed its priority level. Therefore, CRE management could better prioritse their real estate implementations.

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Chapter 1:
Introduction

1.1 Introduction

- 1.1.1 Problem statement
- 1.1.2 Research aims and objectives
- 1.1.3 Societal and scientific relevance
- 1.1.4 Research questions
- 1.1.5 Conceptual model

1.2 Research Methods

- 1.2.1 Research approach
- 1.2.2 Research design
- 1.2.3 Research output

1.1. Introduction

The built environment provides spatial settings for its users' activities. Therefore, it is demanded to continuously adapt, to adjust to its users' ever-changing needs. Disruptions, in many kinds or forms, may at times be inevitable in a growing society. Systems in the built environment would thus need to be well prepared and equipped to tackle the multi-dimensional problem(s) that may emerge (Pinheiro & Luís, 2020). This challenge can also be observed in the shift of business-as-usual, as restrictions and risks necessitated organisations to adapt their operations and adopt different ways of conducting their businesses. Such crisis may bring the realisation that puts resilience as an essential capacity to prepare against an unknown disruption in the future.

Real estate is one of the highest expenses for almost every business (Norris, 2014; Gibler & Lindholm, 2012). This expense is often second only to businesses' human resource costs. The ongoing COVID-19 pandemic urged corporate real estate (CRE) actors to reassess the current setting of their businesses to become more resilient by adapting the existing business plans and operational models (JLL, 2020a). The pandemic challenged the real estate sector to respond to a broader spectrum of problems, including the efforts to harmonize sustainability and resilience, safeguard health and well-being, as well as to enhance the productivity of its users (Pinheiro & Luís, 2020; JLL, 2020a).

The economic downturn due to the pandemic also urged businesses to rethink the efficiency of their current operations. Reducing resource consumption in non-value producing processes and activities could be one strategy that a business may adopt to minimise consumption (Jylhä, 2013; Jylhä, 2021) and create a more resilient system. In this perspective, activities that do not produce value are regarded as waste (Womack & Jones, 1996; Liker, 2004; Jylhä, 2013). Nevertheless, CRE industries are also expected to deliver sufficient value creation for their customers (Winch, 2010). Jylhä (2021) argued how the current management research tend to disregard the importance of the production phase, knowing its central role in value creation. The argument was supported by a previous comment by Koskela and Ballard (2012) who questioned the lack of attention given to the production phase in popular management theories.

Similarly, the importance of the production phase in corporate real estate management (CREM) theories appeared to be less pronounced. In addition, strategic CREM alignment mainly focuses on its vertical alignment (Jylhä, 2019), which commonly refers to alignment between three levels of corporate, business and functional scopes (Kathuria et al. 2007; Jylhä, 2019). On the other hand, efficient waste management requires horizontal CREM alignment, demanding research to expand from "strategic CREM alignment" into "smart CREM alignment" (Jylhä, 2019, page 1197). Furthermore, values created in a particular business may need to be continuously evaluated and updated to adjust to the current needs of the business and, by doing so, minimise irrelevant value delivery. This emphasised the need to continually improve the process to reach a desirable output, one that matches the customer's demand and the market condition. Consequently, efficiency will be significantly increased, which could decrease organisations' susceptibility, and therefore could potentially increase an organisation's resilience.

1.1.1. Problem statement

Resilience is a crucial element for corporate real estate industries. It is required to support the continuity of the business during uncertainties and to accommodate the changing demand of its actors. Nevertheless, studies are yet to fully explore resilience in the CRE context. CRE actors need to have sufficient knowledge on how resilience could be achieved in their organisations and the value of its implementation.

Despite the recent increase in popularity, the core concept of resilience in general is yet to be clearly defined (Meerow, Newell & Stults, 2016; Desouza & Flanery, 2013) and remained to be a somewhat abstract idea (Desouza & Flanery, 2013; Davoudi, Brooks & Mehmood, 2013). To date, existing definitions of resilience tend to be rather vague and even contradictive to one another (Meerow et al., 2016; Hassler & Kohler, 2014; Pizzo, 2014). Meerow et al. (2016) also argued on the instability of the existing definitions of resilience, which may lead to a situation where stakeholders agree with the general concept of resilience without having a shared understanding of its exact implication (Brand & Jax, 2007). Several research also pointed out how this theoretical inconsistency caused difficulties in operationalising and developing resilience metrics in practical circumstances (Gunderson, 2000; Pizzo, 2014; Vale, 2014; Meerow et al., 2016). This ambiguous and unaligned theoretical preconception of resilience often makes it difficult for resilience efforts to be practically implemented, especially in the core operational plan of a CRE.

The ambiguity surrounding the perception of resilience created a need for the re-conceptualisation of its definition and the determination of its evaluation methods. Such approach was deemed necessary to systematically investigate the contribution of resilient CRE to a particular business organisation. Additionally, the presence of multiple CRE asset classes may demand a class-specific operationalisation to account for each asset class' unique needs. The collection of empirical evidence of various classes may thus be essential to determine the applicability of resilience approaches in selected CRE asset classes.

1.1.2. Research Aims and Objectives

This study aimed to advance and explore the applicability of resilience in CRE through its re-conceptualisation and operationalisation in various CRE asset classes. This was done by redefining resilience and implementing the defined extended concept in various asset classes of CRE. The current study analysed suitable features to distinguish the various extent of resilience and its value contribution to the core organisation. Additionally, approaches to advance and maintain resilience in CRE industries were explored. The measures to maintain resilience in CRE industries incorporated the concept of continuous improvement, which was defined as one of the key concepts of lean thinking (Jylhä, 2013; Jylhä, 2021). Through the efforts to maintain resilience, the analysis explored the idea of total CRE alignment in enabling businesses to continuously minimise waste generation while maintaining relevant value delivery.

Therefore, the objective of this research can be defined as the following.

- Contribute knowledge to the field of CRE for both academic and practical settings
- Formulate an unbiased definition of resilience in CRE to be further advanced in academic settings and to be utilised in practice
- Identify the possible contributions for resilient CRE to overall business organisations

- Provide distinguishable features for creating a more resilient CRE in various sectors and provide a general framework to assess resilience in a broader context of subjects
- Facilitate the decision-making processes for CRE managers and experts for a more resilient real estate
- Explore and evaluate critical approaches for various CRE asset classes actors to improve and maintain resilience.

1.1.3. Societal and Scientific Relevance

This research is expected to deliver contributions to both societal and scientific communities. The societal and scientific relevance of this research is explained below.

Societal Relevance

In the past few years, actors in the built environment have been competing to achieve sustainability goals. However, in light of the recent crisis, it is realised that planners should also be resilient and prepared to respond to a broader scope of issues (Pinheiro & Luís, 2020; JLL, 2020a). The real estate department of an organisation may ensure the efficiency of its value production by continuously assessing external situations and make the required adjustments to ensure the continuity of its resilience. It is also known that businesses are mainly interested in reducing its cost and increasing its revenue (Krumm et al., 1998; JLL, 2020b). Thus, the idea of continuous improvement may also fit in this context in decreasing real estate cost by minimising waste production caused by irrelevant value delivery.

The current study explored potential strategies to enhance and operationalise resilience in different asset classes of CREM. By doing so, this study may contribute to the efforts to improve the applicability of resilience efforts, particularly within the analysed CREM asset classes.

Scientific Relevance

This research attempts to operationalise resilience in different asset classes of CRE. The outcome of this research may contribute to answering several research gaps in this related field.

First, resilience has been an essential concept in the urban setting, particularly in the context of climate crisis. Cities have been viewed as a living lab of resilience, both in the academic and the practical contexts (Meerow et al., 2016). The current study reconceptualised resilience in CRE to align it with the current societal setting.

Secondly, despite the popularity of CRE and resilience as individual topics, the idea of achieving resilience in CRE industries are rarely explored. This research investigated the approaches to enhance resilience in different asset classes of CRE by fitting its concept to the needs and demands of varying CRE industries.

Third, the conceptual application of lean thinking is often limited to waste reduction. This research attempted to broaden this interpretation by emphasising constant value creation and continuous improvement alongside waste reduction in enhancing resilience. Real estate acts as one of the resources to maximise value creation of an organisation (CoreNet Global, 2015). The existing resources in CREM indicate that this can be achieved through strategic alignment within the organisation. Jylhä (2019) pointed out how popular strategic alignments tend to focus solely on the vertical alignment

within the organisation while neglecting horizontal strategic alignment. Vertical alignment focuses on the coordination between different hierarchical levels of an organisation, while horizontal alignment targeted the decision areas within a function (Kathuria et al., 2007; Jylhä, 2019). The concept of lean thinking also accounts for an organisation's horizontal alignment to minimise waste (Jylhä, 2019). This research may contribute to developing our understanding of how total alignment of CRE industries can be achieved.

Lastly, this research attempted to identify resilient approaches that are generally applicable for CRE industries, and class-specific approaches for the selected asset classes. The general approaches identified a number of resilience aspects that may be shared between the selected common asset classes while evaluating the generality of different resilient strategies. Furthermore, the class-specific approaches developed more precise suggestions for the selected asset classes, since every class has its unique characteristics.

1.1.4. Research Questions

CRE industries may benefit from improving their resilience. In addition, organisations are required to ensure the continuity of their resilience. As such, the state of resilience should be regarded as a long-term capacity of an organisation instead of a temporary effort in tackling momentary disruptions. Nevertheless, the definitions of resilience tend to be somewhat inconsistent across recent literature, creating an ambiguity regarding its exact definition. The reconceptualization of resilience in the CRE context was thus needed before exploring its operationalisation approaches in different CRE asset classes.

Based on the previously defined problem statement and research goals, the main question of this research can be formulated as:

How can resilience be advanced in the context of corporate real estate?

Exploring and advancing resilience requires the contextual understanding and formulation of a resilient CRE itself, followed by the advancement of its efforts. Therefore, this research focused on two critical scopes: 1) the re-conceptualisation and 2) the operationalisation of resilience. Here, the re-conceptualisation of resilient CRE was performed to address the theoretical gap surrounding the terminology of resilience in the CRE context. In contrast, the operationalisation of resilience was aimed to improve the applicability of resilient approaches. In line with this, four sub-questions were generated to guide the process of the current study.

Re-conceptualisation of Resilient CRE (Theoretical Focus)

Q1

What is the extended definition of resilience and its features that fits the context of CRE industries?

The first sub-research question focused on creating a contextual definition of resilience that would be applicable to the CRE industries and identifying suitable feature(s) to evaluate the extent of resilience of a CRE organisation.

Q2

Why should CRE industries enhance resilience from the value delivery perspective?

This question was aimed to further explore and identify the value of resilience CRE to their core organisation. The outcome of this research question may provide a substantial justification to advance resilience in CRE industries. The second sub-research question also creates a basis concept from which attempts to improve resilience in real estate industries would be investigated.

Operationalisation of Resilient CRE (Practical Utilisation)

Q3

How can resilience be operationalised and optimised in various CRE asset classes?

The third sub-research question attempted to advance resilience capability of the selected CRE asset classes. At this stage, approaches to realize resilience in various asset classes were identified and analysed. The approaches for resilient real estate may differ for every asset class, even though some of the approaches may also be applicable to multiple commercial classes of real estate.

Q4

What are the potential measures that CRE industries may take to maintain their resilience?

Continuing from the series of approaches analysed in previous sub-question, the current question aimed to investigate how CRE industries may maintain their state of resilience.

The four consecutive sub-research questions navigated the current research in exploring the possible approaches to equip CRE industries with resilience capabilities. Figure 1.01. illustrates the relations between the main question and its four sub-research questions.

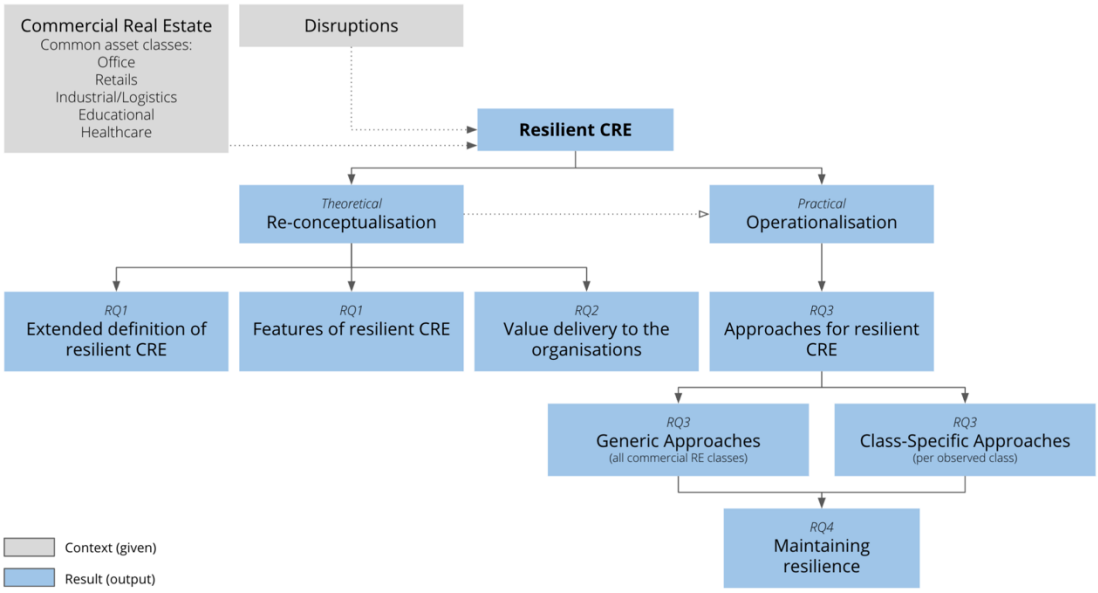


Figure 1.01. Relation of research questions (source: Author).

Two types of theoretical and empirical research methods need to be conducted to better prepare the CRE organisations. First, theoretical evidence provided a basis to evaluate the currently applied resilience practices in different CRE classes. The subsequent empirical study provided factual information regarding the ongoing resilient efforts performed by practices. To note, it is not impossible for a resilience effort to be conducted without an original intention on resilience improvement. Finally, empirical information obtained in the current study were evaluated to determine potential measures for organisations to maintain their resilience capability.

1.2. Research Methods

This chapter describes the methodologies used in different stages of the study. The research approach, design, and output will be discussed in the following sub-sections.

1.2.1. Research Approach

The current research was aimed to identify suitable approaches to improve and maintain resilience in various CRE asset classes. This was achievable through the exploration of resilient CRE. As explained in the introduction, despite both resilience and CRE topics had been researched separately, resilient CRE is yet to be addressed in the academic setting. This research adopted a more exploratory stance in attempt to derive new information rather than to confirm an existing theory. This explorative research created a relatively unstructured research process (Bryman, 2012).

This research was conducted through a qualitative research methodology. Previous research about resilience and CRE theories were used as a foundation to link between these two topics, whereas empirical data collection was used to prove the validity of this newly generated theory, and advanced the findings. In addition, an iterative process between collected data and generated theory (Bryman, 2012) was conducted to account for information obtained at the later stage of the study into the developed theory.

1.2.2. Research Design

Research design creates a framework to collect and analyse data (Bryman, 2012). The research design consisted of two main methods, namely 1) theoretical study, and 2) empirical study, followed by the iteration between these findings (Figure 1.02). The theoretical study aimed to create an extended definition of resilience and its features that fit in the context of CRE industries, as well as to identify the value of enhancing resilience in organisations. This step was concluded by the formulation of a literature-based framework of resilience in CRE asset classes. The empirical study focused on assessing real-case scenarios and the advancement of the literature-based framework based on the evidence found during the case studies. The output of this empirical study was the resilience approaches supported by evidence, based on evaluation and multiple analysis types. The approaches include generic and class-specific suggestions of various commercial real estate, and the measures for achieving continuous resilience. This allows larger varieties of organisations to maintain their resilience capability over a long period.

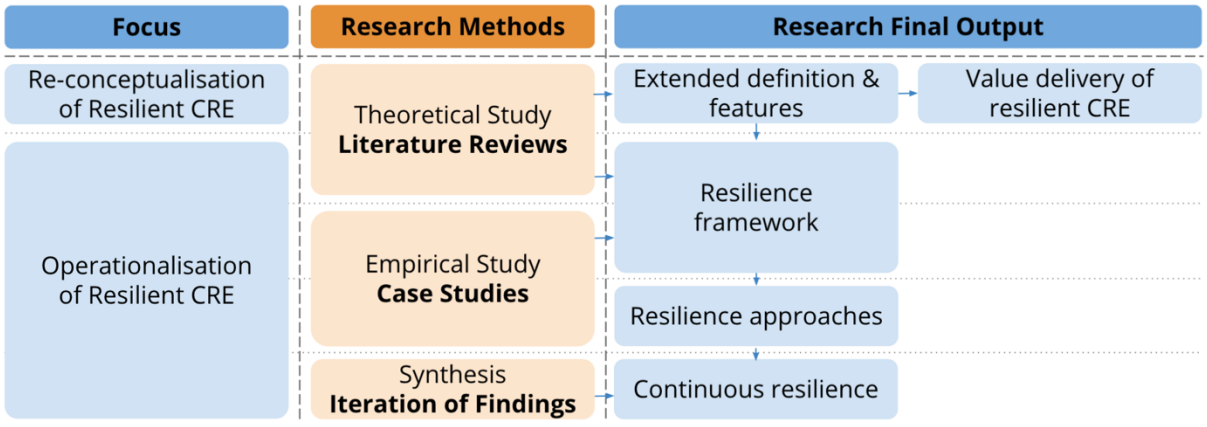


Figure 1.02. Research methods (source: Author).

Selection of Asset Classes

The theoretical study (Step 1) was conducted based on six common commercial classes. These classes include 1) offices, 2) retails, 3) industrial and logistics, 4) data centres, 5) healthcare infrastructures, and 6) educational campuses. The literature-based framework was also generated based on these six asset classes. However, due to the explorative nature of this research, there should be more than one organisation studied for each selected asset classes to create robust evidence-based resilience approaches. To create a feasible empirical data collection, these six asset classes were further constricted into three representative asset classes: 1) office, 2) retails, and 3) industrial/logistics.

Figure 1.03 further explains the extensive research methods.

Theoretical Study

The theoretical study attempted to reconceptualise resilience concept that fits in the context of CRE and investigate how resilience could be measured and assessed. Subsequently, the contribution of resilience to the value of organisations was identified. In addition, a literature-based resilience framework was formulated. The theoretical study was conducted through a literature review with an iterative process.

The first phase of this literature review analysed both CRE and resilience topics. In order to answer the first and second sub-research questions, the author assessed the definitions, ideas and findings from scientific journals, books, conferences and scientific reports. The author acknowledged all of the findings, but selected a number of relevant sources to be used as the basis of the analysis. The extended definition and the features of resilience were then generated to answer the first research question. This output was also used as a basis for the subsequent steps in the study. The literature review was continued with the identification of resilience capability to the value delivery of an organisation, which answered the second research question.

The theoretical study was concluded with a literature-based framework on how resilience could be enhanced in CRE. This was done by integrating the prior findings from scientific publication with real estate trends, market conditions and CRE company reports. This theoretical framework served as a starting point for answering the third research question. Furthermore, empirical data collection was needed to further develop the understanding of this topic, based on real-life practices.

Empirical Study

The empirical study aimed to advance the literature-based resilience framework and deliver resilient CRE management approaches in two forms: first, by addressing generic-applicable approaches, and second, focusing on the class-specific approaches suggested for each selected asset classes.

The empirical study was performed based on the literature-based framework through case studies in which critical aspects of an actual project were identified. This allowed the acquisition of a more holistic view of different asset classes (Bryman, 2016). Data collection from case organisations were conducted independently. For each case organisations, information was collected through in-depth interviews with actors in respective asset classes. In-depth interviews allowed the researcher to be positioned at the interviewee's constructed reality, allowing a deeper understanding of each asset classes' context (Blaikie & Priest, 2019).

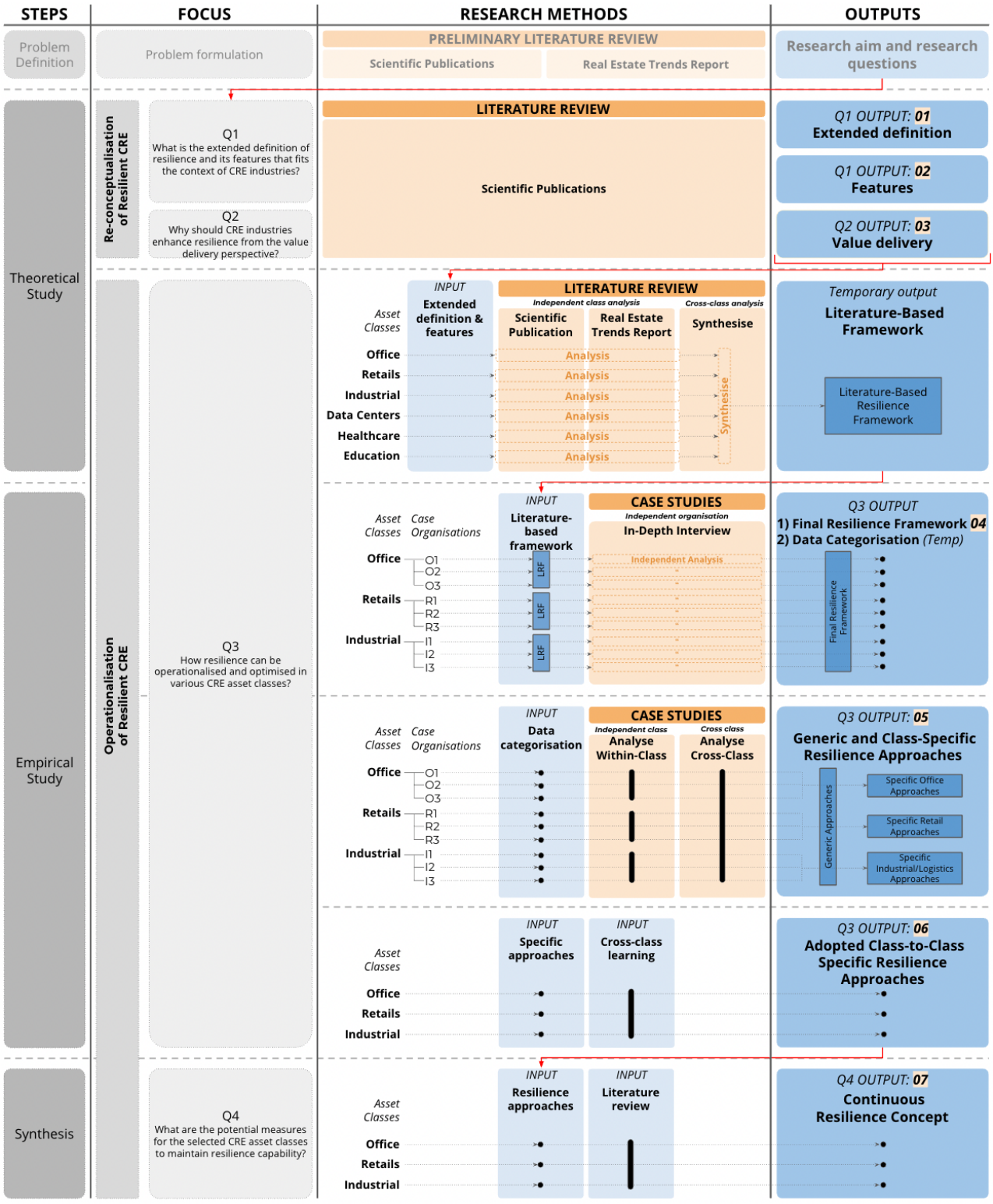


Figure 1.03. Expanded research design (source: Author).

The empirical study phase consisted of several analytical steps. The first step was to categorise the data collected based on the resilience framework while simultaneously advancing the framework based on the data gathered. Here, empirical data was used to further improve the model (resilience framework) while simultaneously applied to formulate the output in an iterative manner. Next, within-class and cross-class analyses were conducted. Within-class analysis analysed asset classes independently,

whereas cross-class analysis compared three selected asset classes to understand better the reasoning behind different approaches of various classes. Furthermore, the cross-class analysis provided learning capacity from one class to another. Therefore, cross-class learning provided a series of adopted class-to-class specific resilience approaches.

Synthesis of Theoretical and Empirical Study

Resilience approaches needed to have an additional layer of security to maintain the continuance of resilience. Here, the identified resilience approaches were compared to literature information to identify potential strategies to maintain the continuation of resilience capabilities.

1.2.3. Research Output

This research provided a set of solutions to advance resilience in several CRE asset classes to overcome external problems and uncertainties. The study generated approaches that could assist relevant asset classes to assess, develop, and improve their real estate spaces, as well as to maintain their resilient capabilities. It should be acknowledged that due to the organisations' diverse background, the formulation of only one generic strategy applicable to all forms of organisations in CRE industries was not attainable. Therefore, the suggestions generated in this study would possess a certain level of flexibility to allow organisations to self-tailor the strategy to fit their unique needs.

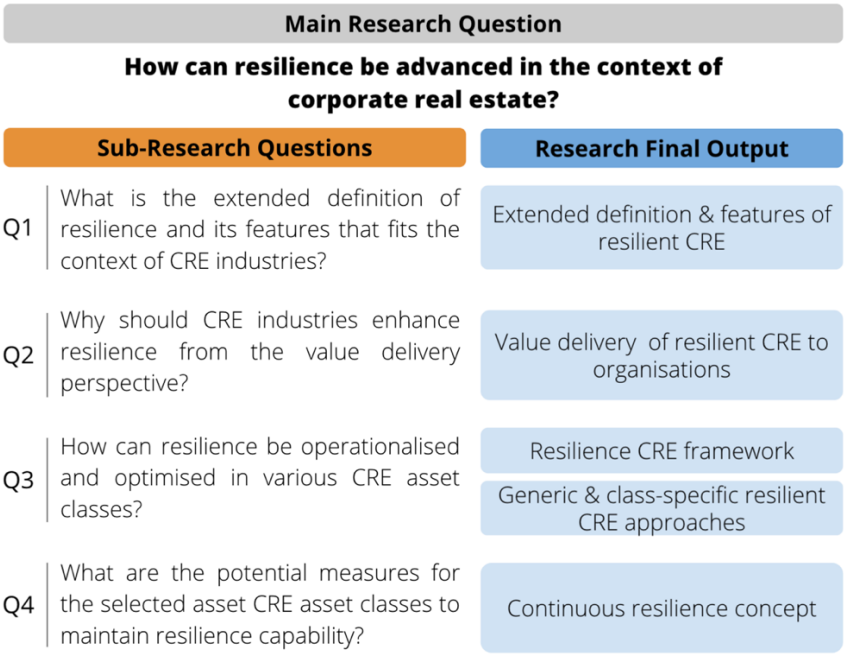


Figure 1.04. Research output based on the steps (source: Author).

This research delivered one central output of approaches to advance resilience of the selected CRE asset classes, and their applicability potential to other asset classes. The sets of approaches were differentiated to 1) generic approaches applicable for whole commercial real estate, and 2) the series of specific approaches for each selected asset classes. In addition, several complementary theories were delivered in the process: the extended definition of resilience that would be relevant and applicable to CREM context, its assessment technique, the framework of resilience CRE, and how organisations maintain their ability to provide relevant value delivery, continuously. The relation between the research question and its outputs can be seen in Figure 1.04.

Dissemination and audiences

The audience of this research are the CRE academics and CRE organisations. This research was conducted in the Netherlands, and the empirical data was gained from companies located in The Netherlands. The output of this research, especially the extended resilient CRE concept, the framework and the generic approaches, could also be utilised by CRE management outside The Netherlands. Specific approaches may be applicable to worldwide CRE companies, although further applicability assessments may be needed. Furthermore, the basic concept of assessing suitable resilience approaches is broadly applicable to various specialisations in built environment, in multiple scales.

Chapter 2:
Theoretical Study

2.1. Literature Review: Resilient Corporate Real Estate

- 2.1.1. Corporate real estate
- 2.1.2. Redefining resilience
- 2.1.3. Synthesise: Resilience in CRE industries
- 2.1.4. Summary of literature review findings

2.2. Literature-Based Resilience Framework

- 2.2.1. Categorisation of trends and concepts identified to three different assessments
- 2.2.2. Literature-based framework for resilient CRE
- 2.2.3. Tendency per asset classes
- 2.2.4. Transitioning to empirical study

2.1. Literature Review: Resilient Corporate Real Estate

This chapter dissects two main topics of resilience and CRE, followed by a third section that synthesises these two different fields, through a comprehensive literature review method (Figure 2.01). In the first sub-chapter, corporate real estate in general is explained, along with value delivery in the real estate context and the impact of the current crisis in these various asset classes. The findings are that these asset classes are urged to adapt their operational model to maintain their success rate, and in other words, become more resilient.

The terminology of resilience and its preceding ideologies are discussed in the second subchapter. Some research depicted resilience not as a theory but as a concept. Thus, resilience should continuously be adapted to fit in the recent societal context. Other studies also pointed out the problems associated with resilience. Therefore, this subchapter further analysed the concept of resilience, starting from the general theory and the associated issues, guidelines in redefining resilience, followed by the compilation of resilience concepts in different contexts. Based on the supporting theories, this part concludes the re-conceptualisation of resilience and selected features which believed to be suitable for the research context.

The third subchapter synthesises the findings from the previous subchapters, starting from the concept of resilience in CRE industries, followed by the value of resilience in the context of CRE management. The literature review was concluded by a preliminary attempt of ensuring the continuity of resilience in CRE industries. Continuous improvement possesses the potential to maintain resilience over a longer period of time. Resilience is also highly connected to other well-known concepts, such as continuity (Hassler & Kohler, 2014). It is then believed that through continuous improvement, the most current perception of customers' value would be better captured, thus safeguarding the relevancy of the value delivery and avoid waste produced by 'irrelevant value delivery' in CRE industries. This would lead to continuous resilience, due to the constant adjustments of the organisations to external changes.

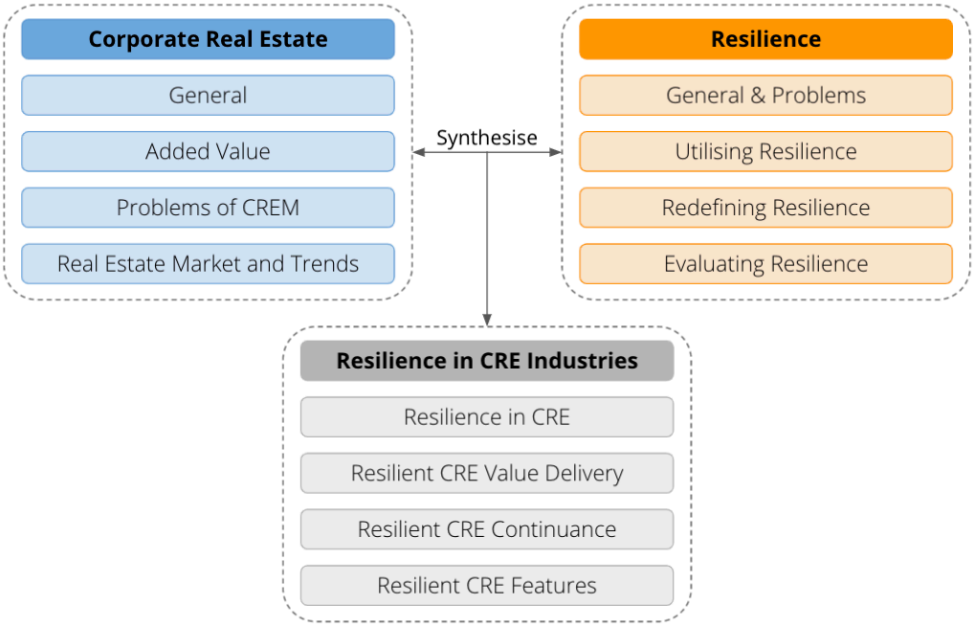


Figure 2.01. Literature review scheme (source: Author)

2.1.1. Corporate Real Estate

Corporate real estate can be defined as a set of properties that serves as the physical entity in which an organisation's business activity takes place. The stated organisation's primary business is often not directly related to the real estate, even though the management of the organisation's real estate may occur as an ancillary activity related to its primary business activity (CoreNet Global, 2015). Here, CREM is defined as the management of real estate by private institutions or businesses (de Jonge, et al., 2009). This includes the strategic and operational alignment of demand and supply sides (de Jonge, 1994; de Jonge, et al., 2009) to deliver mutual added value.

In CRE context, the real estate supports its business functionality as a way to represent its demand and/or user. CRE activities first developed by solely focusing on the management of the business' physical properties. Over the course of time, the scope of its activity may develop into the creation of strategic value through contributions in devising workplace solutions, efficiency enhancement in real estate space, and supply chain through strategic recommendations. Nowadays, CRE are shifting its actors' perception of real estate as cost to real estate as value drivers for its organisation (CoreNet Global, 2015).

Real estate as value

Real estate has the capability to cater custom-fitted products and services (Krumm, Dewulf & De Jonge, 1998). Because of this ability, real estate is not merely an inevitable cost for the organisation but as an asset that may contribute to the creation of value for its occupants by enabling knowledge exchange as well as triggering innovations. Therefore, real estate may also increase the value to an organisation (Jylhä, 2013). This ability is the basis of identifying the added value of CRE management to the organisation (Krumm et al., 1998).

Krumm, Dewulf, and de Jonge (1998) argued that there are essential features to provide added value through the management of CRE, which included 1) the organisation's capabilities and resources, 2) the authorities' ever-changing objective within the corporation, 3) the current context of the organisation's specific market conditions, and 4) the corporate awareness about the presence of products and services that are immediately accessible as a part of the organisation's department. The contextual implications of these features will be further discussed in section 2.1.3.

Various CREM model used to provide added value

Henderson & Venkatraman (1989) provided a theory of strategic alignment framework that was originally developed for the Information and Communications Technology (ICT) field, which can maximise added value to the organisations. This required cross-domain relationships between four quadrants (Figure 2.02). The strategic alignment theory has been used frequently in the context of real estate. According to Jylhä (2019), a strategic alignment is often focused mainly on horizontal alignment, even though simultaneous expansion to both horizontal and vertical alignments – known as the smart CREM alignment – appeared to be more favourable. This would maximise the relevant value delivery and simultaneously avoid irrelevant value delivery in an organisation. Henderson & Venkatraman's strategic alignment model was continuously adapted to many variations that fits more on the context of real estate (Vande Putte, 2019), including the adaptation made by Krumm, et al. (2000) as seen in Figure 2.03. However, it should be emphasised that these two theories (Figure 2.02 & 2.03) were needed to be utilised in two different contexts despite its visual similarities.

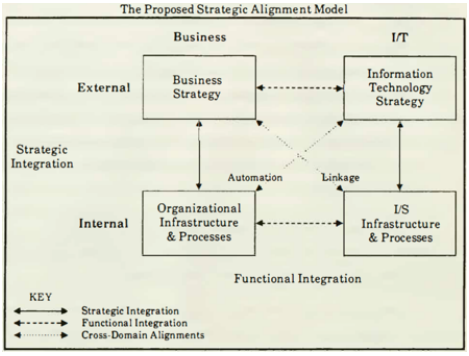


Figure 2.02. Strategic alignment framework (source: Henderson & Venkatraman, 1989).

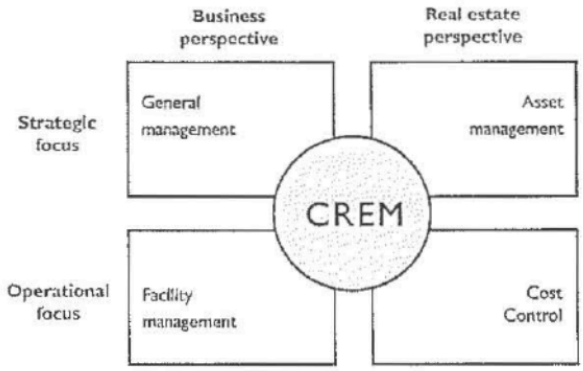


Figure 2.03. Four views scheme (source: Krumm, et al., 2000)

The strategic alignment of Henderson & Venkatraman (1989) represented the relationship between the businesses' entity with their resources. Meanwhile, the four views scheme of Krumm et al. (2020) focused on internal alignments within a CREM function (Vande Putte & Jylhä, 2021). In a common CREM context, Krumm et al. (2000) four views scheme combines two perspectives of business and real estate and two focuses of strategic and operational scopes. Based on the overlapping and non-identical nature of these two theories, Vande Putte & Jylhä (n.d.) proposed the following preposition, visualised in Figure 2.04.

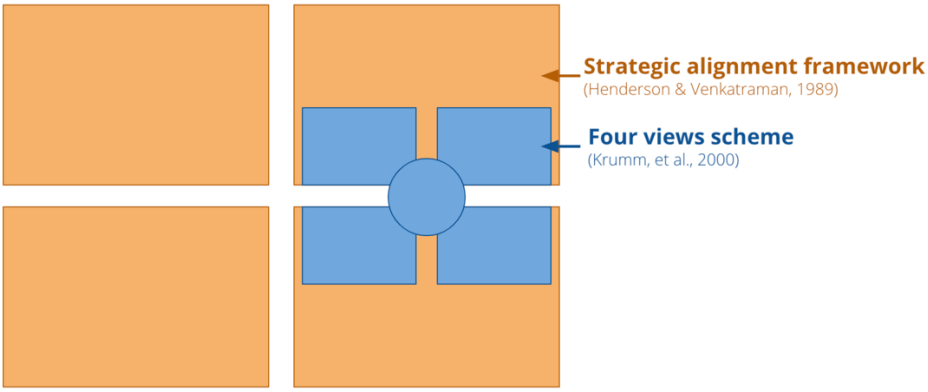


Figure 2.04. Positioning of strategic alignment and four views scheme (source: Vande Putte & Jylhä, 2021)

Strategic alignment framework represents the broader view of the entire company when CRE can be viewed as a resource for the company's business. However, the four views scheme focuses on the narrower scope of CREM context within the industry. Therefore, it should be noted that the left column of the strategic alignment framework was placed in its current position to represent the entire business *of a* company, while the left column of four views scheme represents the CREM business *within* the company (Vande Putte & Jylhä, 2021).

Asset classes in real estate

At a glance, the real estate industry is divisible into the residential and commercial sectors (Dummies: A Wiley Brand, n.d.). Residential properties are mainly rented to families and individual for private purposes. On the other hand, commercial sector focuses on business purposes that generate income. This sector represents a broad range of business types. Hence, it can be categorised into various asset classes. The common asset classes include offices, retails, and logistics (Chen, J., & Anderson, S, 2020).

Different asset classes were differently affected by the disruptions, such as the ongoing COVID-19 pandemic. Generally, European Union area experienced weak economic growth in 2020. Nevertheless, it is projected to have a robust recovery specifically in the second half of the following year (CBRE, 2020c). This empirical study focuses on six different commercial classes – namely offices, retails, industrial/logistics, data centres, healthcare, and educations – and assess the pandemic's impacts on these asset classes. Table 2.01 shows the trends that emerged and the actual condition of real estate markets in 2020.

Table 2.01. 2020 Real estate market, emerging concept and trends of the selected asset classes (source: Author, from various sources)

Asset Classes	2020 Real Estate Market (actual condition)	Emerging Concepts and Trends (current and projected tendency)
Offices	• Investment progress: decline 25-30% (CBRE, 2020a, July) • User behaviour: Wait and see attitude of tenants (CBRE, 2020a, July) • Condition: Amsterdam, The Hague, Utrecht → Continued shortage of high-quality offices and vacancy levels 2% (CBRE, 2020a, July)	• Role of physical office: **meeting place**, vital importance to **facilitate interaction, communication & collaboration**, to maintain **employee health, well-being and productivity.** (JLL, 2020a, April; CBRE, 2020a, July; Cushman & Wakefield, 2020, August; Savills, 2020) • General trend: **distributed workspaces** with **greater agility**, while **reducing office footprint**. (CBRE, 2020c, December) • Workspace level physical requirement: - emphasis on **high quality tech-driven office spaces**, **accessibility, convenience, sustainability, flexible layout, wellness capability, hygiene, minimum air quality requirement.** (CBRE, 2020a, July; CBRE, 2020c, December; Savills, 2020) - **Flexible space** Long term: key feature global office markets (JLL, 2020a, April; CBRE, 2020c, December; Savills, 2020) • System-level requirement: **organisational resilience** (Savills, 2020) • Workstyle model: support **remote working**, **agile choice-based work patterns, hybrid combination** of remote working, district offices hubs and headquarter offices. (CBRE, 2020c, December; Savills, 2020)
Retails	• Investment progress: decline 40% (CBRE, 2020a, July) • User behaviour: - consumers shop less, while making use of the local facilities. (CBRE, 2020a, July) - retailers use the current conditions to acquire retail space on more beneficial agreement. - online retailers to seek smaller, city-store offline markets. (CBRE, 2020c, December) • Condition: dropping rents and expansion of yields in high streets of Europe (CBRE, 2020c, December)	• General trend: **e-commerce expansion**, **flexible omni-channel retail model** and **sustainable fulfilment** (JLL, 2020a, April; OECD, 2020, October) • Sector-specific trend: increasing demand on **groceries, boutique gyms, leisure wear, household appliances and goods,** as well as **home device and technology**. (CBRE, 2020c, December) • Spatial requirement: **Necessary to repurpose locations** that are no longer in demand as retail real estate. (CBRE, 2020a, July)
Industrial	• User behaviour: - Investors are threatened by the impacts of nitrogen crisis and its political implications. (CBRE, 2020)	• General trend: **durability** on this asset classes in **uncertain economic conditions**, yet **dependent to the condition of supply-chains**. (Marcus & Millichap, 2020, May) • Physical trends: - **Centralisation** to maintain safety oversight, which may result in **vacant smaller clusters**

	- Short-time leases is a way to deal with the ongoing crisis (Marcus & Millichap, 2020, May)	- Emphasis on **last-mile distribution space** in result of stay-at-home regulation - **Safety stockpiling** and **cold storage use** - Space demand evaluation is necessary (Marcus & Millichap, 2020, May)
Industrial (Logistics)	• Investment progress: remains stable (CBRE, 2020a, July) • User behaviour: wait and see attitude of tenants in logistic sector (CBRE, 2020a, July) • Condition: - Pre-let projects - E-commerce increase: positive impact on logistical demand (CBRE, 2020a, July)	• General trends: - Concentration on **supply chain risk mitigation** and **resilience** - Expectation of **higher rental growth in urban areas** due to higher demand from e-commerce sectors, bringing **logistics closer to urban consumers** - **Transformation of retail parks to logistics distribution centres** (JLL, 2020a, April; CBRE, 2020c, December) • Site requirements: Warehouse **demand near ports** is increasing because interruption on international shipping (Marcus & Millichap, 2020, May) • Building-level physical requirements: - Demand for **modern units with higher ceiling height** to increase **efficiency** through **technology and automation** - Increasing demand of **cold-storage facilities**, especially for non-store distribution center of supermarkets due to increasing online grocery orders. (CBRE, 2020c, December)
Data Centres	• Investment progress: - this sector is benefited by the COVID-19 pandemic - increasing demand but not enough supply (CBRE, 2020c, December) • Conditions: power supply overconsumptions (CBRE, 2020c, December)	• General trends: Shifting behaviors to anything **online**, and this trend will continue to grow. (CBRE, 2020c, December) • Site-selection trends: - High emphasise on land selection depends on the **government/local regulations towards the energy consumptions** of data centres. - High demand in the locations **where hyperscalers have built out cloud availability zones** (companies that have dominated public cloud services) (CBRE, 2020c, December)
Healthcare	• Investment progress: - remains stable - investors still showing interest (CBRE, 2020a, July)	• General trends: **Digitalisations (e.g., digital consultations)** that is resulted in positive experience due to financial and time-saving benefits (CBRE, 2020d) • Specific trends: **patient-oriented care** (CBRE, 2020d) • Design trends: evidence-based design, **multi-year maintenance plan** (MYMP) - 3 thematic focuses: safety, well-being and staff effectiveness - Spatial layout - Effect of the environment (CBRE, 2020d) • Increasing demands: **healthcare centres**, **nursing homes** and **senior housing** especially due to the aging Dutch population. (CBRE, 2020a, July)
Education	• Investment progress: - Increasing investment on education technology (HolonIQ, 2020, July; Gallagher & Palmer, 2020, September) - Public universities have higher return on investment than private institutions (Business Insider, 2020, August) • User behaviour: university reduces tuition fees which resulted in the increase of enrollment	• General trends: - increasing **technology** and **online course design** (McKinsey, 2020a, April) - **hybrid solution** for campuses, which combined high-tech campus with analogue, old-school campus (Den Heijer, 2020, July) • Workspace requirements: strengthen norms in workspaces (McKinsey, 2020a, April) • Plan of action: scenario planning processes and portfolio of actions (McKinsey, 2020a, April)

	(Gallagher & Palmer, 2020, September) • Conditions: - Decrease in public fundings, which may affect the university income (Estermann, et al., 2020, May)	
Overall	• Investment progress: - Weak economic growth in European Union area (CBRE, 2020c, December) - Global CRE deal volume declined about 36% year over year (Deloitte, 2020b, December) • Conditions: - Some asset classes have been positively impacted (e.g., healthcare, industrial, data centers), some negatively impacted (e.g. offices and retails). (Deloitte, 2020b, December) - Higher operational costs due to stricter and additional health and safety measures (Deloitte, 2020b, December)	• Site-level trends: Pandemic increase the preference of **lively central locations** with **high urban amenities**. (Cushman & Wakefield, 2020, August) • Activity-level trends: **Digitization and technology-driven requirements** - Cloud-based collaborations and data sharing - Productivity tools to lower technology in-house expenses and increase flexibility - "Security-by-design", customized controls integrated to the new solutions (Deloitte, 2020b, December) • Priorities: **Health, safety** and **well-being** (CBRE, 2020c, December) • Concerns: **cybersecurity** and **privacy concerns** (Deloitte, 2020b, December) • Accuracy on the projected trends: **Clearer trends will emerge post COVID-19 vaccine.** (CBRE, 2020c, December) • Plan of action: - Acceleration of **digital transformation** - IoT sensor data - Improvement of **data analytics** - **Safeguard data privacy** and **improve cybersecurity** - Enhance business resilience through operational level optimisations - Enhance asset portfolios (Deloitte, 2020b, December)

The current pandemic situation created a high degree of uncertainties. Table 2.01 identified the decreasing investments in most of the selected asset classes. However, there is a significant increase of interest for digitalisation in offices and educational campuses to support remote working and learning. A rise in digital consultation for healthcare facilities and a boost in e-commerce for retail sector which also appeared to have impacted the use of logistical spaces, created significant influence for the data centre facilities. There were also trends and shifts in roles that may alter future requirements of these asset classes.

Businesses are demanded to rethink and reinvent themselves to become more resilient and adapt their operational model to better fit into the "new normal" phase (JLL, 2020a). Changes are bound to happen one way or another. In this context, JLL (2020a) projected four stages of transition: prepare, respond, re-entry, and re-imagine. The success rate of a business' future depends on how well they manage these stages. Therefore, the identified trends and conditions on Table 2.01 will be utilised in formulating the resilience strategy. Nonetheless, looking beyond the pandemic, real estate sector is still projected to remain stable. A lot of pre-pandemic real estate trends are expected to remain functional in shaping this sector (JLL, 2020a).

2.1.2. Redefining Resilience

The importance of resilience needs to first be embraced. As the world become the witness of the ongoing catastrophic events, it is realized that change is indeed inevitable. Resisting or ignoring the inevitable change will only exacerbate a system's vulnerability and relinquish further opportunities. Yet, every system responded differently to disturbances, depending on their context, scales, and their unique ongoing condition (Brian & Salt, 2006). This section will dissect the concept of resilience that will be used in its re-conceptualisation to fit in the CRE industries.

The word "resilience" came from the Latin word of "*resilire*" which means "to bounce back" (Merriam-Webster, n.d.). In a literal sense, resilience can be defined as an ability to recover to its normal state after receiving an external pressure, through two different ways by (1) being strong, or (2) being flexible (Merriam Webster, Cambridge Dictionary, and Oxford Languages). The term 'resilience' has been used more and more frequently in the recent years (Hassler & Kohler, 2014) in academic reports, practical and policy discussions (Meerow et al., 2016; Deppisch, 2017a), where the term was seen as a way to respond to issues in climate change, socio-economic insecurities and other uncertainties (Davoudi et al., 2013). This interest has increased even more since the start of the COVID-19 pandemic (Deloitte, 2020a; covid19resilience.org; Ernst & Young, 2020; McKinsey, 2020b). Although this growing interest of resilience enables its integration in urban contexts, there is a risk that this term becomes ambiguous (Hassler & Kohler, 2014) and rather abstract (Desouza & Flanery, 2013) especially in the academic field (Lhomme, Serre, Diab, & Laganier, 2013; Pendall, Foster, & Cowell, 2010; Meerow et al., 2016).

Guideline in redefining resilience

An unambiguous definition that fits into the discipline of CRE industries needs to be developed before its implementation to the selected asset classes (Hassler & Kohler, 2014). In the understanding the resilience, several research pointed out the importance of asking the fundamental questions such as "resilience *of what?*" (Hassler & Kohler, 2014; Deppisch, 2017a), "resilience *to what?*" (Hassler & Kohler, 2014, Meerow et al., 2016; Porter & Davoudi, 2012), "resilience *from what?*" (Porter & Davoudi, 2012), "resilience *for whom?*" (Hassler & Kohler, 2014; Deppisch, 2017a; Meerow et al., 2016), as well as "*when, where and why?*" (Meerow et al., 2016). In addition, answering "*who gets to decide?*" (Porter & Davoudi, 2012) also plays a significant role in the planning context where political reasons are inseparable, whereas answering this question will not just responding to the challenges but shaping the further approaches as well (Davoudi et al., 2013).

The first question ("resilience *of what?*") may refer to the resilience in the context of the built environment, specifically in the CRE industries. Several research gave multiple suggestions regarding the operationalisation of the built environment with multi-scale and through a different period of time. Addressing the second question, "resilience *to what?*", may require further elaboration of threats and the multiple scenarios regarding the connectivity of one threat to another as well as how that would impact on the built environment itself. Thus, the re-conceptualisation of resilience would only be discovered through multiple scenarios which then become a pattern of specific industry or clusters of similar industries (Hassler & Kohler, 2014).

Resilience through different lenses

There are numerous definitions of resilience that may support a diverse interdisciplinary scientific research regarding the tpic (Star & Griesemer, 1989; Meerow et al., 2016). Generally, resilience can be

defined as the recovery capability of a system following external shocks. In an urban context, Meerow et al. (2016) defined resilience as a system's ability to manage or immediately recover to their desired functions in event of a disruption, which is to acclimate to the changes, and to rapidly change the systems that do not comply towards its future adaptation ability. Hassler and Kohler (2014) proposed their own definition of resilience, which can be applied and continually developed to fit multi-levels in the built environment. Their general definition was centralised on "capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks, and therefore identity" (Hassler & Kohler, 2014, page 125). Note that in this definition, the term "coping" was considered to exist outside the scope of resilience. Coping has a negative connotation for being a bare reaction following a disruption (Cambridge Dictionary, n.d.-a; Dictionary.com, n.d.). Hence, coping was described as merely dealing with the condition, but not responding the problem which caused the disruption. On the other hand, resilience depicted the presence of an effort to respond or address the problem itself.

Hassler and Kohler (2014) as well as Swanstorm (2008) argued how resilience is a conceptual framework. Therefore, resilience could not be simplified into a theory. Meerow et al. (2016) also believed that the definition should remain flexible to enable collaboration with various disciplines. Hence, exact redefinition of resilience into a single concept should be treated as an important step during a research to fit its wide contextual perception to the context of the particular field of interest. Subsection 2.1.3 will further elaborate on the concept of resilience in CRE industries.

Resilience can be used as a bridging concept between disciplines (Beichler et al., 2014; Chelleri & Olazabal, 2012; Deppisch, 2017a). Many of the definitions emphasised generic adaptability and flexibility (Coaffee, 2013; Desouza & Flanery, 2013; Wardekker et al., 2010; Meerow, et al., 2016; Davoudi et al., 2013). According to Hassler & Kohler (2014), resilience is highly related to other concepts such as continuous, long-term goals and stability. These concepts showed that resilience may change according to the scales to which it is being reviewed upon (Hassler & Kohler, 2014). The definition of resilience concept from different authors and subject areas is summarized on Table 2.02.

Table 2.02. Definition of resilience from different authors (Source: Author, from multiple sources)

Source				Subject area	Definitions
Type	**Topic**	**Year**	**Author**		
Others	Dictionary	n.d.	Oxford Languages	Literal definition	"1. the capacity to recover quickly from difficulties; toughness. 2.the ability of a substance or object to spring back into shape; elasticity."
Others	Dictionary	n.d.-b	Cambridge English Dictionary	Literal definition	"the ability of a substance to return to its usual shape after being bent, stretched, or pressed"
Others	Dictionary	n.d.	Merriam-Webster	Literal definition	"1: the capability of a strained body to recover its size and shape after deformation caused especially by compressive stress 2: an ability to recover from or adjust easily to misfortune or change"
Journal	Regional Science	2005	Rose & Liao	General, Compilation	"the capacity to absorb stress and shocks (Holling; 1973; Perrings, 2001)"
Others	Social-ecological systems	n.d.	Resilience Alliance	General, Compilation	"Resilience is the capacity of a social-ecological system to absorb or withstand perturbations and other stressors such that the system remains within the same regime, essentially maintaining its structure and functions. It describes the degree to which the system is capable of self-organization, learning and adaptation (Holling 1973, Gunderson & Holling 2002, Walker et al. 2004)."
Book	Resilience thinking	2006	Brian & Salt	General	"The ability of a system to absorb disturbance and still retain its basic function and structure" (p. 1)

Book	Disaster risk reduction	2009	UNISDR*	General	"The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions." (p.24) **UNISDR: United Nations International Strategy for Disaster Reduction*
Journal	Planning Practice & Research	2013	Coaffee	General	". . . the capacity to withstand and rebound from disruptive challenges . . ." (p. 323).
Journal	Technological Forecasting & Social Change	2010	Wardekker et al.	General	". . . a system that can tolerate disturbances (events and trends) through characteristics or measures that limit their impacts, by reducing or counteracting the damage and disruption, and allow the system to respond, recover, and adapt quickly to such disturbances" (p. 988).
Journal	Building research & information	2014	Hassler & Kohler	General	"The capacity of a system to experience shocks while retaining essentially the same function, structure, feedbacks and therefore identity" (p. 125).
Others	Urban resilience thinking	2014	Elmqvist	General	"The capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, and feedbacks, and therefore identity (i.e., capacity to change in order to maintain the same identity)" (Table 1)
Journal	Environment & Urbanization	2012	Brown et al.	Climate change resilience	". . . the capacity . . . to dynamically and effectively respond to shifting climate circumstances while continuing to function at an acceptable level. This definition includes the ability to resist or withstand impacts, as well as the ability to recover and re-organize in order to establish the necessary functionality to prevent catastrophic failure at a minimum and the ability to thrive at best" (p. 534).
Journal	Regional Science	2005	Rose & Liao	Business resilience	"inherent ability and adaptive responses that enable firms and regions to avoid potential losses" (p. 75)
Journal	Regional Science	2005	Rose & Liao	Economic resilience	"economic resilience refers to the ability or capacity of a system to absorb or cushion against damage or loss" (p. 78)
Journal	Landscape and Urban Planning	2016	Meerow, Newell & Stults	Urban resilience	"Urban resilience refers to the ability of an urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity" (p.39).
Journal	Cities	2013	Desouza and Flanery	Urban resilience	"ability to absorb, adapt and respond to changes in urban systems" (p. 89).
Journal	Resilience and urban risk management	2013	Lhomme et al.	Urban resilience	". . . the ability of a city to absorb disturbance and recover its functions after a disturbance" (p. 222).
Book	Urban regions	2017	Athanasiadou & Tratsela	Urban resilience	"a resilient city is a flexible, easily transformed 'organism' which comes in a form of equilibrium to satisfactorily meet quality criteria of living" (p. 19)
Others	Urban resilience	2012	Chelleri & Olazabal	Urban resilience	"multidisciplinary framework to explore the reactive, recovery and adaptive capacities and also the transformability of (and within) urban systems" (p. 74)

The definitions from Table 2.02 have recurring characteristics such as **strength, resistance, porosity, elasticity, adaptability, transformability, responsiveness, and quick recovery**, as summarised in Table 2.03. The selected definition of these eight characteristics is presented below and Figure 2.07.

Strength vs Resistance

Strength is defined as toughness, whereas *resistance* refers to a system's ability to withstand force and pressure which allows it to retain its original state. In this case, *strength* can refer to a system's ability to tolerate disturbances or protect against damages or loss. *Resistance*, on the other hand, can be defined as a system's intrinsic capability to resist changes and maintain their current state.

Porosity

Porosity refers to a system's ability to absorb external disturbances (Figure 2.05).

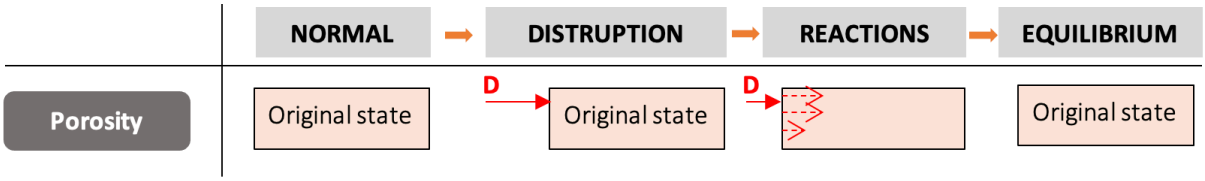


Figure 2.05. Illustration of porosity (source: Author)

Elasticity vs Adaptability vs Transformability

Elasticity refers to the ability of a system to bend and return to its initial condition. *Adaptability* is a system's capability to incrementally adjust their structure that is not necessarily identical to its original state. Meanwhile, *transformability* refers to a system's capability to learn and innovate a new structure unlike its original state. Such structural changes may require radical alteration of the system's current pathway. Figure 2.06 illustrates the difference between three characteristics.

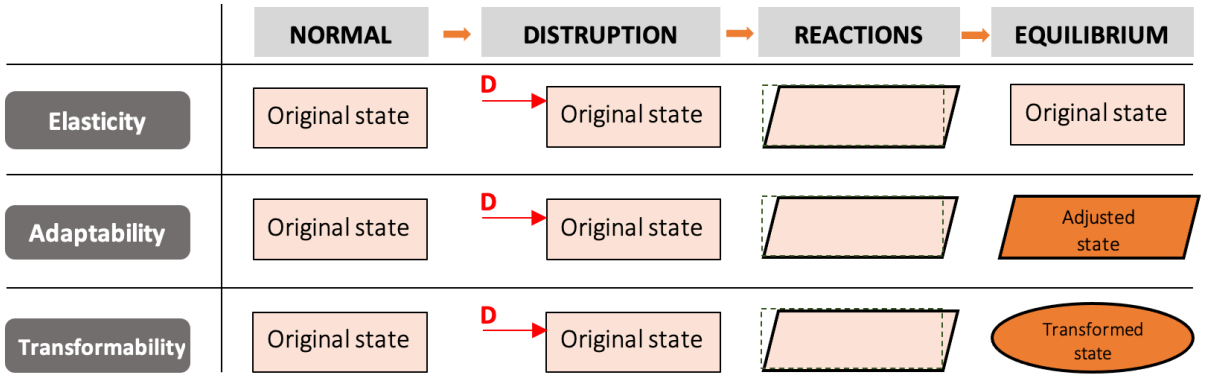


Figure 2.06. Illustration of elasticity, adaptability, and transformability (source: Author).

Responsiveness

Responsiveness refers to a system's capacity to respond in the event of external disruption(s).

Quick Recovery

Quick recovery refers to a system's ability to quickly recover to their normal operation and achieve its initial production output after being exposed to an external disruption. This definition does not discriminate the general strategy taken for the system to recover.

Definitions of the recurring resilience characteristics

Strength	: ability to tolerate disturbances or protect against damages or loss
Resistance	: intrinsic capability to resist changes and maintain their current state.
Porosity	: ability to absorb external disturbance(s).
Elasticity	: ability to bend and return to its initial condition.
Adaptability	: capability to incrementally adjust their structure that is not identical to its original state.
Transformability	: capability to learn and innovate a new structure contrast to its original state, which may requires radical transformation of the current pathway.
Responsiveness	: capacity to respond in the event of external disruption(s).
Quick Recovery	: ability to quickly recover to their normal operation and achieve its initial production output following external disruption(s).

Figure 2.07. Definitions of the eight recurring characteristics of resilience (source: Author)

Table 2.03. Characteristics of resilience definitions (Source: Author, from multiple sources)

Source		Definition	Characteristics							
Year	Author		Strength	Resistance	Porosity	Elasticity	Adaptability	Transformability	Responsiveness	Quick Recovery
n.d.	Oxford Languages	"1. the capacity to **recover quickly** from difficulties; **toughness**. 2.the ability of a substance or object to spring back into shape; **elasticity**."	○			○			○	○
n.d.	Cambridge English Dictionary	"the ability of a substance to **return to its usual shape** after being bent, stretched, or pressed"				○			○	
n.d.	Merriam-Webster	"1: the capability of a strained body to **recover its size and shape** after deformation caused especially by compressive stress 2: an **ability to recover from or adjust easily** to misfortune or change"				○	○		○	○
2005	Rose & Liao	"the capacity to **absorb stress and shocks** (Holling; 1973; Perrings, 2001)"			○					
n.d.	Resilience Alliance	"Resilience is the capacity of a social-ecological system to **absorb or withstand perturbations** and other stressors such that the system remains within the same regime, **essentially maintaining its structure and functions**. It describes the degree to which the system is capable of self-organization, learning and **adaptation** (Holling 1973, Gunderson & Holling 2002, Walker et al. 2004)."		○	○	○	○		○	
2006	Brian & Salt	"The ability of a system to **absorb disturbance** and still **retain** its basic function and structure" (p. 1)		○	○					
2009	UNISDR*	"The ability of a system, community or society exposed to hazards to **resist, absorb, accommodate to and recover** from the effects of a hazard in a timely and efficient manner, including through the **preservation and restoration of its essential basic structures and functions**." (p.24) **UNISDR: United Nations International Strategy for Disaster Reduction*		○	○	○			○	○
2013	Coaffee	". . . the capacity to **withstand and rebound** from disruptive challenges . . ." (p. 323).		○		○			○	
2010	Wardekker et al.	". . . a system that can **tolerate disturbances** (events and trends) through characteristics or measures that limit their impacts, by **reducing or counteracting** the damage and disruption, and allow the system to **respond, recover, and adapt quickly** to such disturbances" (p. 988).	○	○		○	○		○	○
2014	Hassler & Kohler	"The **capacity of a system to experience shocks** while **retaining** essentially the same function, structure, feedbacks and therefore identity" (p. 125).	○	○						
2014	Elmqvist	"The capacity of a system to **absorb** disturbance and **reorganize while undergoing change** so as to **still retain essentially the same function, structure, and feedbacks**, **and therefore identity** (i.e., capacity to change in order to maintain the same identity)" (Table 1)		○	○	○			○	
2012	Brown et al.	". . . the capacity . . . to dynamically and effectively **respond** to shifting climate circumstances while **continuing to function at an acceptable level**. This definition includes the ability to **resist** or **withstand impacts**, as well as the ability to **recover and re-organize** in order to establish the necessary functionality to prevent catastrophic failure at a minimum and the ability to thrive at best" (p. 534).	○	○		○			○	○
2005	Rose & Liao	"inherent **ability and adaptive responses** that enable firms and regions to avoid potential losses" (p. 75)				○	○		○	
2005	Rose & Liao	"economic resilience refers to the ability or capacity of a system to **absorb or cushion against damage or loss**" (p. 78)		○	○					
2016	Meerow, Newell & Stults	"Urban resilience refers to the ability of an urban system-and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales-to **maintain or rapidly return to desired functions** in the face of a		○		○	○	○		○

		disturbance, to **adapt** to change, and to **quickly transform systems** that limit current or future adaptive capacity" (p.39).								
2013	Desouza and Flanery	"ability to **absorb, adapt and respond** to changes in urban systems" (p. 89).			○			○	○	
2013	Lhomme et al.	". . . the ability of a city to **absorb** disturbance and **recover** its functions after a disturbance" (p. 222).			○					○
2017	Athanasiadou & Tratsela	"a resilient city is a **flexible**, **easily transformed** 'organism' which comes in a form of equilibrium to satisfactorily meet quality criteria of living" (p. 19)				○	○	○		
2012	Chelleri & Olazabal	"multidisciplinary framework to explore the **reactive, recovery and adaptive capacities** and also the **transformability** of (and within) urban systems" (p. 74)				○	○	○	○	○
		TOTAL	**4**	**10**	**8**	**13**	**7**	**4**	**12**	**8**

Redefining resilience: extended definition of resilience in a general organisational context

Based on the various definitions (Table 2.03) and the recurring characteristics (Table 2.04), it can be concluded that to achieve resilience, a system would have to possess the capability to response (*responsive*) and reach the desirable state in a relatively short time span (*quick recovery*) following an external disruption, through three distinct strategies: (1) by being relatively invulnerable to external disruption (*porosity, strength, resistance*), (2) by being able to recover to its original state following an impact of an external event (*elasticity*), and (3) by being able to reach a new optimum state following an impact of an external event (*adaptability, transformability*). These general definitions are summarised in Figure 2.08.

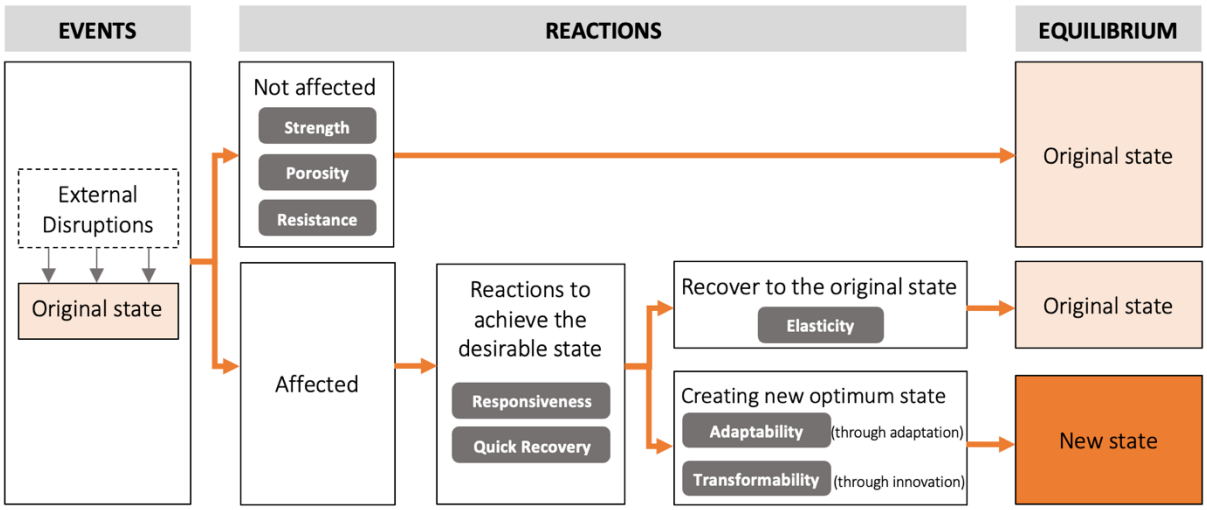


Figure 2.08. Summing up resilience through multiple definitions (source: Author).

This formulation of resilience is also supported by Davoudi, Brooks & Mehmood (2013), who described the prevalence of two different types of resilience: one that maintain its original state and the other that also integrates the adjustment of a state following stress and strains.

In engineering and ecological subjects, resilience is often viewed as the ability to retain an original state following external disruption as mentioned on points (1) and (2) of the three distinct strategies pointed above, with emphasis on both system's duration to bounce back as well as the amount it takes until breakdown point or the change of function (Davoudi et al., 2013). Hence, it focuses on either

maintaining the efficiency or existence of functions (Holling, 1996; Davoudi et al., 2013). Meanwhile, evolutionary resilience tend to focus on resilience beyond equilibrium, which integrate dynamic interaction between persistence, adaptability and transformability through multi-scales and timeframes in a system (Davoudi, 2012; Davoudi et al., 2013). This concept believes in the ability of a system to change, adapt or transform as a response to disruptions (Carpenter et al., 2005; Davoudi et al., 2013). Through adaptive cycle, the system is able to self-organise to maintain resilience. This is considered as a less vulnerable approach to resilience, since the previous approach to "conserve the original state" creates more vulnerability to future stress and strains, which may damage the whole system (Davoudi et al., 2013).

Davoudi's theory about evolutionary resilience (2013) fits the re-conceptualisation described in Figure 12. *Strength*, *resistance*, *porosity* and *elasticity* identified in Figure 2.08 can be considered as persistence, while adaptability and transformability were identifiable from both the literature (Davoudi, 2013) and the prior analysis. In addition, achieving resilience requires not only the capability of a system to recover from disruption but also the ability to develop preparedness to assess transformation opportunities. In this context, preparedness was viewed as an essential aspect due to the unknown and sometimes inevitable nature of external changes (Figure 2.09). The preparedness characteristic perceived as the capability to guide transformation directions of the future. Evolutionary resilience also admitted its continuality, which is associated with continuous learning and transformative potentials (Davoudi et al., 2013). This finding was thus in line with the concept of continuous improvement to help achieving resilience in a long-time span, which will be further discussed in section 2.1.3.

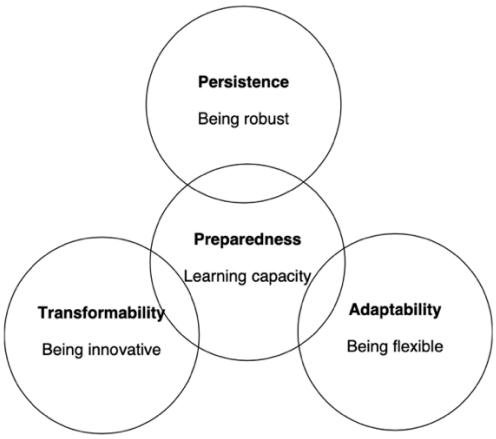


Figure 2.09. Components of resilience (source: Davoudi et al., 2013).

Features of resilience

Concluding from the extended definition of resilience and the discussions above, we can perceive the three pathways in achieving resilience, which were persistence, adaptability and transformability (Chelleri, Waters, Olazabal, & Minucci, 2015; Chelleri & Olazabal, 2012; Davoudi et al., 2013; Elmqvist, 2014; Meerow et al., 2016). Persistence was referred to the basic principle of engineering that demands systems to be resistant towards disturbances and have the ability to maintain their functional condition (Chelleri, 2012; Davoudi et al., 2013; Meerow et al., 2016). Although resistance in a system is necessary, others believed that adaptation and fundamental transformation are more favorable (Brown et al., 2012) because it is less vulnerable to future uncertainties (Davoudi et al., 2013), despite its requirement of a more extensive structural changes. This is especially important when the current system is deemed unable to persist their normal condition (Folke, 2006; Jerneck & Olsson, 2008). Davoudi et al. (2013)

also added the fourth component of preparedness, which reflects on the intentions of actions and interventions of the actors involved. The following Table 2.04 will further dissect and compare on each of the features.

Table 2.04. Features of resilience. (Source: Author, adapted from Davoudi et al., 2013; Meerow et al., 2016; Davoudi, 2012)

	Persistence	Adaptability	Transformability	Preparedness
State	**Maintain** original state	**Allow changes** on one's structure		-
Capability	**Being robust**	**Being flexible and resourceful**	**Being innovative**	**Learning capacity**
Explanation	Ability to **resist disturbances** by resisting a certain level of stress and strain, during and shortly after impacts	Ability to **handle disturbances**, by making **incremental changes**	Ability to **move towards more desirable** pathway following disturbances	The capacity to **reflect** the intentionality of actions and interventions.
Characteristics	**Short-term robustness, rigidity**. In short-term context, this characteristic have positive connotations. However, in a long-term context, rigidity may be detrimental.	Requires both **flexibility** & **resourcefulness** • Flexibility: acknowledges the existence of networks and cooperation as a way to resilience. • Resourcefulness: related to efficiency, quickness and diversity	Disruptions are considered as the "omega" phase of creative destruction, but it will be continued instantly by an "alpha" phase of **revival and restructuring**, that leads to **uncertain pathways**.	Critical features: • Understanding **probability of events** • Identifying **potential opportunities and vulnerabilities**
Perceived as	• **Marker of resilience** • Indicator of a **well-managed system**	**Start of** structural/systematic **change**	• **Transformation of an system's pathway** • Can be considered as an opportunity to potentially transform systems to entirely different pathways that are more desirable to the organisations. • Yet, to come up on what desirable could be, it may involve the politics and power.	The **human capacity of foresight, intentionality, and anticipation**

Through the aforementioned discussions, we can perceive resilience as a spectrum instead of a state with binary characteristics of either resilient or not resilient. Resilience has a range, and the **four features of (1) persistence, (2) adaptability, (3) transformability and (4) preparedness are the suitable features to determine the resilience capability of a CRE organisation.** Persistence is considered as a marker of resilience (Davoudi et al., 2013), which means that organisations can be considered as resilient if it possesses at least this particular characteristic. Furthermore, the current hypothesis perceived the three out of four features, (1) persistence, (2) adaptability and (3) transformability, as a sequential characteristic (Figure 2.10). In other words, if adaptability is possessed, then an organisation would inherently also possess persistence capabilities. The following empirical study was performed to evaluate the feasibility this proposed explanation.

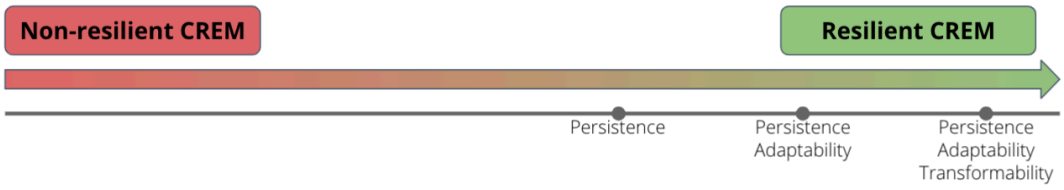


Figure 2.10. Hypothesis: Characteristics of resilience features (source: Author).

The positioning of the fourth component of preparedness was not as straightforward as the other three features. Due to its abstract nature, this feature could not be positioned in the sequence as seen in Figure 14. The existence of (1) persistence, (2) adaptability, and (3) transformability does not guarantee the presence of (4) preparedness component. This will be further investigated in section 2.1.3.

2.1.3. Synthesise: Resilience in CRE Industries

Extended definition of resilience in CRE context

The previous sub-chapters of described corporate real estate and resilience separately. In these previous discussions, the general term of resilience was redefined (Figure 2.08). Here, the term resilience that fits into the context of CRE industries is discussed. Figure 2.11 elaborates the **redefined concept of resilience in CRE industries**, which is the definition that is utilised in this research.

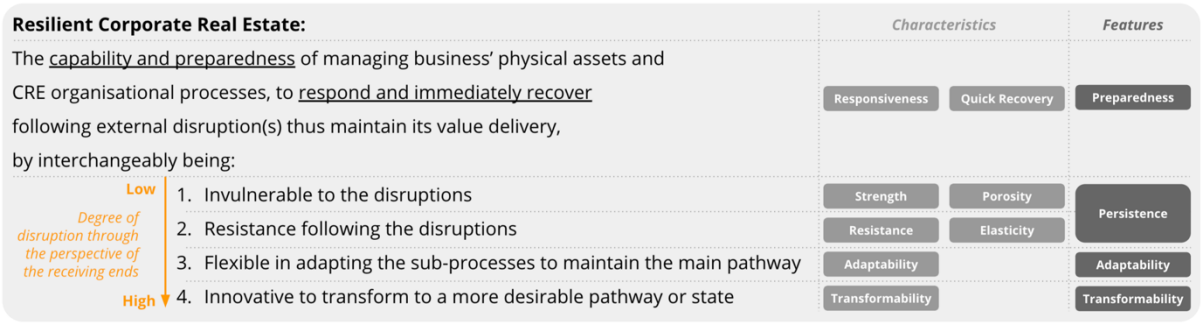


Figure 2.11. Definition of the resilient CRE (source: Author).

Resilient CREM as an added value to the organisation

Real estate decisions may pose direct and/or indirect impact on the core business (Gibler & Lindholm, 2012). Corporate real estate provides added value to the overall organisational performance, and indirectly generates income (de Jonge, 1994; de Jonge et al., 2009). The long-term real estate decision may thus support or hinder an organisation's operational activities (Weatherhead, 1997). On previous discussion, Krumm, Dewulf & de Jonge (1998) identified the three key elements to provide added values within an organisation, which includes corporation's capability and resources as well as the ever changing demands, contexts and markets. Change in the economic conditions and built environment circumstances may require changes in the real estate context (de Jonge, et al., 2009).

Therefore, enhancing resilience capability in real estate would provide additional value to the CRE management and, consequently, to the overall organisation's performance. In the event of an external disruption, such as physical disasters, economic downturn, or global epidemic, having resilience in an organisation's real estate management may sustain the organisation's ability to provide stable output. Resilience capability is one of the determining factors that decides if the disruptions create would hinder the main business activities of an organisation.

Table 2.05. Comparison between contribution of real estate and resilience to the organisations (source: Author, adapted from de Vries, 2007 & de Jonge, et al., 2009)

Ten contributions of real estate to the core organisations (de Vries, 2007; de Jonge et al., 2009, p. 18)	Contribution of resilient real estate to the core organisations	Explanation
1. Increasing productivity	✓	Maintaining productivity in events of external disruptions.
2. Supporting image	×	n/a
3. Enhancing flexibility	✓	Enhancing flexibility to adapt and transform in an organisation.
4. Improving culture	×	n/a
5. Stimulating innovation	✓	Resilience requires constant evaluation and innovation.

6. Increasing satisfaction	✓	Resilience capability protects users' satisfaction during disturbances.
7. Enhancing synergy	✓	Enhancing synergy between organisation (internal) and its external environment.
8. Reducing cost	✓	Cost reduction through its readiness to respond to changing circumstances.
9. Controlling risks	✓	Minimising risks through its readiness to respond to external disruptions.
10. Expanding funding possibilities	×	n/a

Based on de Vries (2007), real estate contributes to the organisation's objective achievement and facilitates its performance in ten ways (Table 2.05). Based on theory-based reasoning, having a resilience capability may support the real estate management in achieving objectives and facilitating performance in seven out of the ten ways described by de Vries. These included maintaining productivity in events of disruptions, controlling and minimising risks, and creating a synergy between organisations and its external environment.

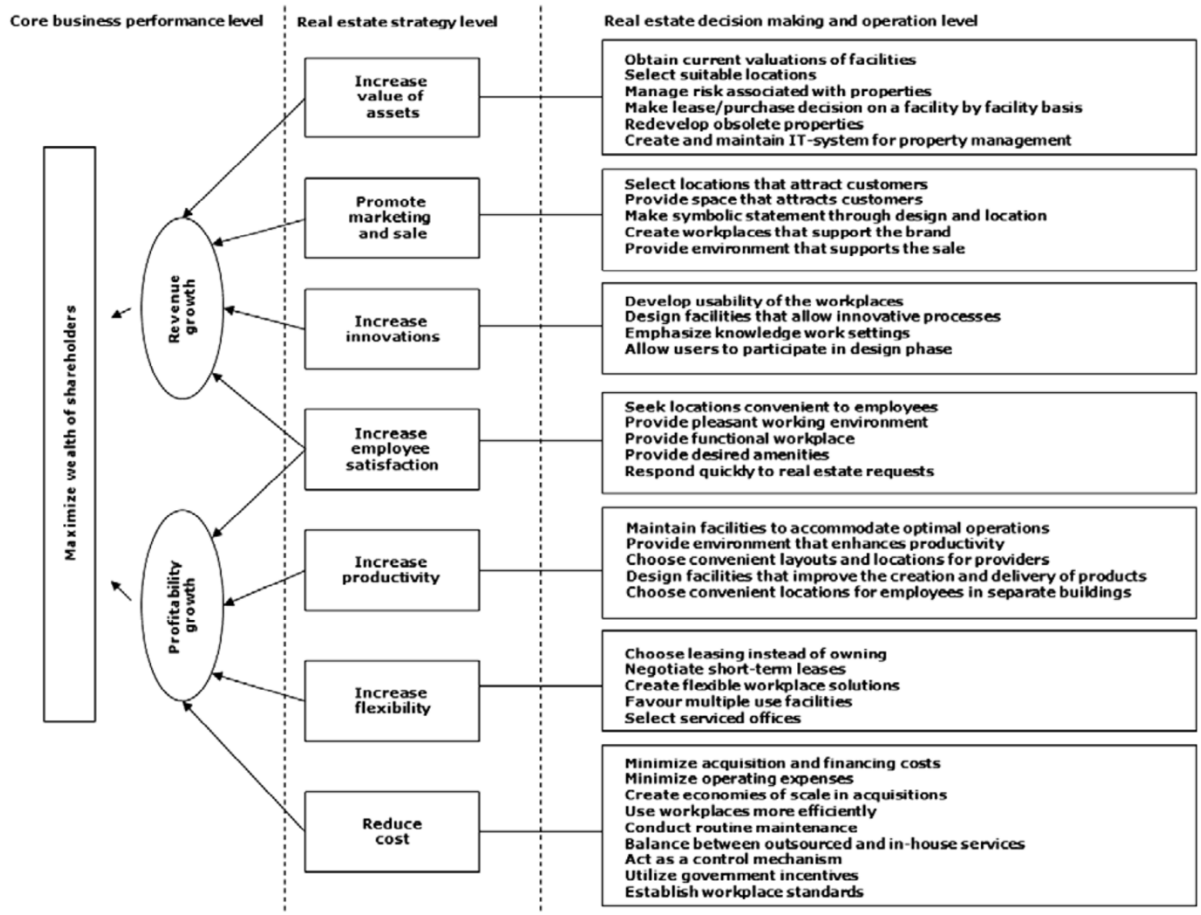


Figure 2.12. Original model* of CRE decisions impact to core business strategy (source: Lindholm et al, 2006, p. 466).
(*) Revised model, which includes environment sustainability component, can be seen in Figure 17.

Gibler & Lindholm (2012) identified seven alternatives in which CRE may contribute in supporting the main business strategies (Figure 2.12). The seven alternatives of strategic levels identified strategic advancement approaches that could lead to either revenue or profitability growth, consequentially maximising stakeholders' wealth. However, during disruptions, CRE that has resilient capability may maintain its revenue and profitability growth by maintaining the seven strategic approaches (Figure

2.13). The operational level decisions identified in Figure 2.12 may also contribute to resilient approaches, which will be identified in Chapter 4 of the Empirical Study.

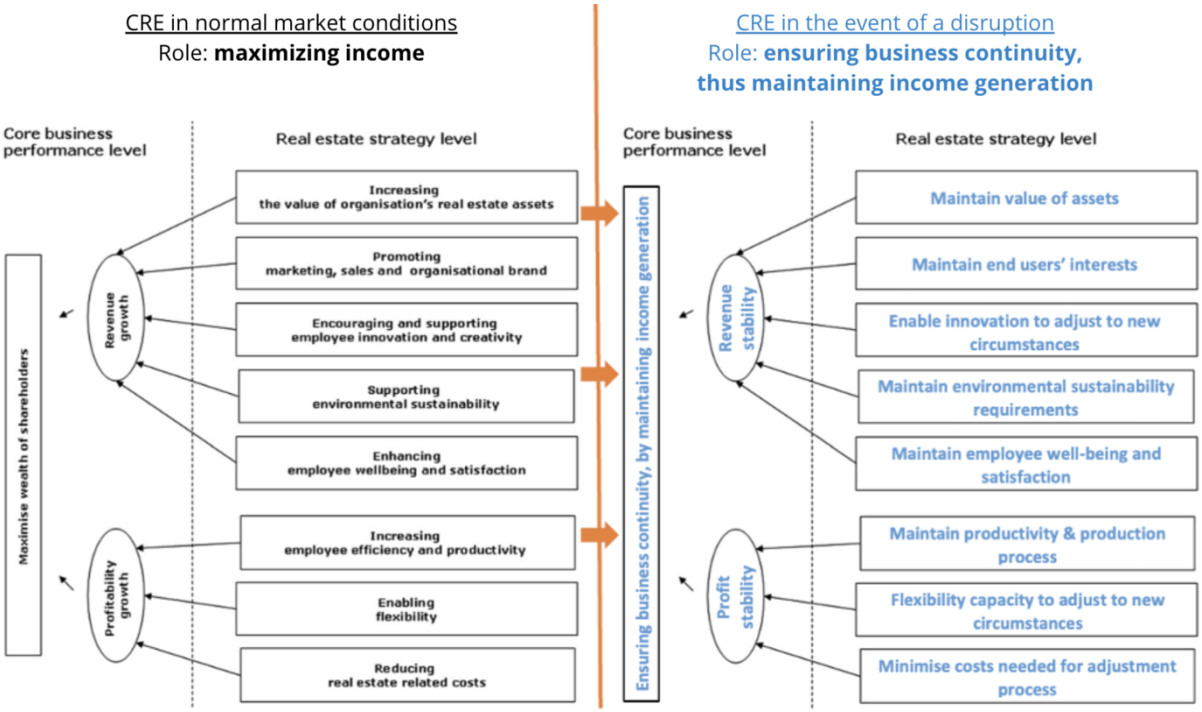


Figure 2.13. Resilient CRE impact to core business strategy, using the revised model (source: modified from Gibler & Lindholm, 2012).

Overall, a resilient real estate will equip and prepare businesses to respond well in event of disruptions. Failure to equip businesses with resilient capability could lead to unfavourable momentary decisions driven by concerns during disturbances (Gibler & Lindholm, 2012). Such events may endanger the business continuity. A resilient real estate is proven to add value to the organisations, especially during various magnitude and nature of disruptions. Resilient real estate can be achieved through series of basic real estate decisions. The following analyses would further identify and classify real estate approaches that could influence resilience capacity within organisations.

Continuity of resilience in CRE industries

The aim of this research is not only to create a strategy for asset classes of CRE to become more resilient, but also to sustain this capability continuously. As explained in section 2.1.2, resilience is linked to long-term goals and stability concepts (Hassler & Koher, 2014). Once resilience is established, CRE industries should be able to maintain and ensure the continuity of resilience in a long-time span instead of being a temporary capacity. That way, resilience supports industries in conducting their business activities. In addition, incorporating resilience in an organisation's real estate should help businesses provide added value in their business activities, especially in the event of an external disruption.

Hassler & Kohler (2014) also connected resilience with the concept of continuity. This was in line with the concept of lean thinking, whereas the key to emphasise value creation for its customer is not merely about capturing customer value and minimising waste, but also continuous improvement (Jylhä, 2013). Below, the three concept of lean thinking is elaborated, while emphasizing one of the concepts of continuous improvement. The concept discussed in the following section of the literature study was used in a later phase of the research, specifically in the attempt to answer the topic of the fourth

research sub-question: maintaining resilience. See Section 5.6 of continuous resilience CREM for the synthesis of this literature review with the obtained case studies.

Lean Thinking

The concept of 'Lean' was first introduced in 1988 by Krafcik. The concept was further popularised by Toyota Production System (TPS), by distinguishing work and waste (Ohno, 1989). Ohno (1989) believes that people need limit production to the level that is needed at the particular instance and, by doing so, minimizes the use of resources. Since then, lean thinking has been recognised as a widely applicable philosophy which goal is to achieve resource efficiency (Chávez et al. 2019; Jylhä, n.d.).

The three concepts of lean, 1) capturing customer value, 2) waste minimisation, and 3) continuous improvement are aimed to achieve efficient and effective use of resources (Jylhä, 2013; Jylhä, n.d.). The three concepts has to be implemented simultaneously to achieve lean management.

Lean thinking aims to implement customer value during the creation phases (Koskela, 2000; Jylhä, 2013). In this case, customer value is defined to how a customer, based on their personal perception, judges the worth of a service or a product. As such, this conception of value is not limited to the service or product's worth in money. This personal appreciation of a product or service may be rooted in a customer's learned perceptions, tendencies, or past evaluation of that particular service/product (Woodruff, 1997; Jylhä, 2013). Lean thinking positions customer value creation as the main goal of its value creation phase (Jylhä, 2013).

The lean thinking framework pursues customer value by enhancing the efficiency of its production phase (Pasquire & Salvatierra-Garrido, 2011; Jylhä, 2013). In addition to that, minimisation of waste was also identified as a key role in the creation of this value as waste and its sources were often found to interrupt production (e.g., Imai, 1997; Womack and Jones, 1996; and Liker 2004) and is associated with value loss (Koskela, 2000). Value creation process in lean thinking includes, 1) value-creating activities, 2) support activities (necessary actions that do not create value), and 3) non-value-generating activities. In this context, lean thinking is aimed to exclude as much non-value-generating activities as possible from the process flow (Jylhä, 2013).

Lean thinking also places continuous improvement as a way to maintain waste exclusion from its processes and, by doing so, maximises the generation of customer value. The ever-changing nature of customer's perception about value leads to a continuous emergence of wasteful processes in a company's production flow. This demanded companies to continuously evaluate their process and operations to maintain the streamlined stance envisioned by lean thinking (Shingo, 1989; Jylhä, 2013).

Overall, the achievement of an effective and resource-efficient process needs to account all of these three concepts of lean. Waste minimisation is required to create an efficient process. Customers' value is also important because product and value delivery would not be possible should it be focused solely on waste eliminations, especially knowing how these output presents as a commodity and/or service for the customers. In addition, continuous improvements are viewed to be as essential as value capturing and waste minimisation due to the customers' ever-changing demands and views. Therefore, processes need to be constantly updated and improved in order to maximise value delivery and eliminate its irrelevant value delivery processes.

Continuous Improvement

Continuous improvement plays a big role on establishing a lean management in CRE industries. Through continuous improvement, the customers' value would be better captured and updated from time to time. Such efforts will then minimise the generation of waste in the process.

Since 1986, the term *kaizen* (Japanese: continuous improvement) has become one of the fundamental concepts of management in Japan. This philosophy believes that the success of an organisation is achievable only through constant improvement by multi-level actors within an organisation, including workers and managerial level actors alike (Imai, 1997).

Western management style tends to emphasise innovation, which often lead to problems at a later stage that are more complex to mitigate. The *kaizen* concept, on the other hand, emphasises on incremental improvement of human resources such as communication, training, involvement, and discipline – minute low-cost development approaches which gradually accumulate into an impactful result (Imai, 1997).

The *kaizen* strategy put more attention to its process, which includes the plan-do-check-act (PDCA) and the standardise-do-check-act (SDCA) cycles, as well as total quality management (TQM), just-in-time, and total productive maintenance (TPM) concepts (Imai, 1997).

Continuous improvement in CRE industry to maintain resilience

Real estate is a rather static factor. Nevertheless, the context of which real estate belongs is continuously changing. Demands will always change, and stakeholders may vary from time to time (de Jonge, et al., 2009). In order to maintain their businesses, CRE industries have to evaluate their output (which includes products and services), as well as their client relations (Krumm et al., 1998). The previous sub-section emphasised the dynamic demand of the client and the market. As such, it is important for CRE departments to be aware of this dynamicity (Krumm et al., 1998).

Overall, the concept of continuous improvement in CRE industries could ensure that the ever-changing demand and market situation will be accommodated continuously (de Jonge, et al., 2009), thereby producing relevant values while simultaneously avoiding unnecessary value delivery. Through constant update of their current products and services, the CRE industries should continuously adjust to the external environment. By doing so, CREM can further improve their relation with their clients, and by doing so helping the organisation in maintaining their positions in the corporation and sustain resilience in their business activities.

Continuous improvement is also related to the preparedness characteristic described by Davoudi et al. (2013). Preparedness, as a learning capacity, demands organisations to reflect, assess the probability of events, and identify the potential impact of both favourable and unfavourable circumstances (Davoudi et al., 2013). Therefore, through the implementation of continuous improvement, the CRE organisations become more prepared in maintaining resilience over the course of time. This is further reassessed through the synthesis with the empirical data in Section 5.6, which attempted to formulate a concept to maintain resilience.

2.1.4. Summary of Literature Review Findings

The CRE sector is projected to remain relevant and stable following the COVID-19 pandemic (JLL, 2020a). As such, CRE is expected to maintain their ability to deliver value to their core businesses. However, certain adjustments might be necessary due to the shift of trends and the realisation of the current system's inadequacy to deal with some types of disruptions. In order to create a more resilient CRE, trends were assessed to be able to make a reasonable projection.

Resilient corporate real estate was re-conceptualised as the **capability and preparedness in the management of businesses' assets and CRE organisational processes, to respond and immediately recover following disruptive external event(s), through a dynamic interaction of being: (1) invulnerable or (2) resistant, (3) flexible in adapting the organisations' sub-processes to maintain their main pathways, or (4) innovative to transform to more desirable pathways.** These four features possess their own characteristics. The four features utilised for the research are (a) persistence, (b) adaptability, (c) transformability, and (d) preparedness, which were adopted from the theory of evolutionary resilience proposed by Davoudi et al. (2013).

The literature analysis identified preparedness as an organisation's capacity to learn. Meanwhile, one of the concepts of lean management emphasises continuous improvement as a recurring evaluation to maintain the delivery of relevant values and minimise the waste produced by the irrelevant value delivery (Shingo, 1989; Jylhä, 2013). During the theoretical synthesis phase, it was realised that continuous improvement could be one of the suitable ways to maintain preparedness in CRE, allowing the sustenance of their resilience capability and satisfy the preparedness characteristic of resilience. Therefore, **improvement of resilience in CRE management industries can be restricted into (a) persistence, (b) adaptable, and (c) transformable features of the asset classes. The fourth feature of (d) preparedness is used to maintain resilience in a long term.**

2.2. Literature-Based Resilience Framework

Here, resilient CRE is further elaborated based on the findings from previous literature review. As a starting point for the operationalisation of resilient CRE, this sub-chapter aimed to produce a literature-based framework to assess resilience through an iterative process of examining recent scientific publications, real estate trends, market conditions, and CRE companies' annual reports. This literature-based framework is used as a basis for empirical study.

The formulation of the literature-based framework was conducted in two steps. First, the trends that were identified on Table 2.01 were classified to three distinct features, namely (a) persistence, (b) adaptability and (c) transformability. As discussed before, the fourth feature, (d) preparedness, was excluded from the current resilience strategy due to its position as a means to maintain resilience after the operationalisation approaches has been established. At this stage, another literature review outside the scope of Table 2.01 was conducted. The outcome of this first step was the classification of the asset classes' concepts and trends to different assessment scope and the categories that represents each trend (see Table 2.07).

Subsequently, based on the outcome of the first step, a framework was developed as a guide for the subsequent empirical study (Figure 2.16). The framework consisted of checkpoints of the three features (persistence, adaptability, and transformability) that can be applied for every asset classes. This framework acted as a standard to compare asset classes in the next step of the research. This literature-based framework was updated and expanded as new information was collected from the interviews (discussed on Chapter 4).

2.2.1. Categorisation of trends and concepts identified to three assessments

Persistence, adaptability and transformability in CRE are believed to be the features of maintaining value delivery in the event of an external disruption. The features of persistence, adaptability and transformability were identified during the theoretical study. Table 2.06 presented the modified version of the characteristics of these three features.

Table 2.06. Previously identified features of resilience (source: modified from Table 2.04)

	Persistence	Adaptability	Transformability
State	**Maintain** original state	**Allow changes** on one's structure	
Capability	**Being robust**	**Being flexible and resourceful**	**Being innovative**
Explanation	Ability to **resist disturbances** by resisting a certain level of stress and strain, during and shortly after impacts	Ability to **handle disturbances**, by making **incremental changes**	Ability to **move towards more desirable** pathway following disturbances
Characteristics	**Short-term robustness, rigidity**. In short-term context, these characteristics have positive connotations. However, in a long-term context, rigidity may be detrimental.	Requires both **flexibility** & **resourcefulness** • Flexibility: acknowledges the existence of networks and cooperation as a way to resilience. • Resourcefulness: related to efficiency, quickness and diversity	Disruptions are considered as the "omega" phase of creative destruction, but it will be continued instantly by an "alpha" phase of **revival and restructuring**, that leads to **uncertain pathways**.

Perceived as	• **Marker of resilience** • Indicator of a **well-managed system**	**Start of** structural/systematic **change**	• **Transformation of a system's pathway** • Can be considered as an opportunity to potentially transform systems to entirely different pathways that are more desirable to the organisations.

Prior to the categorisation of trends, the definitions used for persistence, adaptability and transformability in CRE context were elaborated to avoid ambiguity (Figure 2.14). Here, the term *persistence* was defined as the physical ability to resist external disturbances, which requires physical robustness and rigidity. *Adaptability* was defined as the flexibility and resourcefulness to adapt the sub-processes in the production process in order to maintain the same regular operational pathway. Meanwhile, *transformability* was defined as the ability to innovate a new desirable pathway, which requires more radical changes and creates different operational trajectories.

Definitions of the three features used in CREM context

Persistence : physical ability to resist external disturbances, which requires physical robustness and rigidity.

Adaptability : flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway.

Transformability: ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Figure 2.14. Definition of persistence, adaptability and transformability in CRE industries (source: Author)

The following analysis was aimed to classify the identified trends and concepts (Table 1) into persistence, adaptability and transformability based on their characteristics. This classification was performed using the pre-determined definitions of the three resilience assessments. These trends are also categorised based on their features (Table 2.07).

Table 2.07. Classification of trends to three assessments of resilience (source: Author, from various sources)

Asset Classes	Code	Trends *(Identified from Table 1 and additional sources)*	Assessment: Persistence	Assessment: Adaptability	Assessment: Transformability	Categories
Offices	*[O1]*	**Building and people resistance** from physical disasters (CBRE, 2019)	V			• Space and activities
	[O2]	**Hygiene** capability with minimum air quality requirement (CBRE, 2020a; CBRE, 2020c; Savills, 2020)	V			• Risk and hazards
	[O3]	**Tech-driven** office **space** (CBRE, 2020a; CBRE, 2020c; Savills, 2020)	V			• Digitalisation
	[O4]	**Flex-working space** (JLL, 2020a; CBRE, 2020c; Savills, 2020)		V		• Asset flexibility • Space and activities
	[O5]	**Decentralisation of workspace**, distributed workspace (CBRE, 2020c)		V		• Accessibility • Asset flexibility
	[O6]	**Reconfiguration** of offices as the workspace, to offices as collaboration and meeting space (JLL, 2020a; CBRE, 2020a; Cushman & Wakefield, 2020; Savills, 2020)			V	• Space and activities
	[O7]	Agile **choice-based work patterns** ability (CBRE, 2020c; Savills, 2020)			V	• Accessibility • Space and activities
	[O8]	**Remote-working capability** (CBRE, 2020c; Savills, 2020)			V	• Accessibility
	[O9]	Hybrid **combination of remote working capability** and **headquarters for collaboration and meeting spaces** (CBRE, 2020c; Savills, 2020)			V	• Digitalisation • Input and real estate
Retails	*[R1]*	**Physical resistance** of the ground-level (eye-level) from flood risk (CBRE, 2019)	V			• Space and activities
	[R2]	**Sustainable fulfilment** (JLL, 2020a)	V			• Environmental sustainability

	[R3]	Flexible **omni-channel retail model** (JLL, 2020a)		V		• Asset flexibility • Space and activities • Organisational model
	[R4]	**Repurpose locations that are no longer in demand** as retail real estate (CBRE, 2020a)			V	• Asset flexibility
	[R5]	From physical retail space to **e-commerce** (OECD, 2020)			V	• Digitalisation • Asset flexibility
Industrial / Logistics	*[I1]*	**Physical resistance** from fire risk of industrial activities (CBRE, 2019)	V			• Space and activities
	[I2]	**High ceiling height** (CBRE, 2020c)	V			• Asset flexibility
	[I3]	**Cold storage facilities** (CBRE, 2020c)	V			• Asset flexibility
	[I4]	Distribution centre location in the **urban area** because it is closer to the urban e-commerce consumers (CBRE, 2020c)	V			• Accessibility
	[I5]	**Centralisation** to maintain safety oversight (Marcus & Millichap, 2020)	V			• Risk and hazards • Organisational model
	[I6]	**Easy warehouse accessibility** to the ports (Marcus & Millichap, 2020)	V			• Accommodation of trends
	[I7]	Supply chain **risk mitigation** (JLL, 2020a)		V		• Space and activities
	[I8]	**Decentralisation to create multiple access points**, bringing logistics closer to urban consumers (CBRE, 2020c)		V		• Accessibility
	[I9]	**Transformation** of the retail parks to logistics distribution centre (CBRE, 2020c)			V	• Space and activities
	[I10]	**Automation and technology** in their logistical space (CBRE, 2020c)			V	• Digitalisation • Risk and hazards
Data centres	*[D1]*	**Resistance** by having back-up powers in the event where there are **power failures** (CBRE, 2019)	V			• Space and activities • Organisational model
	[D2]	**Easy cloud accessibility on site**, location where hyperscalers have built out cloud availability zone (CBRE, 2020c)	V			• Accessibility
	[D3]	Increase demand in **IoT** (CBRE, 2020c)		V		• Digitalisation
Healthcare	*[H1]*	**Evidence-based** design (CBRE, 2020d)	V			• Accommodation of trends
	[H2]	**Multi-year maintenance plan** (CBRE, 2020d)	V			• Process and real estate • Organisational model
	[H3]	Focus on **safety, efficiency, well-being, and layout configuration** (CBRE, 2020d)	V			• Risk and hazards
	[H4]	**Increasing safety** by **identifying and analysing major incidents and system failures to reduce future damages** (Iflaifel et al., 2020)		V		• Accommodation of trends • Risk and Hazards
	[H5]	Trainings and simulations to **prepare for unexpected disturbances** (Iflaifel et al., 2020)		V		• Accommodation of trends • Risks and hazards
	[H6]	**Addressing mismatch** between the expectation of the work and how the day-to-day work actually happens, instead only focusing on major incidents/events (Iflaifel et al., 2020)			V	• Accommodation of trends • Input and real estate
	[H7]	**Digital consultations** (CBRE, 2020d)			V	• Accessibility
Educational buildings	*[E1]*	**Easy site accessibility** and integration to the outdoor environment, through through the linkage between society and the university (Ninemann, et al., 2020)	V			• Accessibility
	[E2]	**Having awareness** of the **scarcity of resources** and the **capability of current resources** (Ninnemann, et al., 2020)	V			• Accommodation of trends • Input and real estate
	[E3]	**Digital platform** to support operational of the educational activities		V		• Digitalisation
	[E4]	Ability to **conduct e-learning methods** through the integration of ICT (McKinsey, 2020a)			V	• Digitalisation • Accessibility
	[E5]	**Hybrid environments** of combining: 1) **traditional campus** model with **e-campus**, 2) **virtual** and **physical** spaces, 3) formal and informal spaces. (Ninnemann, et al., 2020; den Heijer, 2020)			V	• Digitalisation • Accessibility
	[E6]	**Innovative campus system**, by making use of the available resources (Ninnemann, et al., 2020)			V	• Space and activities
	[E7]	University **organisational alignment** (Ninnemann, et al., 2020)			V	• Organisational model

The generic categories identified in Table 2.07 was further broken down into three features that can be applied to each of the asset classes. Due to the sequential nature of these three features, the sub-categories would be adjusted as to follow a similar sequential order (Table 2.08). Subsequently, these sub-categories were classified in the resilience framework.

Table 2.08. Breaking down categories into sub-categories and identification of the codes (Source: Author)

Categories	Persistence	Adaptability	Transformability
Accommodation of trends	Physical ability to follow and utilise user trends and needs *Codes: [I6] [H1] [E2]*	Ability to predict user trends and needs *Codes: [H4] [H5]*	Ability to create needs *Codes: [H6]*
Digitalisation	Digitalisation in day-to-day operation to optimise the management of physical assets *Codes: [O3]*	Digitalisation in day-to-day operation to optimise process *Codes: [D3] [E3]*	Digitalisation in business operational *Codes: [O9] [R5] [I10] [E4] [E5]*
Accessibility	Assets with easy physical site accessibility *Codes: [I4] [D2] [E1]*	Decentralisation of the physical asset sites, therefore creating multiple access points *Codes: [O5] [I8]*	Decrease of the dependency of physical site accessibility *Codes: [O7] [O8] [H7] [E4] [E5]*
Property feature flexibility	Physical asset flexibility to accommodate changes *Codes: [I2] [I3]*	Refurbishment of assets to better fit the demand *Codes: [O4] [O5] [R3]*	Repurpose assets that are no longer in demand *Codes: [R4] [R5]*
Environmental sustainability	Reduction of environmental impacts according to regulation *Codes: [R2]*	Reduction of environmental impacts with efforts further than regulation *Codes: n/a*	Contributing positively to surrounding environment *Codes: n/a*
Risks and hazards	Physical safety measures to minimise risks *Codes: [O2] [I5] [H3]*	Systemic efforts to minimise hazards *Codes: [H4] [H5]*	Automation to eliminate hazards *Codes: [I10]*
Space and activities	Physical resistance to disturbances that threatens activities *Codes: [O1] [R1] [I1] [D1]*	Multi-use/space-sharing of the businesses' activity space *Codes: [O4] [R3] [I7]*	Optimisation of the activity-space relation *Codes: [O6] [O7] [I9] [E6]*
Input and real estate	Physical capacity to sustain the critical input-related resources *Codes: [E2]*	Organisational capacity to adapt the source of supply whenever needed *Codes: n/a*	Ability or effort to predict the optimum state of input-related resources *Codes: [O9]*
Process and real estate	Physical capacity to sustain operational process without significant delay in event of disruptions *Codes: [H2]*	Organisational capacity to maintain or adapt operational process to maintain production process *Codes: n/a*	Ability to predict and minimise critical points in the production process *Codes: [H6]*
Organisational model	Rigidity and robustness in operational model *Codes: [I5] [D1] [H2]*	Flexibility in the operational model *Codes: [R3]*	Flexibility in the organisational model *Codes: [E7]*

2.2.2. Literature-based framework for resilient CRE

Henderson & Venkatraman (1989) and their successors developed theories of alignment to improve value delivery in organisations. Having resilience capability in an organisation ensures the value delivery during external disruptions. Previously, Vande Putte & Jylhä (n.d.) conceptualised the different scope of strategic alignment model of Henderson & Venkatraman (1989) and four views scheme Krumm et al. (2000), as seen in Figure 2.02, 2.03, and 2.04. In the scope of this research, the positioning of the alignment can be seen below (Figure 2.15).

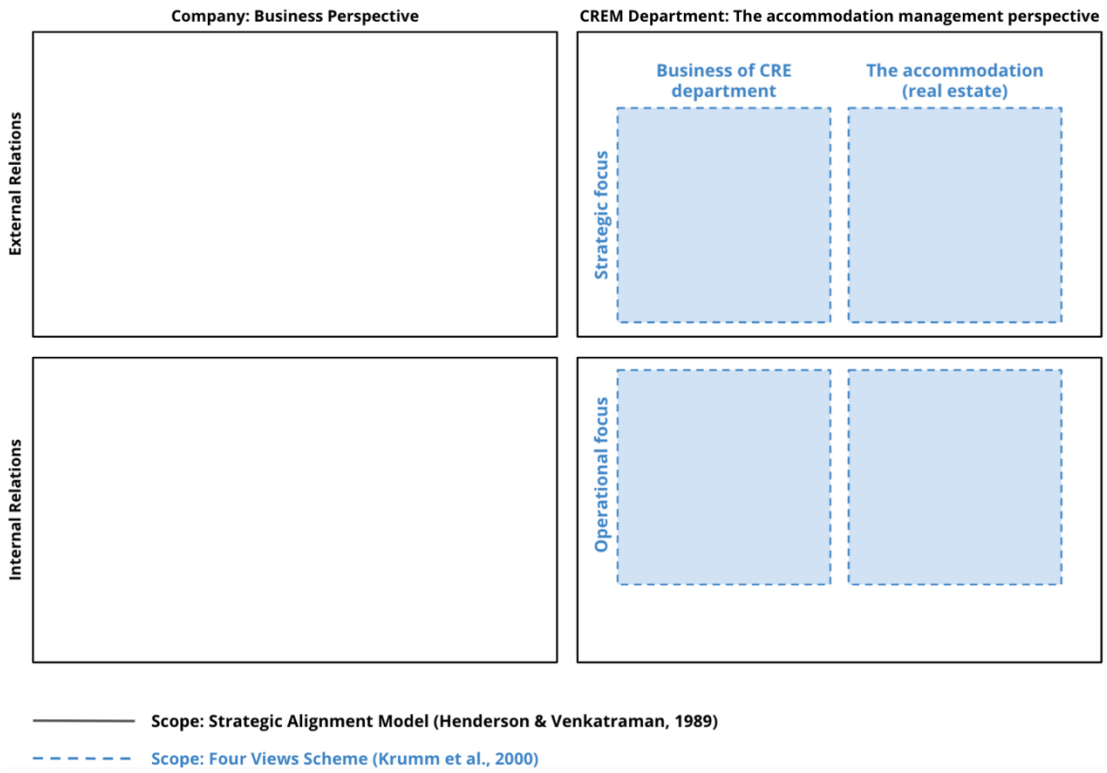


Figure 2.15. Research positioning (source: adapted from Vande Putte & Jylhä, 2021)

The **four-views scheme was selected for this research**. The scope of this research was focused on the development of resilience strategies within the CREM department of an organisation. Therefore, using the strategy framework proposed by Krumm et al. (2000, see Figure 2.03), the sub-categories identified on Table 2.08 can be classified into the literature-based resilience framework (Figure 2.16).

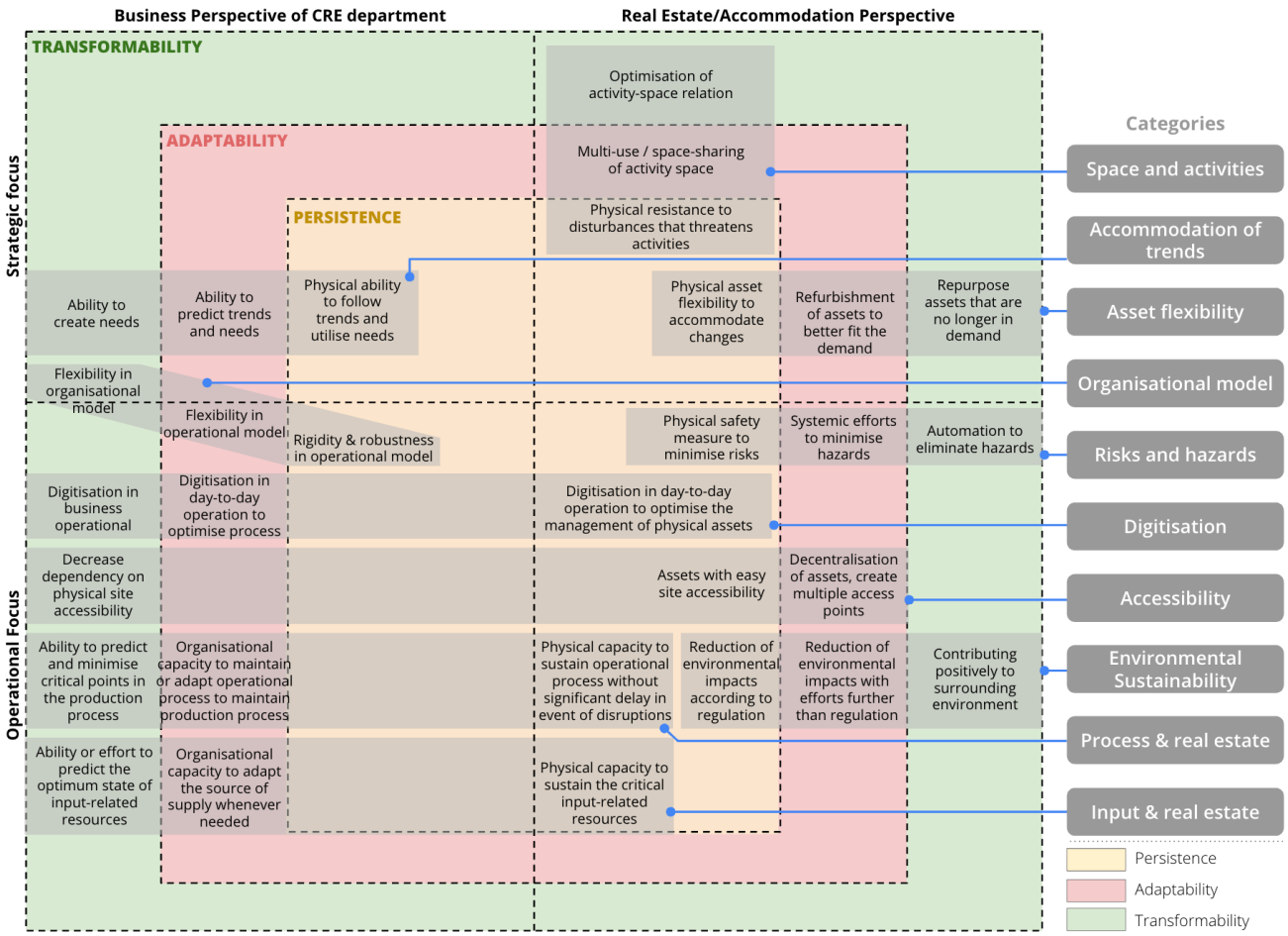


Figure 2.16. Literature-based resilience framework (three features level) (source: adapted from, Krumm et al., 2000)

The literature-derived resilience framework (Figure 2.16) outlines the CREM approaches in various businesses. This scheme covers the CRE department, which can subsequently influence the whole business/company approach. This framework was intended to create a prescriptive suggestion to enhance resilience within the CREM context. Notably, the elements identified in this framework were rather soft and may sometimes overlap the view borders, creating difficulties during its categorisation (Vande Putte & Jylhä, 2021)

The literature-based resilience framework can be seen as four different views of CREM, in three different feature levels, that needs to be integrated to enhance resilience in a CRE organisation. These four views, here depicted in the four quadrants, incorporated both organisational and real estate perspectives (Krumm et al., 2020). This framework is generally applicable to all of the asset classes, and were thus used a standard of evaluation from which differences in various asset classes will be assessed from. This is performed to allow the comparison between asset classes despite the different nature of their organisations.

2.2.3. Literature-based tendency per asset classes

During the assessment of trends in different asset classes, it was evident that all asset classes have different tendency towards the four views. These differences can be seen on Figure 2.17, in which tendencies were mapped on the grey-shaded quadrants. Based on this analysis, it was clear that offices, retails, and industrial/logistic asset classes have the tendency to focus on the real estate/strategic level, whereas healthcare and educational campuses appeared to be focused more on its business/strategic level. Meanwhile, data centres appear to put a stronger emphasis on the business/operational level.

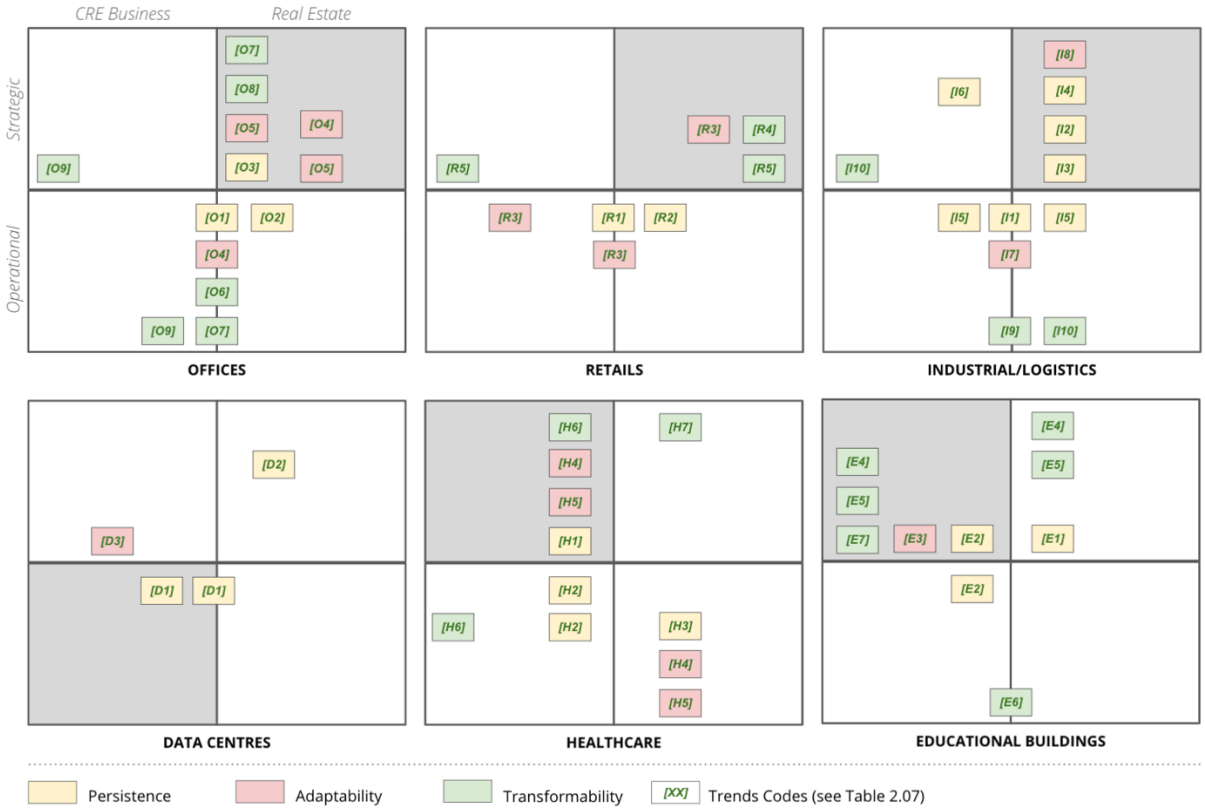


Figure 2.17. Literature-based tendency of each selected asset classes to the four views of CREM (source: Author)

2.2.4. Transitioning to Empirical Study

The literature-based resilience framework identified elements for organisations to use in improving their persistence, adaptability, and transformability, through the four different strategical views (Figure 2.16). Improving these elements may enhance resilience in various asset classes of organisations.

The following empirical study collected data from companies that were chosen to represent various asset classes. Information obtained during the interviews were analysed using the literature-based resilience framework. This analysis was performed to pinpoint elements of the framework that might be critical for a specific asset class.

Nonetheless, it is necessary to note that the data collected in the theoretical study is limited to the topics covered in recent literatures. Therefore, the abundance of information obtained for specific aspects of the literature-based resilience framework may be more limited than those obtainable for the others. In general, the limited availability of information at this stage showed the need of empirical data collection. In the empirical study, the literature-based resilience framework was updated based on data gathered and expanded the concept regarding tendencies of each asset classes to particular views of CREM.

Chapter 3:
Empirical Study Design

Following the theoretical study, empirical data was collected to prove the validity of the literature output and evaluate the previously formulated theory based on real-life cases. Section 1.2 (Figure 1.03) provided a general explanation about the overall research method. The current chapter further elaborated on the methodology of the empirical data collection process.

3.1. Empirical Study Methodology: Case Studies

The empirical data collection was conducted by a series of case studies. As mentioned, 6 asset classes were analysed in the theoretical study. In the empirical study, these asset classes were *narrowed down to three classes*, including 1) offices, 2) retails, and 3) industrial and logistics class. Despite the currently applied restriction, it is not impossible for a similar empirical analysis to be performed on other asset classes that were not included in the current analysis.

3.1.1. Research Design Components

Yin (2009) identified five fundamental research design components. These consisted of (1) case study questions, (2) propositions, (3) units of analysis, (4) logic linking the data to the propositions, and (5) criteria of findings interpretation. The first three components assisted the data collection phase, while the remaining components guided the analysis stage following the data collection step. The following segment will further elaborate on how these five components were applied in the current study.

(1) Case study questions

The previous theoretical study created the re-conceptualisation of resilience and produced a literature-based framework to optimise resilience in different CRE asset classes. Here, case studies were aimed to further investigate on **how resilience can be operationalised and optimised in various CRE asset classes** (research question 3) based on real-life cases.

(2) Propositions

Due to the explorative nature of this research, no propositions were addressed prior to the case studies (Yin, 1994). The purpose of the case study is to validate and advance the re-conceptualisation and optimisation of resilience that was formulated in theoretical study.

(3) Units of analysis

To define the case, the case studies were focused on organisational scale. Therefore, the case study analysed diverse types of companies belonging to the selected asset classes. Specifically, the study will focus on the CRE sector of the companies or organisations that represent the experts of CRE management in a specific asset classes.

To properly scope the case, the data collection were focused on approaches related to real estate decisions. These decisions may include real estate decisions that influenced business operations, or the business decisions that affected the company's real estate. Information pre-processing was also performed to filter out non-CREM related resilience approaches.

(4) Logic linking the data to the propositions

The purpose of the case studies was to find general and specific use of resilience in various asset classes. Though lacking the preposition, the data collected from the case studies were

assessed using the literature-based resilience framework as a basis of analysis. To increase the data reliability, separate case studies were cross-synthesised. The cross-case analysis was not aimed only to produce a generic data, but also to ensure the equivalence of analysis across the different asset classes.

(5) Interpretation of findings

The qualitative nature of the collected data posed a challenge in the quantification of the findings, due to the non-quantifiable information. Nonetheless, the criteria of interpreting the findings were based on the three features of resilience: persistence, adaptability, and transformability. The findings were assessed based on the definitions of these three assessments as well as the extended definition of resilience in the CREM context.

Categorisation of raw findings to the resilience framework offered an opportunity for a quantitative analysis to be performed to further derive additional information from the data. The quantitative analysis was performed by mapping the occurrence of resilience approaches in different organisations. This analysis was performed to evaluate each organisation's priorities and/or preferences regarding a specific resilience approach.

3.1.2. Case Study Design

This research adopted the approach: **multiple-case designs with multiple units of analysis** (Yin, 2009). The case studies included three *case classes*. In each of the selected *case classes*, three *interviews* were conducted (Figure 3.01).

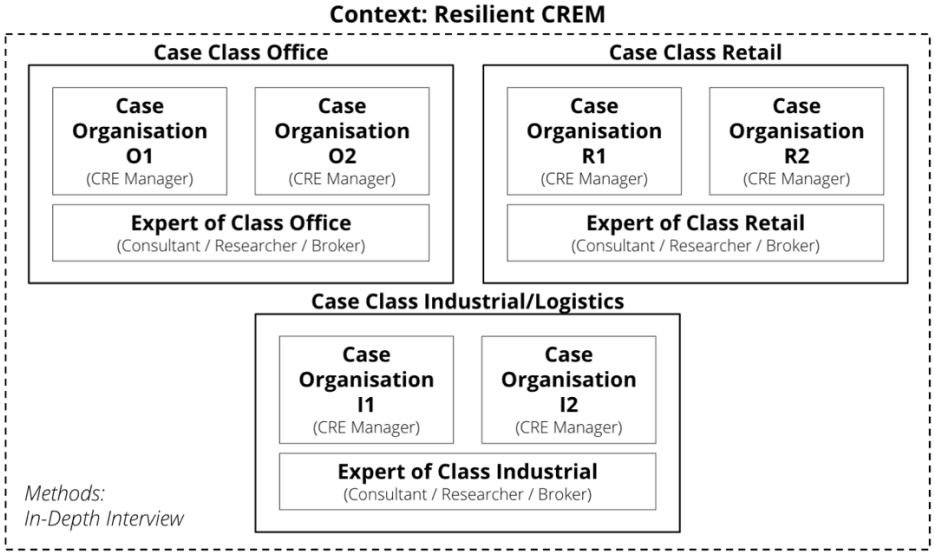


Figure 3.01. Case studies design (source: adapted from Yin, 2009)

Here, *case classes* represent the asset classes, *case organisations* represents the companies selected for this research, whereas *experts* represents CRE professionals in the related asset classes. For each *case class*, one *expert* interview and one/two *organisation case studies with a CRE manager* were performed. This allowed the collection of substantial and representative information from each of the three asset classes. Case studies were conducted through series of in-depth interviews with representatives from each company.

Therefore, the series of questions during the semi-structured in-depth interview were differentiated based on the following two perspectives, regardless of its classes:

(1) CRE managers, which represents one organisation in one asset class
(2) Experts, which advises multiple organisations in one specific asset class

The two sets of in-depth interview questions are available on Appendix A and B. The case study design is summarised on the following Figure 3.02.

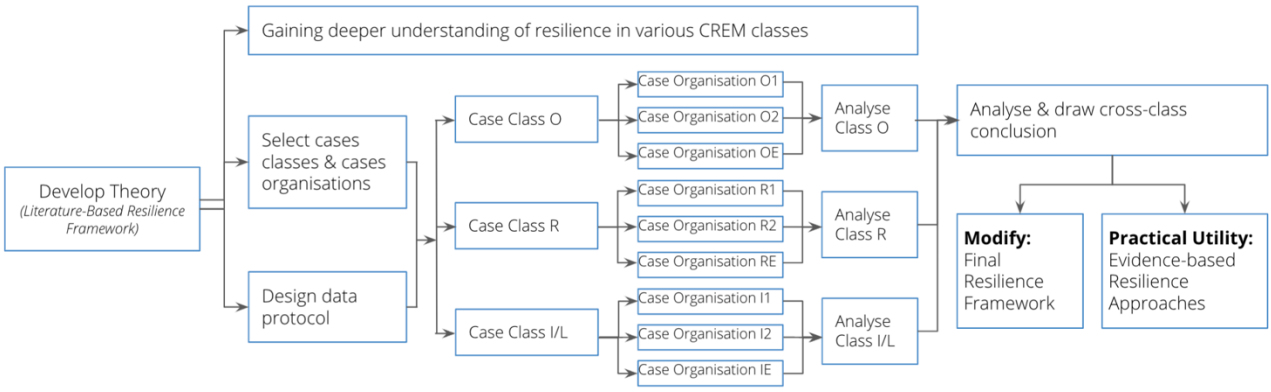


Figure 3.02. Case studies procedure (source: adapted from Yin, 2009)

3.1.3. Interviewee Selection Criteria

There are two types of interviewees, 1) CRE managers and 2) experts:

1) The CRE managers were required to possess a real estate manager role or asset manager role in their respective companies.
2) The experts' informants were consultants or brokers in companies that functions as a real estate adviser in one (or more) selected asset classes. Additionally, experts may also be researchers who specialise in the CRE of the selected sectors.

The detailed interviewee selection criteria are listed on Tables 3.01 and 3.02.

Table 3.01. Criterion for CRE Managers interviewees (source: Author)

	Scope	CRE Manager Criteria	Description
Required	General (all sectors)	Belong to at least one of the three selected asset classes (office, retail, industrial/logistics)	Scope of the empirical data collection
		The organisation is located in The Netherlands	Same context and governmental policies in events of external disruptions
	Office sector	At least one physical office in The Netherlands	Physical real estate decisions will be used as a data
		Remote-working capability for more than 50% of their total employee	Digitalisation is implemented, ability to operate during the current disruption.
	Retail sector	Physical stores present in every province in The Netherlands	Physical real estate decisions will be used as a data, and relatively comparable retail size
		Possibility of online shopping	Digitalisation is implemented, e-commerce is a part of their business plan
	Industrial and logistics sector	At least one physical asset in The Netherlands	Physical real estate decisions will be used as a data
		Remote-working capability for more than 25% of the employees	Digitalisation is implemented

Desired	General (all sectors)	Public or semi-public traded company, or have direct affiliations with publicly traded organisation (e.g. sister company)	Accessible stocks data, relatively comparable size with other organisations
		Operation-based in The Netherlands	Limits the international context and solution to the current approach
		Resilience mentioned as one of the organization's ambition	The organisation is already aiming to be resilient. A certain extent of resilience effort was thus expected.
		Stable number of employees (±10% change in the last 10 years)	Stable organizational condition
		Implemented a minimum of five categories from the resilience framework	The resilience framework can be used as a basis to measure its effectivity to the organisations

Table 3.02. Criterion for Expert interviewees (source: Author)

	Expert Criteria	Description
Required	Expert of at least one out of three selected asset classes (office, retail, industrial/logistics)	Scope of the empirical data collection
	Knowledgeable of the Dutch real estate markets	Scope of the research
	Operates mainly in The Netherlands	Scope of the research
	Advising clients for assets located in The Netherlands	Experienced in the Dutch context of real estate market
Desired	Acknowledge the importance of possessing the five categories included in the resilience framework	The resilience framework can be used as a basis to measure its effectivity to the organisations
	Have in-depth understanding and experience of resilience and its actual implementation to the real estate	The expert's evidence-based resilience implementation can be used as a data and a basis to measure its success.

3.2. Conducted Case Organisation and Expert Studies

Based on the selection criteria, a total of 6 companies and 3 experts were selected for case studies. Each of these organisations represented one out of the three selected asset classes. Figure 3.03 provides an overview of the selected companies and their assigned interviewee code identifier that were used for throughout the analysis.

CASE CLASS		INTERVIEWEES	INTERVIEWEES CODE
OFFICE	Case Office 1	CRE Manager 1	O_CREM_1
	Case Office 2	CRE Manager 2	O_CREM_2
	Expert Office	CRE Expert 1	O_EXP_1
RETAIL	Case Retail 1	CRE Manager 1	R_CREM_1
	Case Retail 2	CRE Manager 2	R_CREM_2
	Expert Retail	CRE Expert 1	R_EXP_1
INDUSTRIAL / LOGISTICS	Case Industrial 1	CRE Manager 1	I_CREM_1
	Case Industrial 2	CRE Manager 2	I_CREM_2
	Expert Industrial	CRE Expert 1	I_EXP_1

Figure 3.03. Overview of the selected cases, experts, and the code used for the interviewees. (source: Author)

Case Organisations Overview

Case Office 1 *Paints and performance coating company*

This publicly traded company is originated in The Netherlands. It has since then expanded worldwide, having office in different countries in different continents. Based on preliminary research, it is evident that this company puts focus on resilient performance as well as contributions to their surrounding environment. However, their resilience efforts in the context of real estate management appeared to be less pronounced compared to their environmental resilience efforts.

Case Office 2 *Financial corporation*

This organisation is a publicly traded Dutch-based banking company. Preliminary research hinted the company's focus on financial resilience. Although this organisation also possessed retail branches, the current interview focused solely on the company's offices. This organisation was known to own several of their assets, in addition to their possession of lease status for some office spaces.

Case Retail 1 *Supermarket chain company*

This supermarket retail company is originated in The Netherlands and is available in almost all major cities. Although resilience is not a part of their ambition, several media acknowledged the company's operational resilience. This organisation also owns most of their assets.

Case Retail 2 *Variety goods and merchandises chain company*

This retail chain is a privately-owned company that can be found in big cities in The Netherlands. Based on the preliminary data collection, resilience did not appear to be listed as one of their ambitions. This organisation mostly rented their retail spaces.

Case Industrial 1 *Life science, health and nutrition corporation*

This industrial organisation is originated in The Netherlands. This organisation owns their industrial spaces and have several industrial activities in different locations in The Netherlands and worldwide.

Case Industrial 2 *Chemistry company**

** Important note:* The interview from the company representative was not recorded as per interviewee's request. Therefore, their statement could not be quoted.

This organisation performs business-to-business industrial transactions. This company is based in the USA, despite being considered as a Dutch company. Therefore, the corporate governance combined both the US and Dutch practices. This organisation owns, manages, and leases industrial spaces in The Netherlands and worldwide.

Table 3.03. Selected CRE managers in relation to the selection criteria (source: Author)

	Sector	Criterion	Case Organisations					
			Office 1	Office 2	Retail 1	Retail 2	Industrial 1	Industrial 2
Required	General (all sectors)	Belong to at least one of three selected asset classes (office, retail, industrial/logistics)	V	V	V	V	V	V
		The organisation is located in The Netherlands	V	V	V	V	V	V
	Office	At least one physical office in The Netherlands	V	V	-	-	-	-
		Remote-working capability for more than 50% of their total employee	V	V	-	-	-	-
	Retail	Physical stores are located in every province in The Netherlands	-	-	V	V	-	-
		Possibility of online shopping	-	-	V	V	-	-
	Industrial and logistics	At least one physical asset in The Netherlands	-	-	-	-	V	V
		Remote-working capability for more than 25% of their total employee, or mostly automated processes.	-	-	-	-	V	V
Desired	General (all sectors)	Public or semi-public traded company, or have direct affiliations (e.g. sister company)	V	V	V	X	V	V
		Originated in The Netherlands	V	V	V	V	V	-
		Resilience is mentioned in their organizational ambition	V	V	X	X	-	V
		Stable number of employees (± 10% in the last 10 years)	X	-	-	-	-	V
		Implements minimum five categories from the resilience framework	V	V	V	V	V	V

Note: V = detected X = not detected - = not applicable/no data

Experts Overview

Office Expert *Consultant occupier workplace strategies*

This expert works in an organisation that provides commercial real estate services worldwide. This organisation was not originated from The Netherlands; however, this company operates largely in the country and is popular among Dutch clienteles. Although the company is known to advise on several real estate asset classes, the selected expert in the interview specializes in the office and workspace sectors.

Retail Expert *Researcher in Dutch retail market*

This expert works in an organisation founded in The Netherlands. The company in which the expert worked in, have specific specialisation of managing portfolios for institutional investors. This organisation is also active in conducting research on the real estate markets. The current interviewee is a researcher for the Dutch retail sectors.

Industrial Expert *Broker and advisor in logistics and industrial sector*

This expert is a partner of an organisation that specialised in in logistics and industrial sector, based in The Netherlands. This organisation provides a connection point from the demand (users) to the supply (asset or landowner), and from the governmental bodies to potential investors. The expert interviewed is mainly focused on the logistics real estate spaces.

Table 3.04. Selected CRE experts in relation to the selection criteria (source: Author)

	Criterion	Experts		
		Office	Retail	Industrial
Required	Expert of at least one out of three selected asset classes (office, retail, industrial/logistics)	V	V	V
	Knowledgeable of the Dutch real estate markets	V	V	V
	Operated in The Netherlands	V	V	V
	Advising clients for their Dutch-located assets	V	V	V
Desired	Acknowledge the importance of possessing at five categories from the resilience framework	V	V	V
	Have in-depth understanding and experience of resilience and its actual implementation to the real estate	V	V	V

Note: V = detected X = not detected - = not applicable/no data

3.3. Empirical Data Collection Methods

The empirical data was obtained in 9 in-depth interviews with CRE managers and experts. The interviews were aimed to collect the real-life approaches of different organisations that could potentially contribute to creating resilience in real estate.

Semi-Structured In-depth Interview

An in-depth interview can be conducted through a semi-structured or non-structured process (Allmark, et al., 2009). In-depth interview allowed a deeper understanding of the interviewees' perspective, experience, and personal opinion (Milena, Dainora, & Alin, 2008). Despite being less structured with a high risk of the emergence of new questions, this method was selected in hope to obtain a more detailed information.

The in-depth interview with both CRE managers and the experts was based on a pre-defined interview protocols (see Appendix A and B). The interviews consisted of general questions that were aimed to prompt an understanding of the business context and their perspective on resilient CRE. Using the current COVID-19 pandemic as an actual example of a disruption, both CRE managers and experts were asked about what CRE could learn from the current crisis, and how better implementation should be. In addition, the in-depth interviews discussed a more conceptual understanding of the literature-based framework and compared the concepts with the interviewees' perspective on their respective expertise.

There were some differences between interview for CRE managers and experts. Interview with CRE managers discussed more about their current approaches to respond to the ongoing disruptions compared to their past approaches. With the experts, discussions were emphasised more on the conceptual CRE management theory and the resilience framework model.

Results

The result of the empirical data collection is summarised in Appendix C. Metadata and citations are not available as an attachment in the current report but can be provided upon request.

3.4. Resilience Approaches: Analysis Techniques

The research methods to operationalise and optimise resilience in various CRE classes consisted of several types of comprehensive analysis (Figure 3.04). This subchapter elaborated the analysis techniques to deliver the three outputs of the third research question of: how resilience can be operationalised and optimised in various CRE asset classes?

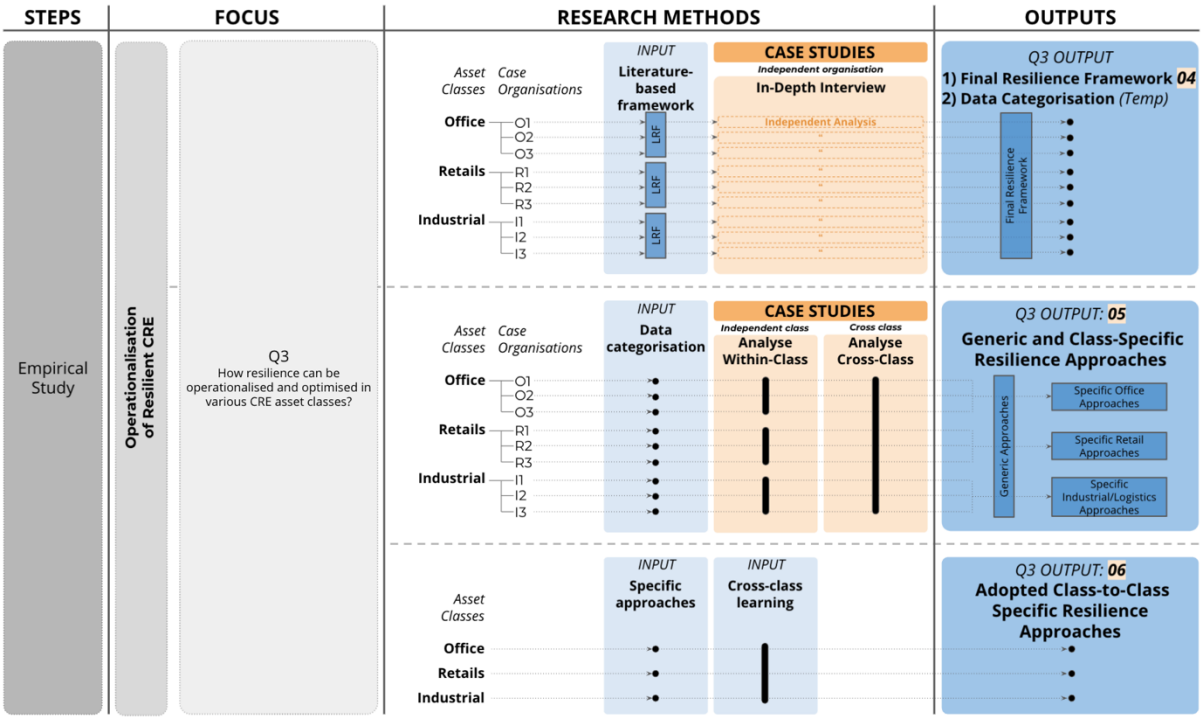


Figure 3.04. Research design of Q3 (source: Author, adapted from Figure 1.03).

Data Analysing Methods

The step-by-step analysis technique (Figure 3.05) and the temporary outputs needed to deliver these final outputs are explained below.

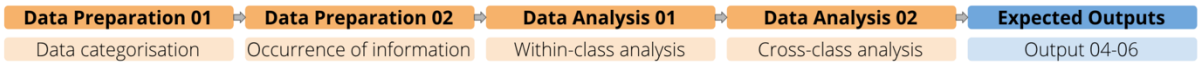


Figure3.05. Resilience approaches analysis techniques (source: Author).

The data gathered from in-depth interviews were transcribed and analysed to produce two main outputs: 1) adapted (final) resilience framework, and 2) generic and specific approaches of resilient CRE. The extensive methods used during the analyses are discussed below.

A. Data Preparation 01 – Categorisation of information

Output:

A1	Data categorisation	*(temporary output)*
A2	Advanced resilience framework	*(final output)*

Principally, the obtained empirical data were used to improve the resilience model and to formulate outputs. The resilience model, which was primarily formulated based on the theoretical study, was assessed and modified based on the observed real-life cases in hope to improve the applicability of the model. The empirical data analysis thus delivered an adapted (final) resilience framework as one of its output.

In the first step of the analysis, data obtained from the interview were processed. Due to the explorative nature of the current research, information obtained from the data was categorised iteratively, along with the advancement of the framework. Here, data were classified to the different categories of the resilience framework (A1), which distinguished between persistence, adaptability, and transformability (P, A, T) while differentiating the sources' class level. The resilience framework consisted of 10 categories, as illustrated on Table 3.05, for every category. Similar tables were generated for each of the identified 10 categories along with its respective P, A, T assessments.

Table 3.05. Illustration of data categorisation (A1) per category (source: Author).

Resilience Framework - Category X (out of 10 categories)*

	Office class			Retail class			Industrial/Logistics class		
	Interviewees	Data	Citation (Proof)	Interviewees	Data	Citation (Proof)	Interviewees	Data	Citation (Proof)
Persistence (of category X)	O_CREM_1			R_CREM_1			I_CREM_1		
	O_CREM_2			R_CREM_2			I_CREM_2		
	O_EXP_1			R_EXP_1			I_EXP_1		
Adaptability (of category X)	O_CREM_1			R_CREM_1			I_CREM_1		
	O_CREM_2			R_CREM_2			I_CREM_2		
	O_EXP_1			R_EXP_1			I_EXP_1		
Transformability (of category X)	O_CREM_1			R_CREM_1			I_CREM_1		
	O_CREM_2			R_CREM_2			I_CREM_2		
	O_EXP_1			R_EXP_1			I_EXP_1		

(*) This table is multiplied to 9 other categories in resilience framework

In parallel to data categorisation, the information was also summarized and aligned on various levels of the analysis. Here, information was aligned between organisations and classes to ensure that a similar type of information to always be classified into the same assessment level within one category (Figure 3.06). The framework was then evaluated based on data compatibility, the resilient CREM extended definition (Figure 2.11), and the definition of P, A, T (Figure 2.14). This alignment and literature-based framework delivered the output of the advanced (final) resilience framework (A2).

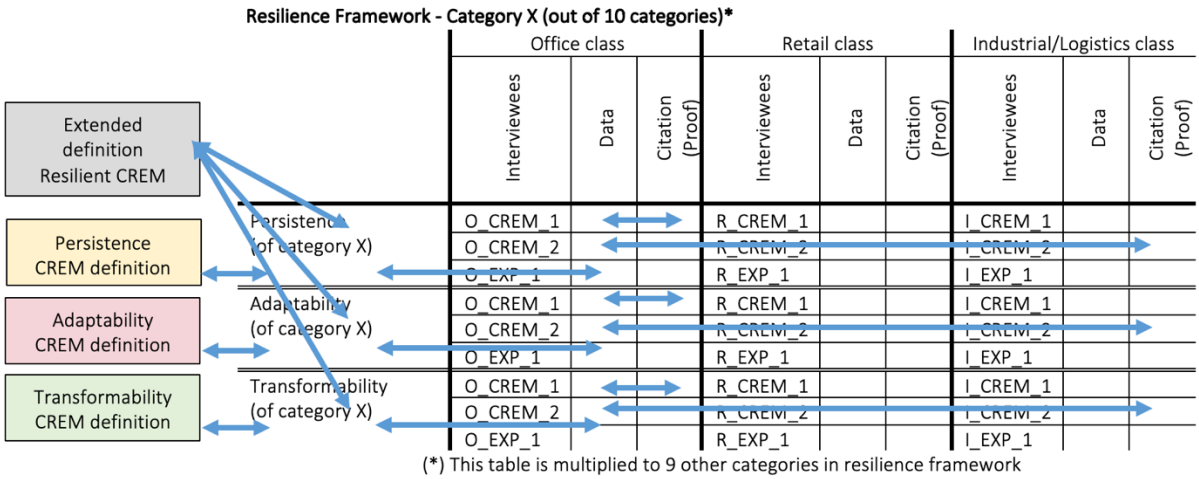


Figure 3.06. Illustration of data alignment per category to create the advanced resilience framework (source: Author).

B. Data Preparation 01 – Occurrence of information

Output:

B1 Occurrence of evidence within organisations *(temporary output)*

Following data categorisation (A1), further analysis was performed to identify the occurrence of related resilience efforts in every category and its assessment. The occurrence analysis ignored the recurrence of information within the same organisation. This was performed to focus the analysis on assessing how common an approach is in different organisations.

C. Data Analysis 01 – Within-class analysis

Output:

C1 Most occurred category *(temporary output)*

C2 Necessary category in each assessment level *(temporary output)*

C3 Dominance of feature levels *(temporary output)*

The current within-class analysis evaluated the three different sectors separately. The analysis was performed based on the occurrence of a resilience category in a particular sector (B1).

The current analysis identified: C1) the category with the most occurrence, C2) which categories needs to possess persistence, adaptability, and transformability, as well as C3) the dominance of features level (P/A/T) in each case class.

D. Data Analysis 02 – Cross-class analysis

Output:

D1 Comparison of approaches between classes *(temporary output)*

D2 Learning potential of approaches cross-classes *(temporary output)*

D3 Sequential categories *(final output)*

The cross-class analysis performed a rather extensive assessment on the ten categories separately. Here the analysis compared various approaches identified in different classes. This comparison and the learning potential of cross-class approaches were further evaluated and adapted in the findings to

ensure that the approaches are applicable to all organisations *within* its respective asset class. The class-specific resilient approaches excluded more class-specific approaches which may only be applied to certain sub-groups of the respective asset class (e.g., excluded the specific supermarket approaches in retail class). Additionally, the cross-class analysis also analysed whether or not the P, A, T assessment showed a sequential attribute in a particular category.

Expected Q3 Outputs

Based on these data analysis process, the analysis technique of the empirical study derived following findings:

1. Final resilience framework *(final output 04)*

2. Generic resilient approaches (applicable to all commercial asset classes) *(final output 05)*
   Derived from cross-class analysis (D1).

3. Class-specific resilient approaches and priority level in selected asset classes *(final output 05)*
   The approaches use only the data gathered from the respective sector. Specific resilient approaches are derived from cross-class analysis (D). Priority of approaches are derived from the within-class analysis (C2) and sequential categories (D3).

4. Adopted class-to-class specific resilience approaches *(final output 06)*
   (Additional approaches for each asset classes derived from other classes)
   The cross-class analysis (D2) allows learning from one class to another. Through this learning capacity, some approaches found in one particular class may be applicable to other classes. The additional approaches sum up the supplementary suggestion that derived from other classes.

These outputs were stated here to create a clear overview on the process of analysis until the result is obtained. The next two chapters analysed and presented the findings.

3.5. Data Plan

This section discusses the data handling process for the data collected in the different stages of the current study. Prior to the interviews, interviewees were asked for their consent regarding the storing and sharing of the information that they provided during the interviews. First, the interviewees were required to sign the Form of Consent, which outlined their participation agreement and their understanding about the context of the interview. Secondly, the interviewer asked the interviewee if he/she allowed for the interview to be recorded. During the data analysis, the name and private information of the CRE managers were encrypted with an alternative identification. Important information may be anonymously quoted, if the related interviewee gave the right of quotation prior to the interview.

The audio and/or video recordings obtained in this study were destroyed after the transcript's validity were confirmed by respective mentors. The transcripts were used to gather information only for the current research's purposes. The original transcript will not be attached in public report.

This research followed the FAIR guiding principles of Wilkinson et al. (2016), by making sure that the analyses would be Findable, Accessible, Interoperable, and Reusable. The final report will be stored on the repository of TU Delft. Suitable keywords will be assigned to the document to make it more findable and accessible. The final document will be stored as a standard document format to ensure accessibility. To ensure interoperability, the current research will be documented in English (U.K. format) and by using the APA-style reference format.

Chapter 4:
Empirical Study Analysis

Section 4.1. presented the final resilience framework, which was derived based on the empirical and the theoretical studies. This advanced (final) framework was used to formulate the resilience approaches which were then used to answer the third sub-research question on the operationalisation and optimisation of resilience in different CRE industries. Subsequently, section 4.2 presented and concluded the result from empirical data collection of each case organisation. The following section 4.3 processed the data to be further analysed on section 4.4, which analysed each of the case classes and performed cross-class analysis (Figure 4.01).

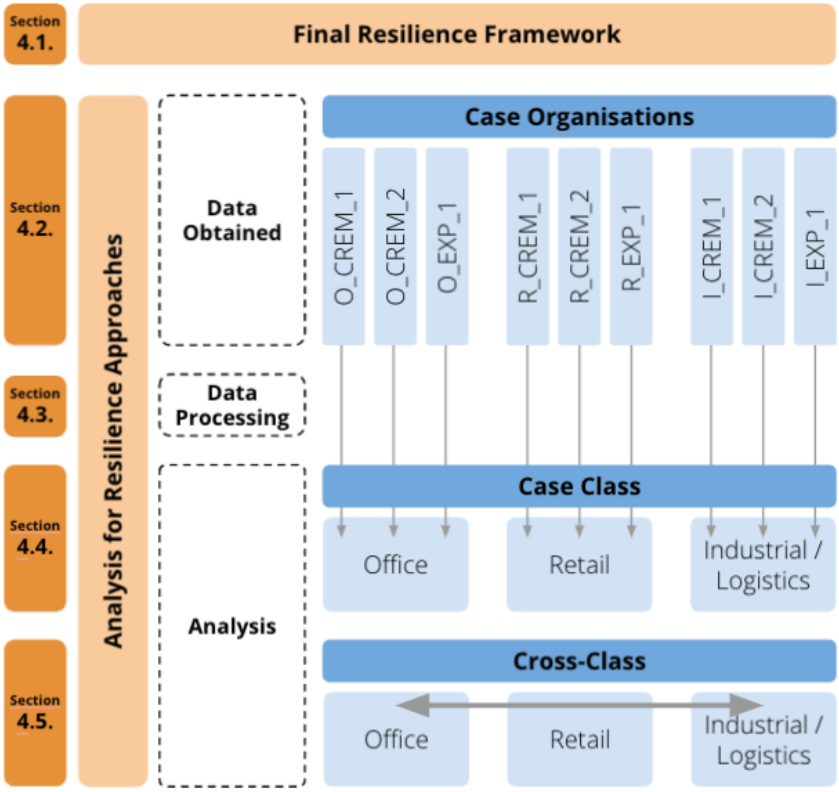


Figure 4.01. Structure and flow of Chapter 4 (source: Author)

4.1. Final Resilience Framework

The empirical analysis included an iterative process which evaluated the previously defined framework, based on the definition of resilience features used in this research and the information gained from case studies. In-depth interviews were designed to identify other resilience approaches beyond the previously formulated categories. This was done by exploring organisations' resilience concepts without presenting the pre-defined framework in the beginning of each interview session.

During data processing, the literature-based resilience framework (Figure 2.16) was further assessed based on empirical findings. This evaluation led to the adjustment and alignment of the categories and its related subcategories in the resilience framework. Following the interview, the formerly defined categories were rearranged (combined and/or added) to accommodate the newly acquired information. Table 4.01 presents the resulting categories of resilience.

Table 4.01. Adjusted categories of resilience and its sub-categories (source: Author).

Categories		Persistence	Adaptability	Transformability
		Final categories		
1	*[NEW]* **Strategic Alignment**	Core business gives input to CRE management	CRE collaborates with the core business	CRE adds significant value to the core business
2	**Accommodation of Trends**	Physical ability to follow trends and utilise needs	Ability to predict trends and needs	Ability to create needs
3	**Digitalisation**	Digitalisation in day-to-day operation to optimise the management of physical assets	Digitalisation in day-to-day operation to optimise process	Digitalisation in business operational
4	**Space and Activities**	Physical resistance to disturbances that threatens activities	Multi-use / space sharing of activity space	Optimisation of activity-space relation
5	*[UPDATED]* **Property Feature Flexibility**	Physical asset flexibility to accommodate changes within the current spatial boundaries	Physical asset flexibility to accommodate changes beyond the limitation of current spatial boundaries	Repurpose assets to accommodate functional changes
6	**Environmental Sustainability**	Reduction of environmental impacts according to regulation	Reduction of environmental impacts with efforts further than regulation	Positive contribution to the surrounding environment
7	*[NEW]* **Financial & Contractual Security**	Ability to ensure the financial and contractual security	Ability to adjust and optimise cost on portfolio	Ability to innovate and drastically change the state of the contractual agreement
8	**Accessibility**	Assets with easy site accessibility	Decentralisation of assets, create multiple access points	Decrease dependency on physical site accessibility
9	**Process and Real Estate**	Physical capacity to sustain operational process without significant delay in event of disruptions	Organisational capacity to maintain or adapt operational process to maintain production process	Ability to predict and minimise critical points in the production process
10	**Input and Real Estate**	Physical capacity to sustain the critical input-related resources	Organisational capacity to adapt the source of supply whenever needed	Ability or effort to predict the optimum state of real estate-related input
		Excluded categories		
A	Asset Flexibility	Physical asset flexibility to accommodate changes	Refurbishment of assets to better fit the demand	Repurpose assets that are no longer in demand
B	Operational Model	Rigidity and robustness in operational model	Flexibility in operational model	Flexibility in organisational model
C	Risks and Hazards	Physical safety measure to minimise risks	Systemic efforts to minimise hazards	Automation to eliminate hazards

Newly Added and Excluded Categories

The category 'Strategic Alignment' was identified during the series of in-depth interview where the relation between CRE management and the overall organisational strategy was found to be essential for maintaining business continuity. 'Property Feature Flexibility' (Category 5) and its subcategories were modified from the former 'Asset Flexibility' category (Category A) to capture a broader scope of flexibility that focuses on both physical space and the extent of capacity to accommodate changes. The newly identified 'Financial & Contractual Security' category focused on the financial and contractual durability of assets in determining the extent of resilience in response to disruptions.

The formerly defined categories of 'Organisational Model' (B) and 'Risks and Hazards' (C) were found to be redundant. Information from 'Organisational Model' (Category B) appeared to be overlapped with the information mainly included in 'Digitisation' (Category 3) and 'Process' (Category 9). Meanwhile, factors covered in the persistence and transformable approaches from 'Risks and Hazards' (Category C) was found to be covered by the definitions of persistence approaches in Category 4 'Space and Activities', and transformability approaches of Category 3 'Digitisation'. Therefore, the data from 'Risks and Hazards' were split and combined into the other categories.

These final categories were classified in four domains, which resulted in the adjusted resilience framework (Figure 4.02).

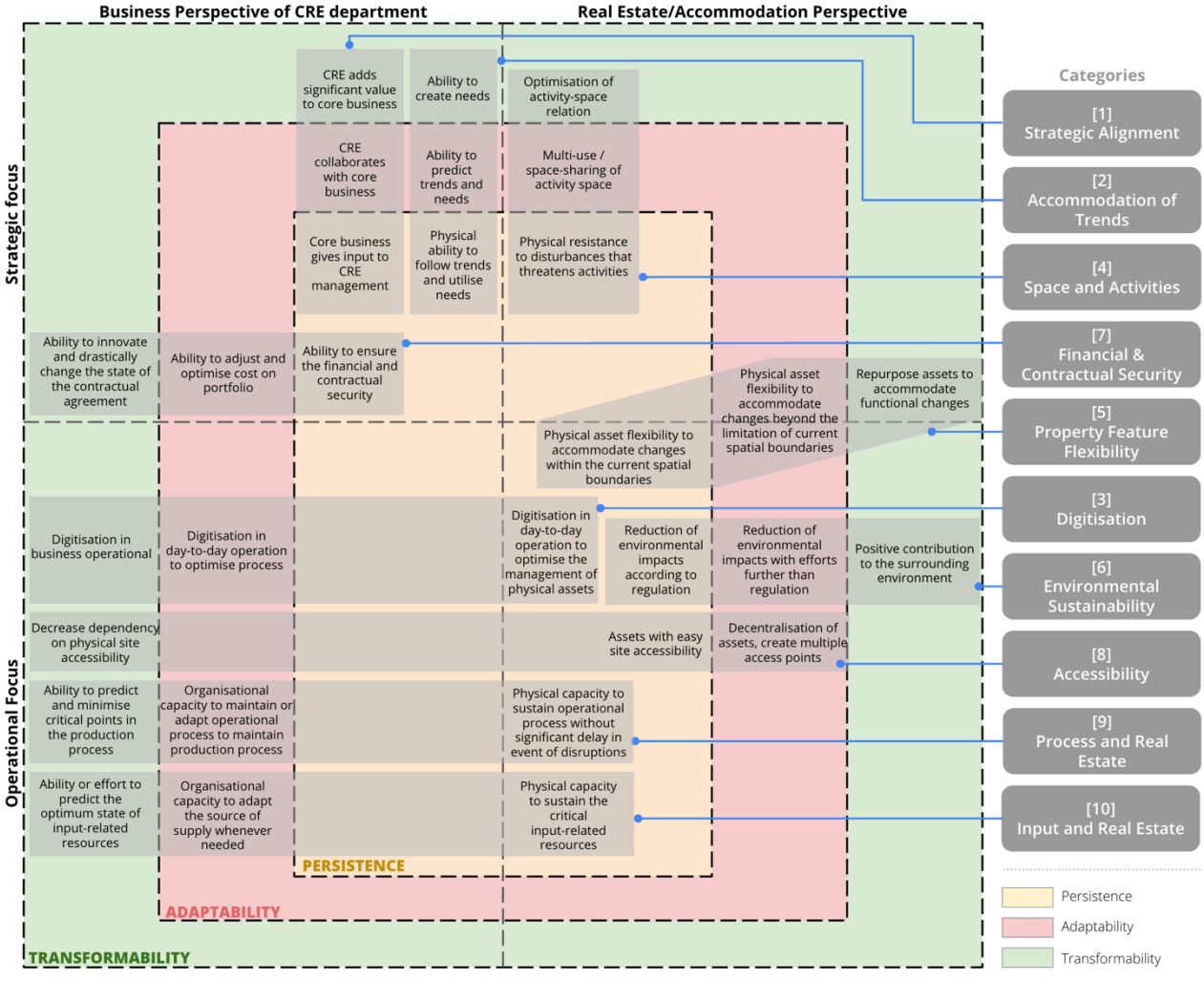


Figure 4.02. Final resilience framework (source: Author)

4.2. Data Overview: Case Organisations and Class-Experts

In this section, the overall result of each case organisation is presented separately. The current section elaborates each observed organisations and insights from experts in different asset classes, and discussed the overall information obtained during the interviews.

It should be acknowledged that the data presented was a combination of organisational overview that every interviewee represents and personal insights from the respective interviewee.

4.2.1. Summary of cases and expert studies

In this section, the results obtained during the 9 interviews were elaborated separately. The current summary emphasised on three main points:

1) How resilient real estate is perceived by the interviewee and the company they represent,
2) What are the necessary resilience categories needed in the company's specific real estate management efforts,
3) The company's overall tendency towards the four domains (strategic/operational focus and CRE business/accommodation perspective; Krumm et al., 2000).

Organisation:	***Case Office 1***	***Paints and performance coatings company***
Interviewee:	***O_CREM_1***	***Corporate real estate manager of the office part***

According to the corporate real estate manager of the first office organisation, resilience was not really their main ambition. The organisation chose rather conventional approaches to their real estate, where all the spatial intervention had to be approved by the executive level of the core organisation. This situation appeared to have created a hindrance on the implementation of resilient office. Nevertheless, the interviewee personally believed that resilient office real estate can be achieved through the accessibility of their physical assets by public transport. The interviewee also emphasised that a lot of investment should be made to better accommodate the users in order to increase workers' productivity, collaboration, and creativity.

[Interviewee]
"What do you think of resilient office real estate?"
[O_CREM_1]
The important topic is accessibility, accessibility by public transport, of course. So, less cars. Accessibility is to make the people feel that this is their office, and that they are eager to come back to the office, because that is the place where creativity is coming from. That's where you connect with people. That's where you feel that you are part of [the company]. And that makes you proud. In my sense, that would be being resilience is about, and making sure that your office would be future-proof.

[O_CREM_1]
"It's strange that we're trying to push them in the smallest of officers and don't really try to do something for it, while in fact the biggest expense is the people. Trying to see how we could stimulate them to produce better, to be creative in giving solutions… that could be, it should be big part of your investment."

Apart from 'Accessibility' (Category 8), 'Property Feature Flexibility' (Category 5) is also believed to be necessary in office organisations. Additionally, 'Environmental Sustainability' (Category 6) is also believed to be an important focus point, although this was based on the sustainable level requirement.

[O_CREM_1]
"And also, sustainability is becoming more and more important focus points. However, it is still a little bit that "we need to, we have to", not yet "we want to", but it is becoming more and more important."

With regard to the four domains of CRE management, the interviewee believed the two left quadrants to be the most important domains. This was due to the necessity to align real estate with core businesses strategy in a long-term manner to support and not hinder the company's growth.

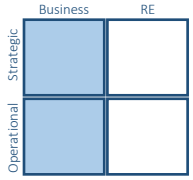


Figure 4.03. Four views tendency by O_CREM_1

[O_CREM_1]
"In the end, the business perspective should of course be the most important one, I would say.
Overall, I would say business perspective because you always want to be aligned with the strategy of the company, not only the short term, for instance during COVID-19, that you make sure that your resilient, but you also want to make sure that where the company wants to be in five years at, the real estate is there and its standing ready. Because real estate process is a long process, buying a property, finding the correct building, so you don't want the real estate to become the one who is holding back the company from moving forward."

Organisation:	***Case Office 2***	***Financial corporation***
Interviewee:	***O_CREM_2***	***Global real estate strategist***

This finance corporation considered resilience as one of their real estate ambitions based on their global strategy. This organisation put significant emphasis on flexibility in their portfolio as an active strategy to create a more resilient real estate. This has been implemented for a few years, and the current COVID-19 pandemic further proved the appropriateness of the pre-implemented standards. Portfolio flexibility is represented in Category 5 (Property Feature Flexibility) of the resilience framework.

[O_CREM_2]
"Yes, absolutely. We consider resilience as one of our main focus. We've been working on the flexibility in our portfolio for 15 years now, as an active part of the strategy. Over the last five or six years, that has increased due to the technical, mainly IT developments in the banking industry. And that's partly a result of the banking crisis 2010-2012. And currently it is speeding up due to the COVID-19 experience, and COVID-19 with experience is not setting a new standard, but it's proving that the-already-implemented standards are right."

As the global real estate strategist, the interviewee believed that the two upper domains are important to focus on. As a banking company, they aimed to set an example to their clients. It is achieved by the combination of CRE business level and spatial accommodation strategies.

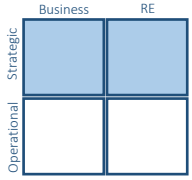


Figure 4.04. Four views tendency by O_CREM_2

Generally, the interviewee projected that office spaces will continue the shift in function to become collaborative space rather than maintaining the standard working space.

[O_CREM_2]
"We see a change because people come to the office not for working in silence, because you can do that from home and avoid any traffic. So the office space will be a bit more meeting area, collaboration areas, little bit standard spaces for the people who do not have all the facilities at home, but the combined meeting area will be a bit more in the foreground, and the rest will be a bit more in the background. That's the change we see due to COVID-19. But then again, that was already a bit happening, but now it's speeding up through."

Organisation:	***Office Expert***	***Commercial real estate services and investment firm***
Interviewee:	***O_EXP_1***	***Advisory workplace strategies***

According to the expert of strategic office workplaces, resilience can be achieved through the alignment of workplaces to the organisational strategy (Category 1), as well as matching the space to its people and their needs. Here, user engagement was deemed necessary to accommodate working spaces based on their activities.

[O_EXP_1]
"You can achieve resilience when you really know the organisation. You understand the work process of an organisation. You really can make a workplace resilient if you let it match with the strategy, but also with the people and what they want. And also, I think it's really important to engage the people in the process. To be able to achieve it, because if you don't understand what people want and what they will use, then you don't know what you should realize, right?"

The interviewee believed that both accommodation of trends and activities (Categories 2 & 4), and the property feature flexibility (Category 5) to be important aspects for achieving a more resilient office. Environmental sustainability, despite its importance, appeared to be mostly regulated by an external body. As such, the presence of environmental resilience efforts was rather given and mandated instead of being an essential aspect for the company.

[O_EXP_1]
"So, in our work field, I think it would be accommodation of activities, accommodation of trends, and asset features. I think that's for us like the main focus."

The interviewee considered that there is no single important domain, yet the alignment within these four domains should be the main focal point. This perspective was quite distinct from other interviewees' views which tend to accentuate the importance of a particular aspect of the domain over the other.

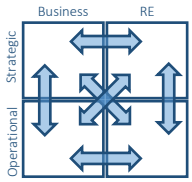


Figure 4.05. Four views tendency by O_EXP_1

[O_EXP_1]
"Personally, for our side in real estate, in our field, all of it is important because what we do is basically like the link between the business perspective and the real estate."

In line with the views of the other interviewees from office sector, the current interviewee recognized the ongoing shift towards hybrid working, as was further accentuated by the lockdown measures during the COVID-19 pandemic. In this context, hybrid working allowed employees to work remotely even though physical office spaces may still maintain their function as a physical platform for networking and collaboration.

[O_EXP_1]
"It's really hard to predict something, but we do see kind of some more like a kind of shift towards hybrid working. So, we don't believe that the office will be gone completely. The clients still want to meet each other face to face. Therefore, physical space is still needed, to meet up. Although this is really a case-by-case situation. I think for us like the main focus now is to really take a case by case and do research for each client to see how the people work."

Organisation:	***Case Retail 1***	***Supermarket chain company***
Interviewee:	***R_EXP_1***	***Director asset management***

Resilient is a very important capability for the currently observed supermarket chain company. Their resilience and agility were identifiable by how well their business operate amidst the current pandemic. The interviewee also specified that their organisational resilience was achieved through their people' efforts to adapt and to adjust with the situation.

[R_CREM_1]
"We find resilience very important, and I think that we have actually been able to show this past year, how resilient and how agile we actually are. If you consider that we used to work at the office most of the time and everyone is now working from home, we've had to make some adjustments obviously in our processes, the way we work. If you consider that we did better than expected as far as our targets are concerned, last year, I think that's a pretty amazing accomplishment actually."

[R_CREM_1]
"I think the biggest way we showed resilience is our people. Because without the people being flexible enough to be able to adjust and work it out like this, it would not be possible."

This retail organisation identified four equally important strategic focuses in their organisation. The four strategic focus points were location, cost minimisation, income maximisation, and shop quality. The first focus of location can be translated to the 8th category of the resilience framework, 'Accessibility'. The second and third focuses could be included to the 1st and 7th categories, which were 'Strategic Alignment' and 'Financial & Contractual Security', respectively. Shop quality could be categorised to 'Accommodation of Trends' (Category 2), which included the accommodation of end-users' needs and demands.

[R_CREM_1]
"We actually are focused on four different things. First of all, we want to secure locations, which means that if we were to leave a location, a shop, we want to be the ones to choose. We don't want our landlord to cancel our rental agreement. We always want to be able to decide ourselves and that obviously depends on the quality of the rental agreements, and insofar as we have control over the situation, so that's the first thing that's important for us.

The second thing that's important for us is that we want to keep our costs as low as possible, so one of our largest aims, our largest targets, is rent reduction, which we can do based on Dutch law and market in which rents are going down.

The third thing we do is we want to have as high an income as possible from our portfolio that we own. So obviously it's as little vacancy is possible, you want our tenants to pay in time, you know things like that.

And our last thing that is definitely not the least important is that we want to have good quality shops for our customers. The people who come to shop in our shops. So, we want to make sure that the outside of the building looks good and inviting. We want to make sure the parking is well-organized, we want to make sure that you can reach our shop as easily as possible, for all the things that you have to do with that. That's also a very important focus for us."

The interviewee identified how strategic real estate accommodation as the most important domain. This was mainly related to their growth and improvement goals – which were outlined by their organisational four strategic focus points. The four focus points can be better achieved through better management of their real estate.

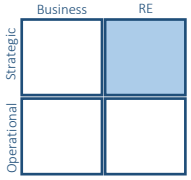


Figure 4.06. Four views tendency by R_CREM_1

[R_CREM_1]
"I think real estate accommodation perspective is that when we look for locations, that's of course most important for us. But I mean, our whole focus is to grow, to get more shops to have more turnover, to improve the shops we have in any way possible. So, I think that I'd say the top right, the real estate accommodation perspective combined with a strategic focus."

Despite the rapidly emerging e-commerce sectors, the interviewee projected the continued importance of physical shops. Without dismissing the importance of one retail type over the other, the interviewee predicted a shift towards an *omni*-channel retail model, which combines both online and physical stores.

[R_CREM_1]
"I believe in omni-channel, so I believe in in physical shops combined with online. And I mean longer term, you don't know of course exactly what's going to happen, but I can imagine that you might order more and more of the shelf products, I think might be ordered more and more online in the future, but I can imagine that the fresh products, people will still want to buy them in physical shops. This is just a guess, but I can imagine there might be a division, and I definitely believe in continued physical shops."

Organisation:	*Case Retail 2*	*Variety goods and merchandises chain company*
Interviewee:	*R_EXP_2*	*Real estate manager*

This organisation perceived resilient real estate as an ability to seamlessly integrate physical and online stores in a dynamic retail format that possesses the capability to follow its customers' demands and trends. The interviewee also emphasised the importance of creating a robust overall performance in the company's competition against similar businesses.

> *[R_CREM_2]*
> *"The one-stop-shop, very easy to bring back consumers inside, you saw the integration of online and offline has to be seamless. It has to be very easy for shoppers to order online, or pick up in store, or order in store, it has to be very cross-channel. And also, if our website for example, is not human-friendly enough, it is going to hurt us and also offline, because people go in, and they expect the same to see what they see online as in store. A lot of attention needs to be in the consumer-friendly way of shopping online and offline. Again, it has to be cross-channel situation. But also, still, investing in new format which is going to be more dynamic in the future I guess, to keep up with the latest design, latest look of field stores, latest produce, of course.*
>
> *It is very complex questions you asked. It has to be whole package. It cannot be lack behind, because consumer has so much choice right now, online and offline, and they expect that something they want, they want it right now. We really need to get used to it. Shops need to be very flexible in that sense. If you don't deliver, they can hop to another retailers in seconds."*
>
> *[R_CREM_2]*
> *"I think flexibility in contract is very important to be resilient."*

Through the lens of the resilience framework, the cross-channel integration was representable by the adaptable feature of Category 3 'Digitisation', which depicted a company's ability to digitise its day-to-day operations. Meanwhile, Category 2 of 'Accommodation of Trends' was fitted to the description of dynamic retail demand. The retail flexibility in terms of spatial arrangement can be classified into the fifth category ('Property Feature Flexibility'). Lastly, the establishment of contract flexibility was categorised to the seventh category, 'Financial & Contractual Security'.

Organisation:	***Retail Expert***	***Real estate portfolio manager company***
Interviewee:	***R_EXP_1***	***Researcher of retail market***

This organisation accentuated the importance of resilient real estate. Resilience can be achieved through the acquisition of core real estate, which was defined as assets that are projected to remain profitable for a longer period of time without considerable functional shift. The interviewee acknowledged the importance of assessing persistence, adaptable, and transformable aspects in each of their asset to determine whether it is profitable to invest on.

[R_EXP_1]
"If we make any investments, we are looking and investing for the long term, so we are preferably investing in anything which is resilient. We are looking for core real estate. So, for us it would be best if we buy something and 20 years from now it still operating at the same way, so we can just every few years upgrade it, invest in it, make it better.

So, for any long-term investor it is essential, for any investment that you're making, to look at exactly at these kinds of things. How persistent is it? And how adaptable, and transformable is it? And these are things that we do take into account."

The interviewee acknowledged the paramount importance of location for a specific business function. The interviewee necessitated the selection of a dominant location for establishing a persistent real estate. In this context, two orientations of a valuable location were identified, which were the convenience and the experience orientations. Experience-oriented stores were mainly located on a high street with a busy footfall and is often located close to the city centres. On the other hand, convenience-oriented stores were aimed for stores which function comes in a daily basis for its customer. For convenience-oriented stores, higher accessibility from the residential sector appeared to be a more important factor. Adaptability in retail real estates could be assessed from the flexibility of the altered space and its ability to fit a different function. On the other hand, from the interviewee's point of view, the concept of transformability was less favoured in real estate due to the often-required investment for the transformation.

[R_EXP_1]
"So, the first one we called "experience," which are the city centre stores. The other one we call "convenience," so it is located close to home, really for the daily purpose.

Right now, what is overarching, very important is that you are on a dominant location for your specific function and that goes for both experience and convenience. You have.. sometimes.. a part of cities where there are two or three smaller shopping centres competing with each other. You don't want to be the smallest one or the one which is not well-accessible, or the one which has not enough parking space, or the ones which is oldest, or if you don't have any space to improve it. What you want is to be or own the shopping centre which likely has the longest future, or you want to be the one which is best accessible or the most parking space. Maybe it's also the one which is next to the library, or, next to a huge healthcare centre. So, you have other type of functions next to your shopping centre, which will be used also in the future by a lot of people in that area. So, the current dominance and also the future dominance. That's a very important part if you talk about persistence. Because the more dominant you are, the likely your asset is the one which is also thriving, performing very well 10 or 20 years from now.

The adaptability, and being able to transform real estate, that's also important. Preferably you have a real estate which is very easily, interchangeable to other uses. I would say that's adaptability, and that's also becoming increasingly important in any investment that we're making.

And the third one, so transformation, that's something that happens at the end. If we are investing in any property, the adaptability which I just mentioned, changing in function and making sure that maybe stores can also be used for healthcare centre, it's connected also to this to this transformation part. Sometimes you might need to make

investments. The bigger the investment you have to make to transform it from one user to another, the less interesting the real estate is. The more flexibility is, the more able it is to house different type of uses, the better."

The retail real estate market is still adjusting and adapting to the demands and technology development of e-commerce. According to the expert in the retails sector, it is necessary to focus on both domains of the strategic level. Retailers were expected to pay specific attention to the development of the retail market. Therefore, decisions and considerations should rather be strategic than operational.

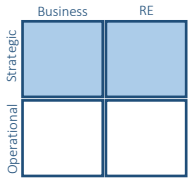


Figure 4.07. Four views tendency by R_EXP_1

[R_EXP_1]
"I would say overall strategic focus is much more important right now than operational focus. And I think right now is the time when every retailer, but also every retail real estate owner is really looking towards okay a how is this market going to develop so… They have choices, as a company or as owner, to choose whether to divest or not, and a lot of the questions are really under strategic level right now and not yet on an operational level. A lot of the most important questions are strategic. But that's more high level."

During the interview, a number of sub-categories were identified as an essential factor for a resilient retail real estate. The identified sub-categories are listed on Table 4.02 for clarity.

Table 4.02. Necessary elements according to Interviewee R_EXP_1

Necessary Elements *(sub-categories)*	Category Origin		
	Category number	Category	Features
Ability to predict trends and needs	2	Accommodation of Trends	Adaptability
Safety	4	Space and Activities	Persistence
Integration with other users	4	Space and Activities	Adaptability
Optimisation of activity-space relation	4	Space and Activities	Transformability
Physical attractiveness of assets	5	Property Feature Flexibility	Persistence & Adaptability
Accessibility	8	Accessibility	Persistence & Adaptability

[R_EXP_1]
"Therefore, for me, I always look from quite high perspective to retail. I'm following market trends. So, for me, here you have the ability to predict trends and needs. That's a very essential one, and really, being able to understand what customers want, what retailers are going to do in the coming years, and then assess: "Okay what kind of real estate do I need to buy or rent?" in my job, that is the most important part.

If you talk about the current crisis and the current threats of the of the retail market, then maybe that the 'optimization of space' and really looking "okay, do I need all the space?" If I don't need all of the spaces, which kind of possible extra users can I integrate? That's also strategic, but it's also already a bit more the operational side of thinking about how markets are going to be. So, that's a very important one.

Next to that is the physical attractiveness of the asset. So, you have flexibility, but also the safety and accessibility."

The interviewee concluded with the opinion that e-commerce will always continue to grow in the retail industries, thus requiring its integration with the physical retail concept.

[R_EXP_1]
"E-commerce is here to stay, and it's going to be, and that it is going to be fully integrated in normal retail."

Organisation:	***Case Industrial 1***	***Life science, health and nutrition corporation***
Interviewee:	***I_CREM_1***	***Real estate manager***

The current life science, health and nutrition corporation acknowledged resilience in their portfolio. However, this organisation had different approaches when it comes to the implementation of its resilient assets. That is, by owning industrial assets, and by maintaining a high vacancy level in their assets. Notably, many of their assets have been owned for considerable period of time, which lead to a net book value of zero. Also, the company also preferred to have higher vacancy level to allow flexible space assignment should the need appear sometime in the future.

[I_CREM_1]
"We do have resilience within the portfolio, meaning that we have a lot of buildings owned, and most of the buildings are just occupied or utilised. Pre-COVID-19 situation, the occupied is for example just 25%, were utilised for 25%, sometimes less. So, there is resilience when it comes to spaces, when it comes to capacity, there is resilience. There's too much resilience."

[I_CREM_1]
"For the company, it's an easy one because most of the properties are owned, and some of the property is owned for 40-50 years, sometimes even longer. So, there's a book value of zero. It is on the balance sheet at no cost."

The organisation's real estate management possessed three main goals, which were the involvement of real estate with core business, the optimisation of facility management cost, and the creation of inspiring workspaces. In the context of resilience framework, it was very important to put a significant emphasis on accommodating the trends and needs of their users (Category 2), as it would contribute to the core businesses.

[I_CREM_1]
"We are working on three goals. And the first goal is involved in the business when it comes to the real estate management, the second goal is to optimise costs. I think the better word would be to lower the cost for facilities management of real estate, and the third goal that we have is to provide inspiring workplaces for our employees."

[I_CREM_1]
"The most important one would be I think accommodation of end-users' trends and needs. Like I mentioned, supporting the business, whatever you do is to support the business, so you would have to deliver what they need, and you have to follow those trends. If they have trends to be more flexible, then you have to make that happen."

These aforementioned real estate management goals also emphasised the importance of the upper left domain of business and strategic perspective. In this case, the real estate part is expected to support the core businesses, thus explained the importance of this domain.

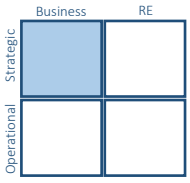


Figure 4.08. Four views tendency by I_CREM_1

[I_CREM_1]
"For me, it's the business perspective. That will be the upper left. My explanation is that whatever we will do as a corporate real estate department, it is always involved supporting the business. It's always about the money, so you would have to follow the business. You would have to learn it, and you have to make sure that they could run their business the best way it's possible. So, you have to adapt to that. For that reason, I would choose, in any case, the left part of the scheme, and I would choose the upper left quadrant."

Organisation:	*Case Industrial 2*	*Chemistry company*
Interviewee:	*I_CREM_2*	*Corporate real estate manager **

** Important note:* The interviewee specifically denied the recording request for security purposes. Therefore, the statements could not be quoted.

Resilience was placed as one of the ambitions of this chemistry company. According to the CRE manager of this company, it is fundamental to create a profound understanding of the core business strategy and collaboration with other relevant stakeholders to create a more resilient CRE. Through better understanding and collaboration, values can be better generated. Consequentially, this would benefit the core organisation. Therefore, 'Strategic Alignment' (Category 1) was deemed necessary from the perspective of this second industrial company.

Secondly, this interviewee believed that company growth should not stop even in the event of a disruption. It was necessary for the company to keep moving forward, and that the real estate department should enable and support the progress amidst the turmoil. However, the resilient approaches, though generalisable, should be assessed in a case by case manner. Therefore, the real estate interventions would deliver only relevant values in the context that is suited for each unique problem, in each asset, for specific demands.

Generally, assessment of real estate management approaches was essential to distinguish functioning from non-functioning strategies. Adaptation was also believed to be an essential feature for the creation of a more resilient real estate management.

Organisation:	*Industrial/Logistics Expert*	*Broker and advisor in logistics and industrial sector*
Interviewee:	*I_EXP_1*	*Partners*

The logistics real estate sector is currently still an emerging sector with a rapidly increasing investment demand from major investors.

[I_EXP_1]
"The logistics real estate segment has become a more interesting segment to invest money from big investors, a lot of users who owned the buildings in the past, sold it now and leased it back, because it was quite profitable for them to sell the buildings with the lease contract."

In terms of resilience logistics, specifically in the context of the current COVID-19 pandemic, the biggest threats were associated with transport and mobility disruptions, which may interrupt supply chains. One ways to overcome an interruption in the supply chain is by stockpiling. However, in general, the whole logistics sector remained relatively resilient throughout the pandemic and was projected to remain profitable in the long run.

[I_EXP_1]
"Yeah, this is very good question because COVID-19 was not something anyone could foresee, right? So it came very sudden so no one knows exactly what it would mean in terms of logistics, supply chains. And the first thing that we saw obviously when it started in China, ships stopped coming from China into the port of Rotterdam, for a few weeks. No ships came in, so meaning that a lot of warehouses, stock could run dry. I mean, of course the companies have stocks, and that's why here maybe in the Netherlands people started in the grocery stores were scared that everything would run out. But yeah, bigger that was not the case because we have a lot of, you know food and that was the case. But for larger companies who rely on a constant supply from China or any other country, that became suddenly problem because the warehouses were going low because of course there's some stock, but you know it was still sold, but no supply came in. Luckily that didn't last too long. I think maybe a few weeks. And then it came again. But this is typical, something that you could not really anticipate. For now, they did, because now they create larger stocks, to avoid, if a second lockdown happens, that they are too dependent on it on those supply chains."

[I_EXP_1]
"Generally speaking, I would say that the logistics real state has turned out to be quite resistant to these kinds of factors in COVID-19. Of course, when the first hit came in March, April and the first lockdown, everything was put on hold for a moment, because everyone was surprised and thinking "OK, what will happen next?" But pretty soon after that, it was business as usual again. In terms of leasing transactions, in terms of investment transactions. So, we actually came up with our latest market report on the logistics market, which also clearly shows that compared to last year, a small dip in take up of logistics space. So, in total, I think last year in total roughly need a little bit more than 3,000,000 square metres were taken up by users, and this year for basically 2020 was a little bit below 3,000,000, but all in all, not that big of a difference. So that proved to us that the logistics market is pretty resilient for these kinds of events, and that's also why investors are really keen on investing it."

The interviewee identified several specific necessities related to logistics spaces. Some of the important components were building specification as well as its positional proximity to the labour pool (specific for value-add logistical services) and the end-users. These components and its connection to the resilience framework is summarised on Table 4.03.

[I_EXP_1]
"I would say if it came to logistics, a few things are most important. The specifications of the building themselves, so the specification of the building is becoming more important. Being closed to labour. Little bit depending on the type of activities, but that's important. And if you're more focusing on the last mile, being close to urban areas, so the

locations to be, the physical location in the environment. Those are still the most important things. And then like pricing or amount of parking for example, or whether or not it's good to reach by public transport, is secondary. But those three elements like I said, 1) location 2) specification and 3) closely to the labour pools, those are still very important factors. And pricing we see is secondary for logistics users."

Table 4.03. Necessary elements according to Interviewee I_EXP_1

Necessary Elements *(sub-categories)*	Category Origin		
	Category number	Category	Features
Building specifications	5	Property Feature Flexibility	Persistence & Adaptability
Proximity to the labour pool	8	Accessibility	Persistence
Proximity to the end-users through last-mile distribution centres	8	Accessibility	Adaptability

In a broader context, the interviewee accentuated the importance for the logistics sector to focus on the physical real estate space (right domains). Logistics real estate needed to possess certain physical requirements, such as sufficient height, availability of loading docks, and other building requirements to support its operation. As such, its reliability on the physical real estate space necessitated the logistics sector to place the physical real estate domains as their focus among the four domains.

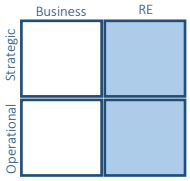


Figure 4.09. Four views tendency by I_EXP_1

[I_EXP_1]
"Physical real estate accommodation, so that's becoming more and more important. There's a set that needs to be sustainable, good stacking height, good floor loads, docks. Yeah, stuff like that. So that's becoming more and more important. Older buildings are not that great anymore, unless there is no alternative then it is still taking by the market, but users prefer new buildings."

4.2.2. Discussion: Overview of all case organisations and expert studies

Generally, most of the organisations' CRE representatives and experts acknowledged the importance of resilience in their real estate space and in the companies' broader business operations. Albeit its importance, some interviewees did not acknowledge resilient real estate as one of their organisation's ambition. During the interview, all interviewees were asked on how resilient could be achieved or practically implemented in their organisation. Several information about real estate approaches emerged, which resulted in a number of suggestions to achieve resilient CRE in different asset classes. These approaches were derived from what the respective organisations had implemented (conducted), as well as approaches that the interviewee thought could work given their experience on the field (ideas).

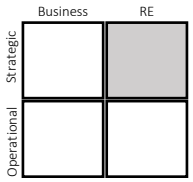
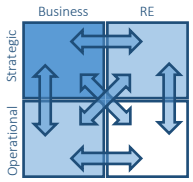
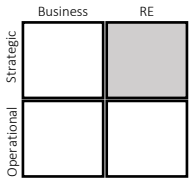
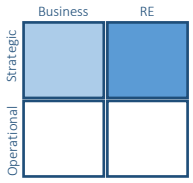
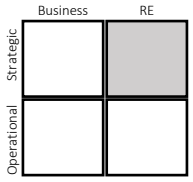
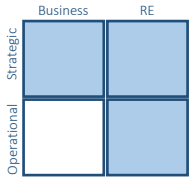
The suggested approaches, specifically the implemented ones, were originally targeted for other organisational ambitions. Nevertheless, its implementation could also contribute to the establishment of a resilient CRE. Because of this, and given the fact that resilient CRE is rarely explored, the approaches pinpointed in this empirical data collection were rather familiar. Therefore, the approaches gathered therefore possessed a potential to operationalise resilient CRE in the three asset classes, through different priorities may be placed on the more common real estate interventions.

The empirical data collection also showed how resilient CRE could contribute to better prepare organisations towards disruptions. Input and process can be maintained, which would lead to minimising risks, maintaining employees and end-customers' satisfactions, enhancing flexibility, and therefore could maintain income for the organisations. These findings were in line with the previous theoretical study that concluded how a resilient CRE may maintain and increase value delivery to its core organisation.

4.2.3. Tendency per asset classes: Iteration between theoretical and empirical findings

Tendencies of the four views in several asset classes were identified during the theoretical study (Section 2.2.3, Figure 2.17). The empirical study, which was conducted through a series of in-depth interviews also created a distinction in the interviewees' views on the importance of the four domains. These were shown in the individual case summary, although two interviewees (R_CREM_2 and I_CREM_2) did not specifically put any of the domains above the others. In this section, information from both the literature and the empirical studies was compared (Table 4.04).

Table 4.04. Comparison between literature-based and empirical-based domain tendencies (source: Author).

Literature Based	Empirical Based	
		**Office sector** There was a difference on the four domains tendency between literature and empirical data. Based on the interview, both CRE managers pointed out the upper-left domain as the most important domain. In contrast, the expert in office spaces stressed the importance on the alignment between these four domains.
		**Retail sector** Information provided from the literature and the empirical studies appeared to be relatively consistent for the retail sector. Here, the upper-right domain was identified to be the most important domain for a resilient retail real estate. However, it should be noted that one of the interviewees (R_CREM_2) did not put any weight regarding this matter.
		**Industrial/logistics sector** Empirical data collection showed the dispersion of data, where three domains were considered equally important. This information was derived from one CRE manager (non-logistics sector) and one logistics expert. The different context of their sectors was expected to cause the differences in their priorities. The second CRE manager also did not put any weight regarding this matter.

Discussion

Information discrepancy was identified between the literature and the empirical studies. This may be caused by several different reasons. First, the tendencies that were identified from the literature studies were mainly retrieved from global reports, whereas the empirical data were collected mainly from experts who operated mainly in The Netherlands. Therefore, cultural preferences were expected to have caused a proportion of the identified disagreement. Secondly, the different perspectives may be caused by variances in the interviewee's personal background and perspective in their respective organisation. As an example, a global real estate strategist of an office organisation may put more emphasis on business/strategic perspective while an office occupier expert emphasised the alignment between the four domains. Also, in the industrial sector, strategic domains appeared to be more important for non-logistics organisations, even though spatial real estate matters were more favourable to focus on for the logistics sector.

The core CREM literatures (Henderson & Venkatraman, 1989; Krumm, et al., 2000) emphasised on the alignment of the four domains. Therefore, close collaboration between different actors in the real estate management was deemed necessary to create a robust real estate management in which every actor focuses on their own domains while collaborating with the other domains.

4.3. Empirical Data Processing for Resilient Approaches

The final resilience framework (Figure 4.02) as the standard of assessment for subsequent analyses. Empirical data processing for resilient approaches was done simultaneously with the advancement of this final framework.

The data collected were classified based on the categories, sub-categories, case classes, and case organisations. The summarized data can be found in Appendix C. Table 4.05 mapped the data based on whether or not persistence, adaptability, and transformability in one particular category was detected on a particular organisation. **This stage of data processing acknowledged the occurrence, but ignored the recurrence of information within one sub-category in one case organisation.**

Table 4.05. Occurrence of different resilience categories in case organisations and expert studies (source: Author).
[V] = detected; [0] = not detected; [X] = counter argument detected; [-] = no data

	Offices			Retails			Industrial and Logistics		
	O_CREM_1	O_CREM_2	O_EXP_1	R_CREM_1	R_CREM_2	R_EXP_1	I_CREM_1	I_CREM_2	I_EXP_1
Category 1| Strategic Alignment									
Persistence: Core business gives input to CRE management	V	0	V	V	0	V	V	_	0
Adaptability: CRE collaborates with core business	V	V	V	0	0	0	V	_	0
Transformability: CRE adds significant value to core business	V	V	0	V	V	V	V	_	V
Category 2 | Accommodation of Trends									
Persistence: Physical ability to follow trends and utilise needs	V	V	V	V	V	V	V	_	V
Adaptability: Ability to predict trends and needs	V	V	V	V	V	V	0	_	V
Transformability: Ability to create needs	0	V	0	V	0	V	V	_	0
Category 3 | Digitalisation									
Persistence: Digitalisation in day-to-day operation to optimise the management of physical assets	V	0	V	V	0	0	0	_	0
Adaptability: Digitalisation in day-to-day operation to optimise process	V	V	V	V	V	V	V X	_	0
Transformability: Digitalisation in business operational	0	V	0	V	0	0	0	_	V
Category 4 | Space and Activities									
Persistence: Physical resistance to disturbances that threatens activities	V	V	V	V	V	V	V	_	0
Adaptability: Multi-use / space sharing of activity space	V	V	V	0	V	V	V	_	0
Transformability: Optimisation of activity-space relation	V	V	V	0	V	V	V	_	0
Category 5 | Property Feature Flexibility									
Persistence: Physical asset flexibility to accommodate changes within the current spatial boundaries	V	V	V	0	V	V	V X	_	V
Adaptability: Physical asset flexibility to accommodate changes beyond the limitation of current spatial boundaries	V	V	V	V	V	V	V X	_	V
Transformability: Repurpose assets to accommodate functional changes	0	0	0	V	V	V	V	_	0
Category 6 | Environmental Sustainability									
Persistence: Reduction of environmental impacts according to regulation	V	V	V	0	V	0	V	_	V
Adaptability: Reduction of environmental impacts with efforts further than regulation	0	V	0	0	0	0	V	_	0

Transformability: Contributing positively to surrounding environment	0	0	0	0	0	0	0	_	0
Category 7 | Financial & Contractual Security									
Persistence: Ability to ensure the financial and contractual security	0	V	V	V	V	0	V	_	0
Adaptability: Ability to adjust and optimise cost on portfolio	0	0	0	V	V	V	V	_	0
Transformability: Ability to innovate and drastically change the state of the contractual agreement	0	0	0	0	0	0	0	_	V
Category 8 | Accessibility									
Persistence: Assets with easy site accessibility	V	V	0	V	V	V	0 X	_	V
Adaptability: Decentralisation of assets, create multiple access points	V	0	V	0	V	V	V X	_	V
Transformability: Decrease dependency on physical site accessibility	V	V	V	0	0	0 X	0	_	0
Category 9 | Process and Real Estate									
Persistence: Physical capacity to sustain operational process without significant delay in event of disruptions	0	0	0	V	0	0	V	0	V
Adaptability: Organisational capacity to maintain or adapt operational process to maintain production process	V	V	V	V	V	0	V	0	0
Transformability: Ability to predict and minimise critical points in the production process	V	V	0	V	0	0	V	0	V
Category 10 | Input and Real Estate									
Persistence: Physical capacity to sustain the critical input-related resources	V	0	V	V	0	0	0	0	V
Adaptability: Organisational capacity to adapt the source of supply whenever needed	0	0	0	0	0	0	0	0	0
Transformability: Ability or effort to predict the optimum state of input-related resources	V	0	V	V	0	0	0	0	0

The occurrence of resilience approaches was normalised to allow unequal number of respondents in the future. This normalisation was performed to allow comparable assessment between asset classes (Table 4.06). Subsequently, Figure 4.10 represents the occurrence of persistence, adaptability and transformability in each asset class, separated by categories in the resilience framework. Notably, counter argument (argument against a particular resilience category/approach) was ignored in the occurrence table and was accounted only during the cross-class analysis.

Table 4.06. Data normalisation of occurrence (source: Author)

OFFICE	n= 3			Normalizing central data		
Category	Occurence			% Occurrence		
	P	A	T	P	A	T
1 | Strategic Alignment	2	3	2	67%	100%	67%
2 | Accommodation of Trends	3	3	1	100%	100%	33%
3 | Digitisation	2	3	1	67%	100%	33%
4 | Space and Activities	3	3	3	100%	100%	100%
5 | Property Feature Flexibility	3	3	0	100%	100%	0%
6 | Environmental Sustainability	3	1	0	100%	33%	0%
7 | Financial & Contractual Security	2	0	0	67%	0%	0%
8 | Accessibility	2	2	3	67%	67%	100%
9 | Process and Real Estate	0	3	2	0%	100%	67%

10 | Input and Real Estate	2	0	2	67%	0%	67%
RETAILS	**n= 3**			**Normalizing central data**		
Category	**Occurrence**			**% Occurrence**		
	P	**A**	**T**	**P**	**A**	**T**
1 | Strategic Alignment	2	0	3	67%	0%	100%
2 | Accommodation of Trends	3	3	2	100%	100%	67%
3 | Digitisation	1	3	1	33%	100%	33%
4 | Space and Activities	3	2	2	100%	67%	67%
5 | Property Feature Flexibility	2	3	3	67%	100%	100%
6 | Environmental Sustainability	1	0	0	33%	0%	0%
7 | Financial & Contractual Security	2	3	0	67%	100%	0%
8 | Accessibility	3	2	0	100%	67%	0%
9 | Process and Real Estate	1	2	1	33%	67%	33%
10 | Input and Real Estate	1	0	1	33%	0%	33%
INDUSTRIAL and LOGISTICS	**n= 3**			**Normalizing central data**		
Category	**Occurrence**			**% Occurrence**		
	P	**A**	**T**	**P**	**A**	**T**
1 | Strategic Alignment	2	2	2	67%	67%	67%
2 | Accommodation of Trends	2	2	1	67%	67%	33%
3 | Digitisation	1	1	2	33%	33%	67%
4 | Space and Activities	2	1	2	67%	33%	67%
5 | Property Feature Flexibility	2	3	1	67%	100%	33%
6 | Environmental Sustainability	2	2	0	67%	67%	0%
7 | Financial & Contractual Security	2	2	1	67%	67%	33%
8 | Accessibility	2	2	0	67%	67%	0%
9 | Process and Real Estate	3	2	3	100%	67%	100%
10 | Input and Real Estate	2	0	0	67%	0%	0%

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

[4] Space and Activities

[5] Property Feature Flexibility

[6] Environmental Sustainability

[7] Financial & Contractual Security

[8] Accessibility

[9] Process and Real Estate

[10] Input and Real Estate

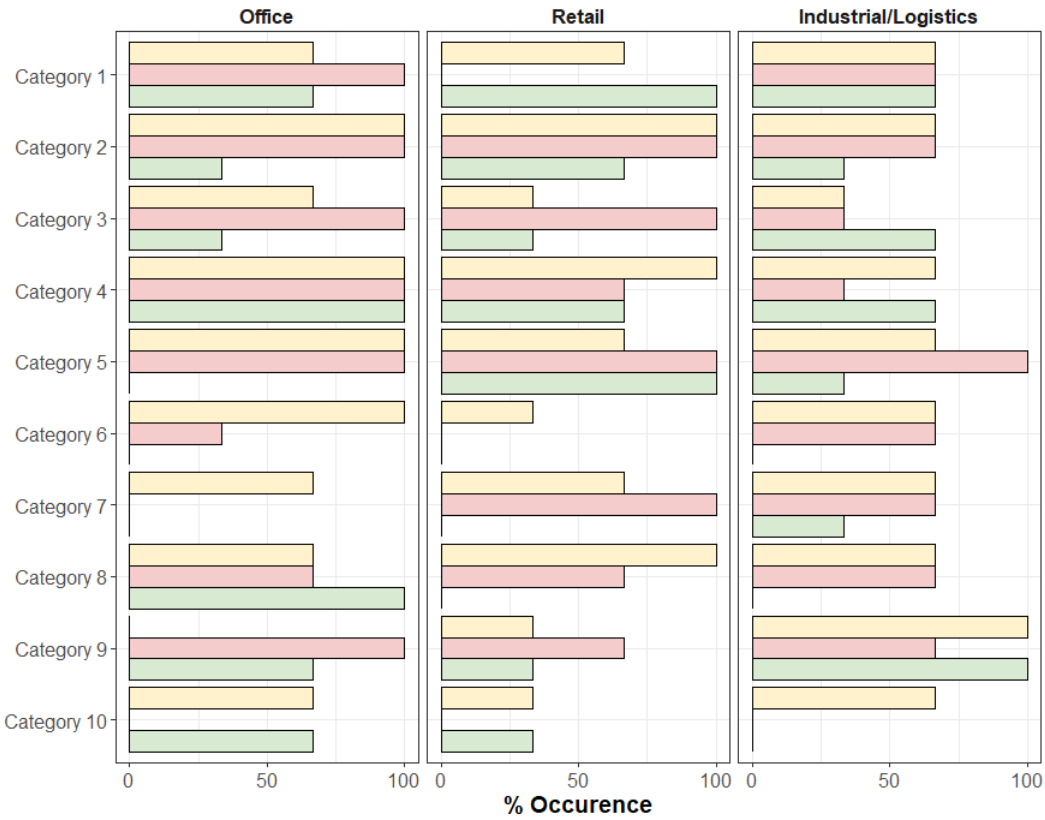


Figure 4.10. Occurrence of data in each category per asset classes (source: Author)

The current analysis performed within- and cross-class comparison on the prevalence of a particular resilience category. Within-class analysis introduced a general investigation per asset classes, whereas the cross-class analysis investigated the generic and specific approaches that may be applicable for each resilience category (Figure 4.11).

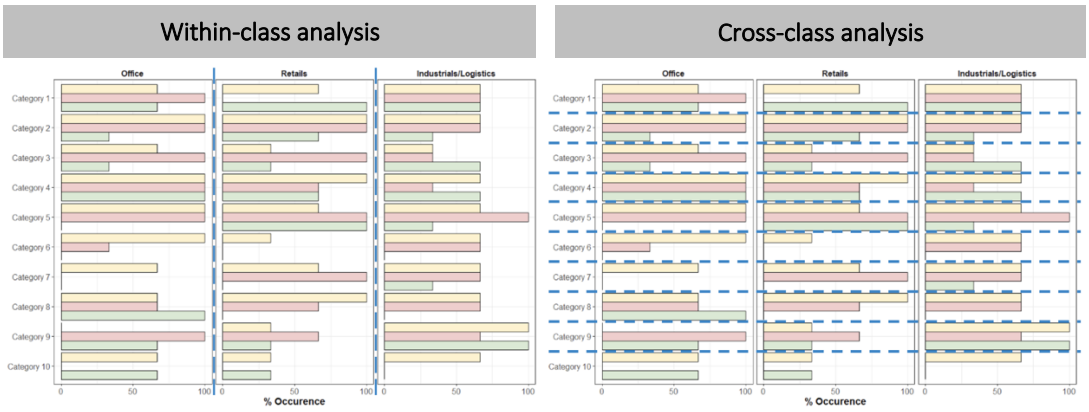


Figure 4.11. Illustration of within-class analysis and cross-class analysis (source: Author).

Core Definitions of Three Features

Persistence : Physical ability to resist external disturbances, which requires physical robustness and rigidity.

Adaptability : Flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway.

Transformability : Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Persistence
Adaptability
Transformability

4.4. Within-class analysis

This section analysed the occurrence of data in each asset classes separately. Each case class analysis outlined (1) the most occurred category, (2) the necessary category in each feature of persistence, adaptability, and transformability (P, A, T), and (3) the dominance of a particular feature in each asset classes.

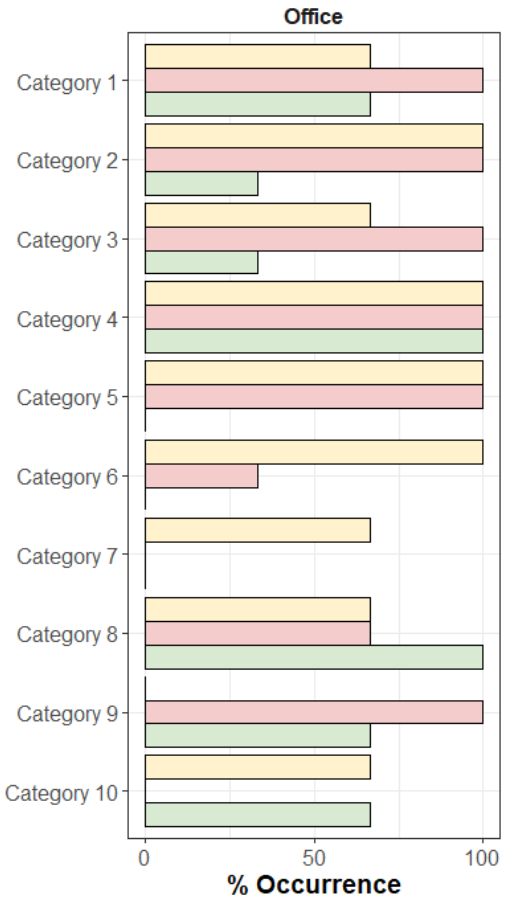


Figure 4.12. Office class empirical data occurrence (source: Author).

4.4.1. Office

With regard to the overall perspective of office real estate sector, interviewees projected that office space will continue to require meeting spaces for collaboration and interaction more than the demand for individual workspaces. This changing trend consequentially led to the increased demand for flexible spaces and digitisation to accommodate prospective functional changes and the need for remote working facilities, respectively.

Within the office class, the relation between space and activities in the workspace (category 4), was observed to be the most dominant. All sub-categories of persistence, adaptability, and transformability were found in all three case-organisations. Therefore, by looking closely to the three P, A, T features of Category 4 (see Table 4.01), it was evident how it was essential for a resilient office space to have (P) physical resistance to disturbances that threatens activities, (A) flexibility in the usage of spaces (through flex-working space), and (T) the ability to optimise its workspace.

[O_CREM_2] on Category 4, Feature: Adaptability (Multi-use / space sharing of activity space)
"People are realising that we can use our offices differently. So no open floors and just sit there 9 to 5, now we have more like open floor and separate silent zones for concentration works, and we are flexible in the mix of that."

Explanation:
Flexibility in the composition of different activity spaces

Looking closely to each of the three P, A, T features, it is fundamental for office sector to possess P, A, T features in different categories. This was derived by observing the 100% occurrence in each feature in the different categories.

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

[4] Space and Activities

[5] Property Feature Flexibility

[6] Environmental Sustainability

[7] Financial & Contractual Security

[8] Accessibility

[9] Process and Real Estate

[10] Input and Real Estate

Core Definitions of Three Features

Persistence : Physical ability to resist external disturbances, which requires physical robustness and rigidity.

Adaptability : Flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway.

Transformability : Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Persistence
Adaptability
Transformability

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

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Transformability : Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Persistence
Adaptability
Transformability

Hence, apart from the fourth category, which requires possession of all sub-categories, persistence assessment in categories 2, 5, and 6 also appeared to be a necessity for resilient office spaces. Meanwhile, adaptability elements also appeared to be necessary for categories 1, 2, 3, 5, and 9, whereas transformability was only required in category 8 (Figure 4.12).

Discussion

Workspaces, which is defined as the spatial environment in which process occurred, has been known to influence its users' productivity, performance, satisfaction, and quality of communication (Brill, 1992; Vischer & Wifi, 2016). The currently obtained empirical data supported this theory by accentuating the importance of accommodating activities in business workplaces.

It was also observed how the office sector required adaptability elements more than persistence or transformability. Adaptability allows incremental changes to happen in the real estate spaces (Davoudi et al., 2013; Meerow et al., 2016; Davoudi, 2012), which is necessary to accommodate the ever-changing demand of its people. Accordingly, office spaces need the flexibility and resources to adapt their working process in order to maintain its demanded output.

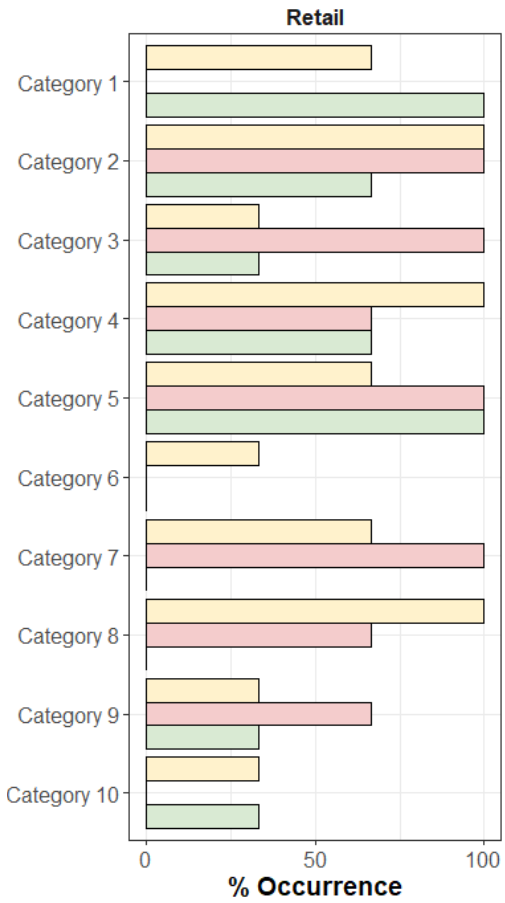

Figure 4.13. Retail class empirical data occurrence (source: Author).

4.4.2.Retail

The three interviewees for the retail sector mentioned the importance of omni-channel characteristics for the present and future of retail real estate. That is, the retail sector should enable customers to procure their products through both online and offline markets. A robust omni-channel retail requires seamless integration and collaboration between both online and offline domains.

Retailers are required to follow their targeted consumers and accommodate them accordingly. Therefore, in this sector, accommodation of trends (Category 2), as well as the property feature flexibility (Category 5) were identified as the most prevalent categories, although none of the categories had all of the three features appeared in every case-organisation (Figure 4.13).

The Persistence and Adaptable features of accommodation of trends (Category 2) was observable from all retail organisations included in the current study. As such, it was evident that the Persistence and Adaptable features of this category were essential for the retail sector. Persistence and adaptable features of Category 2 was described as following (P) and predicting (A) trends.

[R_CREM_2] on Category 2, Feature: Persistence (Physical ability to follow trends and utilize needs)
"But also, still, investing in new format which is going to be more dynamic in the future, to keep up with the latest design, latest look of field stores, latest product, of course."
Explanation: Following the latest real estate trends to attract targeted customers

As for the fifth category of property feature flexibility, the Adaptability and Transformability features were observed to have 100% occurrence. Therefore, the retail real estate is suggested to have asset flexibility to accommodate changes beyond its spatial boundaries (A), and the ability to repurpose assets to accommodate the shift in function (T).

[R_EXP_1] on Category 5, Feature: Transformability (Repurpose assets and accommodate functional changes)
"Preferably you have a real estate which is very easily, interchangeable to other uses. So maybe part of the supermarket is next to the parking place, and you can use it as a pickup point. So, people can order online and then you can even drive right by the store, you may even have maybe a separate door. That's an idea. Maybe you have space on the 2nd floor, which you can transform into offices, or into a healthcare centre. Maybe you have three supermarkets, and one is closing down, and because two supermarkets are doing okay then you can change the third one into a huge fitness centre. These kinds of things, So, I would say that's becoming increasingly important in any investment that we're making"

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

[4] Space and Activities

[5] Property Feature Flexibility

[6] Environmental Sustainability

[7] Financial & Contractual Security

[8] Accessibility

[9] Process and Real Estate

[10] Input and Real Estate

Core Definitions of Three Features

Persistence : Physical ability to resist external disturbances, which requires physical robustness and rigidity.

Adaptability : Flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway.

Transformability : Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Persistence
Adaptability
Transformability

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

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[9] Process and Real Estate

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Transformability : Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Persistence
Adaptability
Transformability

Explanation:
Interchangeable assets to other uses (creating shift in function)

For categories 2, 4, and 8, the persistence feature appeared to be essential in the retails sector, as hinted by the feature's 100% occurrence in these categories. Similarly, the adaptable feature appeared to be required by categories 2, 3, 5, and 7, whereas the transformability feature was required for categories 1 and 5.

Discussion

Category 2, which focuses on the accommodation of trends, appeared to be a rather crucial factor for the retail sector. Organisations needed to follow, predict, and if possible, create the trends and promote the needs of its (potential) consumers to maintain its popularity. Consumers' demands are rapidly evolving, and along with it their preference to shop. According to Bouwinvest (2019), there are four types of shopping behaviour. The online shoppers and store-shoppers were the first two behaviours. Then there was the web-roomer type, which explained the type of consumers who orientate online and buy in store. The last type was classified as store-roomers, which described behaviours opposite to that of web-roomers. The consumer behaviours vary depending on, amongst other things, age, retail type, and area. The retail sector thus needs to predict and accommodate these different consumer targets to maintain their popularity.

In relation to Category 5, the retail industries require flexibility in their property features. Due to the growth of e-commerce in the last few years, retail spaces has been undergoing substantial changes and adjustments to accommodate this rapidly shifting consumer demands. The integration of physical (offline) stores with online market is essential to maintain business resilience (Bouwinvest, 2019). This impacted the retail real estate spaces as well. For the last 10 years, retail spaces in The Netherlands experienced an 11.3% decline in the number of stores, even though a 4.7% increase in the total volume of space was observed (Bouwinvest, 2019). Accordingly, the currently identified accentuation on Category 5 was in line with the current prediction regarding the context and ongoing development of the retails sector.

It was also observed that the adaptability features were the most prevalent for the retail sector. This may be due to the rapid development of consumer demands in the retail sector, which demanded retail industries to possess certain flexibility to adjust and adapt to the inevitable changes. On the other hand, transformability, which required the emergence of a new pathway, may be favourable at a later stage when the retail sector reaches a more stable state.

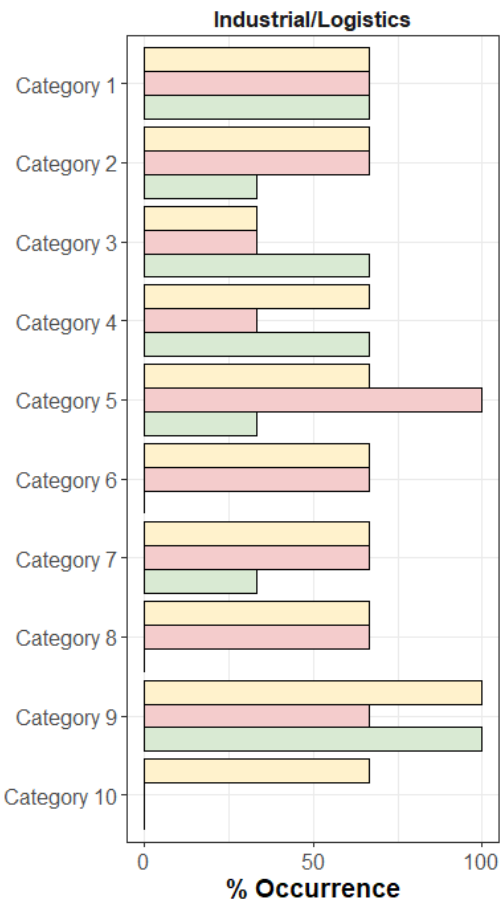

Figure 4.14. Industrial and logistics class empirical data occurrence (source: Author).

4.4.3. Industrial and Logistics

The logistics sector was considered as a part of industrial asset classes in most of the CRE literature. However, the current empirical data suggested the presence of aspects/approaches that were unique only to logistics and non-logistics sectors. Nevertheless, the current within-class analysis treated the two sub-classes as a single overarching class of industrial sector.

The industrial sector focused on slightly different categories than the former two classes. The observation identified Category 9 to be the most common, followed by Category 5, even though none of the categories had all the three features that was generally adopted by all of the case organisations (Figure 4.14).

Category 9, which focused on processes and its relation to real estate, have 100% occurrence in its persistence and transformable features. The persistent feature (Table 14) emphasised its capacity to maintain production process without major delay during disruptions. On the other hand, transformable feature requires organisational ability to predict and minimise critical points in the production process, thus making it less susceptible to disruptions. As such, industrial sectors may need the P & T features to utilise resilience CRE. Adaptability feature in Category 5, which focused on the physical flexibility to accommodate changes beyond the limitation of current spatial boundaries was also identified as a necessity for the industrial sector (Table 13). The observed organisations emphasised the importance of its ability to adjust to different circumstances.

[I_CREM_1] on Category 9, Feature: Persistence (Physical capacity to sustain operational process without significant delay)
"So, if you have five manufacturing plants on global scale, and one of them is in the Netherlands, if you lose that, you have four others left."

Explanation:
Decentralised production points therefore less susceptible and able to maintain production process (in event of disruption)

Discussion

The importance of processes (Category 9) is mainly due to industrial sector's reliance on its production process. In this case class, it is necessary to have persistence elements which emphasises on the capacity to maintain processes in event of disruptions, and transformability which focuses on minimising the critical process points.

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

[4] Space and Activities

[5] Property Feature Flexibility

[6] Environmental Sustainability

[7] Financial & Contractual Security

[8] Accessibility

[9] Process and Real Estate

[10] Input and Real Estate

Core Definitions of Three Features

Persistence : Physical ability to resist external disturbances, which requires physical robustness and rigidity.

Adaptability : Flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway.

Transformability : Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Persistence
Adaptability
Transformability

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

[4] Space and Activities

[5] Property Feature Flexibility

[6] Environmental Sustainability

[7] Financial & Contractual Security

[8] Accessibility

[9] Process and Real Estate

[10] Input and Real Estate

Core Definitions of Three Features

Persistence : Physical ability to resist external disturbances, which requires physical robustness and rigidity.

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Persistence
Adaptability
Transformability

Similarly to the retail sector, flexibility in property features (Category 5) was identified as an important feature for the industrial sector. This was mainly due to the sector's dependency on their physical assets to perform certain activities. Capacity and spatial configurations were two of the most important demands to be addressed in the industrial sector (Benjamin, Zietz & Sirmans, 2003). Though similar with retails, which emphasised the importance of the fifth category, the approaches that were taken by the industrial sector to achieve resilient spatial property features may differ from that taken by the retails sector. This will be further discussed in the cross-class analysis.

In the industrial sector, persistence elements were more dominant than the other two sub-categories. This was likely due to the nature of this class that aims for a robust production process. Persistence in the real estate may thus be needed to maintain the same process as often required to meet their manufacturing standards, thereby confirming the dominance of this sub-category in the industrial sector.

4.5. Cross-class analysis

This section attempts to dissect each of the ten categories (with respect to the P, A, T subcategories), and perform a cross-class comparison between observed classes. **The cross-class analysis was performed to elucidate how persistence, adaptability, and transformability can be achieved in the observed classes. The analysis was based on both literature and empirical data. Notably, various asset classes may have a similar and specific approaches to achieve resilience in different resilience category included in the framework.**

The final resilience framework (Figure 4.02) consisted of 10 categories, each of which was expanded to persistence, adaptability, and transformability. Here, each of the ten categories was broken down further according to the data gained from the case organisations. The current analysis accounts for the identified counter argument(s) against the applied P, A, T features in a particular case (Tables 4.07, 4.09-4.17).

4.5.1. Category 1 | Strategic Alignment

The first category identified the extent of connection between CRE and the main business organisation. Here, a condition where the core business behaves as solely a provider of input to the CRE management to support the business was regarded as a persistent assessment. In contrast, a collaboration between CRE and core business was identified as an adaptable approach. Finally, the condition where the presence of CRE actively adds a significant value to the business organisation was categorised as a transformable approach (Figure 4.15).

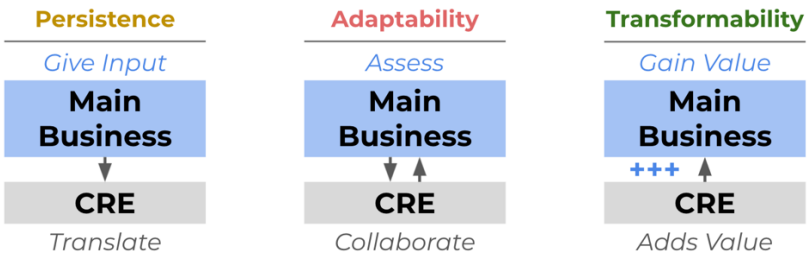

Figure 4.15. Illustration of persistence, adaptability, and transformability in Category 1 (source: Author).

Empirical data result

Table 4.07. Category 1 empirical data summary (source: Author).

*Category 1	Strategic Alignment*											
	Offices				**Retails**				**Industrial and Logistics**			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	**Data**	R_CREM_1	R_CREM_2	R_EXP_1	**Data**	I_CREM_1	I_CREM_2	I_EXP_1
Persistence: Core business gives input to CRE management	Translation of core organisational strategy to real estate strategy	V		V	Translation of core organisational strategy to real estate strategy	V			Translation of core organisational strategy to real estate strategy	V	V	
	Real estate that accommodates and supports the business	V			CRE strategies based on location and business contexts, which differs			V	Real estate that accommodates and supports the business	V	V	

	Streamlining multiple assets to match the global organisational strategy			V	based on external conditions							
Adaptability: CRE collaborates with core business	Alignment of CRE strategy with overall organisational strategy (business plan, ambition)	V	V	V	*(n/a)*				Alignment of CRE strategy with overall organisational strategy (business plan, ambition) by - centralised management - connecting and understanding the core business	V	V	
	Collaboration with other sub-departments to minimise or mitigate risks			V					Collaboration with other stakeholders to minimise or mitigate risks		V	
Transformability: CRE adds significant value to core business	Assessment of value added on the overall business organisation in every consideration of CRE intervention	V	V		Assessment of value added and/or value loss, on the overall business organisation in every consideration of CRE intervention		V	V	Assessment on the extent and size of value added on the real estate to the whole businesses	V		
	Active and dynamic CRE strategy to create positive impact on overall business	V			Active and dynamic CRE strategy, continuous assessment based on everchanging market trends that would impact real estate decisions	V		V	Active and dynamic CRE strategy, by selling the owned assets and lease back, creating added value (more profit to the organisations)			V
									Real estate interventions create value to the core businesses		V	

In office and industrial sectors, all three features were observed in the case organisations. However, organisations in the retail sector only identified persistence and transformability in the relation of CRE and business strategy.

CRE management in all the observed case classes aimed to support the main businesses (persistence) by tailoring its strategy based on the organisations' core ambition. It was also observed that in transformable aspects, all asset classes assessed the value added/loss on their real estate decisions and reflect its impact to the whole business case. All cases also possessed transformability assessment through continuous adjustment in following the market trends to positively impact the core business organisation.

In both offices and industrial sectors, adaptability was observed through the efforts to align CRE strategy with the organisational strategy. Similar information was also identified in every office sector case organisations, which confirmed the importance of this particular alignment within this sector.

> *[O_EXP_1] on Adaptability*
> *"I think resilience in in my work would be described like being able to match your real estate strategy to the business strategy."*

In office sector, efforts to streamline assets to match the portfolio and the business identity (persistence), as well as collaboration of CRE management with other departments in the alignment of supply and demand (adaptability) were identified to be two important aspects. The CRE strategies of retail industries identified the contextual consideration, which may differ based on the condition of its environment and the various retail types (persistence). Meanwhile, in the logistics sub-sector, dynamic CRE strategies appeared to be dominant. This was observable from the sub-sector's tendency to sell

assets and lease it back for more profit. This was caused by the high demand of logistics spaces, therefore providing a high value to their assets.

> *[I_EXP_1] on Transformability*
> *"The logistics real estate segment has become a more interesting segment to invest money from big investors, a lot of users who owned the buildings in the past, sold it now and leased it back, because it was quite profitable for them to sell the buildings with the lease contract."*

Discussion

CRE strategy may generate added value to an organisation and enhance its performance if the CRE is optimally aligned (Haynes, 2012; Gibler & Lindholm, 2012). This category possessed a rather sequential sub-categories, which implied a situation where persistence needs to be fulfilled before reaching adaptability, as is adaptability before transformable. In the office and industrial sectors, these three levels of features were identified. In contrast, adaptability feature was not identified from the retail sector, yet it deemed to be necessary to possess the alignment between the CRE and the core business in this specific sector. In addition, it was argued that the retail sector needed to have a real estate that accommodates and supports the core business, even though the argument was not explicitly mentioned during the case studies.

It was also arguable that some approaches identified in the category was rather generic and might be applicable to other classes beyond the observed three asset classes. Optimally, CRE can contribute significantly to the whole business case. Such state may be reachable through the implementation of both persistence and adaptable approaches. Therefore, CRE should first be able to accommodate the main business, by tailoring CRE strategies based on the core organisation's ambition. Once achieved, organisations can align the CRE strategy with the business through collaboration and assessment between both CRE and other related departments. Through the fulfilment of these two approaches, and with a dynamic strategy, CRE can add significant value to the overall organisation through the constant assessment of value added and loss to the business prior to the execution of a real estate intervention. The generic approaches identified for the first category is listed on Table 4.08.

Table 4.08. Category 1 generic approaches (source: Author).

Category 1: Assessments	Category 1: Generic approaches
Persistence: Core business gives input to CRE management	Real estate that accommodates and supports the business, by tailoring CRE strategy based on overall organisational ambition
Adaptability: CRE collaborates with core business	[*] Alignment of CRE strategy with overall organisational strategy
Transformability: CRE adds significant value to core business	Active and dynamic CRE strategy
	Constant assessment of value added on the overall business organisation

[*] originally only identified in one or two asset classes, but generally applicable to all classes based on inference.

The involvement, integration and alignment of CRE to the core business strategy could enhance effectivity and efficiency for the whole organisation (Gibler & Lindholm, 2012). Therefore, although this category was not observed as one of the most essential categories during the within-class analysis, it may be perceived as an essential success factor for an organisation.

4.5.2. Category 2 | Accommodation of Trends

The second category identified the extent of real estate trend accommodation in the businesses' activity spaces. Persistence in this category was identified as physical ability to follow the given real estate trends, while adaptability was indicated by the ability to predict the emerging trends and accommodate it. Finally, transformability was defined as the ability of real estate configuration to create the demand for the business.

Empirical data result

Table 4.09. Category 2 empirical data summary (source: Author).

Category 2 | Accommodation of Trends												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	**O_CREM_1**	**O_CREM_2**	**O_EXP_1**	**Data**	**R_CREM_1**	**R_CREM_2**	**R_EXP_1**	**Data**	**I_CREM_1**	**I_CREM_2**	**I_EXP_1**
Persistence: Physical ability to follow trends and utilise needs	Appropriate working environment and experience	V	V		Customer-friendly retail spaces		V		Appropriate working environment and experience	V		
	Workspace that responds and accommodates users' demands, activities, and work processes	V		V	Retail spaces that accommodates regional-specific demands and/or context-specific demands		V	V	Logistics spaces that accommodate growing interest of stakeholders on sustainability			V
	Cater the needs of different user types in an organisation		V	V	Constant development of physical assets to accommodate everchanging trends		V		Logistics spaces that follow consumer demands on e-commerce by creating last-mile distribution centre, placing it near the urban consumers			V
	Physical assets as status and identity to attract clients			V	Decent quality and attractiveness of physical assets, physical improvement of deteriorated assets	V	V	V	Remodel assets to fit the modern demand	V		
	Follow the technology development in the industry		V		Follow the latest real estate retail trends		V		Follow trends and needs, through the updated workspace concept	V		
					Tailor locations by following consumers demands, based on organisations' identity and its target market, to attract customers optimally			V				
					Asset location: - Dominance for specific functions - Quality of site surrounding that match the specific retail function			V				
					Accessible in diverse location types: experience and convenience stores			V				
Adaptability: Ability to predict trends and needs	Predict emerging workspace trends and accommodate it			V	Predict emerging trends and accommodate it (e.g. experience vs convenience stores)			V	Predict emerging logistics trends of higher e-commerce demand and accommodate it by last-mile distribution centre			V
	Analyse specific demands on each sub-processes in workspaces and accommodate it			V	Predict and continuous assessment of assets in relation to users' demand	V	V	V	New developments due to projected higher demands			V
	Flexibility in the composition of different activity spaces based on		V		Optimisation of space based on future projection of trends			V	Projecting suitable real estate intervention by profound understanding of		V	

	projected trends and needs								the core business and collaboration with other stakeholders			
	Collaboration with other sub-departments to predict favourable assets			V	Predicting the importance of retail locations in proximity of other prominent retail functions, to fit consumers' demands & convenience	V						
	Actions taken to respond to projected disruptions, by: - Enhancing inclusivity - Maintaining customers interests	V			Asset location based on projected high long-term footfall (high streets are projected to remain favourable for retails)			V				
					Assessment of the composition and balance between physical and online market, based on projected demand and various variables			V				
Transformability: Ability to create needs	Setting example to shape trends and create needs		V		Constant innovation to provide best customer experience	V			Redevelopment to attract new clients and large businesses	V		
	Implement own vision and how it should be utilised in physical spaces		V		Showcasing at retail spaces as a holistic approach to create needs			V				

All three P, A, T features in this category were identified in all three case classes. Some of the identified resilient approaches were found to be applicable for all three case classes. In the persistent feature, office, retail, and industrial sectors all emphasised the importance of following the trends and technological development of their specific field. Additionally, they also identified the need to create a good user experience for their employees and customers.

Adaptability was observed in all classes through the efforts to predict emerging trends and accommodate it. However, the execution of adaptable efforts varied between case classes. The actions taken by the office class included the adjustment of workspaces composition based on the predicted changing activities, as well as actions that is predicted to increase employees' inclusivity. The retail sector mainly accommodated their prediction on changing trends through the space optimisation, evaluation of retail locations with relation to other anchor retail function, and assessment of locations that are expected to remain favourable for a foreseeable future. As for the industrial sector, prediction on trends involves collaboration between stakeholders, as well as the necessity to understand the core business strategy. On logistics sub-sector, actions taken includes the development of new warehouses due to higher demands on e-commerce, which projected to continue rising several years ahead.

> *[I_EXP_1] on Adaptability*
> *"Since few years ago, a lot of development of logistics spaces had been carried out, in all kinds of places. Not only in Randstad area, where we live, but also in other places in the Netherlands. At the moment, we don't foresee any lack of interest. Quite the opposite, we expect more interest."*

The approach of achieving transformability in the current category differs in every sector. It is observed in one of office case organisation that their real estate aim to set example for the prospective clients, therefore creating needs. They also claimed to have their own vision and how it should be utilised in their real estate spaces. In the retail sector, one of the case organisation focuses on constant innovation. A retail expert believes that some retails can function as a platform to showcase their product/services rather than just a shop, to attract prospective new customers of their products. One

case organisation in industrial sector is doing redevelopment of their assets to attract potential clients and large businesses.

> *[I_CREM_1] on Transformability*
> *"The largest part is still industrial sites, and we are demolishing buildings there and we are developing land and attracting new companies and new customers to start their businesses over there"*

Discussion

The second category was one of the categories with the most evidence found during the empirical study. There is recurrence of data in every case-classes in every sub-category, with both similar and different approaches per case organisations. This was mainly due to the fact that every organisation has their own specialties (features, target markets, aims, and contexts). Therefore, it is not surprising that their approaches to accommodate trends are differ from one another.

Specifically on the actions to enhance inclusivity of an office organisation (adaptability), an office decided to consolidate two of their assets into a single headquarter (in Amsterdam). This was performed based on the assessment that the existence of two separate assets created a segregation between employees in different places. The integration of two branch assets into a single headquarter was projected to create a more inclusive working environment, which could contribute positively to the productivity, and significantly influence the business and their respective output.

On retail sector, there are some physical stores that are designated as a holistic approach to the entire business case. These stores may invest more on the showcasing concept, which may cost more and less profitable, if the assessment scope is limited to this particular asset. Showcasing-concept stores may be less profitable by itself; however, these stores provide experience, which may subsequently create a new demand by attracting passers-by. Categorised as a transformable approach, this concept may become profitable when the assessment is expanded to the whole business case. Below, a quote from the selected expert in retail may provide more validity on this matter.

> *[R_EXP_1] on Transformability*
> *"On a more abstract level, stores, especially stores at the Kalverstraat for instance, in some cases they might even lose money. But retailers will still keep them open because these kind of stores are very important for promotion. They are also a marketing channel, like the Lego Store on the Kalverstraat. If it loses money, it's not a problem for Lego because Lego is a brand and they make money on a number of different ways, and they see this as kind of holistic way. So it is really a part of that total business case."*

Nonetheless, CRE department should support the main business, and the main business needs to attract their target market. Therefore, accommodating the users' needs by responding to the trends is one of the key success factors of a business, which can be achieved through real estate approaches.

4.5.3. Category 3 | Digitalisation

The category digitalisation distinguished the three assessments levels based on the extent and the scale of digitalisation that is implemented in the organisation. Persistence identified physical assets digitalisation in optimising daily operation and management of an organisation. Adaptability also identified the optimisation of day-to-day operational process, but the extent, in this case, would reach beyond the physical approaches. Meanwhile, transformability in this category distinguished the digitalisation on the whole business operational scope.

Empirical data result

Table 4.10. Category 3 empirical data summary (source: Author).

Category 3 | Digitalisation												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	**Data**	R_CREM_1	R_CREM_2	R_EXP_1	**Data**	I_CREM_1	I_CREM_2	I_EXP_1
Persistence: Digitalisation in day-to-day operation to optimise the management of physical assets	Sensors placed in physical assets for monitoring purposes	V		V	Self-scanning machine in physical assets to minimise risks	V			Sensors placed in industrial assets		V	
Adaptability: Digitalisation in day-to-day operation to optimise process	Hybrid working: remote working capability for most of employees, reducing physical meeting	V	V	V	Hybrid working: remote working capability for most of employees	V			Hybrid working: remote working capability for some of employees	V		
					Omni-channel retail: Integration and combination of physical and online market	V	V	V	Counter argument: Inability to digitize specific roles/task, especially production/lab work	X		
					Digital workflow and approval processes when possible	V						
Transformability: Digitalisation in business operational	Digital service to replace services done in physical space, to minimise on-site interaction		V		Unmanned units to replace regular physical retail format	V			Maximisation of process automation in industrial production process		V	
									Automation in logistics warehouses			V

Generally, office and retail asset classes possess all of the three assessments of this category. Empirical data collection did not identify data on all assessment levels for the industrial asset class, and a counter argument to the adaptability assessment was detected.

The persistence assessment of digitalisation category was observed as physical digitalisation during the empirical data collection. This involves sensors for monitoring purposes for office sector, and other digital tool (e.g. self-scanning machine) to minimise risks in retail sector. There was no persistence element detected in industrial and logistics sector, yet it should be noted that the absence of evidence in the data does not disregard its actual application in this sector.

Adaptability assessment focuses on digitalisation effort related to process optimisation. All case-classes recognised the role of hybrid working, which requires remote working capability for most of the employees. In offices, this capability reduces the amount of physical meeting that needs to be done in physical asset. Retails, on the other hand, focused on the integration and combination of both physical and online platform as the future platform of the businesses. It should be acknowledged that despite the dominance of remote-working capability in this category, the ability to execute remote operation

is facilitated through digitalisation. Therefore, digitalisation can still be seen as an underlying capacity that facilitates remote working and its related processes.

The transformability assessment of digitalisation in business operational requires more innovative and radical approach to digitise the whole business process. This sub-category was observed in one organisation in each of the three asset classes. One banking organisation in the office sector digitise their entire customer services, and one supermarket chain company aimed to replace some of their physical store to unmanned units. In addition, one logistics expert identified automation of warehouses for their clients. These three approaches have a consequential impact on the usage and configuration of their physical space.

> *[O_CREM_2] for Transformability*
> *"From a technical point of view, we simply see that some branches get one or two people a day, and then you have three people sitting there all day waiting for maybe 1-2 clients. Including the rent, including the security, and that's so costly. When clients come, they're asking for simple services, like "my banking card is not working", "I need to have a paper", or only cash withdrawal, so we have around 3-4 people sitting there for just very minor questions. Now, we switch to.. If your card is not working, you simply click on the Internet, order new card next day, or even the same day, they come. Because it's like other e-commerce sector. You click and collect. So, it's... And that is for banking as well."*

Discussion

In general, progression towards digitalisation appeared to be a favourable process regardless of the sector. Nevertheless, an exception was identified in the industrial sector. The realisation of adaptable assessment in this sector appeared to be less feasible in a number of industry-specific activities, such as research and development, as well as the manufacturing processes – both of which often require physical access of highly specialised infrastructure. Therefore, to some extent, process digitalisation is possible in industrial sector, even though a number of roles are expected to remain outside the reach of digitalisation.

> *[I_CREM_1] for counter argument of Adaptability*
> *"For those people that are needed.. because somebody is working in the lab, they cannot work from home, but they need to work in an office. I can work alone and I do work from home right now. But for labs, it is quite difficult. So, we put the processes in place, so people would be able to come to the lab, and we have some temperature monitoring, sanitising, guidelines, etc."*

The revolutionary approaches of transformability in office and retail sector were also influenced on predicting the future trends, as well as the ability to adopt new technology. In banking industries, as explained before, it was realized that almost all services can be done online, therefore minimising on-site interaction, which subsequently results in the opportunity to optimise the amount of space needed for operation. The supermarket company also projected a long-term decrease in daily commute, therefore physical spaces can be replaced by the unmanned and automated retail space.

4.5.4. Category 4 | Space and Activities

The fourth category focuses on activities and its relation to the accommodated space. Persistence in this category was defined as strength and capability for a physical asset to resist disturbances that may impact the activities that it houses. Meanwhile, the adaptability assessment was defined as the ability to share multiple activities in a space. It can be applied in context of space-sharing of different activities in the same organisation, or, single-purpose space co-utilisation by multiple organisations. Transformable feature in Category 4 was identified as the optimisation of space and activities associated with the space, through the emergence of different trajectories which are not necessarily reversible.

Empirical data result

Table 4.11. Category 4 empirical data summary (source: Author).

Category 4 | Space and Activities												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	**Data**	R_CREM_1	R_CREM_2	R_EXP_1	**Data**	I_CREM_1	I_CREM_2	I_EXP_1
Persistence: Physical resistance to disturbances that threatens activities	Basic maintenance plan to maintain safety and quality	V	V	V	Basic maintenance plan to maintain safety and quality	V	V	V	Sufficient maintenance plan to maintain safety	V	V	
	In compliance to health and safety regulation	V	V	V	In compliance to health and safety regulation	V	V		In compliance to health and safety regulation	V	V	
					Collaboration with external technical & maintenance parties to respond to day-to-day physical incidents	V			Outsource maintenance party to mitigate risks	V		
					Physical improvement of the deteriorated assets		V		Physical resistance towards probable physical disaster (e.g. fire)	V		
					Well-organised retail space	V			Location of sites designated for industrial activities	V		
									Sites to not be easily accessible due to safety reasons	V		
Adaptability: Multi-use / space sharing of activity space	Flexible working space: - Spread into different locations - Desk-sharing concept - Multi-usage of spaces			V	Integration with different-functioned shops to create more efficient space usage, (e.g. one-stop-shops)		V	V	Flexible working space: - Desk-sharing concept	V		
	Flexibility in the composition of different activity spaces	V	V	V								
	Activity-based environment and fit-out		V									
Transformability: Optimisation of activity-space relation	Optimisation of space through continuous assessment of desk ratio (workspace less than total number of employees)		V	V	Optimisation of space based on future projection of trends (smaller & more compact physical stores)			V	Optimisation of space through continuous assessment of desk ratio (workspace less than total number of employees)	V		
	Optimisation of portfolio for future-proof business	V			Optimisation of portfolio for future-proof business		V	V	Optimisation of portfolio to optimise cost		V	
	Hybrid working: office for meeting and collaboration space, to increase creativity, connection, identity; therefore less individual workspace	V	V	V								
	Pay-per-use workspaces (service-based)	V		V								

Streamlining similar asset function that have different target markets		V										
Redefining spatial arrangement based on activity demand		V										

All three features of persistence, adaptability and transformability are observed in the three selected asset classes. Some approaches can be identified in more than one asset class, some are specifically applicable on one class. The occurrence and recurrence of data in the same sub-categories are also varies.

The persistence sub-category has two generic approaches identified in all asset classes and in almost all office and retail case-organisations. These two approaches included maintenance plan to maintain safety and quality, as well as compliance to health and safety regulation. Specifically in the industrial sector, one organisation emphasised the importance of resistance requirement as well as the strict consideration of site location and accessibility due to safety reasons.

Adaptability was described as the capacity of sharing activity spaces. The empirical evidence shows that flexible working space is rather favourable in office and industrial sectors. Both asset classes identified desk-sharing concept. Offices also pinpointed the possibility of open offices or utilisation of co-working spaces. Specifically in the office class, having the flexibility to different layout composition is also identified as an important adaptable capacity during the case study. Meanwhile, retail sector has a slightly different approaches in this sub-category. Two case organisations identified the possibility of integrating several shops with different functions, such as one-stop-shops. By sharing the activity spaces, shops may increase its space-usage efficiency.

> *[R_CREM_2] for Adaptability*
> *"The one-stop-shop, very easy to bring back consumers inside. So if we have a large store which is too expensive, we split the store we take half, and another-functioned business take the other half, so more flexible in that sense. Also, for the benefit of the landlords, so if we have an idea of being more flexible inside the stores, the format of developing together with the other business, I think that landlords should be involved and make it possible more than its right now sometimes. So it goes both ways."*

Transformability, which in this category was defined as the optimisation of activity and space relation, has also both generic and specific evidence. All three case-classes showed the optimisation of space through different approaches. Offices and industrial classes tend to perform continuous assessment of desk ratio to optimise their spaces. This will result in the minimisation of the workstations, which is expected to be less than the total number of employees. Retail sector optimises its space by projecting the future and determine a more favourable and profitable format. Specifically in offices, the hybrid working concept, which minimises the demand for individual workstations at the asset, opens up the opportunities of optimising physical office space. It is also projected that offices may be more beneficial if the physical space put more focus on accommodating collaboration to increase creativity, connection and sense of belonging.

> *[O_CREM_1] for Transformability*
> *"That people also feel that this is their office, and that they are eager to come back to the office because that is the place where creativity is coming from. That's where you connect with people. That's where you feel that you are part of the company. And that makes you proud."*

Discussion

Firstly, this category possesses a sequential characteristic between three sub-categories. This suggested the need to fulfil the lesser assessment levels before achieving higher assessments. In other words, persistence needs to be fulfilled prior to achieving adaptability, and that both needs to be achieved to reach transformable stage.

Secondly, there are approaches that could be generalised and therefore applicable to all asset classes. Some approaches may also be applicable for classes that are not included in the scope of this study. In the pursue of persistence, a sufficient maintenance plan as well as the capacity to follow the health and safety regulations are classified as the two generic approaches. To achieve the transformable state, optimising assets and portfolio could be done through the continuous assessments and projection of trends, making it future-proof.

However, some approaches appeared to be considered only to specific asset classes. Flexible working space, which was observed on office and industrial classes, can be distinguished in several different types. There are hot desks type, which is characterised by free workspaces that anyone can use; open office concept, where there are no segmented or clustered activity space in an asset; and lastly co-working spaces, where a third party may provide a rentable space.

Decent implementation of flexible working space could lead to the transformable state, where an organisation can optimise their space usage. This can be done by the accurate prediction of optimal employee-to-desk ratio. According to O'Neill & Wymer (2011), to establish an optimum employee-to-desk ratio, constant adjustments need to be done, because the value of the ratio changes as employees may change their preferences over time. Thus, to provide an efficient continuous assessment of the desk demand, the support from Digitalisation in physical assets (Category 3, Persistence) may come as a necessary requirement. Sensors can help to retrieve precise data of space usage, which can subsequently be used to inform the adjustment of employee-to-desk ratio.

4.5.5. Category 5 | Property Feature Flexibility

The focus on this category is the property features in relation to its change of usage. The ability of an asset to provide changes within their current space is identified as persistence. Meanwhile, the ability to respond to changes that are beyond their current spatial boundaries fits into the adaptability sub-category. Transformability is the state where organisations have the capability to fully alter an asset's use and functionality.

Empirical data result

Table 4.12. Category 5 empirical data summary (source: Author).

Category 5 | Property Feature Flexibility												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	**O_CREM_1**	**O_CREM_2**	**O_EXP_1**	**Data**	**R_CREM_1**	**R_CREM_2**	**R_EXP_1**	**Data**	**I_CREM_1**	**I_CREM_2**	**I_EXP_1**
Persistence: Physical asset flexibility to accommodate changes within the current spatial boundaries	Flexible & adjustable assets - to accommodate changing trends - to accommodate changing business strategy and work process	V		V	Flexible & adjustable assets - to accommodate changing trends - to improve the deteriorated assets due to costly major transformation		V	V	High vacancy level to accommodate changes	V		
	Flexible in the composition of different activity spaces			V					Building specification to conduct logistics business operation e.g. sufficient or adjustable clear height, quality of floorings and loading docks			V
	Spatial arrangement flexibility due to core portfolio ownership		V						*Counter argument:* Industrial portfolio are normally not very agile	X		
	Regularly adjusted desk ratio		V									
	Hackable spaces to create easy-adjusted assets			V								
Adaptability: Physical asset flexibility to accommodate changes beyond the limitation of current spatial boundaries	Flexible portfolio, through: - Flexible contracts (rental agreement) - Flexible leases (short term / long-term with break option) - Floor-by-floor leases to expand or reduce spaces		V	V	Flexible contracts (rental agreement), creating a security & control over location	V	V		Flexibility to relocate - physical logistics space - some part of light industrial activities (through flexible contract)		V	V
	Combination of ownership in real estate, own and lease		V		Lowering risks by renting space (rather than ownership of assets)			V	Lowering risks by renting space (rather than ownership of assets)			V
	Terminate outdated assets		V		Exit strategies of assets		V		Terminate assets that are no longer serve the business purposes, by: - selling assets and renting the lands - selling assets	V		
	Optimisation of assets by workspace adjustment due to changing demands			V	Optimise or relocate assets, by: - minimise the amount and area of physical stores, with careful assessment - consider the better deals with landlord		V	V	Selling the business including its property	V		
	Consolidate assets	V							Consolidate assets		V	
									Counter argument: Site-context is very rigid due to limited function of industrial sites	X		
Transformability:	*(n/a)*				Unmanned unit to replace regular physical format	V			Redevelopment of assets, focuses on sustainability and circularity	V		

Repurpose assets to accommodate functional changes					Repurpose assets that are no longer in demand		V		Redevelop and repurpose assets functions	V		
					One-stop-shops: integration with other different-functioned shops		V					
					Interchangeable assets to other uses			V				

This category focuses on the features to accommodate the change of usage in assets. The empirical data distinguishes asset flexibility for persistence assessment, portfolio flexibility for adaptable level, and business flexibility to achieve transformable level (Figure 4.16). Business flexibility may require change in format, process, function, and delivery methods.

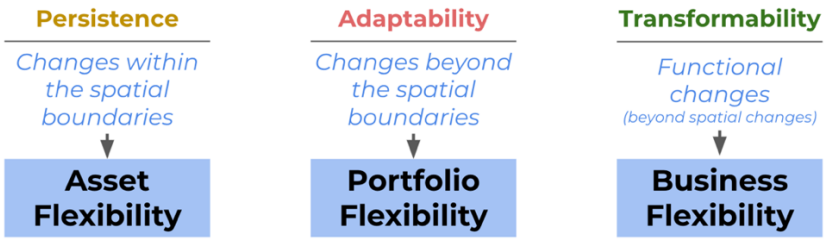

Figure 4.16. Illustration of persistence, adaptability, and transformability in Category 5 (source: Author).

The asset flexibility approaches of persistence required adjustable assets. This had been observed in offices, retails, and logistics sectors. Industrial sector outside logistical spaces may have its own limitation of having adjustable assets.

Portfolio flexibility (adaptability) can be achieved through several approaches. Offices and retails real estate acknowledged the importance of having a flexible contract, which are expected to create security and control over the assets. An office case organisation also pointed out that it is preferred to have short-term leases, or long-term leases with the possibility to break. Flexibility in offices also can be achieved through floor-by-floor leases, when applicable. All case classes acknowledged the importance of having an exit strategy for under-performing or outdated assets, which may require the ability and capacity to terminate assets that are no longer in demand. In this case, logistics sector has the advantage for being easier to relocate due to their straight-forward process characteristics.

> *[O_CREM_2] for Adaptability*
> *"We've been working on the flexibility in our portfolio in the last 15 years now, as an active part of the strategy. It is a standard that we try to avoid any lease longer than three or five years. So typical leases are, from an investors point of view: 10 years. However, unless we really have a long-term strategy, we do not accept 10 years. It will be 5 years, or if it's 10 years it will be 10 years with a break option as a standard policy.*
>
> *We also have very flexible floor by floor leases. Even so, we have all these flexibilities. So, if the company is expanding, we simply take a few extra floors somewhere else and it were winding down some business, we can simply terminate leases. That's part of the flexibility we have."*

Transformability feature in this category, which can be summarised as business flexibility, can be achieved through different approaches. In the retail sector, this included the implementation of unmanned unit and one-stop-shops. The approach observed in industrial sector is the redevelopment of assets, which shifted the business focus towards a more circular and sustainable production.

Discussion

In the industrial sector, high asset flexibility is rarely a feasible option. This was mainly due to the generally less agile characteristics of industrial spaces. The industrial sector (outside the scope of logistics) is also very limited in its capacity to relocate and/or move to other sites. Sites for industrial activities are limited, which therefore narrow down the possibility of changes beyond the current boundaries.

> *[I_CREM_1] for counter argument of Adaptability*
> *"I think the most distinguishing part of that is that we own the land, and it is on the location where the land is polluted. So you don't want to move out, because then you have no other purpose of that land other than just industrial and you still owns it, so why would you move out?"*

The notable absence of transformability in office class are mainly because offices are typically bounded to one type of business. Therefore, shift in function would imply a shift in the business case.

4.5.6. *Category 6 | Environmental Sustainability*

This category focuses on sustainability in the organisations' assets. Since sustainability is regulated in The Netherlands, the distribution of the three assessments were determined as follows. Persistence is identified as sustainable efforts with the levels that are demanded by the regulation. Adaptability included efforts beyond what is required, and transformability are sustainable approaches which would allow organisations to contribute positively to the surrounding environment.

Empirical data result

Table 4.13. Category 6 empirical data summary (source: Author).

Category 6 | Environmental Sustainability												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	**Data**	R_CREM_1	R_CREM_2	R_EXP_1	**Data**	I_CREM_1	I_CREM_2	I_EXP_1
Persistence: Reduction of environmental impacts according to regulation	Sustainable asset features (as regulated)	V	V	V	Sustainable asset features (as regulated)		V		Sustainable asset features (as regulated)	V	V	V
									Sustainable development			V
									Response to municipal and governmental sustainable city ambition			V
									Accommodate growing interest of stakeholders on sustainability			V
Adaptability: Reduction of environmental impacts with efforts further than regulation	Pre-emptively refurbish old buildings with short term lease to be more sustainable		V		*(n/a)*				LEED and BREEAM certification		V	
	Reusing furniture and non-structural elements		V						Focuses on sustainable choices even if it costs more investments	V		
	Goal of Paris agreement implemented 20 years before it is supposed to		V						Redevelopment of assets, focuses on sustainability and circularity	V		
Transformability: Contributing positively to surrounding environment	*(n/a)*				*(n/a)*				*(n/a)*			

Despite being one of the most straight forward categories, the empirical evidence of sustainable asset features was mainly satisfied only to its bare minimum. One organisation in office sector and two industrial organisations attempted to advance their sustainability efforts beyond what were demanded by the regulation (adaptability), while the others decided to simply follow the regulated sustainable requirements. Therefore, asset resilience through sustainability features was only common in the persistent level. On the other hand, efforts to push sustainability to the extent of transformability, were not observed from the current case-organisations. Evidence for these efforts are shown below.

> *[O_CREM_2] for Adaptability*
> *We have our programme and our goal is to be a sustainable on the level of Paris Proof. Paris Proof should be globally implemented in 2050, and in this organisation, we have decided that will be ready in 2030. So that's 20 years ahead of the rest of the world. So that's our ambition, we are working on lots of buildings to get there. Including all the buildings we will stay maybe only five years, because for five years we can do it in the same workstream, and maybe after we leave, we can leave property already on a good scale, as not to just leave and let waste be waste, but we deliver more upgraded property.*

> *[I_CREM_1] for Adaptability*

Yeah, everything we do is being evaluated against sustainability. For example, if you have to choose a property on demolishment or redevelop it and reuse it, that we would typically choose for redevelop then reuse property because it's more sustainable. Even if it would come to the higher costs, we would still choose for that sustainable way. But sometimes we, when it comes to manufacturing property, it's difficult because it was built for purpose, and it's not really possible to redevelop. The only thing you could do is redeveloping the land, redevelop the infrastructure, the surrounding, and that you would have to demolish the property at the same time.

Discussion

Similar with Category 1 (strategic alignment) and Category 4 (space and activities), the sixth category in the resilience framework also possessed a sequential characteristic on its three sub-categories of persistence, adaptability, and transformability. Therefore, lesser assessment levels need to be fulfilled, in order to achieve a higher assessment level.

In office and industrial sectors, all of the observed case organisations stated its efforts in satisfying sustainable requirements according to the regulations. On the other hands, only one case organisation in the retail sector mentioned this aspect. However, the lack of evidence in the other two retail case organisations (R_CREM_1 and R_EXP_1) did not imply that they did not accomplish the regulated sustainable requirements. It was likely that the efforts were not mentioned during the interview, given its pretext as a precondition that is given by other authority body.

The Dutch government aims to reduce its greenhouse gas emission by 45% by 2030 and 95% by 2050, with the basis on emission levels in year 1990 (Ministerie van Economische Zaken, Landbouw en Innovatie, 2021). This goal significantly affects the built environment sector, because built environment is one out of five biggest contributors to greenhouse gas emission in The Netherlands (PBL Netherlands Environmental Assessment Agency, 2020). As this research focuses on commercial real estate, all organisations that belongs to all asset classes can be considered as businesses. In The Netherlands, businesses are required to follow the regulations to conserve energy that are listed in Activities Decree, or known as *Activiteitenbesluit*. The goal of *Activiteitenbesluit* implementation is to reduce energy demand, through the implementation of sustainable technologies and using renewable energy resources. (Netherlands Enterprise Agency, RVO, 2021). That being said, all business assets in The Netherlands needs to fulfil the persistence category.

Three organisations were identified to have sustainable approach beyond the regulation. One office organisation pre-emptively refurbished and upgrade leased buildings, even though it is not required due to its short term lease. This organisation also took a step further by reusing furniture and non-structural elements, and are actively aiming to implement Paris agreement 20 years earlier than what is required. In one industrial organisation, an emphasis was put on choosing sustainable options on their real estate despite a higher capital costs, whenever possible.

4.5.7. *Category 7 | Financial & Contractual Security*

This category emerged during the empirical data collection, where most of the case organisations emphasised the importance of their assets' financial and contractual security. Category 7 was sub-categorized into three features. First, persistence represents the organisations' ability to ensure the security of the asset's finance and contracts. Second, the ability to adjust and optimise the cost of assets is identified as adaptable. Lastly, the ability for CRE department to innovate and create a significant change to their contractual state was defined to be transformable.

Empirical data result

Table 4.14. Category 7 empirical data summary (source: Author).

Category 7 | Financial & Contractual Security												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	**O_CREM_1**	**O_CREM_2**	**O_EXP_1**	**Data**	**R_CREM_1**	**R_CREM_2**	**R_EXP_1**	**Data**	**I_CREM_1**	**I_CREM_2**	**I_EXP_1**
Persistence: Ability to ensure the financial and contractual security	Flexible rental agreement through short-term contracts		V	V	Flexible contracts (rental agreement), which may create security and control over location	V	V		Flexible contract for some assets that functioned as light industrial activities		V	
									Long-term ownership of assets, therefore - zero book value (zero cost) - less risk on the investment *(Applicable to heavy & high investment industrial sites)*	V	V	
Adaptability: Ability to adjust and optimise cost on portfolio	Optimise cost on portfolio through consolidation of assets	V			- Optimise cost on portfolio through careful assessment that does not negatively impact the overall business			V	Optimise cost on portfolio through consolidation of assets		V	
					Maximising income and minimising cost on portfolio - Rent reduction based on Dutch law - Highest income and lowest vacancy possible	V	V		Minimising cost on portfolio e.g. by assessment to create clear overview of the portfolio's depreciation, value, occupancy/vacancy level, desk ratio	V		
Transformability: Ability to innovate and drastically change the state of the contractual agreement	*(n/a)*				*(n/a)*				Sell owned assets and lease back, adding more profit			V

Overall, all selected asset classes indicated the importance of ensuring financial and contractual security of their real estate (persistence level). The most apparent approach in office and retails was through the possession of flexible contracts on rental agreement, which consequentially created security and control over their real estate. Retail and industrial sectors take further step to optimise cost on portfolio (adaptability level). Yet, only in very rare case that transformable level was reachable. This was observed only in one logistics organisation.

Discussion

Having a flexible contract is essential in office and retail sectors in the scope of rented business spaces. Flexible contract gives flexibility to future uncertainties, creating more possibilities depending on

external and internal circumstances, thereby providing business resilience. The case of Hudson's Bay in The Netherlands is the prime example to demonstrate the importance of a flexible contract agreement. According to several news outlet, this company entered a long-term agreement contract with their landlord in exchange for expensive shop renovations. Yet, their bankruptcy made it difficult for Hudson's Bay to pay the rent, and therefore tried to terminate the issued rental guarantees. This created yet another problem for a lot of stakeholders, including the Hudson's Bay itself (Smit, 2020; Smit, 2021).

In some cases, it is possible to innovate ways to increase profits by drastically changing the ownership status of the asset. An expert in logistics assets pointed out that a lot of logistics real estate owner are currently selling their owned assets only to lease back the space. Selling the owned assets create substantial cashflow to the logistics businesses, and therefore increase profit. Moreover, investors are currently keen to invest on logistical spaces due to the growing demand of e-commerce. This can be considered as transformable approach because of the rather extreme outcome of the approach and the difficulty to reverse the action. Nevertheless, it is a more desirable trajectory to resilient businesses in logistics spaces. The following citation elaborate the technical reasoning behind this approach.

[I_EXP_1] for Persistence
"The logistics real estate segment has become a more interesting segment to invest money from big investors. A lot of users who owned the buildings in the past, sold it now and leased it back, because it was quite profitable for them to sell the buildings with the lease contract."

"We have to go a little bit technical. An investor who needs to invest money can go to the stock market, investing in real estate, investing in all kinds of things, and logistics real estate always has been a good asset class to invest at least part of your portfolio. And in the last five years maybe the logistics has become more and more popular, and a very stable place to put your money, because logistics, even in this COVID-19 pandemic turned out to be quite stable. Lots of people order from home now, so all those packages need to be stored somewhere.

The Netherlands in particular if you compare it to the rest of Europe is very well-positioned geographically, so from this from our country we have a good infrastructure. You can reach big parts of Europe quite quickly. We have a good labour force We have a stable climate in terms of politics. We are wealthy country. So from an investor perspective it is very interesting to invest here. And that's why they are very eager to invest money now in logistics, and even more show every year. Which means that tenants, the users, are able to sell it for a lot of money, if they owned it, and then lease it back Because the longer the leases for a building, the better the price will be, generally speaking.

Years ago, for example, if you would sell your building and lease it back for 10 years, as a tenant, then, you could say okay, I will get roughly 10 times the words of the lease per annum, so if you are paying €1 million euros in rent per year and would sell it, years ago, it would roughly get you 10 million in the bank right then, times rents, but now it's going up to 20 or 25 times that money. The yields have gone down very low now, which means that investors need to pay a lot of money to get good product. And for a lot of users that is a lot of reason to sell it and lease it back for 10 years."

4.5.8. *Category 8 | Accessibility*

The eighth category is targeted towards the accessibility of the businesses' activity space. Persistence is identified by assets with easy accessibility. While adaptability is observed through the availability of multiple access points to the organisations' activity space, which may require assets decentralisation. Transformability, which was defined in this research as the ability to innovate a new desirable pathway, is detected if the organisations have the capability to decrease or minimise their dependency to their physical site accessibility.

Empirical data result

Table 4.15. Category 8 empirical data summary (source: Author).

Category 8 | Accessibility												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	**Data**	R_CREM_1	R_CREM_2	R_EXP_1	**Data**	I_CREM_1	I_CREM_2	I_EXP_1
Persistence: Assets with easy site accessibility	Well-accessible office by public transport for employees and majority of clients	V	V		Well-accessible physical retail space	V	V	V	High industrial activities: Well-accessible site from the resources & to transport output to other businesses - - located close to ports		V	
					Ease of access from anchor functions: Retail locations in proximity of - other prominent retail functions - other long-term anchor functions (e.g. library or healthcare centre)	V	V	V	Logistics sector: Highly accessible locations - Near highway and/or ports - Near urban consumers Specific to value-add services: close to labour pool			V
									Specific to value-add logistical services: highly accessible by public transport			V
									Counter argument: Preferred for industrial sites to not be easily accessible by non-relevant visitors due to safety reasons	X		
Adaptability: Decentralisation of assets, create multiple access points	Flex-working space and pay-per-use workspace create multiple access points	V		V	Integration with different-functioned shops to create more efficient space usage, (e.g. one-stop-shops), creating more access points		V		Two types of logistics spaces: 1) regular logistics warehouses 2) last-mile logistics centre, to create more access to the consumer			V
					Products are available in different-functioned stores, therefore creates more access points		V		Decentralised production points therefore less susceptible and can maintain production process in event of disruption	V		
					Accessible in diverse location types, the experience vs convenience locations, therefore creating flexibility to prioritise resources			V	*Counter argument:* Assets in different locations may have different functions/projects managed by different sub-business groups, so specific-skilled employees needs to access a specific building.	X		

Transformability: Decrease dependency on physical site accessibility	Hybrid working reduces dependency to site accessibility (designating office as collaborative and meeting space, and remote-working for individual work)	V	V	V	*Counter argument:* Physical site accessibility become more important for the success of the business due to competition with e-commerce			X	*(n/a)*			
	Reduce dependency to site accessibility & needs for physical interaction with clients, due to digital service		V									

This category of accessibility had a diverse result. Some asset classes, or even sub-sector of asset classes, have their own weight regarding to what extent accessibility (according to three given sub-categories) should be applied to their real estate decision. This explained the detection of several counter arguments found in many sub-categories in various classes. In this category, the industrial sector will be distinguished into two different sub-sectors, (1) specific logistics spaces and (2) industrial facilities outside the logistics scope.

Generally, offices, retails, and logistics sectors stressed out the importance of their accessibility to their end users, employees, and consumers (persistence). Offices prefers their asset to be highly accessible for their workers and clients, while retails' goals are to attract buyers through its easy accessibility. In the retail sector, accessibility also related to the ease of access to and from other anchor functions. Specifically in logistical space of industrial sector, it is preferred to have an easy accessibility to their resources, urban consumers, and specifically to value-add services: the labour pools. However, the industrial sector outside logistics had their own counter arguments regarding easy site accessibility.

Decentralisation of assets to create multiple access points was identified to be the adaptable element in reaching resilience through accessibility. Several evidences were found in different asset classes. In the office sector, the emergence of co-working spaces and pay-per-use workspaces available in major cities appeared to play a significant role in supporting asset decentralisation. Employees can reach any of the rented workspace based on their convenience. In the retail sector, the one-stop-shops and product availability in different-functioned shops created more dispersed accessible locations to procure products. In logistics spaces, the recent development of last-mile distribution centre creates more distributed access to various consumers location. There is a paradox of data for industrial real estate outside the logistics sector, where both supporting and contradicting evidence were found in one organisation. This will be discussed in the discussion section.

The last sub-category in accessibility focuses on the decreasing dependency to physical asset flexibility, which was only found in the office sector. Offices, due to the currently rising concept of hybrid working, decreased its dependency on physical site access. Digital services that support remote working also plays a role in reducing its dependency on physical access. However, this is not the case in retail industry, where it will be explained below.

<u>Discussion</u>

In a glance, office sector's accessibility is influenced by the emergence of flexible workspaces and hybrid working concept, which allows the significant development of their real estate scope. Empirical data from retail class accentuated shop grouping and anchoring as a way to increase accessibility. Retail

businesses that are located in the proximity of anchor sites (e.g. other retails or public spaces) could benefit from increasing its accessibility and attractiveness. The industrial sector, which in this category was separated into two sub-sectors of logistics and manufacturing industries demonstrated distinct accessibility characteristics. Development of last-mile distribution centres of logistics real estate plays a significant roles of asset decentralisation. Nevertheless, decentralisation in the manufacturing industries is rather limited by the highly specialised activities conducted in the assets.

Firstly, on the ease of site accessibility for industrial activities, it is preferred for sites not to be easily accessible from urban areas for safety reasons. Industrial activities need to be located distant from the citizens to protect them, because of the industrial waste or excess. However, industrial activities may need to be easily accessible from the distributors or their supply chain, to guarantee an effective and efficient production process. Observed from the second interviewee (I_CREM_2), this specific requirement is thus different depending on the industrial activity types of each organisation.

Secondly, a disagreement was also detected in the adaptability assessment of industrial activity spaces. In the global scale of industrial businesses, production centres are often distributed to different countries. That being said, it is not surprising to find a product being manufactured in multiple countries. This large-scale of decentralisation create strength to maintain their production process in event of disrupted facilities in one of the manufacturing sites. However, at the smaller scope, decentralisation of assets may be performed, even though its purpose is not to create multiple accessibility. In an organisation in one country, there may be multiple facilities that operates for the organisation's production process. The manufacturing processes tend to be very rigid and inflexible. Therefore, an employee with a specific task may only be able to perform their job by physically being present in a specific facility that supports their task. A direct quotation from the organisation may further explain this particular argument.

> *[I_CREM_1] for supportive argument of Adaptability*
> *"Well, there's another aspect that you should not forget. We are an international company, so if we cannot produce the hand sanitizers or any other product in the Netherlands, we can produce it for example in China and Brazil or anywhere else in the world and ship it. So that still be business continuity"*
>
> *"So if you have five manufacturing plants on global scale, and one of them is in the Netherlands, if you lose the one in the Netherlands, you have four others left".*
>
> *[I_CREM_1] for counter argument of Adaptability*
> *"Each location is different, depends on the project, and project depends on the business group".*

Although it may be optimal to have an accessible industrial facility near the labour pool, but due to the rigidity of activities and for safety reasons, the accessibility to the employees and workers are not the priority of industrial facilities. Although the cost may be minimised if the distance between the facility and the end-customers, applicable safety considerations and/or regulations may prevent industrial facilities from being placed near the highly populated urban area.

A counter argument in transformable assessment of retails was found during the empirical data collection. It is apparent that physical asset accessibility would remain to be important in retail class, and that reducing the physical site accessibility could potentially damage the whole business case. According to an expert in the retail sector, physical store accessibility is one of the success factor for

retail businesses, and is becoming even so due to the competition with e-commerce. The argument was also supported by research in retail, where the collaboration between online and offline market creates an optimum business profit. In addition, the online market will be more favourable if there are physical retail stores present (Bouwinvest, 2019). Therefore, retail market is still dependant to the accessibility of their physical stores.

[R_EXP_1] for counter argument of Transformability
"But that is also something which is in the research. The online market share is higher if you have also a physical presence, and that's supported by a lot research."

"If you look towards the total retail market, accessibility becomes even more important due to the competition from e-commerce. Because previously, you only had one place you could go shopping, so… if you have to pay like 6 euro an hour to park at the Bijenkorf, you will do that because you don't have the alternative. But now you have the alternative of e-commerce so accessibility is even more important."

4.5.9. Category 9 | Process and Real Estate

The current and the following categories (9 & 10) emphasised organisations' input–process–output (IPO) model. In every organisation, an output is determined by the resilience of the organisation's input and its production processes. This category focuses on the process-related resilience, and the next category assessed the input-related resources.

The three features were distinguishable based on the organisation's process capacity to maintain production in event of a disruption. Persistence is recognised as the physical capacity to maintain or sustain operation without consequential delay during disruptions. While persistence is focused on the physical capacity, adaptability is recognised as the organisational capacity to maintain processes. Through the adaptation and adjustment of the sub-processes to maintain the general production pathway. Transformability is the ability of an organisation to minimise the critical production process points, therefore becoming less susceptible to disruptions.

Empirical data result

Table 4.16. Category 9 empirical data summary (source: Author).

Category 9 | Process and Real Estate												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	**Data**	R_CREM_1	R_CREM_2	R_EXP_1	**Data**	I_CREM_1	I_CREM_2	I_EXP_1
Persistence: Physical capacity to sustain operational process without significant delay in event of disruptions	*(n/a)*				Collaboration with external technical & maintenance parties to respond to day-to-day physical incidents	V			Flexibility due to high vacancy level creates the ability to maintain process without significant and long recovery time	V		
					Asset insurance	V			Decentralised production points therefore less susceptible and can maintain production process in event of disruption	V		
					Day-to-day response to calamities	V			Shorten physical distance from warehouse to consumers by last-mile distribution centre			V
									Logistical space is placed in the location close to ports and/or highway, to maintain access to process-essential infrastructures			V
									Safety protocols in place and other capabilities to resume production process during disruptions		V	
Adaptability: Organisational capacity to maintain or adapt operational process to maintain production process	Hybrid working which reduces interaction at physical asset, creates the capacity to maintain or adapt the operational process	V	V	V	Hybrid working which creates the ability to work remotely, creates the capacity to maintain or adapt the operational process	V			Hybrid working which reduces interaction at physical asset, creates the capacity to maintain or adapt the operational process	V		
	Providing alternative workspace in event of physical asset disruptions through flex-working space and pay-per-use workspace	V		V	Adjustable day-to-day processes based on circumstances	V			Ability to adjust the production process to maximise output efficiency		V	
					Adjustment in process & workflow to be less susceptible; e.g. digital workflow and approval processes when possible	V						

					Adapt processes or create alternative to meet increasing output demand	V	V					
Transformability: Ability to predict and minimise critical points in the production process	Learning capacity of: - Process: to enhance preparedness in event of disruption prior to direct impacts - Spatial arrangement & user demand	V	V		Self-scanning to reduce dependency to staffs, therefore minimise critical points	V			Sustainable processes, minimise possibility of creating environmental hazards	V		
	Contingency plans	V			Unmanned unit to replace regular physical format	V			Contingency plans	V		
									Automation - Industrial assets - logistics warehouses		V	V
									Continuous assessment and exploration of last-mile distribution centre due to its relatively new concept			V

Retail and industrial sectors have all persistence, adaptable, and transformable features identified during the empirical study. Offices, on the other hands, seemed to be missing the persistence element. Persistence approaches in the retail sector was observed as a collaboration with maintenance and technical parties, insured assets, and daily response capacity for calamities. In industrial sector, one organisation identified their high vacancy level as a capacity to maintain production process. That is, should there be any disruptions in one industrial facility, it is possible to move the production process to other available assets without significant delay. Specifically in the logistics sub-sector, last-mile distribution centres shorten the distance from product to urban consumers, therefore reducing the organisation's processes susceptibility. Logistical space is also often placed in the location close to ports and/or highway, to maintain access to process-essential infrastructures.

Adaptability approaches in this category is mainly attained process resilience through the implementation of hybrid working. Hybrid working concept adds more ability and pathway to maintain the general processes of all asset classes. In the retail sector, one organisation was regarded to have the ability to adjust their processes and workflow to be less susceptible. Digital workflow and approval processes were developed, and below is the direct quotation.

> *[R_CREM_1] for Adaptability*
> *"So for example, our internal approval process, that was a matter of:*
> *You had a piece of paper with a description and then you had an Excel sheet which had been filled out with spaces where certain number of people had to sign. And then you had the agreement that had to be signed afterwards, that you wanted approval for, and also the mandate document. That pack used to go through the whole office. So, like one or two or three people would sign it within the real estate department, and that would go to the legal department, and then it would go to our finance department and then would go to their CFO to get the approval.*
> *But that was actually physical and people were walking through the office, people had to put their signature with a pen on it, and halfway through April we change that to a digital workflow."*
>
> *"I think since September we now also sign our documents digitally. Not everybody wants to do that, I mean we do, but if the other party doesn't want it, then we still have to do it in person with a pen. But in principle we signed documents now online. So, that's another change we've made."*

Transformability involved the minimisation of the critical production points, to achieve process resilience. The approaches identified in each asset class differed from one another. Office and industrial sectors showed learning capacity and continuous innovation of their own operational process, therefore able to develop and minimise critical points in the process. In retail sector, the replacement

of physical stores to unmanned units was identified as one of the ways to minimise critical threats. Similarly, warehouse automation appeared to be an important strategy to minimise process-related threats in the logistical sub-sector.

Discussion

Overall, persistence approaches in the process resilience lies in the basic physical protection to safeguard an organisation's production process. Although the same was not identifiable from the office sector, the author believes that a similar approach is also being implemented, despite not mentioned during the interview.

With regards to adaptable approaches, it was previously mentioned that all classes emphasised on the hybrid working concept. It should be noted that hybrid working may not be generally applicable for industrial activities, especially for the research and/or manufacturing department. Nonetheless, whenever possible, hybrid working should be one of the ways to improve process resilience, by enabling sub-processes to be tailored and adjusted as needed. Also, it is worth mentioning that in general, there tend to be a portion of main processes that cannot be substituted, even for the sake of resilience.

Retail case organisation showed promising approach to minimise critical points in production process. During the interview, the organisation's CRE department noticed that the ability to work remotely will significantly reduce the number of daily commuters. This will create an impact to their retail store that are located near transportation hubs. Therefore, the organisation started to transform some of their stores into unmanned units.

Logistics sector also attempted to continuously assess their last-mile distribution centre due to its relatively new concept. They specifically acknowledge the needs for constant learning and adjustment in the upcoming years, alongside the new insights that may emerge after the implementation of each improvement. The continuous learning is essential to minimise the critical points of the process.

> *[I_EXP_1] for Transformability*
> *But if you talk about logistics to transform, we just already mentioned the last mile hubs, the last mile logistics. It's definitely something that is looking into now and new developments are also more and more carried out on a cradle to cradle and very sustainable way, so you can demolish it later, reuse the materials, and maybe update it in 10 or 20 years from now when new insights showed that the way we did it now was not the best way to do it.*

4.5.10. Category 10 | Input and Real Estate

The last category of input-related resources, focused on the input part of the IPO model. Similar with the previous category, persistence in this case was defined as the physical ability to sustain critical resources. Adaptability is the organisational capacity to adapt the source of resources to maintain the production process. Meanwhile, transformability required the effort and capability to predict the optimum state of resources to reduce the irrelevant or inefficient resource usage.

Empirical data result

Table 4.17. Category 10 empirical data summary (source: Author).

Category 10 | Input and Real Estate												
	Offices				**Retails**				**Industrial and Logistics**			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	**Data**	R_CREM_1	R_CREM_2	R_EXP_1	**Data**	I_CREM_1	I_CREM_2	I_EXP_1
Persistence: Physical capacity to sustain the critical input-related resources	Ensuring input of materials: stockpiling to maintain supply chain prior to direct impact of disruptions	V			Ensuring input of materials: maintaining supply chain in event of sudden demand increase	V			Ensuring input of materials: stockpiling to maintain supply chain in event of transport disruption			V
	Ensuring input of potential human resources: creating physical office as status and identity, to attract talents			V					Ensuring input of human resources: logistical space is placed in the location close to labour pool (specific to value-add logistics service)			V
									Maintaining input of resources during disruption, by providing job security for its employees		V	
Adaptability: Organisational capacity to adapt the source of supply whenever needed	*(n/a)*				*(n/a)*				*(n/a)*			
Transformability: Ability or effort to predict the optimum state of input-related resources	Invest in human resources, understand users' demand and accommodate it	V		V	Self-scanning device to minimise demand for physical labour	V			*(n/a)*			
	Outsource human resources			V								
	Showcasing at workspaces to enhance users' creativity	V										

There are two main approaches underlying the persistence assessment: (1) ensuring the input of materials and (2) ensuring the input of human resources. The main approaches to ensure materials input was mainly focused on stockpiling and efforts to maintain supply chain prior to the occurrence of disruptive events. However, approaches to ensure the input of quality human resources may vary per asset classes.

Adaptability approaches was not detected during the interview. However, office and industrial real estate departments demonstrated transformable approaches in maintaining input of quality human resources.

Discussion

Human resources, as discussed in the beginning of this report, is the biggest expense for most organisations, second only to real estate expenditures (Norris, 2014; Gibler & Lindholm, 2012). Therefore, human resources are substantial input in IPO model.

Offices ensure input of high-quality human resources (persistence) by creating attractive and appealing workspace. Furthermore, to create an optimum state of its human resources input (transformability), organisations need to understand the demand of its workers and the general expectations from people in the related business. Subsequently, one office organisation (O_CREM_1) proposed to showcase their products in the workspace to catalyse users' creativity. Meanwhile, another office organisation (O_CREM_2) opted to outsource specific employee functions. By outsourcing strategic tasks, the organisation allows fresh ideas and experts outside of their organisation to provide novel insights and advise in creating a broader opportunity and strategic approach. Below is one of the examples of optimisation in input of an organisation.

> *[O_CREM_2] for Transformability*
> *"Yes, and what we are now doing is to outsource part of our business. So we are keeping a small retained organisation for strategy. And all the more strategic research type of work, the operational and technical type of work are being outsourced to third parties because our facility management team, our real estate team, is too small for this portfolio.*
>
> *We used to have like hundreds of projects in the Netherlands, in Europe, in Asia, in United States. But now we're downsizing, so the number of projects are reduced. The experience from people working on these projects are reduced as well. So it was getting too small. You need to get your experience and your new ideas from some other places, and that's one of the reasons."*

The retail sector had different approaches in optimising input on their organisations. Retails tend to minimise the need for human resources, which can be seen by the implementation of automated or unmanned units, to minimise the need for physical labour.

On a lighter note, the absence of adaptability approaches in all classes during the interview could not confirm the absence of adaptable practices in real life cases. It is expected for many of these organisations to have their own alternate supply input in event of interrupted main source of supply.

To conclude, the methods to achieve input resilience may vary from one class to another, or even may from one organisation to another in the same case classes. This is due to unique type of processes, strategic business considerations, activities, and priorities applicable for each individual organisation.

Chapter 5:
Findings

5.1. Resilient CRE Management: Generic applicable approaches for all commercial asset classes

5.2. Transitioning to specific classes approaches

5.3. Resilient Office CREM

5.4. Resilient Retails CREM

5.5. Resilient Industrial and Logistics CREM

5.6. Continuous resilience in CREM

5.7. Conclusion of findings

The theoretical study redefined resilient CREM, provided its assessments, proved the added value to the organisations, and formulated the basis of resilience framework. The empirical study advanced the resilience framework and further evaluated the approaches (within-class and cross-class) to establish CREM resilience in a particular asset class. This chapter reports the findings of generic and specific approaches of resilience in various CRE industries.

Specific approaches distinguished three asset classes of offices, retails, and industrial/logistics sectors. The generic approaches were derived from the repetitive evidence across three classes, which was then believed to be applicable in all asset classes of commercial real estate.

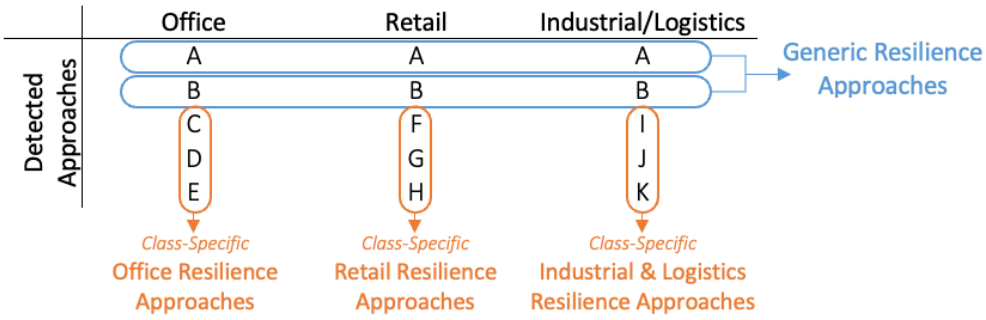

Figure 5.01. Categorisation process of generic and class-specific approaches (source: Author).

The sets of approaches were derived from the cross-class empirical data result (Table 4.07-4.17) and categorised (Figure 5.01 for the brief categorisation process). The generic approaches comprised of real estate decisions that were found during the empirical data collection or believed to be generally applicable to CREM in general. Specific approaches comprised of class-specific CRE interventions which applicability appeared to be unique for the respective class. The derivation of class-specific approaches was explained on section 5.2.

5.1. Resilient CRE Management: Generic applicable approaches for all commercial asset classes

In the previous chapter, several approaches were found for the three observed asset classes. The identified generic approaches may also be applicable to other classes of commercial real estate even though further confirmatory study might be required to determine the applicability of these approaches in asset classes outside the currently observed sectors. Table 5.01 presents the generally applicable approaches for resilient commercial real estate.

The general approaches were derived from the extensive cross-class analysis performed on section 4.5. The identified CRE approaches were observed in each of the 10 categories between the three levels of feature: Persistence, Adaptability, and Transformability. The approaches that were found in all three classes were analysed for its applicability to general CRE industries. Some of the approaches that were not found in all three classes were also analysed and, if suitable, embedded to the list of generally applicable approaches (Table 5.01).

Table 5.01. Generic applicable (all classes) approaches for resilient commercial real estate (source: Author).

	Persistence	Adaptability	Transformability
Category 1 **Strategic Alignment**	Translation of core organisational strategy to real estate strategy	[*] Collaboration of CRE strategy with core organisational strategy	Active and dynamic CRE strategy, focuses on adding value to the core business
			Constant assessment of value added for the overall business organisation
Category 2 **Accommodation of Trends**	Follows technological development of their specific sector and the overall real estate trends	Predict emerging real estate trends and accommodate it, continuously	*(no generic approach)*
	Creates suitable user experience for their employees and customers.	Actions taken to respond the projected disruptions	
	Accommodates user demands, activities, and its processes		
Category 3 **Digitalisation**	*(no generic approach)*	Hybrid concept, the combination and integration of online and offline.	Automation for specific processes and/or services, whenever possible.
Category 4 **Space and Activities**	Basic maintenance plan to maintain safety and quality	*(no generic approach)*	Optimisation of space based on continuous assessments and future projection of trends
	In compliance to health and safety regulation		Optimisation of portfolio to optimise cost
	[*] Physical resistance through the collaboration with external technical & maintenance parties to respond to day-to-day physical incidents		
Category 5 **Property Feature Flexibility**	*(no generic approach)*	Exit strategies for under-performing assets	*(no generic approach)*
Category 6 **Environmental Sustainability**	Sustainable asset, minimising energy demand. *(Regulated in the Netherlands)*	[*] Implementation of regulation as early as possible	*(no generic approach)*
	[*] Response to municipal and governmental sustainable city ambition	[*] Circular efforts on non-structural materials	
	[*] Accommodate growing interest of stakeholders on sustainability		
Category 7 **Financial & Contractual Security**	Flexible contracts for leased spaces	*(no generic approach)*	*(no generic approach)*
Category 8 **Accessibility**	*(no generic approach)*	*(no generic approach)*	*(no generic approach)*

Category 9 **Process and Real Estate**	[*] Collaboration with technical & maintenance parties to respond to day-to-day physical incidents [*] Asset insurance	Hybrid working concept, which creates the ability to work remotely, creates the capacity to maintain or adapt the operational process	*(no generic approach)*
Category 10 **Input and Real Estate**	Ensuring input of materials by stockpiling or maintaining the supply chain	*(no generic approach)*	*(no generic approach)*

[*] originally only identified in one or two asset classes, but generally applicable to all classes based on inference.

Resilience Framework Categories

[1] Strategic Alignment

[2] Accommodation of Trends

[3] Digitalisation

[4] Space and Activities

[5] Property Feature Flexibility

[6] Environmental Sustainability

[7] Financial & Contractual Security

[8] Accessibility

[9] Process and Real Estate

[10] Input and Real Estate

Core Definitions of Three Features

Persistence : Physical ability to resist external disturbances, which requires physical robustness and rigidity.

Adaptability : Flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway.

Transformability : Ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories.

Persistence
Adaptability
Transformability

5.2. Transitioning to Class-Specific Approaches

Section 5.1 presented the generic resilient approaches that may be utilised by various commercial real estate classes. However, each asset class has their own specific processes and characteristics. Therefore, the formulation of class-specific approaches was necessary to better suggest specific asset classes on the operationalisation of resilience. The current section discusses the detailed train of thoughts in delivering the outcome of class-specific approaches.

Categories with sequential P, A, T features

The cross-class analysis revealed how some categories possessed sequential features on their sub-categories. Here, categories 1, 4, and 6, were found to have a sequential characteristics on their persistence, adaptable, and transformable features. Thus, for these categories, the possession of persistence feature appeared to be a requirement for it to achieve adaptability features. Subsequently, the possession of persistence and adaptability was required to acquire transformability features in the category.

The three features of strategic alignment (category 1) were described as: CRE management that received input from its core business (P), CRE management collaborates with the core business (A), and CRE adds significant value to the core businesses. As discussed on cross-class analysis, this category's sequential characteristic was rather straightforward, considering CRE management that contributes significantly to the overall organisations (T) would also collaborates and receives input from the core business.

Space and activities (category 4) also appeared to have possessed a sequential P, A, T characteristics. Fundamentally, the accommodation of activities focused on assets' ability to house the organisation's activities. The P, A, T features included its resistance to disturbances (P), multi-use and space sharing (A), and optimisation of activity-space relation (T). Physical resistance to disturbances (P) acted as a basic requirement that needed to be possessed before having the ability to share spaces (A). Also, the capability to obtain a shared-use a space (A) may also serve as a starting point for space optimisation (T). These explained the sequential attribute of the fourth category.

Category 6 (Environmental sustainability) possessed the following features: efforts of reducing environmental impact according to regulation (P), efforts to reduce environmental impact beyond what is regulated (A), and positively contributing to the surrounding environment (T). As such, the sequential nature of this category was inherently defined from the features' hierarchical definition.

The other remaining seven categories (2, 3, 5, 7, 8, 9, and 10) did not appear to be sequential. Therefore, in these categories, organisation could possess one higher feature level without needing to fulfil the lesser feature levels.

The analysis of sequential features was used to determine the priority of resilient approaches. More explanation is elaborated below (or see Figure 5.03).

Derivation methods of class-specific approaches: Two subjects of evaluation

The following sub-chapters would separately assess the findings found from the three asset classes separately. The class-specific approaches were derived based on (1) approaches identified during case-class analysis, and (2) priority of approaches as determined from the within-class analysis. Below, the two subject of evaluation was elaborated further.

1) Class-specific approaches of resilient CRE

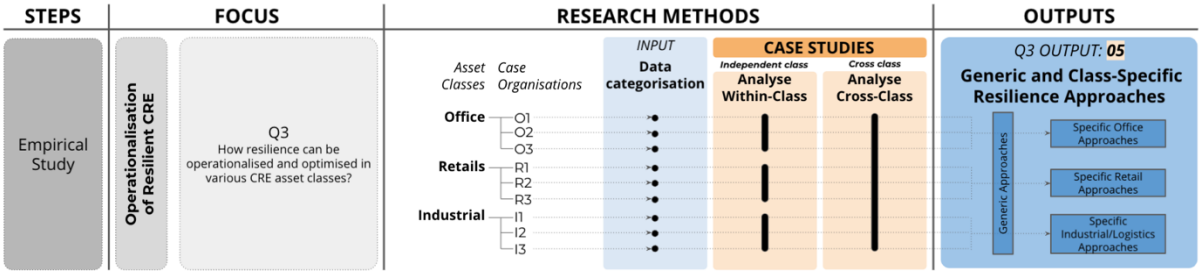

Figure 5.02. Link between data analysis and the approaches (source: Author, adopted from Figure 1.03)

The class-specific approaches were derived from the cross-class empirical analysis (Tables 4.07, 4.09-4.17), which formulated how specific asset classes can implement resilience in their organisation. The approaches were deemed applicable for all organisations for the particular asset class. Thus, the analysis excluded the specialised approaches limited to one branch of a sector, or otherwise stated. This exclusion means that approaches limited to banking industries (O_CREM_2), or only applicable to supermarket retail businesses (R_CREM_1), were rejected in the class-specific approaches.

The generic approaches for all asset classes (Table 5.01) were excluded from the specific approaches (Tables 5.02-5.04).

2) Priority of approaches on particular asset classes

Along with the specific approaches, the following three sub-chapters analysed resilience approach priorities of each asset classes. This priority assessment was driven by the common knowledge of cost optimisation and revenue enhancement in every business strategy (Krumm et al., 1998; JLL, 2020b). Therefore, priority of approaches was assessed to determine the arrangement of implementation, which may subsequently minimise irrelevant value delivery.

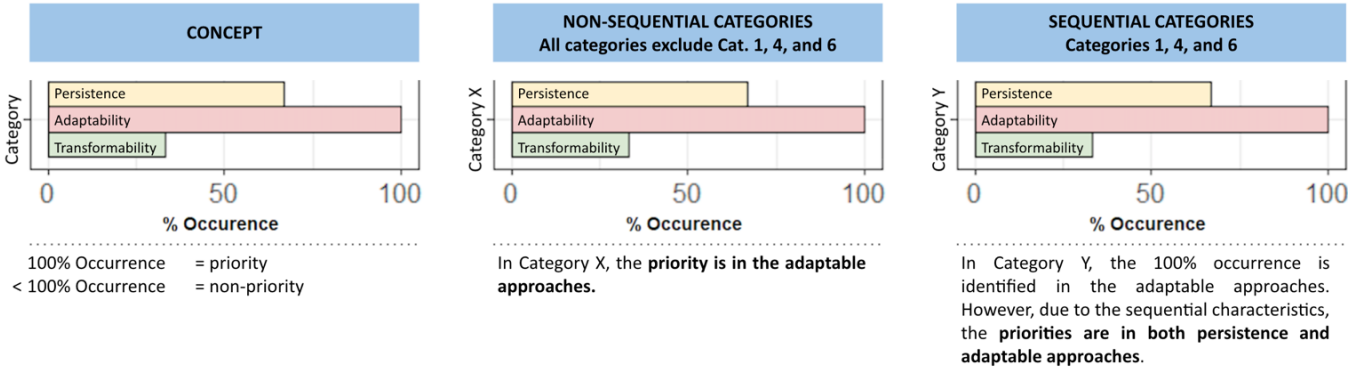

Figure 5.03. Priority assessment methods for specific classes resilience approaches (source: Author)

The priority of approaches was derived based on the high occurrence of a specific approach, as discussed in the within-class analysis (Figures 4.12-4.14.). Considering the sequential characteristics of

categories 1, 4, and 6, for these categories, the prevalence of features of a higher hierarchy would inherently indicate the prevalence of features that were placed lower in the category's hierarchy. For example, if 100% occurrence was identified for the transformability features of Category 1, 4, or 6, both persistence and adaptability features were also expected to be a priority. The methodology for priority assessment was summarised on Figure 5.03.

5.3. Resilient Office CRE Management

Resilient office real estate can be achieved, improved, and advanced through the implementation of the approaches provided. Table 5.02 presented the approaches (*shown in cells of table*) and its priorities (*shaded in blue*). The priority of approaches was derived based on the occurrence analysis (Figure 4.12), while taking into consideration the sequential characteristics possessed by some of the categories. More detailed explanation about the priority approaches can be seen in Figure 5.03. Is recommended for CRE office management to prioritise this blue-shaded approaches.

Table 5.02. Resilient CRE approaches for the office sector (source: Author).

	Persistence	Adaptability	Transformability
Category 1 **Strategic Alignment**	*(no specific office approach, see generic approach)*	Collaboration with other sub-departments to minimise or mitigate risks	*(no specific office approach, see generic approach)*
Category 2 **Accommodation of Trends**	Accommodate diverse users' needs and processes within an organisation	Analyse, predict, and accommodate specific demands on each sub-processes in workspaces.	Setting example to shape trends and needs
	Physical assets appeal to attract clients and employees	Flexibility in the composition of different activity spaces based on projected trends and needs	Implement own vision and how it should be utilised in assets
		Inclusivity between employees, specifically between workers from different office spaces.	
Category 3 **Digitalisation**	Sensors placed in physical assets for monitoring purposes	Reduction of physical meeting	Digital process to replace repetitive processes done in physical space, to minimise dependency for on-site interaction
Category 4 **Space and Activities**	*(no specific office approach, see generic approach)*	Flexible working space: - Hot desks / desk sharing - Co-working space - Assets distributed in different locations	*Optimising asset:* - Continuous assessment of desk to person ratio, therefore always adjusting to the optimum composition. - Continuous assessment of spatial arrangement based on changing activity demands
		Flexibility of the composition of different activity spaces	Hybrid working concept creates less demand for individual workstations
		Activity-based environment and fit-out	Pay-per-use workspaces (service-based)
			Streamlining similar asset functions despite its insignificant differences
Category 5 **Property Feature Flexibility**	*Asset scale:* Flexibility to adjust spaces to different activity (e.g. through hackable spaces) to: - accommodate changing trends - accommodate changing business strategy and work processes	*Asset scale:* Optimisation of assets size by continuous workspace adjustment based on changing demand	*(no approach detected)*
	Asset scale: Flexible number of workspaces due to regularly adjusted desk-to-person ratio	*Portfolio scale:* Flexible portfolio, through: - Flexible contracts (rental agreement) - Flexible leases (short term / long term with break option) - Floor-by-floor leases when possible	
	Portfolio scale, with impact to asset scale flexibility:	*Portfolio scale:* Combination of ownerships status (own and lease)	

	Flexible spatial arrangement due to core portfolio ownership	*Portfolio scale:* Consolidate assets	
Category 6 **Environmental Sustainability**	*(no specific office approach, see generic approach)*	*(no specific office approach, see generic approach)*	*(no approach detected)*
Category 7 **Financial & Contractual Security**	Flexible rental agreement through short-term contracts or long-term contract with break option	Optimise cost on portfolio through consolidation of assets	*(no approach detected)*
Category 8 **Accessibility**	Well-accessible office by public transport for employees and majority of clients	Flexible working space and pay-per-use workspace, which creates multiple access points	Reduces the dependency to site accessibility through: - Hybrid working concept - Digital processes which replace repetitive processes done in assets
Category 9 **Process and Real Estate**	*(no specific office approach, see generic approach)*	Providing alternative workspaces in event of physical asset disruptions, through pay-per-use workspace and co-working spaces	Learning capacity of: - Process: to enhance preparedness in event of disruption prior to direct impacts - Spatial arrangement and user demand
			Contingency plans
Category 10 **Input and Real Estate**	Ensuring input of potential human resources: creating physical office as status and identity, to attract talents	*(no approach detected)*	Invest in human resources, understand users' demand and accommodate it
			Outsource human resources
			Showcasing at workspaces to enhance users' creativity

Priority, based on Figure 4.12 and assessment method of Figure 5.03.

The approaches listed on Table 5.02 were suggestive rather than regulative. It should be noted that the absence of approaches did not imply the absence of possible actions in a specific feature of a particular category. Here, the absence of approach indicated that no evidence was obtained for the specific feature level of respective categories during the interviews. In line with that, the approaches listed on Table 5.02 table did not imply the absence of other viable approaches.

Table 5.02 identified resilient real estate approaches based on what was identified *within* the office sector. Meanwhile, the cross-class analysis (Chapter 4) allowed the comparison and learning between asset classes. Some resilience approaches that were originally identified from other sectors may also be applicable for the office sector. In this study, such approaches were referred to as adopted class-to-class specific resilience approaches.

Adopted class-to-class specific resilience approaches

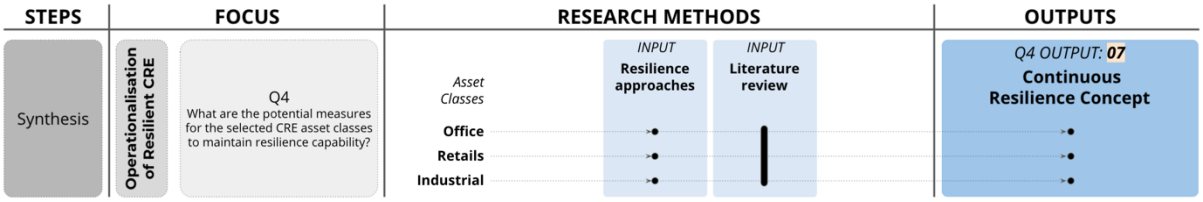

Figure 5.04. Adopted class-to-class specific resilience approaches (source: Author, adopted from Figure 1.03)

1) **Origin class** : Retails
   Category 7 : Financial & Contractual Security
   Feature : Adaptability
   Ability to adjust and optimise cost on portfolio

Approach : Optimise cost on portfolio through careful assessment that does not negatively impact the overall businesses

Though excluded from the priority approaches, the originally retail-oriented approach was expected to also be applicable for the office sector. Expert in the retail sector emphasised the importance of careful assessment before taking action to reduce the business space total area. Optimisation of portfolio, which resulted in the reduction of cost, cannot only be decided based on the numbers and the percentage of the total area that was not profitable. Reducing the area or the number of assets may sometimes be costly, and the overall impact may cost more than the amount prior to reduction. This can be applicable to office spaces, because area reduction, consolidation, and termination of assets can create a significant damage to other aspects. Therefore, careful assessment of office space optimisation is necessary to maintain financial resilience.

2) Origin class : Retails
Category 9 : Process and Real Estate
Feature : Adaptability
Organisational capacity to maintain or adapt operational processes to maintain production processes
Approach : Adjustment in process and workflow to be less susceptible
Example: digital workflow and approval processes when possible

The adaptable feature on Category 9 was expected to be one of offices' most essential resilience approach. Offices could learn and adopt one of the retail sector's identified approach, such as the adjustment in process and workflow, to be less susceptible to disruptions. The retail sector also provided concrete example to this approach through the implementation of digital workflow and approval processes. By replacing the conventional signature-based approval step(s), digital approval may minimise offices' dependency on physical interactions, which may pose as a susceptibility point during a disruption.

5.4. Resilient Retails CRE Management

Table 5.03 presents the approaches to resilient retail real estate and its priorities. Similarly to the resilient office CRE management, the approaches discussed in this section were suggestive and did not eliminate other potential approaches.

Table 5.03. Resilient CRE approaches for the retail sector (source: Author).

	Persistence	Adaptability	Transformability
Category 1 **Strategic Alignment**	CRE strategies based on location and retail type, which differs based on external conditions (e.g. sites & neighbourhoods)	*(no specific retails approach, see generic approach)*	Continuous assessment of CRE strategy based on everchanging market trends that would impact real estate decisions
Category 2 **Accommodation of Trends**	Customer-friendly retail spaces	Optimisation of space based on future projection of trends	Constant innovation to provide best customer experience
	Retail spaces that accommodate regional-specific demands and/or context-specific demands	Predicting the importance of retail locations in proximity of other prominent retail functions, to fit consumers' demands & convenience	Showcasing at retail spaces as a holistic approach to create needs
	Decent quality of physical assets, and improvement of deteriorated assets	Asset location based on projected high long-term footfall (high streets are projected to remain favourable for retails)	
	Tailor locations by following consumers demands, based on organisations' identity and its target market, to attract customers optimally	Assessment of the composition and balance between physical and online market, based on projected demand and various variables	
	Asset location: - Dominance for specific functions - Quality of site surrounding that match the specific retail function		
	Accessible to diverse location types: experience and convenience stores		
Category 3 **Digitalisation**	Self-scanning machine in physical assets to minimise risks	Omni-channel retail: Integration and combination of physical and online market	Unmanned units to replace regular physical retail format
		Digital workflow and approval processes when possible	
Category 4 **Space and Activities**	Physical improvement of the deteriorated assets	Integration with different-functioned shops to create more efficient space usage, (e.g. one-stop-shops)	*Asset scale:* Smaller & more compact physical stores, as projected
	Well-organised retail space		*Portfolio scale:* Optimising portfolio by adjusting the amount of physical stores
Category 5 **Property Feature Flexibility**	Flexible & adjustable assets - to accommodate changing trends - to improve the deteriorated assets due to costly major transformation	Flexible contracts (rental agreement), creating a security & control over location	Adjusting from regular physical format to unmanned unit
		Lowering risks by renting space (rather than ownership of assets)	Repurpose assets that are no longer in demand
		Optimise or relocate assets, by: - minimise the amount and area of physical stores, with careful assessment - consider the better deals with landlord	One-stop-shops: integration with other different-functioned shops
			Interchangeable assets to other uses
Category 6 **Environmental Sustainability**	*(no specific retails approach, see generic approach)*	*(no approach detected)*	*(no approach detected)*
Category 7		Maximising income and minimising cost on portfolio	*(no approach detected)*

Financial & Contractual Security	Flexible contracts (rental agreement), which create security and control over location	- Rent reduction based on Dutch law - Highest income and lowest vacancy possible	
		Optimise cost on portfolio through careful assessment that does not negatively impact the overall business	
Category 8 **Accessibility**	Well-accessible physical retail space	Integration with different-functioned shops to create more efficient space usage, (e.g. one-stop-shops), creating more access points	*Counter argument:* Physical site accessibility become more important for the success of the business due to competition with e-commerce
	Ease of access from anchor functions: Retail locations in proximity of - other prominent retail functions - other long-term anchor functions (e.g. library or healthcare centre)	Products are available in different-functioned stores, therefore creates more access points	
		Accessible in diverse location types, the experience vs convenience locations, therefore creating flexibility to prioritise resources	
Category 9 **Process and Real Estate**	Day-to-day response to calamities	Adjustable day-to-day processes based on circumstances	Digital tools (e.g. self-scanning) to reduce dependency to staffs, therefore minimise critical points
		Adjustment in process & workflow to be less susceptible; e.g. digital workflow and approval processes when possible	Digital processes to replace physical format
		Adapt processes or create alternative to meet increasing output demand	
Category 10 **Input and Real Estate**	Maintaining supply chain in event of sudden demand increase	*(no approach detected)*	Digital tools (e.g. self-scanning) to minimise demand of human resources to do physical labour

Priority, based Figure 4.13 and assessment method of Figure 5.03.

Table 5.03 described resilient retails real estate approaches identified *within* the retails case organisations. As previously specified, the cross-class analysis (Chapter 4) provided an overview of various approaches in different classes. This overview identified one resilience approach from the office sector that can potentially be applied on the retail sector.

Adopted class-to-class specific resilience approaches

1) **Origin class** : Office
   Category 3 : Digitalisation
   Feature : Persistence
   Digitalisation in day-to-day operation to optimise the management of physical assets
   Approach : **Sensors placed in physical assets for monitoring purposes**

   In the retail sector, digitalisation was identified to be a potential resilience approach, even though its occurrence indicated that its application was rather ancillary than priority (Figure 4.13). Nevertheless, this office-oriented approach may be applicable to improve the resilience of a retail industry. To an extent, the use of sensors can help the retail sector to analyse and optimise their assets.

5.5. Resilient Industrial & Logistics CRE Management

Industrial and logistics sector's approaches were divisible into three groups, approaches applicable for both logistics and non-logistics sectors (excluding generally applicable approaches listed on Table 5.01), approaches applicable only for the logistics sector, and approaches applicable only for the non-logistics sector. Here, approaches that were deemed applicable for both the logistics and non-logistics sectors were determined by derivation from either of the two sectors. This was due to the unavailability of empirical evidence indicating an applicable approach for both sectors based on the interviews alone.

Table 5.04 presents the approaches to resilient industrial and logistics real estate, and its priorities. These approaches were not regulative and may accommodate other potential approaches that are yet to be identified from the currently available information.

Table 5.04. Resilient CRE approaches for the industrial and logistics sector (source: Author).

	Persistence	Adaptability	Transformability
Category 1 **Strategic Alignment**	*(see generic approach or below)*	Collaboration with other stakeholders to minimise or mitigate risks	*(see generic approach or below)*
Specific logistics	*(n/a)*	*(n/a)*	Selling owned assets and lease back, creating added value (more profit to the organisations)
Category 2 **Accommodation of Trends**	Remodel assets to fit the modern demand	New developments due to projected higher demands	Redevelopment to attract new clients and large businesses
			Projecting suitable real estate intervention by profound understanding of the core business and collaboration with other stakeholders
Specific logistics	Accommodate growing interest of stakeholders on sustainability	*(n/a)*	*(n/a)*
	Follow consumer demands on e-commerce by creating last-mile distribution centre, placing it near the urban consumers		
Category 3 **Digitalisation**	*(no approach detected)*	*(see generic approach or below)*	*(see generic approach or below)*
Specific non-logistics	*(n/a)*	*Counter argument:* Inability to digitize specific roles/task, especially production/lab work	*(n/a)*
Category 4 **Space and Activities**	Outsource maintenance party to mitigate risks	*(see generic approach or below)*	*(see generic approach or below)*
	Physical resistance towards probable physical disaster		
Specific logistics	Building specification to conduct logistics business operation e.g. sufficient or adjustable clear height, quality of floorings and loading docks	Lowering risks by renting space (rather than owning the space)	*(n/a)*
Specific non-logistics	Location of sites designated for industrial activities	Flexible working space, through desk sharing concept	Optimisation of space through continuous assessment of desk-to-person ratio
	Sites not to be easily accessible due to safety reasons		
Category 5 **Property Feature Flexibility**	*(see specific approaches below)*	Terminate assets that are no longer serve the business purposes, by: - selling assets and renting the lands - selling assets	Redevelopment of assets, focuses on sustainability and circularity
			Redevelop and repurpose assets functions

Specific logistics		Flexibility to relocate physical logistics space	
Specific non-logistics	High vacancy level to accommodate changes	Consolidate assets whenever possible	*(n/a)*
	Counter argument: Industrial portfolio are normally are not very agile	*Counter argument:* Site-context is very rigid due to limited function of industrial sites	
Category 6 **Environmental Sustainability**	*(no specific approach, see generic approach)*	*(no specific approach, see generic approach)*	*(no approach detected)*
Category 7 **Financial & Contractual Security**	*(see generic approach or below)*	Minimising cost on portfolio e.g. by assessment to create clear overview of the portfolio's depreciation, value, occupancy/vacancy level, desk ratio	*(see generic approach or below)*
Specific logistics	*(n/a)*	*(n/a)*	Changing ownership status to create more profit
Specific non-logistics	Long-term ownership of assets, therefore zero book value (zero cost) and less investment risks	Optimise cost on portfolio through consolidation of assets	*(n/a)*
Category 8 **Accessibility**	*(see generic approach or below)*	*(see generic approach or below)*	*(no approach detected)*
Specific logistics	Highly accessible locations - Near highway and/or ports - Near urban consumers Specific to value-add services: close to labour pool	Two types of logistics spaces: 1) regular logistics warehouses 2) last-mile logistics centre, to create more access to the consumer	*(n/a)*
	Specific to value-add logistical services: highly accessible by public transport		
Specific non-logistics	High industrial activities: Well-accessible site from the resources & to transport output to other businesses - located close to ports	Decentralised production points therefore less susceptible and can maintain production process in event of disruption	*(n/a)*
	Counter argument: Preferred for industrial sites to not be easily accessible by non-relevant visitors due to safety reasons	*Counter argument:* Assets in different locations may have different functions/projects managed by different sub-business groups, so specific-skilled employees needs to access a specific building.	
Category 9 **Process and Real Estate**	*(see generic approach or below)*	*(see generic approach or below)*	Sustainable processes, minimise possibility of creating environmental hazards
			Contingency plans
Specific logistics	Shorten physical distance from warehouse to consumers by last-mile distribution centre	*(n/a)*	Continuous assessment and exploration of last-mile distribution centre due to its relatively new concept
	Logistical space is placed in the location close to ports and/or highway, to maintain access to process-essential infrastructures		
Specific non-logistics	Flexibility due to high vacancy level creates the ability to maintain process without significant and long recovery time	Ability to adjust the production process to maximise output efficiency	*(n/a)*
	Decentralised production points therefore less susceptible and can maintain production process in event of disruption		
	Safety protocols in place and other capabilities to resume production process during disruptions		
Category 10 **Input and Real Estate**	Ensuring input in event of transport disruptions	*(no approach detected)*	*(no approach detected)*
Specific logistics	Ensuring input of human resources: logistical space is	*(n/a)*	*(n/a)*

	placed in the location close to labour pool (specific to value-add logistics service)		

Priority, based on Figure 4.14 and assessment method of Figure 5.03.

In addition to the above listed approaches, the cross-class analysis derived a number of approaches that were originally identified for the office and retail sectors to be applicable also for the industrial and logistics sectors.

Adopted class-to-class specific resilience approaches

1) **Origin class** : Office
   Applicable to: Logistics

   Category 2 : Accommodation of Trends
   Feature : Persistence
   Physical ability to follow trends and utilise needs
   Approach : **Follow the technology development in the industry**
   Experts and professionals in retail and logistics CRE expected e-commerce to continue to grow in the foreseeable future (Section 4.2, R_EXP_1 interview; Table 2.01). Thus, the impact of e-commerce was also expected to be significant for the logistics sector. In addition, the logistics expert mentioned that the regulation of stacking height in warehouses has increased in the recent years due to the use of new equipment and other infrastructural developments. Therefore, the logistics sector was required to follow the technology development in order to accommodate the ongoing growth of the market and its demands.

2) **Origin class** : Office and Retails
   Applicable to: Logistics

   Category 5 : Property Feature Flexibility
   Feature : Persistence
   Physical asset flexibility to accommodate changes within the current spatial boundaries
   Approach : **Flexible and adjustable assets, to accommodate changing trends and processes**
   The change in stacking height preference influenced the height requirement in the warehouses. Along with the increased process automations and other technological developments, the assets of the logistics sector may need to be flexible and adjustable to facilitate the implementation of these new technologies.

3) **Origin class** : Retails
   Applicable to: Industrial (excluding logistics)

   Category 4 : Space and Activities
   Feature : Persistence
   Physical resistance to disturbances that threatens activities
   Approach : **Physical improvement of the deteriorated assets**
   There are certain rules for conducting industrial activities, particularly related to its manufacturing, production, assembly, and research activities. Deteriorated assets need to be improved to avoid catastrophic events.

5.6. Continuous Resilience in CRE Management

Despite the rather static characteristics of the real estate industry, the built environment context which is accommodated by real estate, is continuously changing. In the literature review, continuous improvement, as a portion of the lean concept, was identified to be a potential concept for CRE industries to maintain resilience over a period of time. Thus, CRE industries should constantly evaluate their performance (Krumm, et al., 1998) in order to continue accommodating the ever-changing demand of the business (de Jonge, et al., 2009) and avoid irrelevant value delivery (Jylhä, 2013). The fourth resilient CRE features of preparedness, which was adopted from Davoudi et al. (2013), was deemed to be a suitable feature for organisations to maintain their resilient capabilities.

The currently obtained empirical data supported this theory. Reflected on the series of generic and class-specific approaches, the data emphasised how continuous improvement underlined several approaches on different resilience categories. In the generic approaches (Table 5.01), several suggestions included the dynamic and active CRE strategy, as well as constant assessment of value delivery of the current real estate interventions. In addition, space was suggested to be regularly assessed to maintain its optimality. In office-specific approaches, an optimal space can be maintained through a constant assessment of desk to person ratio and by reflecting on the current activity demands. Retail-specific approaches also suggested a continuous assessment on the market trends and consumers' demands in guiding real estate decisions. An expert in the logistic sector specifically highlighted the importance of constant evaluation and exploration of last-mile distribution centre-type warehouse due to its relatively new concept. Therefore, based on the confirmation by several interviewees, the approaches detected includes the constant evaluation on their current approaches.

Looking at the broader view, change is inevitable. This research defined approaches for a resilient real estate through three feature levels of persistence, adaptability, and transformability. Whilst change is a constant, the then-defined transformable approaches may be the next basic requirement of persistence and that the requirements for a resilient CRE will always evolve in time. Therefore, the maintenance of resilience in commercial real estate requires preparedness, which is achievable through constant evaluation and continuous improvement on an organisation's current approaches.

5.7. Conclusion of Findings

The findings of this research presented two applicability levels of approaches, which are the generic and class-specifics recommendation to better equip CRE industries to be resilient towards disruptions. Different asset classes may possess their own characteristics. Therefore, it might be important for organisations to follow both of its generic and specific requirements instead of focusing solely on the generally applicable suggestions. However, it should be acknowledged that the *class-specific approaches must be applicable to all organisations in their respective class*. That being said, the approaches that were highly specialised to one domain of organisation (e.g. only applicable to banking in office sector, or supermarkets in retail sector) were excluded in the current findings albeit being detected during the empirical data collection. Additionally, due to the distinct characteristics of the in the industrial and the logistics sectors, additional approach distinction was created to account for approaches that were applicable only for the logistics or the non-logistics sectors, in addition to those that were deemed applicable for both.

The specific approaches to promote resilience in CRE industries were rather familiar and well-known, especially considering the features of persistence and adaptability. Interestingly, these approaches were originally implemented by the observed organisations not as a way to obtain resilience, but as a strategy to fulfil other organisational goals. Thus, this research identified relatively common approaches that may promote resilience in specific asset classes.

In a general sense, the optimum state of an organisation was defined as the state when value delivery is maximised while the required level of resilience is maintained. Transformability may possess the most innovative and top-level resilience approaches. However, for some aspects (categories), transformable approaches may not be the optimal state to possess without costing a lot of value delivery trade-offs. In addition, transformability approaches were highly specific for every business cases. Therefore, it may not be easily streamlined in asset classes scope. Lastly, preparedness was required for organisations to maintain their resilience capability. Preparedness can be achieved by continuous assessment and improvement of the resilience approaches, therefore CRE management could always adjust to the evolving nature of the built environment.

Chapter 6:
Conclusion

6.1. Research conclusion

6.2. Research contributions and larger implications

6.3. Research evaluations

6.4. Research limitations

6.5. Future studies

6.1. Research Conclusion

Corporate real estate, being the second highest expenditure in almost every business, needs to be resilient on their processes, decisions, and implementations. Equipping CRE management with resilience capability could help businesses to respond to the inevitable external changes, anticipate further opportunities, and maintain business continuity in the event of a disruption. The goal of this research is to advance resilience in the context of corporate real estate. The current study defined resilience in the context CRE and attempted to advance CRE resilience capabilities.

This research explored, addressed, utilised, and maintained resilience in various CRE asset classes. The research provided the answer to the main research question by sequentially addressing its four research sub- questions.

Q1 What is the extended definition of resilience and its features that fits the context of CRE industries?

The extended definition of resilience was formulated through literature review on CRE management theories and by exploring the concept of resilience used in multi-disciplinary contexts. **Resilient CRE in this research was defined as the capability and preparedness to manage businesses' physical assets and CRE organisational processes to respond and immediately recover following external disruptions, thus allowing the maintenance of value delivery. This can be achieved by being 1) invulnerable, 2) resistant towards disruptions, 3) flexible in adapting the organisational sub-processes to maintain the same pathway, or 4) innovative in creating a more desirable pathway or state.** These four response methods should be utilised accordingly depending on the scale and the extent of disruptions to the receiving ends.

The **features used** to advance resilience in CRE industries can be categorised into **(a) persistence, (b) adaptable, and (c) transformable resilient features**, as adapted from Davoudi, et al. (2013). In his theory of evolutionary resilience, Davoudi, et al. (2013) proposed the fourth component of preparedness, even though its implementation was restricted in the current research as an indispensable factor for the maintenance of resilience capability, which was discussed on the fourth research question.

Q2 Why should CRE industries enhance resilience from the value delivery perspective?

Real estate decisions impact to the core business (Gibler & Lindholm, 2012). As such, real estate decision may provide added value and generate income for the organisation (de Jonge, 1994; de Jonge et al., 2009). Krumm, Dewulf & de Jonge (1998) conferred that organisations can provide added value by awareness of its capability, resources, and the changing markets. Hence, creating resilient CRE may deliver value to the CRE management and to the core organisation. A resilient real estate can be one of the determinants that decides whether a disruption would hinder business activities. Here, the actual contribution of resilient real estate was discussed using two theories by de Vries (2007) as well as Gibler & Lindholm (2012). Possessing resilient capability in an organisation's real estate would help businesses to maintain a stable output, especially during disturbances.

Q3 How can resilience be operationalised and optimised in various CRE asset classes?

Two main deliverables were provided to answer this research question. **The first deliverable** was the **resilience framework (Figure 6.01),** which may be used to assist organisations to assess their resilience capability. The resilience framework provided a basis for analysing the important criterion of a resilient industry. Additionally, the resilience framework can also be used to analyse asset classes beyond the observed three sectors.

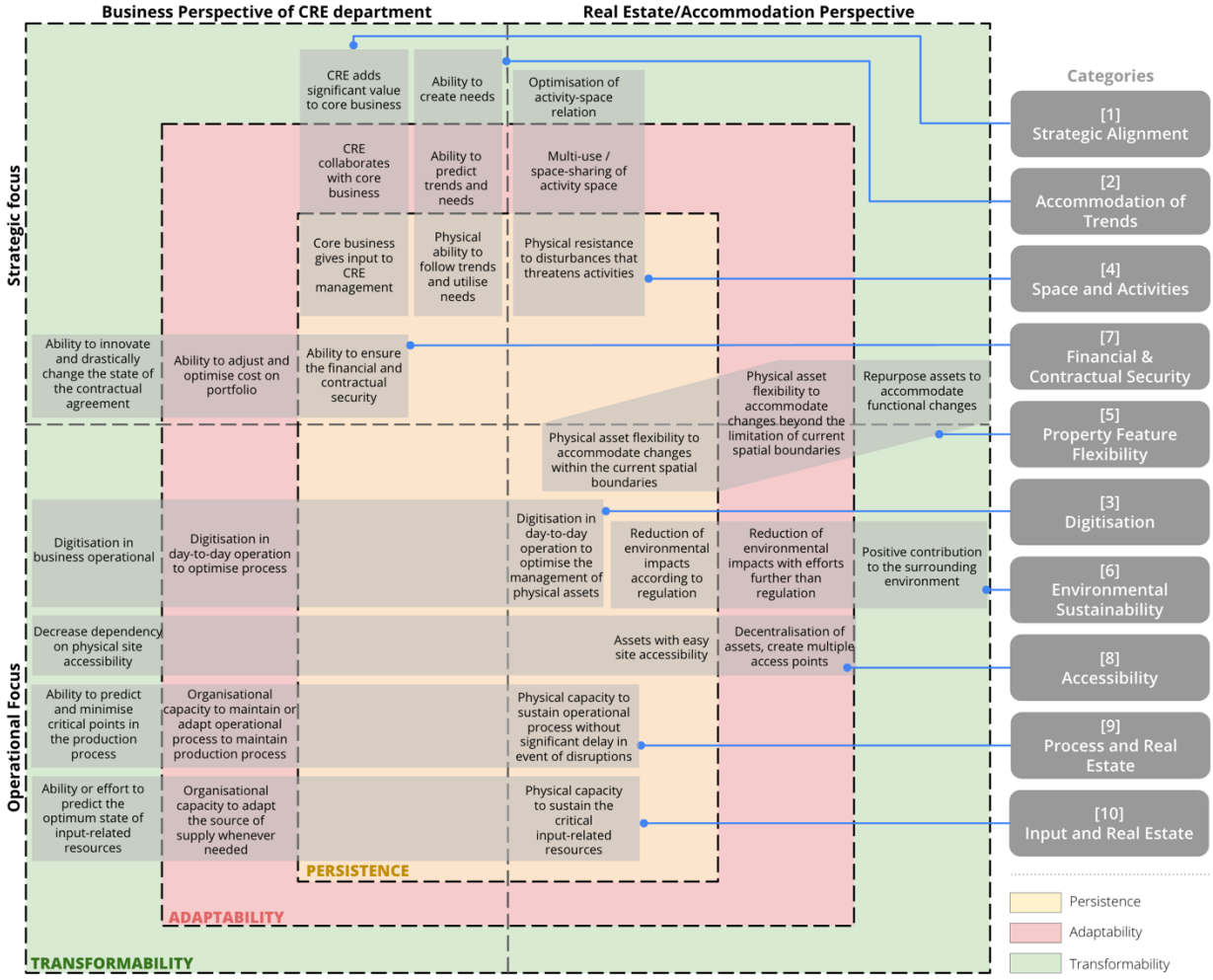

Figure 6.01. Final resilience framework (source: Author, replicated from Figure 4.02).

The second deliverable consisted of **a set of suggested approaches for the operationalisation of resilience in CRE**. The sets of approaches could help organisations to implement resilience in their real estate management. The approaches were derived from information obtained from theoretical and empirical studies. The recommended approaches may appear to be a rather familiar form of intervention. During the empirical study, it became clear how many of the identified resilient approaches were originally targeted to achieve other institutional aims. In such cases, the current research showed how these approaches would also contribute to the organisation's CRE resilience.

This research introduced four sets of approaches to help CRE industries operationalise and optimise their resilience capability. These four sets of resilience approaches consisted of one set of generic approaches, which is applicable for a larger scope of commercial real estate, and three class-specific approaches for the office, retail, and industrial/logistics classes. Each set of approaches consisted of suggested operationalisation efforts through the lens of 10 categories and 3 features of the resilience

framework (Figure 6.01). **Categories 1, 4, and 6 were found to possess sequential characteristics of their persistence, adaptable, or transformable (P, A, T) features**. Categories 1, 4, and 6 represented 'Strategic Alignment', 'Space and Activities', and 'Environmental Sustainability', respectively. This means that in these three categories, persistence needs to be possessed before reaching adaptable efforts, and acquiring transformability requires the possession of both lesser features (Figure 6.02). In contrast, the remaining seven categories' features appeared to be independent to each other and can be possessed without acquiring another, as was the case for categories 1, 4, and 6.

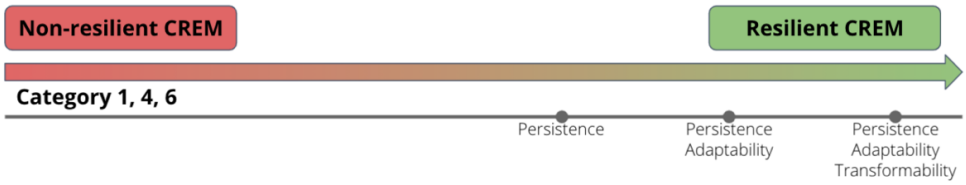

Figure 6.02. Sequential characteristics of Category 1, 4, and 6 (source: Author).

The **generic approaches** consisted of general ideas on how CRE industries could better operationalise and optimise resilience. The generic approaches were detected in 8 out of 10 categories from the resilience framework. Here, the P, A, T features of the approaches were also identified whenever applicable. The first category of strategic alignment showed generic characteristics in all three P, A, T features. The CRE of commercial real estate industries was thus suggested to receive input (P), to align strategies (A), and to contribute significantly (T) to their respective core business organisation – all of which may be achievable through the following approaches:

- (P) Translation of core organisational strategy to real estate strategy
- (A) Collaboration between real estate departments and other departments and core businesses
- (T) Possession of active and dynamic CRE strategy, and perform constant assessment of value added of current real estate approaches to the core businesses

Other generic approaches included the responsiveness and prediction to market trends and demands, hybrid working capability as well as space optimisations to save costs.

The **class-specific approaches** presented three separate suggestions for the office, retail, and industrial/logistics sectors. These approaches were supported by the priority assessment of the interventions, which allowed specific organisations to plan the decisions accordingly. Also, adopted class-to-class specific resilience approaches were provided, which consisted of approaches that were adopted from other identified case-class.

Office-specific approaches identified several priority approaches. The occurrence analysis identified the fourth category, "Space and Activities", as the most important category in the office sector, in which all of the three P, A, T features of space and activities appeared to be prioritised. The approach in this specific category included:

- (A) Flexibility of working space and the composition of office spaces
- (T) Optimisation of asset level through continuous desk-to-person ratio assessment, and in portfolio level through assessment of assets' performance for future-proof businesses
- (T) Hybrid working capability

Other office-specific priority approaches included the ability to analyse and identify specific demands in the sub-processes (Category 2; Adaptability), flexibility in contractual agreement (Categories 5;

Adaptability and 7; Persistence), and reduced dependency on physical site access through the development of digital work platforms and processes (Category 8; Transformability).

In the retail sector, the class-specific priority approaches consisted of the extent of organisational responses to the ongoing market trends and demands (Category 2). In this second category, a number of real estate approaches can be taken in several different feature levels:

- (P) Creation of customer-friendly retail spaces, accommodation of regional or context specific demands, selection of retail location that follow the targeted consumers demands, and decent quality of the site's surroundings.
- (A) Prediction and accommodation of future trends, through prediction of future footfall of a specific area
- (A) assessment of the balance between online and physical markets
- (T) Showcasing at retail spaces as the holistic way to create needs (although not defined as priority approaches).

Other retail-specific approaches included site selection in the proximity of other prominent functioned facilities such as healthcare centres or public library, which may improve the retail stores' footfall over time (Category 8; Persistence). Asset integration with other retail forms was also popular among the observed retail organisations. Another suggestion was to shift the ordinary physical stores to a rather automated unmanned stores (Category 5; Transformable), which may be used to eliminate a proportion of manpower-related sources of process susceptibility.

Industrial and logistics sectors during the data analysis were further sub-categorised into three subsets of suggestions. This categorisation was based on the industrial and logistics sectors' unique characteristics. Thus, the suggestions included a set of approaches applicable to both logistics and non-logistics sector, and two sets of approaches that were applicable only to the industrial or logistics sectors. In comparison to the office and retail sectors, the industrial and logistics sectors showed a dominance of approaches in process-related CRE interventions (Category 9). The approaches applicable for both logistics and non-logistics sector in this process category (on transformability level) were emphasised on the development of sustainable processes to minimise environmental hazards and the possession of contingency plans. Specifically for the logistics class, the approaches detected for Category 9 (process) included:

- (P) Shorten the physical distance from warehouses to consumer by last-mile distribution centres
- (T) Automation in logistics warehouses
- (T) Continuous exploration of last-mile distribution centres due to its relatively new concept.

In general, CRE industries showed the ability to implement the operationalisation of resilience. As CRE industries often belongs to the larger core organisations, approaches taken in industries should also account for the balance between cost of resilience effort implementation in relation to its value delivery. Hence, to optimise resilience efforts, a priority of approaches had to be applied on the provided approaches. CRE management can benefit optimally by prioritising some of the approaches. Additionally, the current resilience framework may be utilised for further exploration and identification of novel resilience efforts.

Q4 What are the potential measures that CRE industries may take to maintain their resilience?

Actors involved in the management of CRE spaces should be aware of the ever-changing demands and needs of the real estate's occupiers. Therefore, real estate industries should be prepared to accommodate the constantly shifting context of its built environment. The preparedness capacity of CRE industries can be achieved through continuous evaluations, exploration, and improvement to the current real estate decisions. This include having a dynamic and active real estate strategy to avoid irrelevant value delivery and to continuously provide relevant values to their core organisations.

This research provided sets of approaches for resilient CRE, as seen through the three features of persistence, adaptability, and the rather innovative approaches of transformability. Looking through the evolving lens of the built environment, the currently identified transformable approaches were expected to, one day, be a basic approach for future organisations. Therefore, to maintain resilience capability in a commercial real estate, it may be necessary to possess the preparedness feature, which can be achieved by constant evaluation and continuous improvement on the organisation's real estate decisions.

Main Research Question:

How can resilience be advanced in the context of corporate real estate?

The four sub-research questions created building blocks to assist CRE industries advance their resilience capability. This research and its methods had provided the research goals and objectives.

The first building block reconceptualised resilience in the context of real estate, resulted in its extended definitions as well as the identification of the three applicable resilient features of persistence, adaptability, and transformability in CRE. The second component delivered in this research was the justification of resilient CRE value contributions to the alignment within the core organisations. This confirmed the necessity of resilience capability in CRE, two individually popular fields which was almost never been explored collectively before. These two antecedent building blocks served as a contribution to the academic side of CRE field.

The two primary building blocks provided a basis for the utilisation of resilient CRE in a practical setting. Through the defined resilient CRE features, a general resilience framework could be constructed. This acted as a tool for the subsequent operationalisation of the predefined theories. Through empirical data collection and by using the resilience framework, approaches to improve resilience in various CRE asset classes were provided. The sets of approaches, along with its identified priorities, may facilitate the decision-making processes to implement resilience capability in organisations. Lastly, the research was further assured its applicability, through the utilisation of preparedness feature. This can be achieved through continuous improvement of real estate decisions. This constant evaluation and improvement capabilities help CRE industries to maintain resilience over a longer period of time, thus protecting the continuation of relevant value delivery to their respective organisations. These components provided the contributions to the practical side of CRE.

These building blocks could be applied to other asset classes of the commercial real estate and to the larger CRE context. In the end, this study delivered a series of outcomes that would help CRE industries to implement resilience in their practices. At the same time, the findings of this research provided a basis for future studies to further explore the operationalisation of resilience in an even larger scope of CRE.

6.2. Research Contributions and Larger Implications

This research contributed to the corporate real estate management field by expanding our knowledge on resilient real estate. Specifically, this research re-conceptualised resilient CRE management through the determination of its extended definition, identification of its features, development of its framework, and the identification of its added value to the core organisations. This research also contributed to the operationalisation of resilient CRE by providing a set of suggested approaches that were expected to be widely applicable to different scopes of real estate management. Furthermore, the framework and the three resilience features could be widely implemented for the assessment of resilience in a different field of research.

In conclusion, this research contributed to both the academic and practical communities. First, by filling the literature gap in the scientific literature by connecting the previously exclusive resilience and corporate real estate topics. This bridging of information may further promote the exploration of novel strategies to create a better, more prepared, and agile real estate industries. Secondly, the approaches can be utilised directly by CRE management that operates in (but not limited to) The Netherlands. The implementation of these approaches may further enhance preparedness of their real estate management and subsequently safeguard their core businesses. Resilient real estate is hoped to better equip organisations to protect business continuity, especially during the times of unprecedented crisis.

6.3. Research Evaluations

Yin (2009) suggested four tests to evaluate the quality of a research design, which consisted of construct validity, internal validity, external validity, and reliability. The current study excluded internal validity assessment due to its unfeasible implementation in an exploratory research. Below are the evaluations of the study using the three suggested assessment.

Construct Validity

First, construct validity focuses on the appropriateness of the operational method for the topics studied (Yin, 2009). Two tactics to construct validity were implemented in this research. First was the empirical data collection, which used several sources of evidence obtained from three representative asset classes. These sources were also varied based on the perspective and position within its respective asset class by distinguishing CRE managers and experts of a particular sector. The chain of evidence was also established by quotations as well as the acknowledgement of each data to specific interviewees, thus further secure its validity.

External Validity

The external validity test evaluated the generalisation of study findings in a larger scope of contexts (Yin, 2009). First tactic included the use of theory constructed in literature review to single-case studies which, in the current study's case, was a single organisation. This was further replicated to other organisations within and across case classes in order to fulfil the second suggested tactic of external validity. One of the outputs was a generic approach which was believed to be applicable for larger scope of commercial real estate.

Reliability

The reliability test determined the repeatability of research methods and the data collection procedures of a study (Yin, 2009). The quantitative conversion and data normalisation following empirical data collection allows comparable results to other studies that used the same methods. Within this context of evaluation, the current study can be said reliable due to its potential to be expanded to other asset classes using the same theory, methods, protocols, and procedures. The process can also be operationalised to real estate management outside the scope of The Netherlands. Furthermore, a larger resilience assessment can also be done to other sub-group (e.g. resilient supply chain) within any business using the resilience framework as a basis, albeit the need of slight modifications to fit in the context of the particular sub-groups.

6.4. Research Limitations

Every research has its own limitation, and acknowledging research limitations allows learning and create rooms for improvements. The currently presented results for the logistics and industrial sectors were limited due to the post-hoc separation of the logistics and the industrial (non-logistics) classes. The decision to combine the two classes was originally made based on evidence during preliminary literature review. However, during the empirical data collection, it became evident that resilient approaches taken by industrial and logistics-oriented organisations were distinctly different. This created difficulties during the formulation of approaches. This was solved through the separation of approaches for this sector, which differentiated between approaches applicable for both sub-sectors, and suggestions specifically designated for each sub-sector. Nevertheless, the separation between the logistics and (non-logistics) industrial sectors resulted in an unequal number of classes observed for these two asset classes. This made it difficult for the two resulting classes to be included in the occurrence analysis, especially knowing that the information obtained in the logistics sector was only based on one interview. Despite the limited interpretation, the current study decided to create a distinction between the logistics and the industrial classes to better formulate class-specific resilience approaches.

The exploration and identification of resilience approaches performed in the current study was limited to that applicable on the asset class level. The applied scope on the asset class level limited the identification of approaches that may be specialised to one sub-domain of an asset class. In other words, resilience approaches that are specialised only on a specific sub-sector of an asset was not fully explored in the current study. As discussed before, specific banking approaches (interviewee O_CREM_1) and supermarket approaches (interviewee R_CREM_1) needed to be excluded, to create a set of applicable approaches for all organisations *within* that respective class. Therefore, it limited the formulation of highly unique approaches. Nevertheless, it should be acknowledged that each organisation has their own special characteristics that requires specific approaches to ensure business continuity during disruptions.

Lastly, the current research took a more explorative standpoint and adopted the semi-structured in-depth interview method during the empirical data collection. The interview method was deemed fit to gather information in a relatively unexplored topic – such as resilience in CRE – and was able to discover important information that would otherwise not be retrievable with a more structured interview format. However, the method made it possible for some relevant information (e.g. resilience approach-related real estate decisions) to be missed during the interview. Therefore, the absence of information for some organisations could not be seen as an implication of absence of viable resilience approaches. Nevertheless, the current semi-structured in-depth interview method was able to obtain substantial information to serve as a basis for other research in the future.

6.5. Future Studies

This study opened up other research opportunities for further resilient CRE exploration. First, the next studies could analyse other asset classes such as healthcare institutions, educational campus, data centres, and other classes in commercial real estate industries that are yet to be observed in the current study. This can be done by replicating the currently used methodology and by adding modifications to fit the future studies' specific goals and conditions. Furthermore, future research could scope down the research to sub-classes of each class, therefore increases the applicability of the approaches.

The findings of the current study also revealed the existence of an optimal state for classes to utilise resilience. Interestingly, none of the classes showed a tendency towards transformable approaches as its optimal state. This finding thus elucidated how excessive resilience efforts may be less profitable to the total business case. This was probably because transformable approaches, which were identified as the innovation of new pathways, may require a significant number of investments. Therefore, future study may further analyse the cost-benefit trade-offs of transformable efforts within an organisation.

Chapter 7:
Reflection

7.1. Research Positioning within the Master Track

This research is conducted under Delft University of Technology, master's programme of Architecture, Urbanism, and Building Sciences (AUBS), within the track Management in the Built Environment (MBE). MBE emphasises on the managerial dimension and the process-related integration between various industries. As the graduation thesis, this study focuses on one of the core discipline of MBE track, the Real Estate Management (REM) department. Real estate management focuses on the management of the physical entities that houses organisations' business activities. This requires the managerial perspective to integrate processes and resources, in order to help organisations' value formation.

The graduation research explores towards a resilient corporate real estate, by redefining its concept and its features, developing a framework, and formulating sets of approaches to various asset classes of commercial real estate. Specifically, this research provides sets of suggestions to better manage various organisations' real estate spaces, therefore able to better accommodate its users and their activities.

7.2. Relevance of the Research

This research delivered several findings, which are relevant to both academic and practices. In regards to the academic relevance, findings such as 1) the resilience definition, 2) its features, 3) added value of resilience to the organisation, 4) resilience framework, and 5) concept of continuous resilience provides a fresh perspective of CRE theories. This is due to limited available resources of resilience CRE, albeit each topic separately are rather prominent on its own.

The generic and specific approaches are undoubtedly relevant to the CREM practices. The suggested approaches pinpoint a number of well-known real estate interventions that can specifically contribute to resilience within an organisation. Furthermore, the priority of approaches allows organisations to prearrange the necessary implementations for organisations to focus on primarily. The resilience framework and concept of continuous resilience are also helpful for the CREM practices, to further assess their current approaches, and to maintain resilience continuously.

Overall, this research is hoped to create a significant positive impact to the REM department, the larger MSc AUBS institution, the scientific community within this field, and for relevant practices.

7.3. Research Methods and Approach

Theoretical Study

The first step of theoretical study set a foundation to the rest of the research. An extensive literature review was performed during the first stage of this research. Due to the limited information of resilience CRE, the literature review had two starting point, resilience in one end and CRE management in the other end. These two different subjects were analysed separately, and the connecting dots were formed after substantial data from both context had been gathered. This theoretical study is similar to the conventional way of building a bridge, where constructions on each end needs to be established first, before reaching to the middle and connect both grounds.

The literature review delivered substantial sets of output, 1) the extended definition of resilience, 2) its features, 3) added value to the organisation, and 4) the literature-based resilience framework. The extended definition and the selected features underlie the whole research, as these two output facilitated the next steps of the research. The literature-based framework set a basis for empirical data collection and categorisation of data.

Empirical Study

Building from the literature-based framework, the empirical data collection consisted of series of semi-structured in-depth interview with the selected asset classes representatives. This method of data collection is interesting during the conversations within the interviewees, because every interview is different, and new questions may emerge based on the information gathered along the interview.

Data categorisation following the interview were rather a tedious and time-consuming process. First, the transcribing and coding process needs to be very thorough, as sometimes the information is gathered by reading between the lines, and was subtly positioned by the interviewee. Secondly, categorising the information to the framework is an iterative process, which requires going back and forth to all data, checking and re-checking the comparability of one identified data to another similar information. This long process successfully advanced the former literature-based framework, to the final resilience framework that is proven by both theoretical and empirical study. Also, the data categorisation provided a stepping stone to operationalise resilience in various CRE institutions.

Operational Phase

The last operational phase was built up from the previous output. The categorised data were analysed extensively and iteratively, therefore able to create sets of generic and specific approaches for CRE organisations to advance and maintain their resilience. Through different methods of analyses, the approaches identified can be further scoped down to the priorities and non-priorities approaches for each classes. This would help CRE institutions to plan their real estate interventions based on the necessities and significance of impact.

7.4. Research Process

The graduation research journey was very challenging, yet at the same time very insightful. The nature of this explorative research had created a lot of ambiguity and hesitation of the progress, wondering if the adopted methods were appropriate to answer to the main goal of the research. However, the uncertainties had created an awareness to reflect and re-assess the research pathway, in which most of the time led to a better and more responsible process. Fortunately, the mentors Dr. Tuuli Jylhä and Dr. Aksel Ersoy provided me with substantial and detailed feedbacks, at the same time continuous guidance to help me see the bigger picture.

This research was inspired by the COVID-19 pandemic. Although unfortunate, this crisis had created an awareness to be better prepared and equipped for the future uncertainties, and always evolving ahead of time. Resilience, despite some sarcasm of it being just the buzzword, possess potential and hope to for organisation to survive and become better albeit the challenges.

To conclude, CRE management, amongst others, needs to be capable to address changes, adapt to changes, and innovate to advance their systems. Adopting the famous saying that are often associated with Charles Darwin, it is not the strongest that survives, but rather, the ones that are most adaptable to change.

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Appendix A: Interview Protocol – Corporate Real Estate Manager

Graduation Laboratory 2020/2021
Management in the Built Environment
Delft University of Technology

Interviewer : Danica Antonia Widarta
Current Title : **Exploration towards a Resilient Corporate Real Estate:**
Re-conceptualisation and Operationalisation of Resilience in Various Corporate Real Estate Asset Classes

Interviewee : [Name] Organisation : [Organisation name]

Introduction

Firstly, I would like to thank you for participating in this interview. As mentioned in my messages, this interview is a part of empirical studies of my graduation research carried for the Faculty of Architecture and the Built Environment of TU Delft.

My research aims to create a strategy to enhance resilience within various corporate real estate asset classes, including [office/retail/industrial] sector. Previously, I have conducted a theoretical study which resulted in an extended definition of resilience in corporate real estate, and a literature-based resilience framework. This resilience framework analyses several CRE approaches to become more resilient, based on theoretical evidence. This interview is the subsequent step of my research, which aims to gather empirical data that provides validity of my current theoretical framework, as well as gaining new insights on more information that may not be presented during my literature study. The outcome of the empirical study will be evidence-based strategies for each selected asset classes to improve their resilience.

This interview will consists of five main sections about your **experience managing the real estate of [company name]**, and one additional section of reviewing my literature-based resilience. I would like to point out that there is no right or wrong answers. The information gathered will only be used for academic purposes, and will be treated confidential and following the FAIR guiding principle.

This in-depth interview will be conducted in approximately 45 minutes to one hour of duration. Please keep in mind that you may refuse to answer any of my questions, and that you may withdraw from this study at any time.

Practicalities

I would like to ask you if you are okay with this interview being recorded. I would like to assure you that the recordings will be properly destroyed after the transcription's validity has been confirmed with my mentors.

[RECORD]

I am going to repeat the question because it is now recording. Are you okay with this interview being recorded?

Part 1 - General

- Can you briefly elaborate your position at [company name] and the responsibilities within the company?
- How long have you been working at [company name] or similar type of position?

Part 2 - Resilience

The word 'resilience' becomes more and more popular, especially during this unfortunate COVID-19 pandemic.

- Does your company considers resilience as a part of the ambition?
  [If the answer is a yes]

  - Can you elaborate more on that?
  - How does resilient is implemented or approached in CRE function of an organisation?

[If the answer is a no]

  - How resilient is seen in the CRE function of the organisation?

- What do you think of resilient [office/retail/industrial] real estate?
- What makes an [office/retail/industrial] real estate resilient?

In my research, resilient corporate real estate is defined as the capability and preparedness of an organisation's CREM department to response and immediately recover, in the event of external disruptions, by interchangeably being invulnerable, resistance, flexible towards disruptions, or (4) being innovative to transform to a more desirable pathway or state.

This results in three general approach during disruptions: (1) persistence, (2) adaptable, and (3) transformable. Persistence (1) is defined as the ability to resist external disturbances, which requires physical robustness and rigidity. Adaptability (2) is the flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway. As an example, an organisation able to do remote working is the adaptability, which maintains the same general procedure but have the flexibility and resource to do it remotely. Transformability (3) is the ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories. This requires a major transformation which does not maintain the same procedure.

- Can you share your experience managing [company]'s real estate where your approach lead to being persistance to certain kind of disruptions?
- What about the times where you need to adapt or transform your organisational or physical arrangement in event of disruptions?

Part 3 - Disruption (COVID-19 pandemic)

We can agree that the COVID-19 pandemic is one of the biggest unpredictable disruption of last year, and still are now. It challenges almost everyone on this planet to deal and even adapt to this situation.

- Can you share your CRE manager perspective of resilient real estate before and after the COVID-19 pandemic?
- What are the biggest shift in your in your point of view regarding the resilience of physical accommodation strategy (spatial related) and organizational arrangements?

As a reference, if you don't mind me asking,

- Is your company hiring more or less during this pandemic?
- Besides the staffs that are needed on-site, are most of the employees work remotely?

Part 4 - Current approach

- Can you elaborate what and why are you satisfied and/or dissatisfied with [company]'s current real estate resilience approach?

Part 5 - Beyond COVID-19 pandemic: Future recommendation

As we can learn from the past, disruptions can be in any form, pandemic, economic downturn, and other crisis. As a corporate real estate manager, you may want to be prepared with uncertainties ahead.

- So, looking beyond COVID-19 pandemic, what do you think an essential and/or ideal approach of a resilient [office/retail/industrial] in terms of:
  - The [company]'s physical accommodation strategy
  - Organisational arrangements
  - Other arrangements that could influence business decision

- What are the concerns related to your version of an ideal strategy? Why and how could these concerns be mitigated?
- How can you ensure that resilience can be safeguarded over the course of time?

Part 6: Current theoretical framework

I have heard your stories on managing [company] real estate and I am inspired by your experience.

In the earlier theoretical stage of my research, I have developed a literature-based resilience framework based on two perspective of business/real estate, two focus of strategic/operational, and three approaches of persistence/adaptable/transformable. This will be further improved and developed based on the information I have gained today. Currently, I have 10 categories, as you can see in the image.

[SHOW EXPANDED RESILIENCE FRAMEWORK]

- Out of four quadrants, what are the most important domains that an [office/retail/industrial] needs to focus on, and why?
- What are the necessary elements, shown in the grey colors of categories and sub-categories are essential to be possessed by an [office/retail/industrial]?
- As a real estate manager, do you think it is feasible to possess all of these sub-categories? Or you would rather focus on improving particular key-elements?
- Do you have any other input regarding this framework?

Additional

Do you have any relevant information that would be beneficial for this research?

Closing

I would like to express my gratitude for making your time to contribute in this research. I gained valuable knowledge from you.

[Optional, if the interviewee ticked that they would like to receive my project update once it is finished]
I would share my result with you once my graduation thesis has been finalized.

Appendix B: Interview Protocol – Expert from Selected Asset Classes

Graduation Laboratory 2020/2021
Management in the Built Environment
Delft University of Technology

Interviewer : Danica Antonia Widarta
Current Title : **Exploration towards a Resilient Corporate Real Estate:**
Re-conceptualisation and Operationalisation of Resilience in Various Corporate Real Estate Asset Classes

Interviewee : [Name] Organisation: [Organisation name] Asset Class : [O/R/I]

Introduction

Firstly, I would like to thank you for participating in this interview. As mentioned in my messages, this interview is a part of empirical studies of my graduation research carried for the Faculty of Architecture and the Built Environment of TU Delft.

My research aims to create a strategy to enhance resilience within various corporate real estate asset classes, including [office/retail/industrial] sector. Previously, I have conducted a theoretical study which resulted in an extended definition of resilience in corporate real estate, and a literature-based resilience framework. This resilience framework analyses several CRE approaches to become more resilient, based on theoretical evidence. This interview is the subsequent step of my research, which aims to gather empirical data that provides validity of my current theoretical framework, as well as gaining new insights on more information that may not be presented during my literature study. The outcome of the empirical study will be evidence-based strategies for each selected asset classes to improve their resilience.

This interview will consists of 4 main sections about your experience, and one additional section of reviewing my literature-based resilience. **In this interview, you would be considered as an expert of [office/retail/industrial] sector, because of your expertise on advising companies from this industry**. The information gathered will only be used for academic purposes, and will be treated confidential and following the FAIR guiding principle.

This in-depth interview will be conducted in approximately 45 minutes to one hour of duration. Please keep in mind that you may refuse to answer any of my questions, and that you may withdraw from this study at any time.

Practicalities

I would like to ask you if you are okay with this interview being recorded. I would like to assure you that the recordings will be properly destroyed after the transcription's validity has been confirmed with my mentors.

[RECORD]

I am going to repeat the question because it is now recording. Are you okay with this interview being recorded?

Part 1 - General

- Can you briefly elaborate your position at [company name] and the responsibilities within the company?
- How long have you been working at [company name] and in the related field?
- Can you share your experience in general of advising and providing real estate consultancy for your clients?
    - What types of clients do you usually advised your expertise?

Part 2 - Resilience

The word 'resilience' becomes more and more popular, especially during this unfortunate COVID-19 pandemic.

In my research, resilient corporate real estate is defined as the capability and preparedness of an organisation's CREM department to respond and immediately recover, in the event of external disruptions, by interchangeably being invulnerable, resistance, flexible towards disruptions, or being innovative to transform to a more desirable pathway or state. This results in three general approaches during disruptions: (1) persistence, (2) adaptable, and (3) transformable.

- Based on your expertise, what do you think of resilient [office/retail/industrial] real estate?
- What makes an [office/retail/industrial] real estate resilient?

As I mentioned before, there are three general approach of a resilient organisation, which are (1) persistence, (2) adaptable, and (3) transformable. Persistence (1) is defined as the ability to resist external disturbances, which requires physical robustness and rigidity. Adaptability (2) is the flexibility and resourcefulness to adapt the sub-processes in order to maintain the same pathway. As an example, an organisation able to do remote working is the adaptability, which maintains the same general procedure but have the flexibility and resource to do it remotely. Transformability (3) is the ability to innovate a new desirable pathway, which requires more radical changes and the emergence of different trajectories. This requires a major transformation which does not maintain the same procedure.

- In your opinion, to what extent an asset should be resistance to future disruptions, and how adaptable and transformable an asset should be?

Part 3 - Disruption (COVID-19 pandemic)

We can agree that the COVID-19 pandemic is one of the biggest unpredictable disruption of last year, and still are now. It challenges almost everyone on this planet to deal and even adapt to this situation.

- What are the impacts of this COVID-19 pandemic to the [office/retail/industrial] market, especially in The Netherlands? Does the perspective of resilient [office/retail/industrial] shifted because of this pandemic?
- As an expert in [office/retail/industrial] space, what is the biggest, most prominent change in the perspective of resilience before and during COVID-19 pandemic?
- What are the biggest shift in your in your point of view regarding the resilience of physical accommodation strategy and organizational arrangements?

Part 4 - Beyond COVID-19 pandemic: Future recommendation

As we can learn from the past, disruptions can be in any form, pandemic, economic downturn, and other crisis. As a [consultant/expert],, you may want to be prepared with uncertainties ahead.

- So, looking beyond COVID-19 pandemic, if I was a client that are looking to acquire a [office/retail/industrial] space for my businesses, what would you advise to me?
- What do you think an essential and/or ideal approach of resilient [office/retail/industrial] in terms of:
    - The [company]'s physical accommodation strategy
    - Organisational arrangements, if you could provide any advice about this
    - Other arrangements that could influence business decision
- What are the concerns related to your version of an ideal strategy? Why and how could these concerns be mitigated?
- How can you ensure that resilience can be safeguarded over the course of time?

Part 5: Current theoretical framework

I have learned a lot from your stories on advising an [office/retail/industrial] real estate and I am inspired by your experience.

Can I show you some slides?

So, in the earlier theoretical stage of my research, I analysed various trends from different asset classes. From these emerging trends, I have developed a literature-based resilience framework based on Krumm's four view scheme which consists of two perspective of business/real estate and two focus of strategic/operational.
[SHOW KRUMM, et al. (2000) FRAMEWORK]
I added another layer to this framework, which is the three approaches of persistence/adaptable/transformable.
[SHOW STRUCTURE OF EXPANDED FRAMEWORK]

Based on this structure, I analysed the positioning of these emerging trends. This is my expanded resilience framework. Currently, I have 10 categories, as you can see in the image. This will be further improved and developed based on the information I have gained today.
[SHOW EXPANDED RESILIENCE FRAMEWORK]

- Out of four quadrants, what are the most important domains that an [office/retail/industrial] needs to focus on and why?
- What are the necessary elements, shown in the grey colors of categories and sub-categories are essential to be possessed by an [office/retail/industrial]?
- As an expert in [office/retail/industrial] sector, do you think it is feasible to possess all of these sub-categories? Or you would rather focus on improving particular key-elements?
- Do you have any other input regarding this framework?

Additional
Do you have any relevant information that would be beneficial for this research?

Closing
I would like to express my gratitude for making your time to contribute in this research. I gained valuable knowledge from you.

[Optional, if the interviewee ticked that they would like to receive my project update once it is finished]
I would share my result with you once my graduation thesis has been finalized.

Appendix C: Empirical Data Summary

	Offices				Retails				Industrial and Logistics			
	Data	O_CREM_1	O_CREM_2	O_EXP_1	Data	R_CREM_1	R_CREM_2	R_EXP_1	Data	I_CREM_1	I_CREM_2	I_EXP_1
Category 1| Strategic Alignment												
Persistence: CRE supports main business: Translating organisational strategy to physical reality	Tailor CRE strategy based on overall organisational ambition	V		V	Tailor CRE strategy based on overall organisational ambition	V			Tailor CRE strategy based on overall organisational ambition	V	V	
	Real estate that accommodates and supports the business	V			CRE strategies based on location and business contexts, which differs based on external conditions			V	Real estate that accommodates and supports the business	V	V	
	Streamlining multiple assets to match the global organisational strategy			V								
Adaptability: CRE collaborates with the main business	Alignment of CRE strategy with overall organisational strategy (business plan, ambition)	V	V	V					Alignment of CRE strategy with overall organisational strategy (business plan, ambition) by - centralised management - connecting and understanding the core business	V	V	
	Collaboration with other sub-departments to minimise or mitigate risks			V					Collaboration with other stakeholders to minimise or mitigate risks		V	
Transformability: CRE adds significant value to the main business	Assessment of value added on the overall business organisation in every consideration of CRE intervention	V	V		Assessment of value added and/or value loss, on the overall business organisation in every consideration of CRE intervention		V	V	Assessment on the extent and size of value added on the real estate to the whole businesses	V		
	Active and dynamic CRE strategy to create positive impact on overall business	V			Active and dynamic CRE strategy, continuous assessment based on everchanging market trends that would impact real estate decisions	V		V	Active and dynamic CRE strategy, by selling the owned assets and lease back, creating added value (more profit to the organisations)			V
Category 2 | Accommodation of Trends												
Persistence: Physical ability to follow trends and utilise needs	Appropriate working environment and experience	V	V		Customer-friendly retail spaces		V		Appropriate working environment and experience	V		
	Workspace that responds and accommodates users' demands, activities, and work processes	V		V	Retail spaces that accommodates regional-specific demands and/or context-specific demands		V	V	Logistic spaces that accommodate growing interest of stakeholders on sustainability			V
	Cater the needs of different user types in an organisation		V	V	Constant development of physical assets to accommodate everchanging trends		V		Logistic spaces that follow consumer demands on e-commerce by creating last-mile distribution centre, placing it near the urban consumers			V
	Physical assets as status and identity to attract clients			V	Decent quality and attractiveness of physical assets, physical improvement of deteriorated assets	V	V	V	Remodel assets to fit the modern demand	V		
	Follow the technology development in the industry		V		Follow the latest real estate retail trends		V		Follow trends and needs, through the updated workspace concept	V		
					Tailor locations by following consumers			V				

					demands, based on organisations' identity and its target market, to attract customers optimally							
					Asset location: - Dominance for specific functions - Quality of site surrounding that match the specific retail function			V				
					Accessible in diverse location types: experience and convenience stores			V				
Adaptability: Ability to predict trends and needs	Predict emerging workspace trends and accommodate it			V	Predict emerging trends and accommodate it (e.g. experience vs convenience stores)			V	Predict emerging logistics trends of higher e-commerce demand and accommodate it by last-mile distribution centre			V
	Analyse specific demands on each sub-processes in workspaces and accommodate it			V	Predict and continuous assessment of assets in relation to users' demand	V	V	V	New developments due to projected higher demands			V
	Flexibility in the composition of different activity spaces based on projected trends and needs		V		Optimisation of space based on future projection of trends			V	Projecting suitable real estate intervention by profound understanding of the core business and collaboration with other stakeholders		V	
	Collaboration with other sub-departments to predict favourable assets			V	Predicting the importance of retail locations in proximity of other prominent retail functions, to fit consumers' demands & convenience	V						
	Actions taken to respond to projected disruptions, by: - Enhancing inclusivity - Maintaining customers interests	V			Asset location based on projected high long-term footfall (high streets are projected to remain favourable for retails)			V				
					Assessment of the composition and balance between physical and online market, based on projected demand and various variables			V				
Transformability: Ability to create needs	Setting example to shape trends and create needs		V		Constant innovation to provide best customer experience	V			Redevelopment to attract new clients and large businesses	V		
	Implement own vision and how it should be utilised in physical spaces		V		Showcasing at retail spaces as a holistic approach to create needs			V				
Category 3 | Digitalisation												
Persistence: Digitalisation in day-to-day operation to optimise the management of physical assets	Sensors placed in physical assets for monitoring purposes	V		V	Self-scanning machine in physical assets to minimise risks	V			Sensors placed in industrial assets		V	
Adaptability: Digitalisation in day-to-day operation to optimise process	Hybrid working: remote working capability for most of employees, reducing physical meeting	V	V	V	Hybrid working: remote working capability for most of employees	V			Hybrid working: remote working capability for some of employees	V		
					Omni-channel retail: Integration and	V	V	V	Counter argument:	X		

					combination of physical and online market				Inability to digitize specific roles/task, especially production/lab work			
					Digital workflow and approval processes when possible	V						
Transformability: Digitalisation in business operational	Digital service to replace services done in physical space, to minimise on-site interaction		V		Unmanned units to replace regular physical retail format	V			Maximisation of process automation in industrial production process		V	
									Automation in logistics warehouses			V
Category 4 | Space and Activities												
Persistence: Physical resistance to disturbances that threatens activities	Basic maintenance plan to maintain safety and quality	V	V	V	Basic maintenance plan to maintain safety and quality	V	V	V	Sufficient maintenance plan to maintain safety	V	V	
	In compliance to health and safety regulation	V	V	V	In compliance to health and safety regulation	V	V		In compliance to health and safety regulation	V	V	
					Collaboration with external technical & maintenance parties to respond to day-to-day physical incidents	V			Outsource maintenance party to mitigate risks	V		
					Physical improvement of the deteriorated assets		V		Physical resistance towards probable physical disaster (e.g. fire)	V		
					Well-organised retail space	V			Location of sites designated for industrial activities	V		
									Sites to not be easily accessible due to safety reasons	V		
Adaptability: Multi-use / space sharing of activity space	Flexible working space: - Spread into different locations - Desk-sharing concept - Multi-usage of spaces			V	Integration with different-functioned shops to create more efficient space usage, (e.g. one-stop-shops)		V	V	Flexible working space: - Desk-sharing concept	V		
	Flexibility in the composition of different activity spaces	V	V	V								
	Activity-based environment and fit-out		V									
Transformability: Optimisation of activity-space relation	Optimisation of space through continuous assessment of desk ratio (workspace less than total number of employees)		V	V	Optimisation of space based on future projection of trends (smaller & more compact physical stores)			V	Optimisation of space through continuous assessment of desk ratio (workspace less than total number of employees)	V		
	Optimisation of portfolio for future-proof business	V			Optimisation of portfolio for future-proof business		V	V	Optimisation of portfolio to optimise cost		V	
	Hybrid working: office for meeting and collaboration space, to increase creativity, connection, identity; therefore less individual workspace	V	V	V								
	Pay-per-use workspaces (service-based)	V		V								
	Streamlining similar asset function that have different target markets		V									
	Redefining spatial arrangement based on activity demand		V									
Category 5 | Property Feature Flexibility												
Persistence: Physical asset flexibility to accommodate changes within the current spatial boundaries	Flexible & adjustable assets - to accommodate changing trends - to accommodate changing business strategy and work process	V		V	Flexible & adjustable assets - to accommodate changing trends - to improve the deteriorated assets due to costly major transformation		V	V	High vacancy level to accommodate changes	V		

	Flexible in the composition of different activity spaces			V					Building specification to conduct logistics business operation e.g. sufficient or adjustable clear height, quality of floorings and loading docks			V
	Spatial arrangement flexibility due to core portfolio ownership		V						*Counter argument:* Industrial portfolio are normally not very agile	X		
	Regularly adjusted desk ratio		V									
	Hackable spaces to create easy-adjusted assets			V								
Adaptability: Physical asset flexibility to accommodate changes beyond the limitation of current spatial boundaries	Flexible portfolio, through: - Flexible contracts (rental agreement) - Flexible leases (short term / long-term with break option) - Floor-by-floor leases to expand or reduce spaces		V	V	Flexible contracts (rental agreement), creating a security & control over location	V	V		Flexibility to relocate - physical logistics space - some part of light industrial activities (through flexible contract)		V	V
	Combination of ownership in real estate, own and lease		V		Lowering risks by renting space (rather than ownership of assets)			V	Lowering risks by renting space (rather than ownership of assets)			V
	Terminate outdated assets		V		Exit strategies of assets		V		Terminate assets that are no longer serve the business purposes, by: - selling assets and renting the lands - selling assets	V		
	Optimisation of assets by workspace adjustment due to changing demands			V	Optimise or relocate assets, by: - minimise the amount and area of physical stores, with careful assessment - consider the better deals with landlord		V	V	Selling the business including its property	V		
	Consolidate assets	V							Consolidate assets		V	
									Counter argument: Site-context is very rigid due to limited function of industrial sites	X		
Transformability: Repurpose assets to accommodate functional changes					Unmanned unit to replace regular physical format	V			Redevelopment of assets, focuses on sustainability and circularity	V		
					Repurpose assets that are no longer in demand		V		Redevelop and repurpose assets functions	V		
					One-stop-shops: integration with other different-functioned shops		V					
					Interchangeable assets to other uses			V				
Category 6 | Environmental Sustainability												
Persistence: Reduction of environmental impacts according to regulation	Sustainable asset features (as regulated)	V	V	V	Sustainable asset features (as regulated)		V		Sustainable asset features (as regulated)	V	V	V
									Sustainable development			V
									Response to municipal and governmental sustainable city ambition			V
									Accommodate growing interest of stakeholders on sustainability			V
Adaptability: Reduction of environmental impacts with efforts further than regulation	Pre-emptively refurbish old buildings with short term lease to be more sustainable		V						LEED and BREEAM certification		V	
	Reusing furniture and non-structural elements		V						Focuses on sustainable choices even if it costs more investments	V		

	Goal of Paris agreement implemented 20 years before it is supposed to		V						Redevelopment of assets, focuses on sustainability and circularity	V		
Transformability: Contributing positively to surrounding environment												
Category 7 | Financial & Contractual Security												
Persistence: Ability to ensure the financial and contractual security	Flexible rental agreement through short-term contracts		V	V	Flexible contracts (rental agreement), which may create security and control over location	V	V		Flexible contract for some assets that functioned as light industrial activities		V	
									Long-term ownership of assets, therefore - zero book value (zero cost) - less risk on the investment *(Applicable to heavy & high investment industrial sites)*	V	V	
Adaptability: Ability to adjust and optimise cost on portfolio	Optimise cost on portfolio through consolidation of assets	V			- Optimise cost on portfolio through careful assessment that does not negatively impact the overall business			V	Optimise cost on portfolio through consolidation of assets		V	
					Maximising income and minimising cost on portfolio - Rent reduction based on Dutch law Highest income and lowest vacancy possible	V	V		Minimising cost on portfolio e.g. by assessment to create clear overview of the portfolio's depreciation, value, occupancy/vacancy level, desk ratio	V		
Transformability: Ability to innovate and drastically change the state of the contractual agreement									Sell owned assets and lease back, adding more profit			V
Category 8 | Accessibility												
Persistence: Assets with easy site accessibility	Well-accessible office by public transport for employees and majority of clients	V	V		Well-accessible physical retail space	V	V	V	High industrial activities: Well-accessible site from the resources & to transport output to other businesses - located close to ports		V	
					Ease of access from anchor functions: Retail locations in proximity of - other prominent retail functions - other long-term anchor functions (e.g. library or healthcare centre)	V	V	V	Logistics sector: Highly accessible locations - Near highway and/or ports - Near urban consumers - Specific to value-add services: close to labour pool			V
									Specific to value-add logistical services: highly accessible by public transport			V
									Counter argument: Preferred for industrial sites to not be easily accessible by non-relevant visitors due to safety reasons	X		
Adaptability: Decentralisation of assets, create multiple access points	Flex-working space and pay-per-use workspace create multiple access points	V		V	Integration with different-functioned shops to create more efficient space usage, (e.g. one-stop-shops), creating more access points		V		Two types of logistics spaces: 1) regular logistics warehouses			V

					2) last-mile logistics centre, to create more access to the consumer							
					Products are available in different-functioned stores, therefore creates more access points		V		Decentralised production points therefore less susceptible and can maintain production process in event of disruption	V		
					Accessible in diverse location types, the experience vs convenience locations, therefore creating flexibility to prioritise resources			V	*Counter argument:* Assets in different locations may have different functions/projects managed by different sub-business groups, so specific-skilled employees needs to access a specific building.	X		
Transformability: Decrease dependency on physical site accessibility	Hybrid working reduces dependency to site accessibility (designating office as collaborative and meeting space, and remote-working for individual work)	V	V	V	*Counter argument:* Physical site accessibility become more important for the success of the business due to competition with e-commerce			X				
	Reduce dependency to site accessibility & needs for physical interaction with clients, due to digital service		V									
Category 9 | Process and Real Estate												
Persistence: Physical capacity to sustain operational process without significant delay in event of disruptions					Collaboration with external technical & maintenance parties to respond to day-to-day physical incidents	V			Flexibility due to high vacancy level creates the ability to maintain process without significant and long recovery time	V		
					Asset insurance	V			Decentralised production points therefore less susceptible and can maintain production process in event of disruption	V		
					Day-to-day response to calamities	V			Shorten physical distance from warehouse to consumers by last-mile distribution centre			V
									Logistical space is placed in the location close to ports and/or highway, to maintain access to process-essential infrastructure			V
									Safety protocols in place and other capabilities to resume production process during disruptions		V	
Adaptability: Organisational capacity to maintain or adapt operational process to maintain production process	Hybrid working which reduces interaction at physical asset, creates the capacity to maintain or adapt the operational process	V	V	V	Hybrid working which creates the ability to work remotely, creates the capacity to maintain or adapt the operational process	V			Hybrid working which reduces interaction at physical asset, creates the capacity to maintain or adapt the operational process	V		
	Providing alternative workspace in event of physical asset disruptions through flex-working space and pay-per-use workspace	V		V	Adjustable day-to-day processes based on circumstances	V			Ability to adjust the production process to maximise output efficiency		V	
					Adjustment in process & workflow to be less	V						

					susceptible; e.g. digital workflow and approval processes when possible							
					Adapt processes or create alternative to meet increasing output demand	V	V					
Transformability: Ability to predict and minimise critical points in the production process	Learning capacity of: - Process: to enhance preparedness in event of disruption prior to direct impacts - Spatial arrangement & user demand	V	V		Self-scanning to reduce dependency to staffs, therefore minimise critical points	V			Sustainable processes, minimise possibility of creating environmental hazards	V		
	Contingency plans	V			Unmanned unit to replace regular physical format	V			Contingency plans	V		
									Automation - Industrial assets - logistics warehouses		V	V
									Continuous assessment and exploration of last-mile distribution centre due to its relatively new concept			V
Category 10 | Input and Real Estate												
Persistence: Physical capacity to sustain the critical input-related resources	Ensuring input of materials: stockpiling to maintain supply chain prior to direct impact of disruptions	V			Ensuring input of materials: maintaining supply chain in event of sudden demand increase	V			Ensuring input of materials: stockpiling to maintain supply chain in event of transport disruption			V
	Ensuring input of potential human resources: creating physical office as status and identity, to attract talents			V					Ensuring input of human resources: logistical space is placed in the location close to labour pool (specific to value-add logistics service)			V
									Maintaining input of resources during disruption, by providing job security for its employees		V	
Adaptability: Organisational capacity to adapt the source of supply whenever needed												
Transformability: Ability or effort to predict the optimum state of input-related resources	Invest in human resources, understand users' demand and accommodate it	V		V	Self-scanning device to minimise demand for physical labour	V						
	Outsource human resources			V								
	Showcasing at workspaces to enhance users' creativity	V										

Appendix D: Consent Form CRE Managers

Interview Brief

Graduation Laboratory 2020/2021
Management in the Built Environment
Delft University of Technology

Dear [Name],

With this letter, I would like to invite you to participate in my graduation study titled *Exploration towards a Resilient Corporate Real Estate: Re-conceptualisation and Operationalisation of Resilience in Various Corporate Real Estate Asset Classes.* This study is carried out to fulfill my master's thesis in the Faculty of Architecture and the Built Environment, Delft University of Technology. This thesis aims to provide strategies for various corporate real estate (CRE) asset classes to increase their resilience, therefore able to overcome external problems and minimise uncertainties. The final output of this research will provide applicable suggestions to improve and maintain the resilience capability in selected asset classes of CRE industries.

This interview will lasts approximately 45 to 60 minutes. I would like to ask permission to record this interview for transcribing and analysing the information. The transcript would be coded anonymously, and the original recording will be deleted once the accuracy of the transcript has been confirmed. You can always say that you would rather not participate. You can also change your mind at a later date and withdraw your participation. During the interview, you are free to omit any question.

If you participate, I ask you to sign this consent form at the next page and return a PDF to me. I will also sign the letter and return the PDF to you. I do to ensure that I will treat your data and answers with confidentiality. Your organization will not be able to read the interview report. I only produce a general and anonymous report on the experiences of corporate real estate managers. When I quote your words, I promise not to use your name and make sure it is not clear who may have said this. I will erase your name and contact details immediately upon completion of the investigation.

Should you have any questions about this study, please do not hesitate to contact me (email: Danica.Antonia.Widarta@student.tudelft.nl).

If you would like to participate in this interview, could you please complete and sign the statement below and send us the PDF by e-mail?

Sincerely,

Danica Antonia Widarta

Interview Consent Form

Graduation Laboratory 2020/2021
Management in the Built Environment
Delft University of Technology

Interviewer : Danica Antonia Widarta
Current Title : **Exploration towards a Resilient Corporate Real Estate:**
Re-conceptualisation and Operationalisation of Resilience in Various Corporate Real Estate Asset Classes

Interviewee : **[Name]** Organisation : **[Institution Name]**

Please tick the appropriate boxes:	Yes	No
I. Taking part in the study		
1. I declare that I have been clearly informed about this research. I have been able to ask questions about the study, and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to be a participant in this study. I understand that I can refuse to answer questions, and I can withdraw from the study at any time, without having to give a reason.	☐	☐
3. I understand that taking part in this study involves answering questions that will be audio-recorded, with the sole purpose of transcribing the interview and analysing the information, after which, the recordings will be deleted.	☐	☐
II. Use of information in the study		
4. I understand that the information I provide will be used only for academic purposes of the graduation project and corresponding presentation at TU Delft, unless indicated that certain information is confidential.	☐	☐
5. I understand that personal information collected about me that may recognize my identity [e.g. name and/or email address], will not be shared beyond the study team.	☐	☐
6. I agree that my information can be quoted in research outputs. In case of quotation, I will be able to review the relevant text chapters prior to its publication.	☐	☐
7. I understand in case that this research will be published, I will not be identified as a participant in this research in any publication.	☐	☐
III. Future use and reuse of information by others		
8. I acknowledge the publication of graduation thesis results at the TU Delft educational repository to be used for future research and learning. The graduation thesis document will not provide my name or other personal details, unless agreed otherwise.	☐	☐
IV. Results		
9. I would like to receive a short summary of the results of the study at the end of the study. For this reason, I give permission to keep my name and address details until the end of the research.	☐	☐

Date (DD/MM/YYYY) : _____ *Interviewer:*
Full Name (in capital letters) : _____ Danica Antonia Widarta
Participant's Signature : *Signature:*

_____ _____

Appendix E: Consent Form Experts

Interview Brief – Expert from Selected Asset Classes

Graduation Laboratory 2020/2021
Management in the Built Environment
Delft University of Technology

Dear [Name],

With this letter, I would like to invite you to participate in my graduation study titled *Exploration towards a Resilient Corporate Real Estate: Re-conceptualisation and Operationalisation of Resilience in Various Corporate Real Estate Asset Classes.* This study is carried out to fulfill my master's thesis in the Faculty of Architecture and the Built Environment, Delft University of Technology. This thesis aims to provide strategies for various corporate real estate (CRE) asset classes to increase their resilience, therefore able to overcome external problems and minimise uncertainties. The final output of this research will provide applicable suggestions to improve and maintain the resilience capability in selected asset classes of CRE industries.

This interview will lasts approximately 45 to 60 minutes. I would like to ask permission to record this interview for transcribing and analysing the information. The transcript would be coded anonymously, and the original recording will be deleted once the accuracy of the transcript has been confirmed. You can always say that you would rather not participate. You can also change your mind at a later date and withdraw your participation. During the interview, you are free to omit any question.

If you participate, I ask you to sign this consent form at the next page and return a PDF to me. I will also sign the letter and return the PDF to you. I do to ensure that I will treat your data and answers with confidentiality. This interview will be done anonymously. I will ensure that your contact details will not be shared in the public report. I will erase your contact details immediately upon completion of the analysis. Yet, as an expert of the selected asset classes, I may ask you if I can publish important quotes with your name. I will provide the relevant chapter of my thesis and ask if you prefer your name hidden or published.

Should you have any questions about this study, please do not hesitate to contact me (email: Danica.Antonia.Widarta@student.tudelft.nl).

If you would like to participate in this interview, could you please complete and sign the statement below and send us the PDF by e-mail?

Sincerely,

Danica Antonia Widarta

Interview Consent Form – Expert from Selected Asset Classes

Graduation Laboratory 2020/2021
Management in the Built Environment
Delft University of Technology

Interviewer : Danica Antonia Widarta
Current Title : **Exploration towards a Resilient Corporate Real Estate:**
Re-conceptualisation and Operationalisation of Resilience in Various Corporate Real Estate Asset Classes

Interviewee : **[Name]** Organisation : **[Institution Name]**

Please tick the appropriate boxes:	Yes	/	No
I. Taking part in the study			
1. I declare that I have been clearly informed about this research. I have been able to ask questions about the study, and my questions have been answered to my satisfaction.	☐		☐
2. I consent voluntarily to be a participant in this study. I understand that I can refuse to answer questions, and I can withdraw from the study at any time, without having to give a reason.	☐		☐
3. I understand that taking part in this study involves answering questions that will be audio-recorded, with the sole purpose of transcribing the interview and analysing the information, after which, the recordings will be deleted.	☐		☐
II. Use of information in the study			
4. I understand that the information I provide will be used only for academic purposes of the graduation project and corresponding presentation at TU Delft, unless indicated that certain information is confidential.	☐		☐
5. I understand that personal information collected about me that may recognize my identity [e.g. email address and/or personal contact details], will not be shared beyond the study team.	☐		☐
6. I agree that my information can be quoted anonymously in research outputs.	☐		☐
7. In case of quotation, I will be able to review the relevant text chapters prior to its publication, in which I may choose to publish or hide my identity.	☐		☐
III. Future use and reuse of information by others			
8. I acknowledge the publication of graduation thesis results at the TU Delft educational repository to be used for future research and learning. The graduation thesis document will not provide my name or other personal details, unless agreed otherwise.	☐		☐
IV. Results			
9. I would like to receive a short summary of the results of the study at the end of the study. For this reason, I give permission to keep my name and address details until the end of the research.	☐		☐

Date (DD/MM/YYYY) : _____ *Interviewer:*
Full Name (in capital letters) : _____ Danica Antonia Widarta
Participant's Signature : *Signature:*

_____ _____

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Danica Antonia Widarta
Management in the Built Environment
Delft University of Technology